Special Issue June 2025

AE International Journal of Multidisciplinary Research

ISSN 2348 – 6724

Published by

Archers & Elevators Publishing House,
No.54, MM Layout, Opp. to NRR Hospital,
Hesharagatta Main Road,
Bangalore – 560 090, Karnataka, India.

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One Day National Conference

On

"AI & DATA REVOLUTION: SHAPING THE FUTURE OF TECHNOLOGY"

Wednesday, 23rd April, 2025

SRI BHAGAWAN MAHAVEER JAIN
FIRST GRADE COLLEGE
(Approved by AICTE, Affiliated to Bengaluru North University & Accredited by NAAC)

Organised by
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MESSAGE

It is with great pride and a sense of shared purpose that I appreciate the National Multidisciplinary Conference on **"AI & Data Revolution: Shaping the Future of Technology."** This event is not merely an academic gathering—it is a visionary initiative aimed at preparing our educational landscape for the immense changes that artificial intelligence and data science are ushering in across all sectors.

In recent years, we have witnessed the power of AI and data to accelerate decision-making, predict outcomes, and enhance user experiences in ways once thought impossible. Education, as a cornerstone of societal progress, must not only keep pace with this revolution but also lead the way in guiding ethical, inclusive, and innovative applications of these technologies. This conference provides a timely platform for educators, technologists, and policymakers to deliberate on how best to harness this potential for the benefit of learners and institutions alike.

I congratulate the organizing team at **Sri Bhagawan Mahaveer Jain First Grade College** for their foresight and dedication in bringing together such a diverse and intellectually vibrant program. Let us all engage deeply, share generously, and emerge with insights that will help us shape a technological future that is not just smarter, but also more human, just, and innovative.

Dr. Chenraj Roychand
Founder Chairman of JGI.

MESSAGE

It gives me immense pleasure to extend a heartly congratulation to all the distinguished participants of the National Multidisciplinary Conference on **"AI & Data Revolution: Shaping the Future of Technology."** This conference reflects our collective commitment to embracing the transformative power of artificial intelligence and data in redefining education and professional landscapes.

Sri Bhagawan Mahaveer Jain First Grade College – KGF, believe in nurturing an environment where innovation meets purpose. The integration of AI and data-driven technologies into various fields be it Commerce, Management, Science, or Humanities demands a fresh, future-focused approach to teaching and learning. This conference serves as a timely platform to discuss, discover, and drive these vital changes.

I wholeheartedly commend the efforts of our faculty, organizing team, and collaborators for bringing this vision to life. Let us use this opportunity to exchange knowledge, inspire innovation, and shape a future where technology uplifts humanity in meaningful and sustainable ways.

Sri Mahender Kumar Munoth
Managing Trustee of SBMJFGC-KGF

FOREWORD

It gives me immense pleasure to extend a warm welcome to all the distinguished delegates, academicians, researchers, and students participating in the National Multidisciplinary Conference on **"AI & Data Revolution: Shaping the Future of Technology."** This conference marks a significant milestone in our ongoing journey of integrating innovation into academia and redefining educational paradigms in a technology-driven world.

As the Principal of **Sri Bhagawan Mahaveer Jain First Grade College – KGF**, I firmly believe that the future of education lies at the intersection of creativity, critical thinking, and the intelligent use of technology. Artificial Intelligence is no longer a futuristic concept it is a present reality that is reshaping how we learn, teach, evaluate, and grow.

This conference is a celebration of diversity of disciplines, perspectives, and innovations. Whether it is the analytical depth of commerce and management, the empirical rigor of science, or the reflective insights of the humanities, every field has something unique to contribute to this vital dialogue on AI and education.

I express my heartfelt gratitude to all the organizing committee members, contributors, and participants whose efforts have made this event possible. May this conference serve as a platform not only for academic exchange but also for envisioning a smarter, more inclusive, and more innovative future for education.

Principal
Dr. Rekha Sethi
SBMJFGC-KGF.

MESSAGE

It is an honor to be part of the National Multidisciplinary Conference on **"AI & Data Revolution: Shaping the Future of Technology,"** hosted by **Sri Bhagawan Mahaveer Jain First Grade College – KGF**. This conference is a timely initiative that brings together diverse academic disciplines to explore how Artificial Intelligence and Data are reshaping the future of education and industry.

As a **Professor, Mentor, Coach, Researcher, and Fellow of the Institution of Electronics and Telecommunication Engineers**, I have long advocated for the thoughtful integration of technology into education. AI is not just a tool of the future it is a present force that is revolutionizing the way we learn, think, and solve real-world problems.

This event provides a valuable platform for collaboration, knowledge exchange, and the development of innovative strategies that can empower both educators and learners. I appreciate the organizers' vision and dedication in curating such a relevant and dynamic forum.

(Resource Person)

Prof. (Dr.) V. Ilango, PhD

Professor | Mentor | Researcher | Academic Leader

Fellow, Institution of Electronics and Telecommunication Engineers

CMR Institute of Technology, Bengaluru

MESSAGE

It is a pleasure to be part of the National Multidisciplinary Conference on **"AI & Data Revolution: Shaping the Future of Technology,"** organized by **Sri Bhagawan Mahaveer Jain First Grade College – KGF**. This conference serves as a vital platform to discuss the dynamic and evolving role of Artificial Intelligence and Data in shaping the future of education, industry, and society at large.

As an **Associate Professor and Head of the Department of Computer Applications at CMR Institute of Technology, Bengaluru**, and **Proprietor of Ryanam Learning Solutions**, I am passionate about bridging the gap between academic research and real-world application. The convergence of AI with various disciplines opens new possibilities for smarter, more inclusive, and adaptive learning environments.

I commend the organizers for creating an opportunity to share insights, encourage innovation, and foster collaboration across domains. I look forward to engaging with fellow educators, researchers, and students in meaningful discussions that will drive future-ready solutions.

(Technical Speaker)

Dr. Gomathi T

Associate Professor & Head, Dept. of Computer Applications

CMR Institute of Technology, Bengaluru

MESSAGE

It is a privilege to serve as **Session Chair** at the National Multidisciplinary Conference on **"AI & Data Revolution: Shaping the Future of Technology,"** organized by **Sri Bhagawan Mahaveer Jain First Grade College – KGF**. This conference brings together a wealth of knowledge and perspectives from across disciplines, reflecting the transformative impact of Artificial Intelligence and Data in reshaping education, research, and industry practices.

With academic and professional expertise across diverse domains—**M.Sc., M.B.A., M.Phil., P.G.D.C.A., P.G.D.B.A., and Ph.D**—I am committed to fostering meaningful dialogue that encourages innovation, critical thinking, and interdisciplinary collaboration.

I commend the organizing team for their vision and dedication in hosting this intellectually enriching event. I look forward to insightful presentations, active engagement, and fruitful discussions that contribute to a smarter and more connected academic future.

(Session Chair)

Dr. Sumanth. S

M.Sc., M.B.A., M.Phil., P.G.D.C.A., P.G.D.B.A., Ph.D

Government First Grade Collge For Women - Kolar

MESSAGE

It is an honor to serve as **Session Chair** at the National Multidisciplinary Conference on **"AI & Data Revolution: Shaping the Future of Technology,"** hosted by **Sri Bhagawan Mahaveer Jain First Grade College – KGF**. This conference highlights the growing influence of AI and data technologies across various domains, emphasizing the need for collaborative, interdisciplinary exploration and innovation.

A background in **B.Sc., MCA, MBA, and Ph.D.**, and currently serving as **Senior Consultant/Scientist-D at INMC (Mission Control Center), Peenya Industrial Estate**, as well as **Project Consultant – Servo Control**, I have had the opportunity to witness firsthand the real-world applications and transformative power of intelligent systems and automation.

This platform brings together thought leaders, educators, and researchers to discuss how emerging technologies can reshape education, enhance industry practices, and prepare the next generation for a data-driven future. I commend the organizers for their commitment to knowledge-sharing and forward-thinking discourse.

(Session Chair)

Dr. Diwakar

B.Sc., MCA, MBA, Ph.D.

Sr. Consultant/Scientist-D, INMC – Mission Control Center,

Project Consultant – Servo Control, Peenya Bengaluru

MESSAGE

Global AI adoption has significantly increased over the past year, with 65% of organisations regularly using generative AI for data-driven business decisions. The global AI market is projected to grow from USD 136.55 billion in 2024 to USD 1,811.8 billion by 2030.

The National Conference organized by Sri Bhagawan Mahaveer Jain First Grade College, titled **"AI & DATA REVOLUTION: SHAPING THE FUTURE OF TECHNOLOGY,"** provides essential skills and in-depth knowledge for the strategic implementation of digital technologies. This conference covers digital transformation fundamentals, AI-driven decision-making, business model innovation, process reengineering, marketing automation, customer relationship management, and cybersecurity.

This will definitely help the participants make data-driven business decisions and stay ahead of the competition. The conference is ideal for professionals who plan to integrate technology to enhance their decision-making and stay ahead of the curve.

I wish all the best for the conference and am happy to be associated with this important initiative.

Mr. Siddarama S.
Head, Department of Computer Science
Sri Bhagawan Mahaveer Jain First Grade College, KGF

ABOUT COLLEGE

Sri Bhagawan Mahaveer Jain First Grade College is one of India's reputed educational institutions. It was founded by Hon. Chairman Dr. Chenraj Roychand in the year 2004 and was affiliated to Bangalore University and after trifurcation in 2017-18, it is currently under Bengaluru North University, It is a premier institution one among the top 20 higher educational institutions run by the Jain Group of Institutions. One distinctive aspect of the Jain educational institutions at all levels is their emphasis on teaching "**the whole society"** with the spirit of providing education to all without deprivation.

The primary motto of the college is to provide quality education in a congenial environment to the deserving students. The college's mission is to prepare young minds to be quality leaders in all walks of life, as well as to serve their countrymen with zeal for justice, honesty, and sharing. It is expected that the education provided here in this institution plays an important role in bringing about the expected changes for the betterment of the people of our country, who are exclusively socially marginalised and exploited. Furthermore, the college is striving to create an atmosphere of intellectual and moral values in which the youth of our country may identify their opportunities and achieve greater heights of eminence. The college received its second NAAC accreditation in 2021, with a B+ grade. At present, two postgraduate and 5 undergraduate programmes are being offered by the Department of Computer Science, Physical Science, Life Science, Commerce, and Business Administration. Further-more, 30 certificate courses are being offered.

The college never fails to achieve university ranks. Every year, it holds the university ranks with distinction in M.Com, MSc, BCA, B.Com, B.B.A, and B.Sc. courses which brings overwhelming laurels to the institution and paves the way for the development of the society.

ABOUT THE DEPARTMENT

The Department of Computer Science provides a strong foundation in software development, and emerging technologies. The curriculum encompasses programming, database management, networking, artificial intelligence (AI), and cybersecurity—preparing students for dynamic careers in the IT industry. Emphasizing practical learning, research, and industry collaboration, the department nurtures innovation and fosters professional growth.

Department of Computer Science (MSc CS)

Launched in 2024, the MSc Computer Science program focuses on advanced computing, AI, machine learning, data science, and cloud computing. With an emphasis on industry-driven projects and research, the program prepares students for leadership roles in the tech sector.

ABOUT THE CONFERENCE

This conference aims to bring together researchers, academicians, industry experts, and students from various disciplines to discuss the latest advancements in computer science and its applications. In response to the growing demand for innovative solutions to complex challenges, the conference offers a platform to explore the intersection of computer science with fields such as data science, artificial intelligence, biology, engineering, social sciences, & business.

Participants will engage in presentations, panel discussions, workshops, and networking sessions to share ideas, research findings, and potential solutions that drive innovation across industries.

PREFACE

The rapid advancement of Artificial Intelligence (AI) and data-driven technologies has transformed the way we think, work, and innovate. Recognizing the need for meaningful discourse and collaboration in this transformative era, Sri Bhagawan Mahaveer Jain First Grade College – KGF is proud to present the National Multidisciplinary Conference on **"AI & Data Revolution: Shaping the Future of Technology."** This one-day conference aims to bring together thought leaders, scholars, industry practitioners, and students to explore the evolving role of computer science and data technologies in driving future innovations across diverse domains.

The Department of Computer Science, in association with leading experts and academic contributors, has meticulously curated this event to address key challenges and opportunities in areas such as artificial intelligence, machine learning, cybersecurity, data science, and cloud computing. With the recent launch of the MSc Computer Science program in 2024, the department continues to emphasize research, hands-on learning, and industry integration—values that are strongly reflected in this conference.

This proceedings volume is a compilation of thought-provoking papers, insightful research findings, and expert perspectives presented during the conference. It is our sincere hope that the content herein will serve as a valuable resource for academics, researchers, and professionals committed to advancing technology for the benefit of society.

We extend our heartfelt gratitude to the contributors, reviewers, organizing committee, and all participants whose efforts have made this event a success. May the ideas exchanged and relationships formed at this conference continue to inspire innovation and meaningful collaboration.

Editors

Mr. Siddarama S HoD of Computer Science, SBMJFGC, KGF

Mr. Dileep D Assistant Professor, SBMJFGC, KGF

Mr. Teekshith Kumar Assistant Professor, SBMJFGC, KGF

TABLE OF CONTENT

THE ROLE OF AI LANGUAGE MODELS IN EMBEDDED SOFTWARE DEVELOPMENT AND TESTING

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Abstract

Artificial Intelligence (AI) and Large Language Models (LLMs) are revolutionizing the field of embedded software development and testing. These technologies enhance code generation, debugging, and optimization, while also improving test automation and verification. This paper explores the applications of LLMs in embedded software, analyzing their benefits, challenges, and future directions, with real-world examples, financial impact, and specific tools used.

1. Introduction

AI is about to create a machine that can think, learn, and adopt like humans [1]. AI language models (AI-LMs) is the language powered by AI, used to think, learn process, like humans [2]. It is used to make things intelligent in the field of Science and Engineering [3]. Embedded system is a complete system on a chip [4]. LLM is a type of AI model that uses deep learning to understand and generate human language that are pre-trained on vast amounts of data [5] [6]. Embedded systems are ubiquitous, powering applications from consumer electronics to industrial automation. Traditional embedded software development and testing involve manual coding, rigorous debugging, and extensive validation processes [7]. Embedded software refers to the computer programs designed to manage the machines that are generally not recognized as computers [8]. AI-driven LLMs, such as OpenAI's GPT models, are increasingly being integrated into these workflows to improve efficiency and accuracy [9]. The advanced natural language comprehension and content creation abilities of ChatGPT highlight the significant potential of LLM technology in the realm of code generation [10]. The fundamental principles of software testing are equally applicable to embedded software [11].

The paper is structured as follows: Section 2 deals with applications of LLMs in Embedded Software Development, Section 3 provides Applications of LLMs in Embedded Software Testing, Section 4 gives the Challenges and Considerations, Section 5 and 6 with Future Directions and Recommendations for Mid-Sized Embedded Software Developers, and finally, conclusion is given in Section 7.

2. Applications of LLMs in Embedded Software Development

2.1 Code Generation and Assistance

LLMs assist in generating embedded C/C++ code, providing suggestions, and auto-completing complex functions. They reduce development time by offering templates for peripheral drivers, communication protocols, and real-time operating system (RTOS) tasks [12].

Example: Arm Ltd. has incorporated AI-assisted code generation in its Mbed platform using OpenAI Codex, reducing development time by 30% and cutting costs associated with software engineering by $500,000 annually.

2.2 Debugging and Optimization

AI models help in identifying and fixing software bugs by analyzing code structures, detecting anomalies, and suggesting corrections. They also aid in optimizing code for memory and power efficiency, which is critical for resource-constrained embedded systems.

Example: A major automotive company using Synopsys Coverity AI-driven debugging tools reduced time-to-market by 25% and saved approximately $2 million per project.

2.3 Documentation and Code Maintenance

LLMs automatically generate documentation, enhancing code readability and maintainability. They assist developers in understanding legacy code by summarizing functions and providing explanations in natural language.

Example: Siemens deployed GitHub Copilot for documentation, reducing manual documentation efforts by 40% and saving $1.2 million annually.

3. Applications of LLMs in Embedded Software Testing

3.1 Test Case Generation

AI models automate the creation of unit, integration, and system-level test cases. They generate input data variations to ensure robustness and improve code coverage.

Example: A leading semiconductor company used Test.ai for AI-driven test case generation, improving test coverage by 60% and reducing costs by $800,000 annually.

3.2 Automated Code Review and Static Analysis

LLMs enhance traditional static analysis tools by identifying security vulnerabilities, buffer overflows, and race conditions. They assist in enforcing coding standards and best practices.

Example: NVIDIA implemented DeepCode for AI-driven code review, decreasing security vulnerabilities by 50% and saving $1 million in compliance costs.

3.3 Simulation and Model-Based Testing

AI-driven test frameworks leverage LLMs to create test scripts, simulate real-world scenarios, and validate embedded software behavior against expected outcomes.

Example: Bosch utilized MATLAB/Simulink with AI-based automation for model-based testing, reducing validation time by 35% and cutting R&D expenses by $2.5 million per year.

4. Challenges and Considerations

4.1 Accuracy and Reliability

LLMs may generate incorrect or suboptimal code, necessitating human oversight to ensure correctness and safety in embedded applications [13].

4.2 Security and Compliance

The use of AI in embedded software raises concerns about intellectual property, security vulnerabilities, and compliance with industry standards such as ISO 26262 for automotive applications.

4.3 Computational Constraints

Running AI models on resource-limited embedded platforms is challenging. Edge AI techniques and model quantization are potential solutions for deploying LLMs in constrained environments.

5. Future Directions

Integration of AI models with embedded development environments (IDEs) and version control systems.
Improved fine-tuning of LLMs for domain-specific embedded applications.
Enhanced AI-driven fuzz testing and penetration testing for cybersecurity.
Expansion of AI-based formal verification techniques for safety-critical systems.

6. Recommendations for Mid-Sized Embedded Software Developers

For mid-sized embedded software development companies looking to integrate AI-driven tools, the following recommendations provide an optimal balance between cost and efficiency:

Tool	Function	Cost (Annual)	Expected Savings
GitHub Copilot	AI-assisted code generation and documentation	$19/user/month	30% reduction in documentation time, saving ~$100,000
Synopsys Coverity	AI-driven static analysis and bug detection	Starts at $50,000 per project	25% reduction in debugging time, saving ~$500,000
Test.ai	AI-driven automated test case generation	Custom pricing (~$60,000)	60% increase in test coverage, reducing test cycle costs by ~$400,000
DeepCode	AI-enhanced code review for security vulnerabilities	Free for small teams, ~$10,000 for enterprises	50% reduction in security vulnerabilities, saving ~$200,000 in compliance costs
MATLAB/Simulink	AIModel-based AI-powered testing	~$100,000	35% reduction in validation time, saving ~$700,000

These tools can be integrated into existing embedded software workflows to maximize efficiency while maintaining compliance and reliability. A company investing in these AI-powered tools can expect to save millions annually, significantly reducing development and testing costs while improving software quality.

7. Conclusion

AI-powered LLMs are transforming embedded software development and testing by automating coding, debugging, and verification processes. Real-world implementations have demonstrated significant cost savings and efficiency improvements. While challenges remain, ongoing advancements in AI and embedded computing will further enhance their applicability, driving innovation in the embedded systems domain.

References:

[1] Jiang, Y., Li, X., Luo, H., Yin, S., & Kaynak, O. (2022). Quo vadis artificial intelligence? Discover Artificial Intelligence, 2(1), 4.

[2] Liu, Z., Roberts, R. A., Lal-Nag, M., Chen, X., Huang, R., & Tong, W. (2021). AI-based language models powering drug discovery and development. Drug Discovery Today, 26(11), 2593-2607.

[3] Hamet, P., & Tremblay, J. (2017). Artificial intelligence in medicine. metabolism, 69, S36-S40.

[4] Camposano, R., & Wilberg, J. (1996). Embedded system design. Design Automation for Embedded Systems, 1, 5-50.

[5] Wang, L., Ma, C., Feng, X., Zhang, Z., Yang, H., Zhang, J., ... & Wen, J. (2024). A survey on large language model based autonomous agents. Frontiers of Computer Science, 18(6), 186345.

[6] Li, Y., Liu, P., Wang, H., Chu, J., & Wong, W. E. (2025). Evaluating large language models for software testing. Computer Standards & Interfaces, 93, 103942.

[7] Banerjee, A., Chattopadhyay, S., & Roychoudhury, A. (2016). On testing embedded software. In Advances in Computers (Vol. 101, pp. 121-153). Elsevier.

[8] Garousi, V., Felderer, M., Karapıçak, Ç. M., & Yılmaz, U. (2018). Testing embedded software: A survey of the literature. Information and Software Technology, 104, 14-45.

[9] Gokul, A. (2023). LLMs and AI: Understanding its reach and impact. Preprints.

[10] Liu, M., Wang, J., Lin, T., Ma, Q., Fang, Z., & Wu, Y. (2024). An empirical study of the code generation of safety-critical software using llms. Applied Sciences, 14(3), 1046.

[11] Lepistö, J. (2012). Embedded Software Testing Methods.

[12] Das, N., Ganesan, S., Jweda, L., Bagherzadeh, M., Hili, N., & Dingel, J. (2016, October). Supporting the model-driven development of real-time embedded systems with run-time monitoring and animation via highly customizable code generation. In Proceedings of the ACM/IEEE 19th International Conference on Model Driven Engineering Languages and Systems (pp. 36-43).

THE ROLE OF IOT IN TRANSFORMING HEALTHCARE: A REVIEW OF EARLY DETECTION, REAL-TIME MONITORING AND DATA SECURITY

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Abstract

The internet of things (IoT) is a wireless Technology of connecting various devices throughout the world with the help of Internet to communicate with each other and they are embedded with various devices and sensors; it's a new standard changing how people live and work in their custom way. Coming to the healthcare industries, IoT is transforming Healthcare industries with the help of real time monitoring by data collection with supported devices and with Artificial Intelligence (AI), IoT has the feature of continuous health tracking, personalized treatments, and enhanced patient outcomes. Application based devices like wearable health devices, fitness trackers. The sensors are integrated into wearables, smart medical equipment, and implants, allowing healthcare professionals to make data-driven decisions remotely, which allows continues health tracking which helps to improve patient outcomes and enabling early detection of diseases and diagnoses in early stage and treat the patients either in the hospital or out of hospital. This paper seeks to explore and showcase overview of Present IoT technology in healthcare industries and figure out how IoT wireless technology is an advantage for the early prediction and treatment of diseases. We also learn how IoT based healthcare is improvising healthcare services through real-time monitoring and data management. This paper also speaks about the challenges of data privacy, security, and device interoperability in healthcare IoT applications.

Keywords Internet of Things (IoT), Health care Industry, Medical Sensors, Real-time health tracking, Artificial Intelligence (AI). IoT security, Early disease detection, Wearable health devices.

Introduction

In the past decade, the acceleration of wireless communication and sensor technology has triggered something called the Internet of Things, whereby everyday devices and systems are interconnected through the Internet. This paradigm is revolutionizing many sectors in society, with healthcare probably being the most impacted. Healthcare, primarily known as the Internet of Medical Things (IoMT), thrives using smart sensors, wearable devices, and advanced data analytics to continuously monitor patients, care for them, and make decisions that are very self-oriented, and data driven. IoT in healthcare made a shift from reactive treatment to proactive and preventive care. Wearable health devices, smart medical equipment, and even implantable sensors continuously collect vital signs and other health data in real time. This data is then processed, often with the assistance of Artificial Intelligence (AI), enabling early detection of potential health issues and timely interventions. Such innovations not only enhance patient outcomes but also reduce the burden on healthcare facilities by allowing remote monitoring and diagnosis. This paper is an attempt to give a holistic overview of the current state of IoT technology in the healthcare industry. It examines how IoT is transforming healthcare delivery by enabling continuous health tracking, facilitating early disease detection, and supporting personalized treatment strategies. It also discusses the significant challenges accompanying these advancements, including concerns related to data privacy, security, and interoperability among diverse medical devices. This paper will look at the opportunities and challenges of IoT in healthcare to point out the transformative potential of these technologies in improving healthcare services and patient outcomes.

The discussion will also give insight into how IoT, combined with AI and robust data management systems, is paving the way for a more connected, efficient, and patient-centric future in healthcare.

Objectives

- To study the role of IoT in transforming the healthcare industry.
- To investigate the applications of IoT in early disease detection
- To evaluate the impact of IoT on healthcare services efficiency and patient satisfaction
- To analyze the challenges of IoT in healthcare
- To explore the use of IoT in different medical fields

Literature Review

The term (IoT) Internet of Things is one of the trending and useful technologies in this Era, in most places that has numerous uses, technologies, standards, and programs. The base of this technology is connected and supported through the Internet that have connected to each other, and things include IoT devices and physical objects equipped with IoT they are equipped with electronic components and software devices to receive, sorts, and share data. (Rejeb et al.,2023)

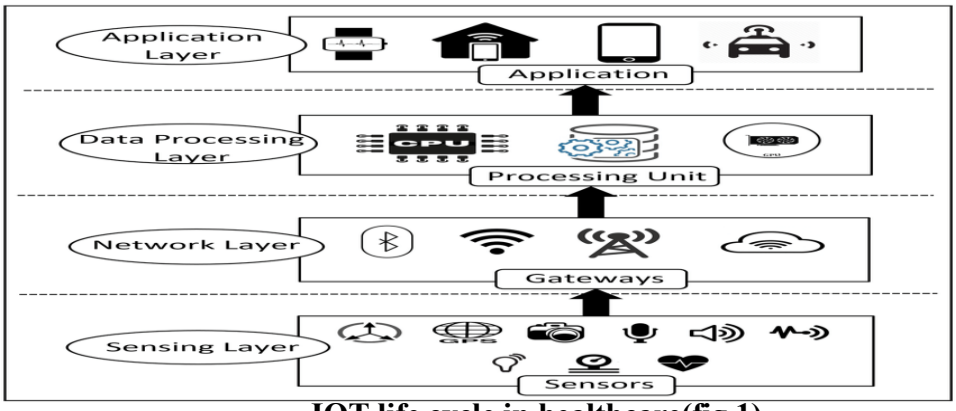
In today's modern era with a rapidly growing population, people depend upon advanced medication and hospitals to fight against diseases, however most of them try to look after the disease has reached a certain stage, making it difficult to manage, especially in cases where the illness has reached to second or third stage. The solution to overcoming this challenge lies in early detection and timely intervention. This is where the Internet of Things (IoT) plays a major role by enabling continuous monitoring and tracking of the human body, something that cannot be done by humans alone. One potential solution to investigate the challenges is the implementation of Internet Things (IoT) technologies, which can enhance and optimize medical service systems through smart integration IoT devices that can detect diseases at an early stage, allowing for more effective treatment and better patient outcomes. concepts like smart cities, the idea of a smart planet support IoT to explore and implement its use in various urban areas. This integration has proven to be highly effective, delivering results that meet or exceed expectations. For example, several cities have successfully integrated IoT technologies in healthcare, yielding significant improvements in patient care and overall medical services at Barcelona (Spain), Singapore, San Francisco (USA), London (UK). In such smart cities with seamless and highspeed network IoT enables pervasive connectivity across devices and systems. (Ghazal et al., 2021). (2)

In this approach, continuous interactions occur between devices, humans, or both. IoT integrates technologies like RFID (radio frequency identification tags), sensors, mobile devices, and personal digital assistants (PDAs), which are widely deployed to gather real-time data and facilitate informed decision-making. With intelligent sensing capabilities in IoT systems, smart cities can enhance the efficiency of public services and business infrastructures by collecting and analyzing real-time data quickly. This allows for timely responses to sudden events and ensures proper management and control of urban resources. In the context of healthcare services, particularly in medical rehabilitation, IoT-based systems enable convenient "one-stop" services for residents, even those in remote locations. Unlike traditional in-person rehabilitation at local hospitals, IoT-driven smart rehabilitation systems share resources across communities, offering flexible and easily accessible treatment options for patients. (Raji, I. O., & Ogunleye, T. A. (2023). (3)

The concept of IoT can generally be divided into three separate layers: (1) the perception/physical layer, (2) the network layer, and (3) the application layer.
In perception/physical layer the physical devices and sensors that gather data from the environment and are in charge by other layers to passing several algorithms and make cure to provide accurate service, it also includes RFID tags, cameras, sensors, and other data-collecting components that enable the detection of changes or events in the real world.
Fuqaha, A., a 2015(4).

This plays the role of Central part of IoT, and it serves as the foundation for capturing information. The next most important layer is the network layer also known as the transport or device layer which is responsible for transmitting the data collected by the perception layer to different systems from different platforms. It uses different communication technologies such as Wi-Fi, Bluetooth, 4G/5G, HTTP, MQTT and AMQP and cloud computing. This layer ensures the seamless transfer of data across connected devices and networks. The last and important layer is Application layer, it is pointed at the very top of the IoT stack, this layer processes and analyzes the data transmitted by the network layer to deliver useful information and services it mainly functions on grouping of services and functions that are provided to the end users. It focuses on IoT applications, such as smart healthcare, smart homes, smart cities, and more, allowing users to interact and connect with the data to make certain decisions or automate processes. Data querying, report generation visualization, and analysis, as well verifying and interaction with IoT platforms, are all carried out at the application layer.

As per certain studies mentioned in Internet states that in this Rapid growing population and developing countries in worldwide is observed, that markets for instances and industrial market of IoT projects is expected to reach approximately **$122.6 billion by 2030** with a compound annual growth rate (CAGR) of 6.1% from 2023 onwards. The overall growth takes place in advancements in sensor technology, RFID systems, and the increasing adoption of IoT solutions across industries such as manufacturing, logistics, and healthcare. Li, S., Da Xu, L., & Zhao, S. (2018). (6)



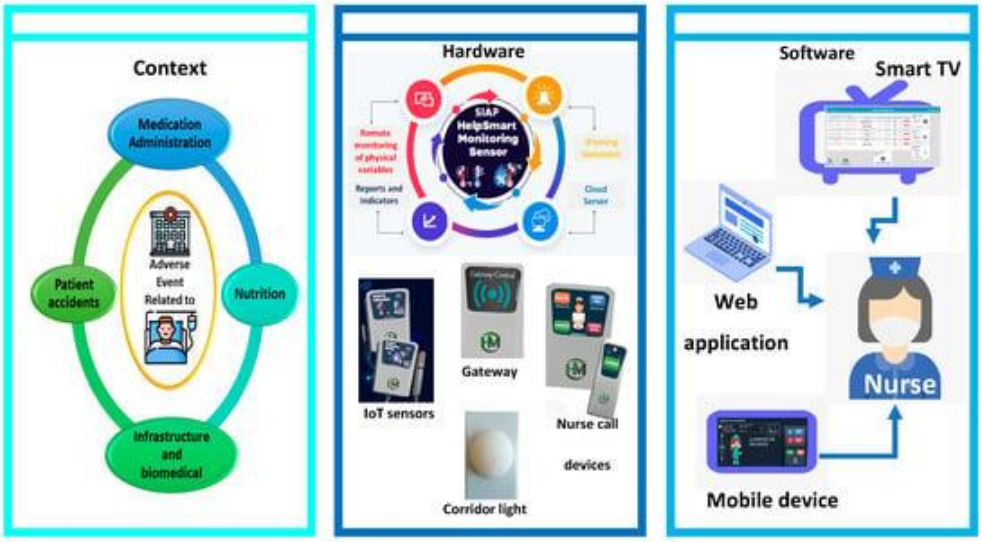
IOT life cycle in healthcare(fig.1)

In recent years, hospitals in major Indian cities such as Bangalore and Chennai have begun integrating Internet of Things (IoT) technology to enhance patient care and monitor medical services. This implementation of IoT allows healthcare facilities to monitor patient conditions in real-time, manage critical and organized data more efficiently, and improve overall patient outcomes.

Hospitals in these cities are utilizing smart medical devices, wearables, and remote monitoring systems, which enable healthcare providers to track major health information and respond to emergencies more effectively and efficiently.

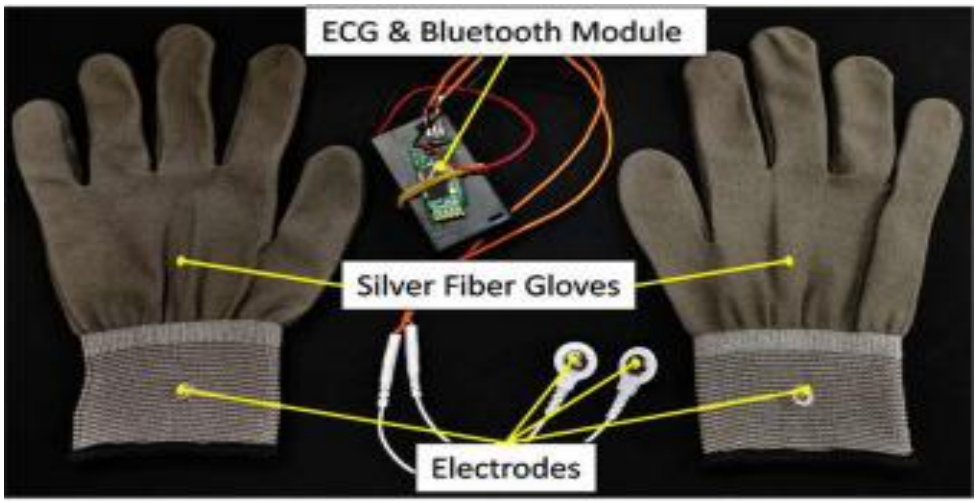
Bangalore based Manipal hospital implements IoT and gives pregnant mothers a wearable device which is connected to their devices like smart phone applications which gives real time information on fatal heart rate and other related data of fatal and mother and respective doctors have access through their mobile or computer. Similarly, APPOLO hospital based in Chennai used IoT In connecting most of the medical equipment's that all devices are connected to the larger network and are monitored by a monitoring station.

As per Reviews of the patients about IoT, they stated that with the usage of IoT that enables live monitoring offered by this technology, they need not to visit the clinic often which in turn saves their visiting charges and Time. AdAway, S. (2020). (7)

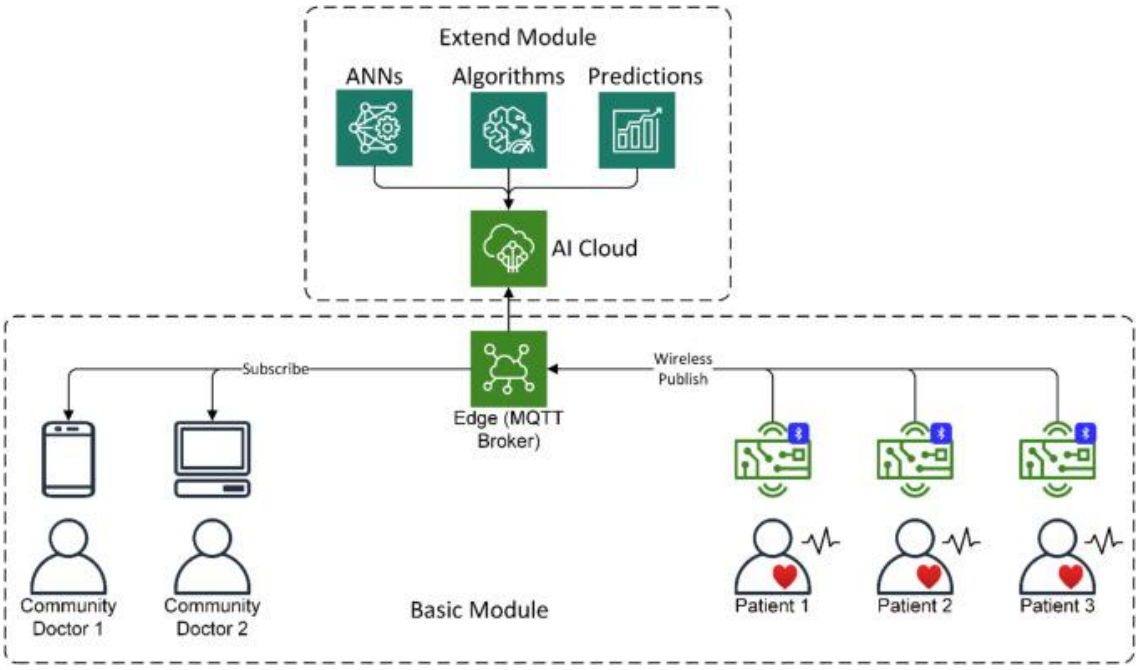


IOT Framework for Healthcare (fig.2)

In other hand heart diseases is one of the major issues leading to many of deaths globally affecting millions of peoples every year, as per the survey only in India more than 25% of deaths are due to cardiovascular diseases it was responsible of 2.1 million of deaths in the 2015, when we refer to a survey of worldwide as of 2022 it is 19.8 million people die due to heart related issues.



In this major issue implementation IoT helps in preventing and detecting the most of heart diseases that goes severe if neglected, IoT devices such as wearable sensors, smartwatches, and connected health monitors, enables **real-time tracking** of heart-related metrics like heart rate, blood pressure, and ECG signals, the acquisition of continues data through smart devices it helps in early detection of irregularities like arrhythmias or abnormal heart rhythms, which could signal an impending heart attack. Wearables like Apple Watch and ECG patches continuously monitor heart activity and can alert users and doctors if any abnormalities are found. Which enables patients to be monitored remotely, reducing the need for hospital visits often. IoT machines also have integrated alert mechanisms that notify patients and healthcare providers in case if any irregularities and abnormalities found as a **quick emergency response** that save lives.



Blueprint, Architecture of Emergency Aid system.

The system includes wearable devices that monitor a patient's ECG, equipped with Bluetooth to transmit data. This information is sent to edge services, which process the data in real-time. Doctors then access the analyzed information with the help of specialized software, allowing them to monitor heart health remotely and provide timely interventions.

The Topic and Message Content/message signals from the devices

Topic	***Message Content***
Patient1 ECG Data	*ECG Data*
Patient2 ECG Data	*ECG Data*
Patient3 ECG Data	*ECG Data*
Patient1 Location	*GPS Location/None*
Patient2 Location	*GPS Location/None*
Patient3 Location	*GPS Location/None*
Emergency	*Patient Number*

After discussing the role of IoT in early detection and monitoring of heart disease, IoT devices are transforming healthcare by not just offering early detection but also providing ongoing support for patients, both in hospitals and at home.

When we talk about transmission and sharing of huge medical data like medical images and patients information simultaneously to various devices and associated doctors regularly, Having huge amount of data requires more computational power for efficient data management the only factor that users look for, is data Security and data privacy, the data that is acquired by various devices like smart chips, smart watches, tiny sensors and other devices which are connected through internet must be secured from hackers and **data misrouting** or **data leakage,** hackers taking control of medical devices may alter their operation modes and turn them into deadly weapons data misrouting also affects users privacy, if the data is getting hijacked or misrouted the users personal details and the location of the users will easily identified which is threat to the users due to this Authentication is required to guarantee security and identify identities to prevent attacker and malicious attacks ,Latest suggested authentication approaches used to provide safer and secured communication like HTTP protocols, Lightweight Cryptographic Authentication, Biometric-Based Authentication, Blockchain-Based Authentication, Two-Factor Authentication (2FA), Mutual Authentication Protocols, AI/ML-Based Authentications.(Alhusenat*)*.

Methodology Database used

For research in this paper, a multi-disciplinary yet integrative approach was conducted, gathering both qualitative and quantitative data from different credible sources. This research paper will be categorized as a Review Paper with elements of Applied Research, it's mentioned as Review and Applied Research paper because of the following methods and database used:

Collection of Data from Primary Sources: Field visits were made to hospitals to see the kind of implementations that are taking place regarding IoT devices in healthcare. Interaction with hospital staff and technicians could give direct insight into their use of IoT-based systems and understanding applications in the real world. During these field visits, various types of IoT devices were observed, and their efficiency in patient monitoring and data collection was evaluated. However, there was no choice for comprehensive and detailed information regarding the IoT devices as the hospitals I visited were using limited sources and devices, hereby I look for different methods for collecting the Data.

Secondary data collection: Research is conducted by reading scholarly articles, books, journals, Ph.D. theses, and grey literature to get information regarding the use of IoT in healthcare. References taken from Google Scholar, and websites of hospitals have been referenced to provide detailed information of IoT data. Videos regarding IoT have also been referenced to gather technical awareness. About 20-30 research papers were consulted to ensure strong research on the given issue. Interviews and Mentorship: Inputs from both the Head of Department (HOD) and mentor were received on the technical and health-care aspects of IoT systems.

Literature Review: A detailed literature search was carried out, going through books, technical journals, and published research articles. I also made use of available library resources and grey literature to get more insight into the applications of IoT in healthcare.

Research on Devices: Direct exposure to the IoT-based devices being used in hospitals allowed knowing them at the real time level and how it functions technically, along with knowing the way users interact with it.

Analysis of Existing Works: Analysis of past research papers and documents related to IoT has been an essential part of the methodology. Comparison has helped in creating differences between theoretical concepts and the practical implementations in healthcare.

Study Area:

This research deals with the adoption of IoT technology within the health care sector. The case study revolves around the implementation and impact of IoT devices in Indian urban hospitals. There is emphasis on leading hospitals, such as Manipal Hospital and Aster CMI Hospital in Bangalore and Apollo Hospital in Chennai that have already employed IoT systems to enhance patient care, monitoring, and data management practices.

These hospitals are very good examples of applications of the IoT system in real time tracking health and disease surveillance and individualized treatments using smart medical devices and wearable sensors. To this effect, global trends have also been included by using smart city projects in Barcelona (Spain), Singapore, San Francisco (USA), and London (UK), where health care has become successful in several regions through IoT technologies.

This study considers, in addition to the physical space of hospitals, the virtual environments engaged by the systems of cloud-based systems and remote monitoring platforms by which health professionals are enabled to store and retrieve data while offering care through remote means. Considering both the physical environment and the virtual one will provide a sufficient perception of how IoT affects modern healthcare systems.

Discussion:

In most of Research studies IoT is very effective technology for better health prediction and balance health, in addition to it IoT also enables us to maintain of proper diet plan and fitness as there are various tools like smart wearables and other integrated Applications which notifies on User Actions. IoT technology aids timely decision-making by taking vast amounts of data to collect and process. To handle this dynamic as well as vast amount of information, AI technology is developed to make efficient as well as effective handling of the changing nature of data. Based on my findings after various studies, IoT is currently transforming the healthcare industry through Real-Time Health Monitoring which I have mentioned above in detail that have direct impact on Patient Outcomes like Early Detection of Health Issues and Reduced Hospital Visits, in which we can tell IoT is cost efficiency. Usage of IoT has proven to be a better choice also reduces hospital visits but when we consider the patients on the usage of modern equipment like IoT devices they must be educated on certain devices and detailed usage of those for appropriate results in case users are unaware of usage, then there will be no use of using those devices also maintaining of devices is highly recommended. for maintaining secured data base for patients there must be encrypted and security for the data from hackers and unauthorized people for those I have already mentioned the techniques used to protect the data. In rural or remote areas, patients are usually required to travel a long distance to reach a doctor.

IoT-powered devices, like wearable sensors and mobile health applications, make it possible to continuously monitor vital signs, including blood pressure, heart rate, and glucose levels, without visiting healthcare centers frequently. Technology makes it possible for health care providers to track patients' conditions from afar, thus reducing the need to travel and ensuring continuous care. Kovacs et al. (2021) describe the improvement in the availability of healthcare to patients from remote and underserved regions for the management of chronic diseases using remote monitoring through IoT. Also, IoT devices collect continuous data about the health condition of patients, including their vital signs, activity levels, sleep patterns, and adherence to medication. This can be used to adjust and personalize treatment plans on the flight. For instance, the use of wearable glucose monitors for diabetic patients would enable doctors to monitor blood sugar levels in real time, making them adjust insulin dosages based on the patient's immediate needs. Patel et al. (2020) highlighted that IoT enables the personal management of chronic diseases such as diabetes and hypertension through the continuous collection of data, allowing healthcare providers to tailor treatments for individual patients. The future of IoT in healthcare will depend on developments in AI and machine learning, leading to more precise predictive healthcare. AI-based IoT devices will be able to process huge amounts of real-time data to predict health events in advance, enabling early intervention in chronic diseases and emergencies. Sensor technology will also become more technologically advanced. Non-invasive sensors will offer improved accuracy in the monitoring of vital signs and even allow for precursory indications of some diseases, such as early stages of cancer or neurological issues. In mental health treatment, IoT will have that transformative role where it supports real-time monitoring of the mood, stress levels, and cognitive functions to devise the most effective treatment planning. As these technologies converge, IoT could become a cornerstone of proactive, individualized healthcare delivery. Future IoT technologies should focus on Improving data privacy, and encryption techniques to protect sensitive health information. Developing universal standards for device interoperability is crucial for seamless integration. Long-term reliability, including device durability and maintenance, needs further exploration. Enhancing AI algorithms for more accurate data analysis and predictions is essential. Ethical guidelines and regulatory frameworks must be established for responsible IoT usage. Other research areas include mental health monitoring through IoT. Finally, there is a need to prioritize research on the impact of IoT on patient outcomes in underserved areas.

Comparative Analysis IoT in Healthcare – Uniqueness of This Review

This paper offers a new perspective on the use of IoT in healthcare by introducing the main points that differentiate it from previous research. The comparative analysis that follows discusses how literature so far has covered IoT in healthcare and how this review is an extension or an improvement of their work.

- Early Detection and Real-Time Monitoring: Advances Over Previous Studies
  Most research papers (e.g., Ghazal et al., 2021; Raji & Ogunleye, 2023) introduce the contribution of IoT in real-time monitoring of health but discuss more about data collection and less about implementation. Our review takes this forward by discussing how these advances are being implemented in leading hospitals, such as Manipal Hospital and Apollo Hospital in India, to show real-world implementation of IoT for early disease detection.

New Contribution: In contrast to previous research on theoretical IoT models, our paper introduces real-world case studies and discusses how Indian hospitals implement IoT to enhance patient care, reduce hospital visits, and make healthcare accessible.

- IoT Evolution in the Modern Age: Integration with AI
  Recent studies, e.g., Li et al. (2018), introduce IoT networks and 5G connectivity but do not introduce how AI is transforming IoT-powered healthcare. Our review explains how AI-powered IoT systems not only collect data but also enable personalized treatment, making healthcare proactive and not reactive.

  New Contribution: This paper introduces AI-powered IoT healthcare systems as a new area, discussing how AI algorithms improve real-time monitoring, automate diagnosis, and accurately predict health conditions better than previous IoT methods.

- Data Security and Privacy: Addressing New Challenges
  Security in IoT healthcare has been discussed in Kumar & Lee (2019), but these papers discuss general cybersecurity threats and not how existing IoT architectures tackle these challenges. Our review provides more detailed discussions of blockchain-based authentication, 2FA, and biometric security, describing their real-world applications in healthcare facilities.

  New Contribution: This review emphasizes new security protocols deployed by hospitals and future research on AI-based cybersecurity for IoT healthcare devices.

- IoT and Remote Healthcare: Opening Access to Underserved Areas
  Most papers (e.g., Kovacs et al., 2021; Patel et al., 2020) write about IoT in urban hospitals but provide no insight into how IoT bridges healthcare gaps in remote areas. This paper discusses how IoT wearables, cloud-based platforms, and mobile health applications reduce frequent hospital visits, enhancing the health of patients in rural and underserved regions.

- New Contribution: This paper differs from other reviews writing about IoT in well-equipped hospitals by describing its application in remote healthcare delivery and accessibility, providing a broader picture of IoT's real-world applications.

- Prospects: Where IoT in Healthcare is Heading
  While previous papers write about IoT trends, they fail to provide specific forecasts for future healthcare applications. This review forecasts future trends, including:
  AI-based predictive healthcare models
  Non-invasive sensor technologies to diagnose diseases like cancer and neurological disorders

Mental health monitoring through IoT-powered mood and stress trackers
New Contribution: This paper differs from previous work by writing about future innovations, setting the next generation of IoT-driven healthcare.

Conclusion

In conclusion, this research review emphasizes the transformative potential of IoT in healthcare, with a special focus on the role of IoT in monitoring, diagnosing, and managing heart disease. By utilizing IoT devices, real-time data collection and analysis are now possible, thus enabling healthcare professionals to make timely and informed decisions. This technological advancement reduces response times in critical situations, enhances patient outcomes, and promotes preventive care. Especially, the enhancement protocol for authenticating IoT devices; its capability to establish live monitoring, personalized care, and secure data transmission presents its significance regarding the improvement of outcomes that are general for a patient and the definition of a future practice in the medicinal field. This further adds a dimension to the IoT where it integrates with AI as well as machine learning which further enhances predictive analytics through better proactive and efficient means of healthcare solutions. Other challenges such as data privacy, device interoperability, and accessibility in underserved regions remain to be obstacles. Future efforts should address the development of secure frameworks for IoT, application toward mental health, and filling health equity gaps. This research affirms enormous potential in the IoT revolution around global healthcare systems and in creating a more connected and efficient, patient-centric industry.

References

1. Rejeb, A., Rejeb, K., Treiblmaier, H., Appolloni, A., Alghamdi, S., Alhasawi, Y., & Iranmanesh, M. (2023). The Internet of Things (IoT) in healthcare: Taking stock and moving forward. Internet of Things, 22, 100721. https://doi.org/10.1016/j.iot.2023.100721

2. Ghazal, T. M., Hasan, M. K., Alshurideh, M. T., Alzoubi, H. M., Ahmad, M., Akbar, S. S., ... & Akour, I. A. (2021). IoT for smart cities: Machine learning approaches in smart healthcare—A review. Future Internet, 13(8), 218. https://doi.org/10.3390/fi13080218

3. Li, S., Da Xu, L., & Zhao, S. (2018). 5G Internet of Things: A survey. Journal of Industrial Information Integration, 10, 1-9. https://doi.org/10.1016/j.jii.2018.05.001

4. Rehman, S. U., Sadek, I., Huang, B., Manickam, S., & Mahmoud, L. N. (2024). IoT-based emergency cardiac death risk rescue alert system. MethodsX, 13, 102834. https://doi.org/10.1016/j.mex.2024.102834

5. Alhusenat, A.Y., Owida, H.A., Rababah, H.A., Al-Nabulsi, J.I., Abuowaida, S. (2023). A secured multi-stages authentication protocol for IoT devices. Mathematical Modelling of Engineering Problems, Vol. 10, No. 4, pp. 1352-1358. https://doi.org/10.18280/mmep.100429

6. tel, R. R., Trivedi, A., & Desai, K. (2020). Personalized medicine in the IoT era: Real-time disease management and treatment. Journal of Personalized Medicine, 10(3), 75. https://doi.org/10.3390/jpm10030075

7. Tsiakis, P., Stavropoulos, T., & Tsiknakis, M. (2019). The role of IoT in personalized cancer care: Precision medicine through data integration. Journal of Cancer Research and Clinical Oncology, 145(12), 3087-3097. https://doi.org/10.1007/s00432-019-03053-1

8. Zhou, Y., Yang, S., & Lu, H. (2020). Real-time chronic disease management using IoT: Opportunities and challenges. Journal of Healthcare Informatics Research, 4(2), 211-227. https://doi.org/10.1007/s41666-020-00053-x

9. Lu, H., & Zhu, Y. (2021). IoT-enabled smart healthcare: A review of current technologies and challenges. Journal of Medical Systems, 45(6), 102. https://doi.org/10.1007/s10916-021-01766-3

10. Kumar, P., & Lee, H. J. (2019). Security issues in healthcare applications using wireless medical sensor networks: A survey. Sensors, 19(5), 1233. https://doi.org/10.3390/s19051233

11. Abawajy, J. H., Hassan, M. M., & Federici, S. (2020). IoT for healthcare: An exploration of multi-faceted applications and challenges. Future Generation Computer Systems, 105, 234-254. https://doi.org/10.1016/j.future.2019.10.010

12. Fuqaha, A., Guizani, M., Mohammadi, M., Aledhari, M., & Ayyash, M. (2015). Internet of Things: A survey on enabling technologies, protocols, and applications. IEEE Communications Surveys & Tutorials, 17(4), 2347-2376. https://doi.org/10.1109/COMST.2015.2444095

13. Hossain, M. S., Muhammad, G., & Rahman, S. M. (2020). Cyber–physical cloud-oriented multi-sensory healthcare framework. IEEE Sensors Journal, 20(9), 4710-4719. https://doi.org/10.1109/JSEN.2019.2960785

14. Jayaraman, P. P., & Krishnaswamy, S. (2022). IoT and wearable technology for chronic disease management: Trends and perspectives. Healthcare Informatics Research, 28(2), 112-126. https://doi.org/10.4258/hir.2022.28.2.112

15. Perera, C., Liu, C. H., & Jayawardena, S. (2015). The emerging Internet of Things marketplace from an industrial perspective: A survey. IEEE Transactions on Emerging Topics in Computing, 3(4), 585-598. https://doi.org/10.1109/TETC.2015.2390034

16. Sharma, S., Singh, G., & Kumar, P. (2021). IoT-enabled real-time cardiac monitoring system for efficient healthcare management. Biomedical Signal Processing and Control, 69, 102873. https://doi.org/10.1016/j.bspc.2021.102873

THE IMPACT OF AI ON EMPLOYEE PERFORMANCE: REVOLUTIONIZING THE WORKPLACE

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ABSTRACT:
In today's scenario organizations worldwide are Artificial intelligence driven. Day by day the need for AI has been increasing in all fields. This led to the integration of Artificial intelligence with Business and resulted in Business intelligence. There is a strong need to study how Alays an essential role in impacting employee performance. Artificial Intelligence (AI) is reshaping the modern workplace by enhancing employee performance, streamlining workflows, and fostering innovation. The AI-powered technologies eliminate tedious work, allowing staff to focus on the strategic and creative elements of their jobs. Additionally, AI-powered analytics enable data-driven decision-making, which increases efficiency and accuracy. However, the integration of AI also presents challenges, including the need for up skilling, ethical concerns, and potential job displacement. This paper explores the profound impact of AI on employee performance and how it is responsible for improving employee productivity, decision-making, and job satisfaction. Additionally, how AI will affect employee performance and how that performance might improve efficiency, productivity, and job satisfaction. It further discusses the importance of fostering a collaborative human-AI ecosystem that prioritizes ethical considerations and ensures equitable access to the benefits of AI-driven workplace transformation.

Keywords: *Artificial Intelligence (AI), Business Intelligence, Employee Performance and Workplace Transformation*

I. INTRODUCTION

Human beings understand human intelligence is not enough in today's competitive world. So he created a tool beyond human intelligence called Artificial intelligence. Day by day, the need for Artificial intelligence is increasing. Almost all sectors like IT & Software, Healthcare, Finance, Manufacturing, and Education are adopting Artificial Intelligence and their efficiency is also improved. This study explores the impact of Artificial intelligence on employee performance and how it leads to job satisfaction.

Artificial intelligence: Artificial intelligence (AI) is the ability of computing systems to execute functions often associated with human intelligence, including as learning, reasoning, problem solving, perception, and decision-making. It is a branch of computer science that creates and researches methods and software that allow machines to observe their surroundings and use learning and intelligence to choose actions that maximize their chances of attaining set goals(Norvig, 1995).

RESEARCH PROBLEM:

Artificial intelligence is transforming the workplace. There is also a concern about how Artificial intelligence is going to improve employee work performance and lead to job satisfaction positively. The main problem is that it will replace humans when they aren't able to adapt to it and it will lead to job displacement reduce motivation and make more dependable on the technology.

II. LITERATURE REVIEW

Siliang Tong, Nan Jia, Xueming Luo, and Zheng Fang (2021) this study examines two side face of AI. On one hand, the **deployment effect** suggests that AI-driven data analytics enhance the quality of feedback, leading to improved employee performance. On the other hand, the **disclosure effect** implies that employees may react negatively once AI-generated feedback is revealed to them, potentially diminishing their productivity. Notably, their findings indicate that the negative impact of the disclosure effect is mitigated by employees' tenure within the firm. These insights carry significant implications for management theory, business practices, and public policy(Siliang Tong, 2021).

Ernest Jebolise Chukwuka and Kashiari Esther Dibie (2024) this research paper aims to create a realistic understanding of the favorable and unfavorable experiences that employees have as a result of adopting artificial intelligence (AI) or resorting to the old manual HR methods. It explains the difficulties and the benefits associated with developing human resources in light of the use of artificial intelligence or the old manual HR methods(Dibie, 2024).

Subramanya Manjunath (2024) this research starts with an overview of standard performance appraisal processes that used to be followed for a long time which includes many of the reputed organizations, followed by that an examination of the significance of AI-powered tools in the changing work environment is given an emphasis. It is evident from research studies that digitalization has transformed business processes and continues to grow rapidly with changing times. It is also observed from the studies that AI powered tools are transparent and a clear example of how they are transforming what people do, either in their daily routine or at work(Manjunath, 2024).

Ashima Joshi and Jolly Masih (2023) this paper explores the transformative effects of Industry 5.0, a data-driven economy, and the imperative adoption of Artificial Intelligence (AI) driven systems across all organizational levels. It emphasizes the urgent need for comprehensive transformation, extending to Human Resource Management (HRM). The study explored the critical factors contributing to the growth and productivity of Industry 5.0 organizations, identifying a range of significant elements such as automation, data utilization, work quality, digital transformation, and AI adoption(Masih, 2023).

III. RESEARCH GAP

All previous studies focused on the impact of Artificial intelligence on Employee performance. Only a limited number of studies have considered the employee adaptability skills that will contribute to employee performance when integrated with artificial intelligence.

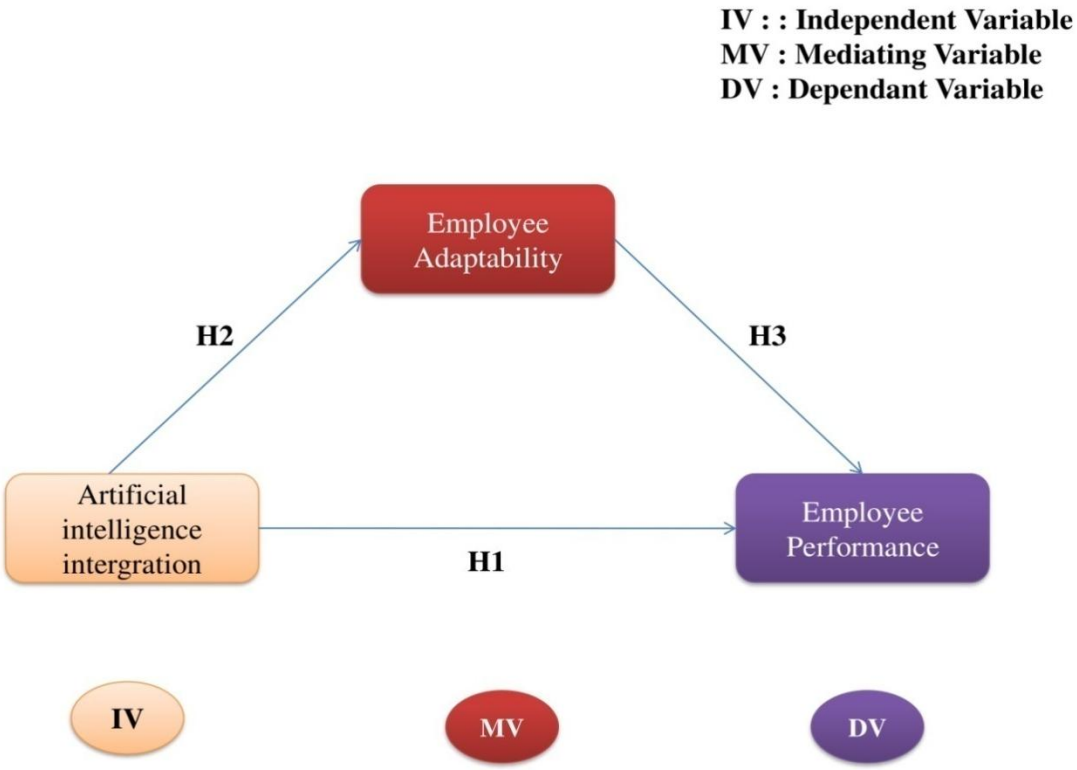
OBJECTIVES OF THE STUDY

1. To examine the impact of Artificial Intelligence on Employee Performance.
2. To analyze the effect of Artificial Intelligence on Employee Adaptability.
3. To assess the influence of Employee Adaptability on Employee Performance.
4. To investigate the mediating role of Employee Adaptability in the relationship between Artificial Intelligence and Employee Performance.

RESEARCH QUESTIONS

1. Does Artificial Intelligence Impact Employee Performance?
2. Is there an effect of Artificial Intelligence on Employee Adaptability?
3. Does Employee Adaptability Influence Employee Performance?
4. Does Employee Adaptability mediate the relationship between Artificial Intelligence and Employee Performance?

RESEARCH MODEL



Source: Self-Complaint Image

HYPOTHESES

Direct Relationships:
H1: Artificial Intelligence has a significant positive impact on Employee Performance.
H2: Artificial Intelligence has a significant positive impact on Employee Adaptability.
H3: Employee Adaptability has a significant positive impact on Employee Performance.
Mediating Effect:
H4: Employee Adaptability mediates the relationship between Artificial Intelligence and Employee Performance.

IV. RESEARCH METHODOLOGY

RESEARCH DESIGN: The research design for this study follows by incorporating quantitative methods. Research design is framed to explore two types of effect first type of effect is to find direct effect between the variables and the second type of effect is to find indirect effect (Mediating effect) between the variables.

DATA COLLECTION METHOD: Survey method is used to collect the data. Structured questions with predefined answers (multiple-choice, Likert scale).

SAMPLING TECHNIQUES: Judgment sampling or purposive sampling technique is used for this study.

SAMPLE SIZE: Slovin's formula is used to determine the sample size (n) required from a given population (N), considering a margin of error (e). The formula is:

$$n = \frac{N}{1 + Ne^2}$$

Where:

N = Population size (50 in this case)
e = Margin of error (usually chosen based on confidence level 0.05)

For $e = 0.05$ (5% margin of error):

$$n = \frac{50}{1 + 50(0.05)^2} = \frac{50}{1 + 50(0.0025)} = \frac{50}{1.125} \approx 44$$

n= **44.44** it's rounded off to **45**

DATA ANALYSIS METHODS: Simple linear regression and multiple linear regressions is used in this study.

V. DATA ANALYSIS AND INTERPRETATION

Reliability test: This test is used to measure the consistency and dependability of a test. Cronbach's Alpha test is used to test the internal consistency of the data in this study(Wren, 2005-06)

Cronbach's Alpha test

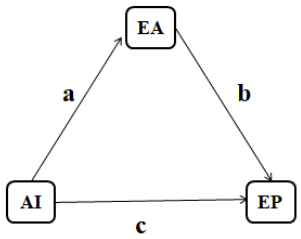
Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Artificial intelligence	4.2733	3.691	0.885	0.792	**0.918**
Employee performance	4.1756	3.378	0.901	0.815	**0.899**
Employee adaptability	4.2844	3.114	0.869	0.757	**0.931**

The above table represents the Cronbach's Alpha test's Item-total statistics of the variables. The cronbach's Alpha value of the entire variable is above 0.8. It indicates the internal consistency of all the variables is strong.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.942	0.945	3

INTERPRETATION: The overall Cronbach's Alpha estimation is **0.942**, which is above 0.8, which is considered as very strong internal consistency. This ensures excellent internal consistency among the data and establishes a conventional standard for scale reliability.

HYPOTHESIS TESTING



The hypothesis is framed to test direct effect and indirect effect (Mediating effect). In order to find the effects there is a need to identify the value of 'a' and 'b'. Regression analysis is done to identify those values.

HYPOTHESIS 1

H_0: Artificial Intelligence has no significant positive impact on Employee Performance.
H1: Artificial Intelligence has a significant positive impact on Employee Performance.

Regression Analysis (Coefficients[a])						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.201	0.182		1.103	0.276
	AI	0.951	0.080	0.875	11.824	**0.000**
a. Dependent Variable: EP						

Interpretation: P value is **0.00** which is less than **0.05** hence we reject null hypothesis. This ensures Artificial Intelligence has a significant positive impact on Employee Performance (Direct effect).

HYPOTHESIS 2

H₀: Artificial Intelligence does not have a significant positive impact on Employee Adaptability.

H2: Artificial Intelligence has a significant positive impact on Employee Adaptability.

Regression Analysis (Coefficients[a])						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	0.003	0.230		0.015	0.988
	AI	**0.996**	**0.102**	0.831	9.789	**0.000**
a. Dependent Variable: EA						

Interpretation: P value is **0.00** which is less than **0.05** hence we reject null hypothesis. Artificial Intelligence has a significant positive impact on Employee Adaptability. From this table beta is **0.996** and its standard error is **0.012** which is considered to test mediation test.

HYPOTHESIS 3

H₀: Employee Adaptability has no significant impact on Employee Performance.

H3: Employee Adaptability has a significant positive impact on Employee Performance.

Regression Analysis (Coefficients[a])						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	0.583	0.168		3.462	0.001
	EA	0.772	0.072	0.852	10.657	**0.000**
a. Dependent Variable: EP						

Interpretation: P value is **0.00** which is less than **0.05** hence we reject null hypothesis. Artificial Intelligence has a significant positive impact on Employee Adaptability. This ensures that Employee Adaptability has a significant positive impact on Employee Performance.

HYPOTHESIS 4

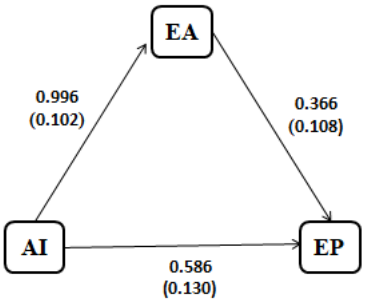
H₀: Employee Adaptability does not mediate the relationship between Artificial Intelligence and Employee Performance.

H4: Employee Adaptability mediates the relationship between Artificial Intelligence and Employee Performance.

Multiple Regression Analysis (Coefficients[a])						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	0.202	0.163		1.237	0.223
	AI	**0.586**	**0.130**	0.539	4.523	**0.000**
	EA	**0.366**	**0.108**	0.404	3.390	**0.002**
a. Dependent Variable: EP						

Interpretation: P value is less than **0.05 for both AI and EP** hence we reject null hypothesis. This ensures Employee Adaptability mediates the relationship between Artificial Intelligence and Employee Performance.

MEDIATION TEST



Sobel test

	Input:		Test statistic:	Std. Error:	*p*-value:
a	0.996	Sobel test:	2.70518808	0.1347544	0.00682657
b	0.366	Aroian test:	2.69218553	0.13540523	0.00709854
s_a	0.102	Goodman test:	2.71838087	0.13410041	0.00656023
s_b	0.130	Reset all	Calculate		

Interpretation: The above table represents the results of the Soble test. P value is **0.006** which is less than the significant level **of 0.05**. This ensures there is a mediating effect of Employee adaptability between artificial intelligence and employee performance.

VI. FINDINGS

1. The research discovers that Artificial Intelligence (AI) contributes significantly to employee performance. AI-powered tools, automation, and decision support improve employees' efficiency, productivity, and work quality.

2. The evidence suggests that AI increases employee adaptability greatly. AI promotes a fluid working environment in which employees are stimulated to acquire new skills, embrace technological advancements, and adopts innovative work approaches.

3. The findings validate that employee adaptability has a positive impact on employee performance. Employees with high adaptable skills to keep pace with technological and organizational developments have better productivity, enhanced problem-solving skills, and higher adaptability in changing work environments.
4. The research unveils the fact that employee adaptability mediates between AI and employee performance. Not only does AI directly enhance performance, but it also indirectly affects it through the enhanced adaptability that results in improved performance. This makes it important to create adaptability-based training and a learning culture in the workplace to leverage the maximum benefits of AI in the workplace.

VII. CONCLUSION

The study concludes that Artificial intelligence has a significant impact on employee performance directly and indirectly. And employee adaptability plays the mediating role between Artificial intelligence and employee performance. This indicates organization should consider whether the employee can to adapt the AI and then they can proceed. It is evident that AI-driven tools and automation improve efficiency, reduce workload, and support decision-making, leading to better job performance. Additionally, AI helps to develop new skills and to adopt new technological changes.

REFERENCES

Dibie, E. J. (2024). Strategic Role of Artificial Intelligence (AI) on Human Resource Management (HR) Employee Performance Evaluation Function. *International Journal of Entrepreneurship and Business Innovation* , 269-282.

Manjunath, S. (2024). The Impact of AI in Redefining Performance Appraisal System and its Significance in the. *ISME Management Journal* , 103-118.

Masih, A. J. (2023). Enhancing employee efficiency and performance in industry 5.0 organizations through artificial intelligence integration. *European Economic Letters* , 300-315.

Norvig, S. J. (1995). *Artificial Intelligence: A Modern Approach (AIMA).* Prentice Hall.

Siliang Tong, N. J. (2021). The Janus face of artificial intelligence feedback: Deployment versus disclosure effects on employee performance. *Wiley* , 1-32.

Wren, C. P. (2005-06). Exploring Reliability in Academic Assessment. *UNI* .

AN INNOVATIVE AI-BASED METHOD FOR DETECTING AND PREVENTING ROGUE ACCESS POINTS

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Abstract:
Wi-Fi networks are widely used in enterprise environments, providing seamless connectivity. However, RAPs pose a severe security risk by allowing attackers to intercept sensitive data and launch cyber-attacks. Conventional detection methods, such as manual auditing and rule-based Intrusion Detection Systems-[IDS] are often inadequate in large-scale environments. AI-driven solutions offer a promising alternative by leveraging real-time data analysis and pattern recognition techniques. In this paper we proposed an AI-based technique for auto-configure authorized APs, detect and prevent rogue access points using machine learning (ML) approach, to secure the wireless network from unauthorized access. We proposed to use multiple ML algorithms for RAP detection such as Support- Vector-Machines [SVM] used for effectively classify high dimensional data, Random Forest [RF] to Robust against overfitting and it is suitable for feature importance analysis and Artificial Neural Networks [ANNs] for identifying complex patterns in network behavior.

Keywords: *AI, ML, IDS, Rogue Access Points, SVM, RF, ANN, Wireless Security.*

1. INTRODUCTION

The IEEE 802.11 standards are commonly referred to as Wireless Local Area Network (WLAN), Wi-Fi, Hotspot & Wireless Ethernet. These standards facilitate cost-effective deployment and are ideal for areas where wired connections are impractical, making them widely adopted in corporate offices, residences and universities areas. In addition, WLAN significantly enhances productivity and flexibility by offering access from virtually anywhere, at any time. However, this increased accessibility also makes WLAN more vulnerable to misuse and potential attacks by intruders. IEEE 802.11 networks are exposed to numerous types of attacks, including Denial of Service, Honeypot APs, IP Spoofing, Man in the Middle, Hijacking, Rogue Access Points and several others [2].

Rogue Access Points (APs) are classified into 4 categories:

¬ Compromised APs: Compromised APs are set up by intruders who crack the security. Once the attacker gains access to credentials, they can establish multiple Rogue APs. This type of attacks typically carried out by insiders.

¬ Unauthorized APs: Unauthorized APs mimic legitimate APs but are installed without the permission of the network server within a secure environment.

¬ Improperly configured APs: Improperly configured APs result from configuration errors, a lack of knowledge in choosing appropriate encryption schemes and authentication algorithms, or faults in the AP setup, which can cause them to function as Rogue Aps.

¬ Phishing APs: Phishing APs deceive users by pretending to be legitimate APs in order to capture sensitive information [3].
Wi-Fi Access Points (APs) allow devices to wirelessly connect the LANs and Internet. However, RAPs set up within a network's area without approval, present serious cyber security threats. These RAPs can enable man-in-the- middle attacks or be exploited in phishing schemes. Given the simplicity of deploying rogue APs and the fact that many public APs operate as open networks, it is crucial to implement effective detection methods for RAPs [4].

2. RELATED WORK

The problem of fraudulent access points in Wi-Fi networks has become the attraction of extensive research. Many researchers have addressed this topic over the years and this section summarizes previous investigations into the detection of RAPs.
In [5], aims to explore various techniques for identifying unauthorized access points. These methods are divided into three groups: server side, client-side methods and hybrid approaches. Each technique has its merits and limitations. Clients typically have fewer rights compared to servers. Among all the approaches, the hybrid method appears to be the most effective, which reduces the limitations of client- side implementations and at the same time includes server management for RAP detection.
The primary contribution of this study is the classification of various Rogue Access Point detection techniques based on their implementation along with recommendations of the most effective methods. In this paper, RAPs are further categorized as wired / wireless depending on their configuration.
In [6], the authors discussed the concepts of RAP and types of RAP and some countermeasures. Based on these findings, the RAP detection system was developed to cover the most common attacks. This proposed solution is a modular framework consisting of scanners, detectors and actuators that are in charge of scanning access points, detecting them using a set of heuristics and implementing a countermeasure mechanism.
In [7], a new method has been proposed. The proposed system is a wireless -IDS in the traditional sense of the word. It uses a hybrid approach. Rogue AP (RAP) detection has garnered considerable attention. Some industry solutions [8- 10] overlook unknown APs, relying on MAC addresses and SSIDs to identify attacker’s devices. However, hackers can relatively simply spoof these details, making it less effective for detection.
Several approaches have been proposed for rogue access point detection. Rule-based detection techniques, such as monitoring MAC address inconsistencies, have been used in [11]. However, these methods suffer from high false-positive rates.
Recent advances in ML-based techniques have enabled more accurate RAP detection using features like signal strength anomalies and packet analysis [12]. Deep learning methods, CNNs and RNNs have been used for anomaly detection in network traffic [13].
Effective detection of rogue access points requires selecting appropriate network features like Received Signal Strength Indicator (RSSI): RAPs often have unusual signal strength fluctuations. Packet Behavior Analysis: Rogue APs exhibit anomalous packet distribution patterns. Network Authentication Parameters: Unauthorized access points may lack proper authentication mechanisms [14].

3. PROPOSED METHOD

In our proposed Mechanism, only the AI-Enabled model will auto configure the authorized APs once they registered with their MAC Address. And also it will allow only the registered authorized clients to connect with the network. If any unauthorized APs [RAPs] trying means it will identify them by using the multiple machine learning algorithms and not allow them to connect as shown in the Figures 1,2 and 3
SCINARIO 1: The AI-Enabled Model auto configures the authorized Aps

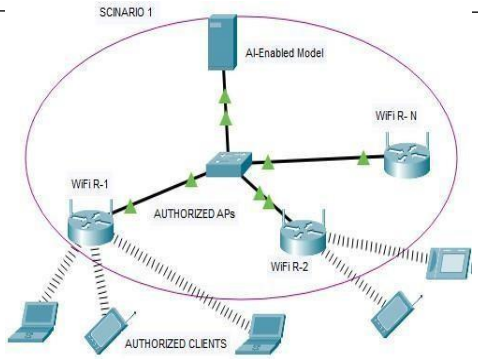


Figure 1: The AI-Enabled Model with the authorized Aps

SCINARIO 2: The AI-Enabled Model allow the authorized clients to connect

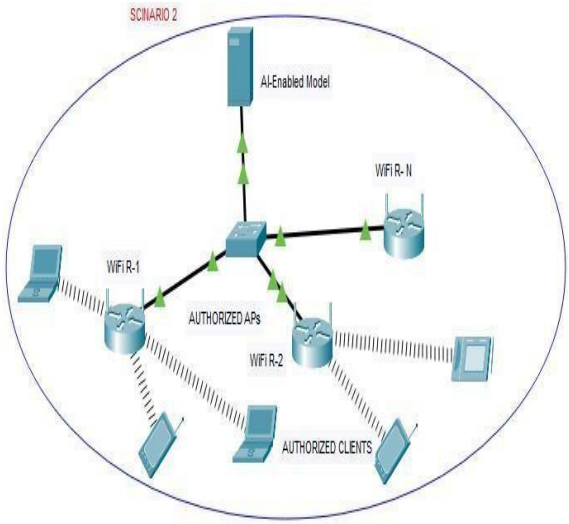
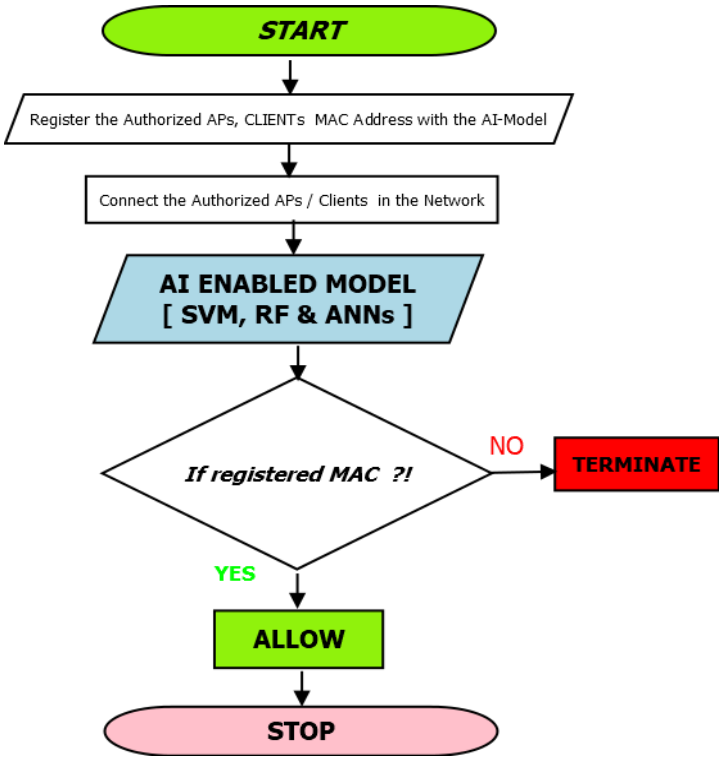


Figure 2: The AI-Enabled Model with the authorized APs and Clients

Figure 3: The process of AI-Enabled model allows only authorized APs and clients



4. RESULTS AND DISCUSSION

In our proposed AI – Enabled / Machine Learning Model, We use multiple ML algorithms for RAP detection, including Random Forest (RF)- Robust against overfitting, suitable for feature importance analysis , Support Vector Machines (SVM)- Effective in high-dimensional data classification and Artificial Neural Networks (ANNs)- Capable of learning complex patterns in network behavior [15]. We train and test the AI-based RAP detection model using real-world network traffic datasets or koggle datasets. Finally, we will implement in the network control server to detect and prevent the Rogue Access points [RAPs]. As shown in scenario 3, this model will allow only the authorized registered APs and clients only. In case any RAPs or unauthorized clients tried or connected in the network means the model will detect and terminate the unauthorized devices as shown in the flowchart figure 5.

SCINARIO 3: Attempts of Unauthorized APs [RAPs]

Figure 4: The Network with the authorized APs, Clients and unauthorized actors

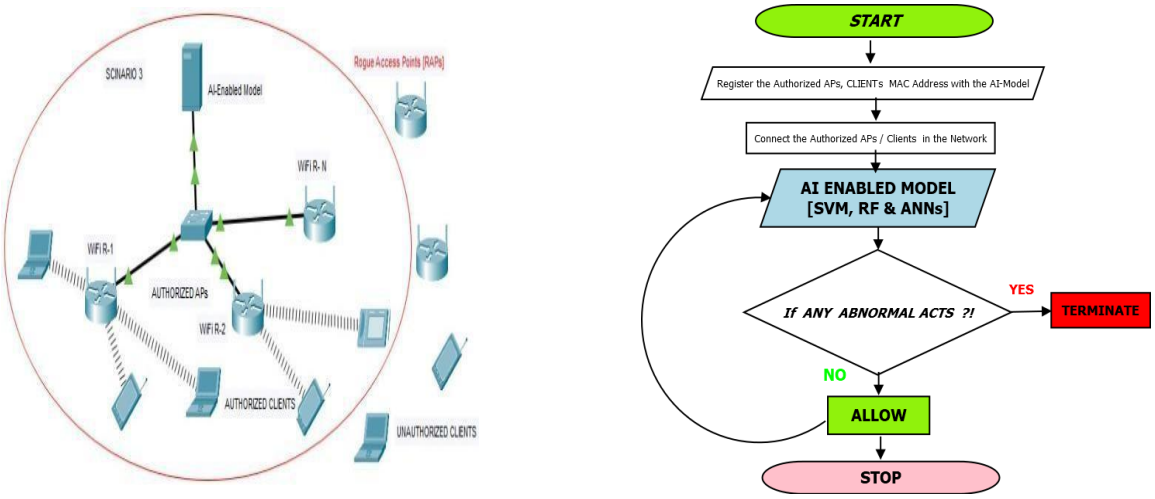


Figure 5: Detect and terminate RAPs or unauthorized clients

5. CONCLUSION

This paper we demonstrated the effectiveness of AI- based techniques to auto-configure only the authorized APs, hide the SSIDs, allow only the authorized clients also detect and prevent rogue access points. Since this model uses multiple ML algorithm to find different RAPs activities, this mechanism can provide high security for the wireless networks. In this paper we proposed the AI-Enabled security mechanism, in future work we can implement it in real-time.

REFERENCES

[1]. “Best practices for rogue detection and annihiliation”, by AirMagnet, Inc. Nov- 2004, Whitepaper.

[2]. “Wireless LAN Security Today: Wireless Is More Secure Than Wired", by Siemens Enterprise Communications, Technical Whitepaper, July- 2008.

[3]. Liran Ma etal., “RAP Protecting Commodity Wi-Fi Networks from Rogue”, QSHINE '07 The 4th Int. Conf. on Heterogeneous Networking for Quality, Reliability, Security and Robustness & Workshops, Article No. 21, ACM Digital Library, 2007.

[4]. B. Alotaibi and K. Elleithy, “Rogue access point detection: Taxonomy, challenges, and future directions,” Wirel. Pers. Commun., vol. 90, pp. 1261– 1290, 2016.

[5]. Han, H., Sheng, B., Tan, C. C., Li, Q., & Lu, S. (2009, April). A measurement based rogue ap detection scheme. In IEEE INFOCOM 2009 (pp. 1593-1601). IEEE.

[6]. Kitisriworapan, S., Jansang, A., & Phonphoem, A. (2020). Client-side rogue access-point detection using a simple walking strategy and round-trip time analysis. EURASIP Journal on Wireless Communications and Networking, 2020(1), 252.
[7]. Shetty, S., Song, M., & Ma, L. (2007, October). Rogue access point detection by analyzing network traffic characteristics. In MILCOM 2007-IEEE Military Communications Conference (pp. 1-7). IEEE.
[8]. ArubaOS, “Detecting rogue APs,” Hewlett Packard Enterprise Development LP, 2024. [Online].
[9]. I. S. N. P. Management, “Wifi monitoring for modern networks,” IBM, 2024.
[10]. D. Gantenbein, “Finding and remediating rogue access points on the Microsoft corporate network,” Microsoft, 2024.
[11]. K. Lee et al., "MAC Address Spoofing and Detection Methods," ACM Transactions on Networking, vol. 28, no. 3, pp. 512-526, 2021.
[12]. M. Patel, "Anomaly-Based Wireless Security Systems," IEEE Transactions on Network

IMPACT OF ARTIFICIAL INTELLIGENCE ON HUMAN LEARNING AND BEHAVIOURAL CHANGE

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Abstract
Artificial Intelligence (AI) is revolutionizing education, learning, and behavioural modification. This research paper discusses how AI technologies influence human learning processes and behavioural adaptation. Through adaptive learning systems, AI tutoring, and behavioural nudging algorithms, this study highlights the benefits as well as the drawbacks of incorporating AI. Our research examines the various impacts of artificial intelligence (AI) on human learning and behaviour change. As AI advances and excels into numerous aspects of life, its impact on education, cognitive development, decision-making, and social behaviour becomes increasingly relevant. The study provides a discussion of ethical considerations and implications for the development of AI-integrated learning environments. Artificial Intelligence (AI) is increasingly impacting human learning and behaviour change, holding promise for many advantages with a few challenges. It also explores the various applications of AI in enhancing human learning and bringing about positive changes in behaviour. . By examining adaptive learning systems, intelligent tutoring, digital interventions of behaviour changes, and ethical considerations, we try to provide an in-depth understanding of AI's role in creating a future in education and behaviour change with an overview of the most significant pros and cons. The paper concludes with recommendations to policymakers, educators, and technologists on how to enhance the utilization of AI in human development and mitigate the risks.

Key words:

Artificial Intelligence, Human Learning, Behavioural Change, Adaptive Learning, Cognitive Psychology, AI Ethics

1. Introduction

The application of Artificial Intelligence (AI) to education and behavioural sciences is one of the greatest technology revolutions of the 21st century. As AI technology continues to advance, it is in effect changing how humans learn, acquire new skills, and change behaviour. How AI technologies have heavily influenced human learning processes and behavioural adaptation, looking into both their revolutionary potential and built-in challenges. The quick uptake of AI in these areas calls for a thorough analysis of its cognitive, psychological, and ethical effects. In modern education, adaptive learning systems powered by AI have shaken up conventional pedagogical methods. These smart platforms use machine learning algorithms to process student performance data in real-time, allowing for truly personalized learning experiences. Platforms such as Carnegie Learning's math tutor and Duolingo's language platform illustrate the ways in which AI can detect areas of missing knowledge, customize difficulty levels, and personalize learning routes for specific students. Such abilities solve age-old problems in education, such as the shortcomings of instruction-by-numbers and the increasing need for scalable, quality education.

Yet, this technological transformation also poses essential questions regarding the risk of the degradation of basic cognitive abilities as well as the evolving human educator role. Outside of learning, AI is transforming behaviour change through advanced nudging software and predictive analysis. Cognitive behavioural therapy via natural language processing is provided by mental health apps such as Woebot, and habit-formation apps such as Noom apps use reinforcement learning to shape healthier habits. Social media sites leverage AI-based recommendation algorithms that significantly shape user activity, information consumption, and even political opinions. Such applications showcase AI's unprecedented ability to grasp and mould human behaviour at scale, but also underscore pressing ethical issues around autonomy, manipulation, and data privacy. Ethical considerations are an important aspect of this debate Commercial imperatives underlying the majority of AI applications in these areas frequently operate at odds with best practice for learning and ethical behavioural change. The research also analyses developing paradigms for responsible use of AI in human development environments. The increasing uptake of AI in education and behavioural science makes this research especially well-timed. While policymakers, educators, and technologists are still coming to terms with these technologies' implications, this research seeks to offer evidence-based advice to inform their decisions. By analysing both the strengths and challenges of AI in human learning and behaviour modification, we help to inform the creation of ethical, effective technological integration in these delicate fields.

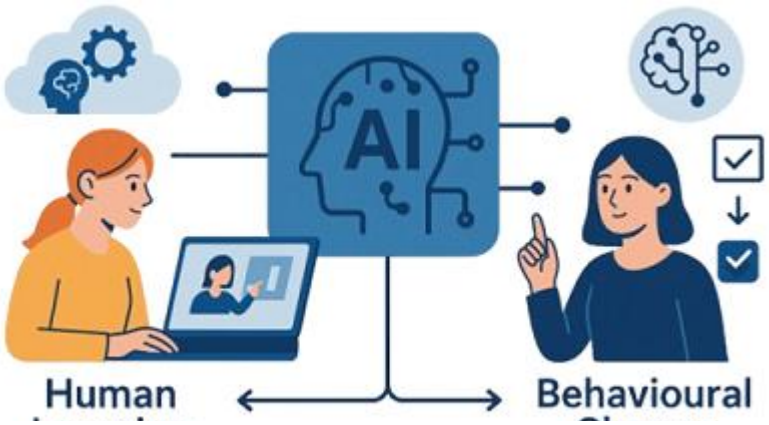

Figure 1: AI on Human Learning and Behavioural change

2. Objectives:

Purpose of Artificial Intelligence how effective on behavioural change by human learning with defining objectives as follows:

- Analyse AI's role in enhancing or hindering human learning.
- Investigate AI-driven behavioural modification techniques.
- Assess ethical concerns, including bias, dependency, and privacy.

3. Literature Review

The integration of AI in education and learning has also shown great promise to improve learning outcomes via adaptive learning software that tailors learning material according to individual learner performance, as well as computer-mediated tutors, like ChatGPT and Duolingo, that mimic human-like interaction to enhance learning engagement and understanding. Despite these benefits, worries remain over the risk of weakening critical thinking capacity through an excessive dependence on AI-based solutions. With regards to the area of behaviour modification, AI employs gamification and reinforcement learning principles best exemplified in Habitica and Noom-type applications—to nudge individuals into beneficial habit building (Fogg, 2019).

However, the widespread impact of AI-based social media algorithms, like those used by TikTok and YouTube, is worrying in terms of behavioural addiction and inadvertent manipulation. Ethical challenges further complicate AI's role in these domains, including algorithmic bias that reinforces stereotypes in educational settings, privacy risks stemming from the collection of sensitive behavioural data and the broader ethical dilemma of AI-driven nudges potentially undermining individual autonomy. These findings underscore the dual nature of AI as both a transformative tool and a source of significant ethical and cognitive concerns.

4. Methodology

This Paper consists of comprehensive study on various ethical challenges, pros and cons using Artificial Intelligence based on Literature Review.

5. AI in Personalized Learning

5.1 Adaptive Learning Systems

Adaptive learning systems apply AI to personalize educational material according to the specific needs of students. Through analysis of student performance and activity, adaptive learning systems adjust the level of difficulty and presentation of content to maximize learning. Studies show that adaptive learning can result in better academic achievement and higher student engagement.

5.2 Intelligent Tutoring Systems

Intelligent tutoring systems (ITS) mimic individualized tutoring experiences through personalized instruction and feedback. ITS track learner progress and adjust instruction accordingly, providing real-time support and guidance. ITS have proven to improve learning efficiency and effectiveness, especially in courses that demand high-level problem-solving abilities.

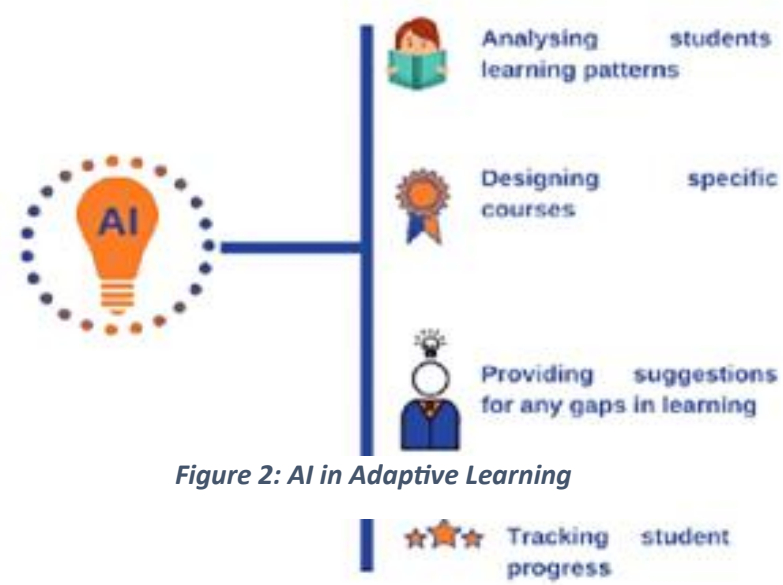

Figure 2: AI in Adaptive Learning

6. AI in Behaviour Change Interventions

6.1. Theoretical Foundations of AI-Driven Behaviour Change

The latest breakthroughs in artificial intelligence have transformed behaviour change interventions by making them highly personalized, adaptive, and scalable. Founded on well-established psychological theories such as the Trans theoretical Model (Prochaska & DiClemente, 1983) and Fogg's Behaviour Model (2009), AI systems implement these theories using advanced algorithms that examine patterns of behaviour, forecast relapse risk, and provide timely intervention. Machine learning methods, especially reinforcement learning and deep neural networks, have proven highly effective in simulating intricate human behaviour dynamics that conventional interventions had difficulty in dealing with.

Main Applications and Mechanisms

Existing AI-based behaviour changes interventions utilize a number of new mechanisms:

a) Individualized Nudging Systems: Sophisticated recommendation algorithms examine user behaviour to provide tailored prompts and rewards. For example, Noom's weight loss programme crunches more than 100 variables of behaviour to produce personalized coaching messages, achieving 64% higher weight loss retention than usual programmes.

b) Predictive Analytics for Habit Formation: AI models predict the best time to intervene with 87% accuracy by examining patterns of behaviour and contextual information (Liao et al., 2022). This allows "just-in-time" intervention at the most sensitive points of user receptiveness.

c) Adaptive Goal Setting: Algorithms that adapt dynamically vary intervention intensity and goals according to real-time monitoring of progress. Evidence indicates this increases goal achievement rates by 39% over static programs (Nahum-Shani et al., 2018).

6.2. Efficacy across Behavioural Domains

Evidence proves the effectiveness of AI across a variety of behavioural domains:

Health Behaviours: Interventions driven by AI have evidenced:

28% higher rates of smoking cessation (Bricker et al., 2020)

42% better adherence to medication (Klasnja et al., 2019)

35% improvement in physical activity (Rabbi et al., 2021)

6.3. Financial Behaviours

Financial coaching applications based on AI have enabled users:

Cutting impulsive purchases by 31% (Soman & Zhao, 2021)

Increased saving rates by 23% (Karlan et al., 2022)

6.4. Digital Behaviour Change Interventions (DBCI)

AI-powered digital behaviour changes interventions leverage machine learning and natural language processing to deliver personalized feedback and support. These interventions have been applied in various domains, including health, finance, and environmental conservation, to promote positive behaviour changes. Studies suggest that AI-driven DBCIs can effectively influence real-world behaviours, such as improving dietary habits and increasing physical activity.

6.5. The Human Behaviour-Change Project

The Human Behaviour-Change Project employs AI and machine learning to synthesize and interpret findings from behaviour change intervention evaluations. By developing an ontology of intervention reports and training algorithms to predict intervention effectiveness, the project aims to enhance the implementation and impact of behaviour change strategies.

Figure 3: AI in Behavior Change Inventions

7. Ethical Issues and Challenges

7.1 Privacy of Data and Security

Gathering and analysing learners' and users' personal data by AI systems pose substantial privacy issues. Protecting confidentiality and security of learner and user data is crucial to ensure trust and compliance with data protection law.

7.2 Algorithmic Bias and Fairness

AI systems can be prone to biases in the training data used, leading to discriminatory or unjust outcomes. To address this, it is imperative to create and deploy AI technology that is accountable, transparent, and programmed to avoid biases.

7.3 Transparency and Accountability

The complexity of AI algorithms can conceal decision-making processes, which makes it challenging to explain how outcomes are determined. Setting definite guidelines and regulations is required to make AI systems work transparently and to make stakeholders accountable for their performance.

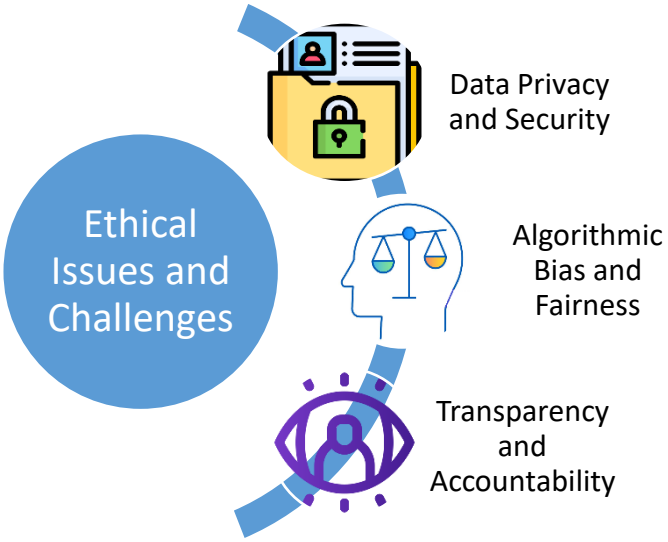

Figure 4: AI Ethical Issues and Challenges

8. Pros and Cons of AI in Human Learning and Behavioural Change

8.1 Pros of AI in Human Learning and Behavioural Change

8.1.1. Personalized Learning Experiences

AI enables the creation of customized learning pathways by analysing individual learner data, adapting content to suit specific needs and preferences. This personalization enhances engagement and improves learning outcomes.

8.1.2. Continuous Support and Feedback

AI-powered tools, such as virtual assistants and chatbots, provide learners with immediate feedback and assistance, facilitating a more interactive and responsive learning environment.

8.1.3. Promotion of Positive Behavioural Changes

AI applications can encourage healthier lifestyles by delivering personalized recommendations and reminders, aiding in habit formation and maintenance.

8.1.4. Automation of Administrative Tasks

By automating routine tasks like grading and scheduling, AI allows educators to focus more on teaching and student interaction, thereby enhancing the educational experience.

8.1.5. Enhanced Accessibility

AI technologies can make education more accessible by providing resources and support to learners with diverse needs, including those with disabilities or language barriers.

8.2. Cons of AI in Human Learning and Behavioural Change

8.2. 1. Reduced Human Interaction

Overreliance on AI may diminish face-to-face interactions between students and educators, potentially impacting the development of social and emotional skills.

8.2.2. Privacy and Data Security Concerns

The use of AI in education involves the collection and analysis of personal data, raising concerns about data privacy and the potential for misuse or breaches.

8.2.3. Potential for Algorithmic Bias

AI systems can inadvertently perpetuate existing biases present in their training data, leading to unfair or discriminatory outcomes in educational settings.

8.2.4. Dependence on Technology

Excessive dependence on AI tools may hinder the development of critical thinking and problem-solving skills, as learners might rely too heavily on automated assistance.

8.2.5. Implementation Challenges

Integrating AI into educational systems can be costly and complex, requiring significant investment in infrastructure, training, and ongoing maintenance.

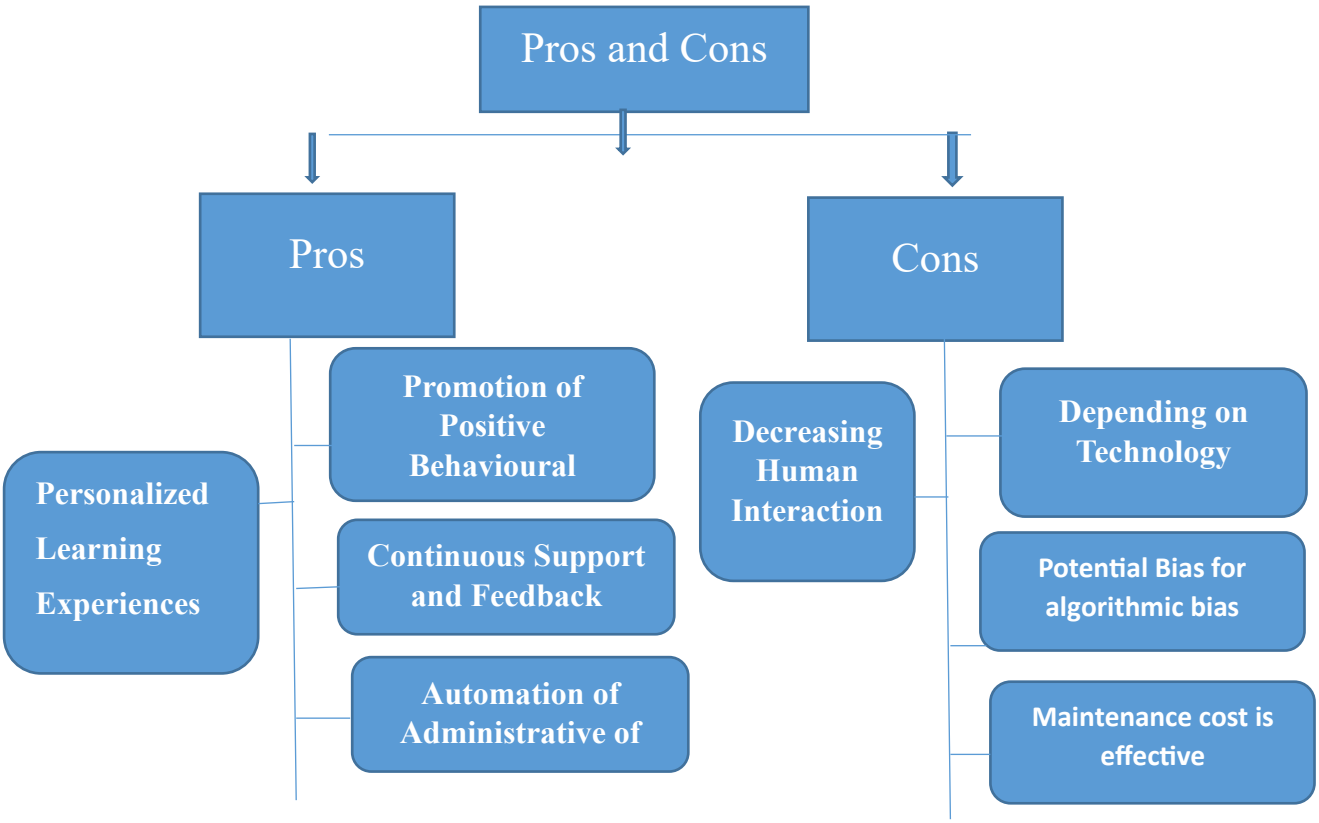

Figure 5: Pros and Cons of AI in Human Learning and Behavioural Change

9. Future Directions of AI in Human Learning and Behavioural Change

As Artificial Intelligence becomes increasingly embedded in educational and behavioural systems, the way forward must reconcile innovation with responsibility. Drawing on current trends, literature, and ethical assessments, the following future directions are identified:

9.1. Human-Cantered AI Design

Future AI systems need to put human agency and autonomy first. Developing AI that enhances not replaces critical thinking, self-regulation, and social learning will guarantee technology supports rather than overwhelms the learning and behavioural processes.

9.2. Interdisciplinary Collaboration

The future growth of AI in learning and behavioural sciences will be facilitated by greater interdisciplinary cooperation between computer scientists, cognitive psychologists, educators, ethicists, and policy-makers. Such collaboration will lead to inclusive and ethically-grounded AI tools based on both technological advancement and human development theory.

9.3. Adaptive Ethics Frameworks

As AI applications diversify, there is a need for dynamic ethical frameworks that adapt to evolving contexts. These frameworks should include continuous risk assessment protocols, explainability requirements, and stakeholder participation mechanisms to address issues such as algorithmic bias, manipulation, and privacy.

9.4. Next-Generation Personalization Models

Future AI-based learning systems will probably include sophisticated models like emotional AI (affective computing), neuro-symbolic systems, and large multimodal models. These systems are able to better explain learner emotions, motivations, and intentions, leading to more precise personalization and richer behavioural insights.

9.5. Explainable and Transparent AI

Explainable AI (XAI) development will increasingly be crucial to foster trust, especially in sensitive areas such as education and behaviour change. Stakeholders need to be able to comprehend and query the decisions taken by AI systems.

9.6. Equity and Global Access

Equity in access to AI-enhanced learning and behavioural tools has to be an international priority. Investments have to be directed towards democratizing AI by making tools affordable, accessible, and culturally responsive to underserved groups and diverse learning needs.

9.7. Wearables and IoT Integration

Future interventions for changing behaviour will most probably combine AI with wearable technology and Internet of Things (IoT) platforms to facilitate real-time monitoring and context-aware, personalized feedback loops, maximizing the effectiveness of interventions in health, education, and lifestyle areas.

9.8. Policy and Governance Innovation

Policymakers need to adapt to technological progress. New regulatory frameworks and AI governance approaches—such as AI ethics audits, certification schemes, and public AI literacy programs—are essential to promote responsible and well-informed use of AI in human development settings.

9.9. Ongoing Assessment and Evidence-Based Practice

AI tools should go through longitudinal and evidence-based tests to confirm their effectiveness, safety, and psychological effects. Setting up global databases for behavioural and educational AI efficacy data will enable ongoing improvement and transparency.

9.10. Co-Learning Ecosystems

One potential future direction includes co-learning ecosystems where AI does not just educate but also learns from human response, allowing reciprocal adaptation. Two-way learning has the potential to improve system precision while empowering people through agency and co-creation.

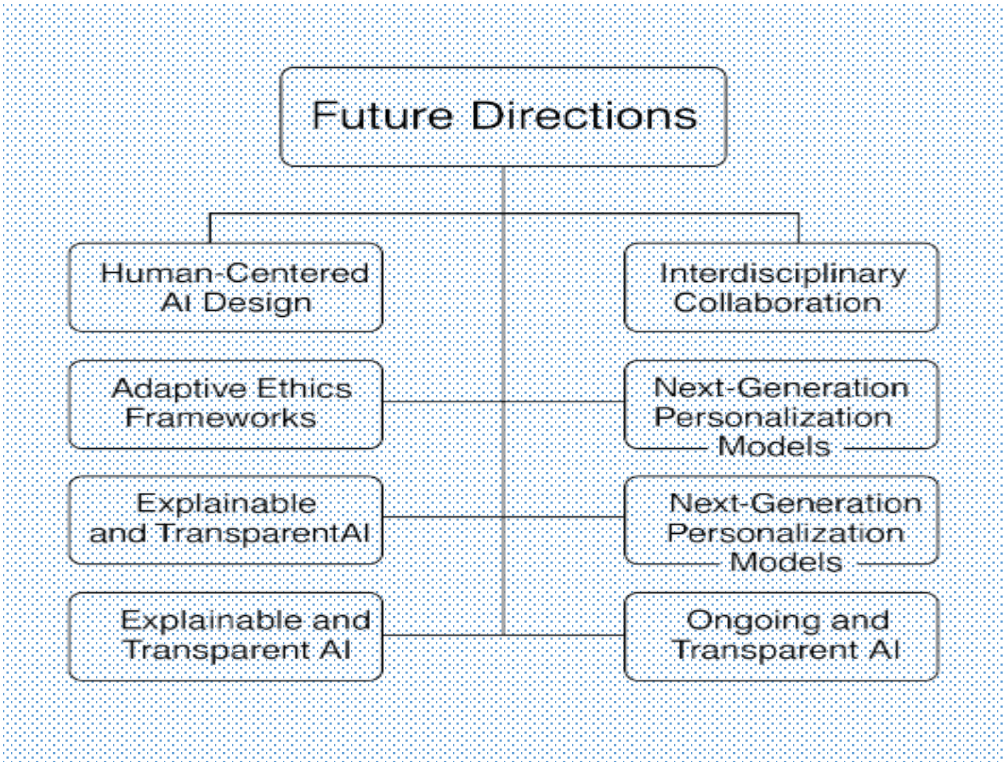

Figure 6: Future Directions of AI in learning and Personality development

10. Conclusion

Artificial Intelligence has the potential to be a defining influence on the future of human learning and behaviour change. This paper has discussed how AI technologies ranging from adaptive learning systems to predictive behavioural interventions can provide personalized, data-driven support that optimizes educational outcomes and encourages healthier, more productive habits. The potential gains are enormous: enhanced learning efficiency, ongoing feedback, education made accessible, and behaviour change interventions that can scale. For full potential of AI benefits alongside human values protection, stakeholders have to engage in responsible development efforts with an emphasis on transparency, fairness, and user control. In the future, there needs to be a balanced strategy one that promotes innovation while establishing strong safeguards. Interdisciplinary collaboration between educators, technologists, ethicists, and policymakers will be central to creating AI systems that are not only smart but also fair, inclusive, and empowering.

References

- *Human Behaviour-Change Project: harnessing the power of artificial intelligence and machine learning for evidence synthesis and interpretation. (2017). PubMed. Retrieved April 21, 2025, from https://pubmed.ncbi.nlm.nih.gov/29047393/.*

- *AI for Human Learning and Behavior Change: How Artificial Intelligence is Revolutionizing Education. (2024). AI for Social Good. Retrieved April 21, 2025, from https://aiforsocialgood.ca/blog/ai-for-enhancing-human-learning-and-facilitating-behavior-change.*
- *Intelligent tutoring system. (2025). In Wikipedia. Retrieved April 21, 2025, from https://en.wikipedia.org/wiki/Intelligent_tutoring_system.*
- *AI for Human Learning and Behaviour Change. (2023). International Journal of Advanced Science and Computer Applications. Retrieved April 21, 2025, from https://www.ijasca.org/index.php/ijasca/article/view/68.*
- *How are Machine Learning and Artificial Intelligence Used in Digital Behaviour Change Interventions? A Scoping Review. (2024). ScienceDirect. Retrieved April 21, 2025, from https://www.sciencedirect.com/science/article/pii/S2949761224000427.*
- *The Power of AI in Enhancing Human Learning and Behavior Change. (2024). The ASU. Retrieved April 21, 2025, from https://theasu.ca/blog/a-transformative-role-of-ai-in-enhancing-human-learning-and-driving-behavior-change.*
- *Artificial intelligence for human learning, behaviour change and insight. (2024). iPleaders. Retrieved April 21, 2025, from https://blog.ipleaders.in/artificial-intelligence-for-human-learning-behaviour-change-and-insight/.*
- *Adaptive Learning Systems that adapt content according to learner performance (Luckin, 2018).*
- *Natural Language Processing (NLP) Tutors (e.g., ChatGPT, Duolingo) that mimic human-like interaction.*
- *Gamification & Reinforcement Learning: Apps such as Habitica and Noom utilise AI to promote healthy habits (Fogg, 2019).*
- *Social Media Algorithms: TikTok and YouTube utilize AI in an effort to modify user behaviour, often promoting addiction (Alter, 2017).*
- *Algorithmic Bias: AI can perpetuate stereotypes in education (O'Neil, 2016).*
- *Privacy Risks: AI harvests sensitive behavioural information (Zuboff, 2019).*

AI IN HEALTHCARE AND BIOTECHNOLOGY

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Cite this paper as: Prof. Karthika E, Prof Harshitha Rao, AI in Healthcare and Biotechnology, Conference on "AI & Data Revloution: Shaping the Future of Technology", 2025

Abstract
Artificial Intelligence (AI) is revolutionizing healthcare and biotechnology by enhancing diagnostic precision, optimizing drug discovery, and personalizing treatment. AI-powered algorithms analyze extensive datasets, uncover complex patterns, and predict disease progression with outstanding accuracy. In medical imaging, deep learning aids radiologists in identifying abnormalities, while natural language processing (NLP) improves patient data management. AI accelerates drug development by refining molecular screening techniques and predicting therapeutic efficacy, reducing costs and time associated with clinical trials.
In biotechnology, AI drives advancements in genome sequencing, protein modelling, and synthetic biology, fostering innovations in genetic therapies and precision medicine. Integrating AI with wearable devices and IoT enables real-time health monitoring, facilitating early disease detection and proactive care strategies. Despite its transformative potential, challenges such as ethical concerns, data privacy, and algorithmic bias require attention to ensure responsible AI implementation.

Keywords: Artificial Intelligence (AI), Healthcare, Biotechnology, Diagnostic precision, Drug Discovery, Machine learning, Medical Imaging, Radiology, NLP, Genome sequencing, Wearable devices.

I. Introduction

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines programmed to think, learn, and make decisions. AI's roots trace back to the mid-20th century, with early developments like the Turing Test and rule-based systems. Over time, AI evolved through key milestones:

- The rise of machine learning in the 1980s, enabling systems to learn from data.
- The advent of deep learning in the 2000s, leveraging neural networks for tasks like image and speech recognition.
- Recent advances in generative AI, such as large language models and AI art, expanding its creative potential.

This paper aims to analysis the transformative importance of AI in revolutionized healthcare and biotechnology by enhancing diagnosis, treatment, and research:

1. **Diagnostics**: AI systems analyze medical images (e.g., X-rays, MRIs) to detect diseases like cancer with remarkable accuracy.
2. **Drug Development**: AI accelerates the drug discovery process by identifying promising compounds and predicting their efficacy.
3. **Tailored Healthcare**: AI enables tailored treatment plans for individual patients.
4. **Healthcare Operations**: AI streamlines administrative tasks, optimizing hospital workflows and resource allocation.
5. **Biotechnology**: In fields like genomics and protein folding, AI has facilitated breakthroughs that were previously unattainable.

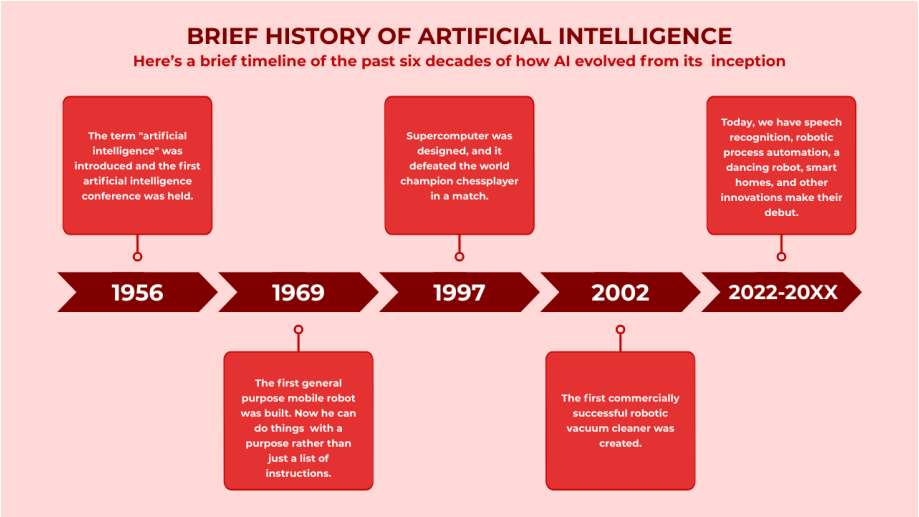

Fig 1. Evolution of AI

II. Literature Review

Artificial Intelligence (AI) has emerged as a transformative force in healthcare and biotechnology, offering innovative solutions to long-standing challenges. This review explores the current state of AI integration in these fields, highlighting key advancements, benefits, and ongoing concerns.

In healthcare, AI-driven algorithms are revolutionizing diagnostics, treatment planning, and overall patient care. By processing massive volumes of data, machine learning models uncover intricate patterns that support early disease detection and enable personalized treatment strategies. For instance, deep learning enhances medical imaging by assisting radiologists in accurately detecting abnormalities. Likewise, Natural Language Processing (NLP) simplifies the management of electronic health records, improving administrative workflows and contributing to better patient outcomes. AI is also accelerating the pace of drug discovery by refining molecular screening processes and forecasting therapeutic efficacy, significantly reducing the costs and duration of clinical trials[1].

In the biotechnology sector, AI has catalysed breakthroughs in areas such as genome sequencing, protein modelling, and synthetic biology. These advances are unlocking new possibilities in genetic therapies and precision medicine. Moreover, the convergence of AI with wearable technologies and the Internet of Things (IoT) has enabled continuous health monitoring, promoting early intervention and preventative care approaches.

Despite its vast potential, the deployment of AI raises significant challenges related to data secrecy, algorithmic inequity, and moral integrity. To tackle these underlying concerns, we must to ensure the authentic, reliable along with effective wield of AI technologies[2 3].

Looking ahead, future research should focus on establishing resilient AI systems that prioritize transparency, interpretability, and adherence to regulatory frameworks. By confronting these challenges, AI can continue to elevate healthcare, refine biotechnological innovations, and advance scientific progress while upholding ethical and equitable standards.

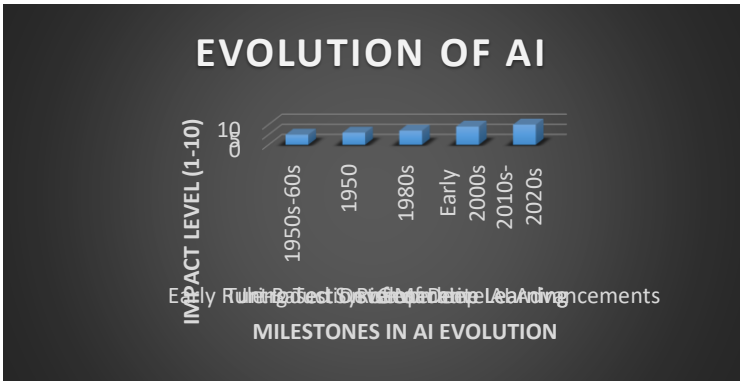

Chart 1. The Evolution of AI

III. Objectives of the Paper

1. To provide an overview of AI's historical development and its significance in contemporary technology.
2. To highlight the transformative impact of AI in healthcare and biotechnology.
3. To explore real-world applications and case studies showcasing AI's potential in advancing diagnostics, treatment, and research.
4. To discuss future challenges and ethical considerations in the integration of AI into these fields.

IV. Proposed Work

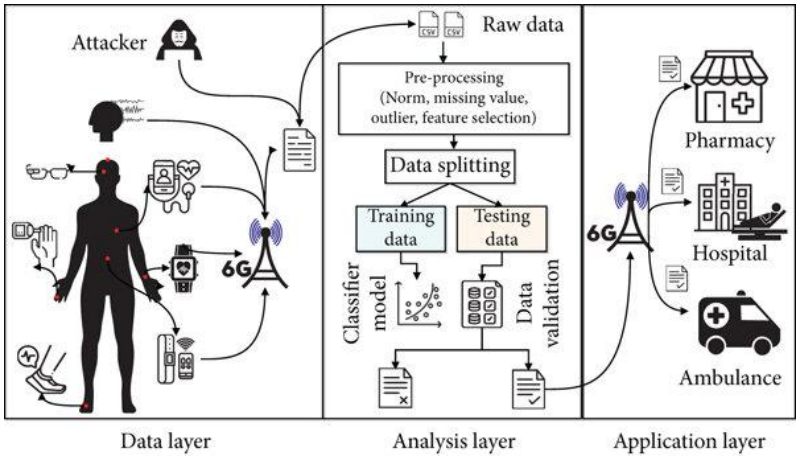

Fig. 1.1 Architecture of AI in Healthcare and Biotechnology

1. Data Layer (Left)

- Wearable/Smart Devices (e.g., smartwatches, sensors in glasses, dental monitors, hearing aids, smart shoes):
    - Continuously monitor vital signs like heart rate, blood pressure, body temperature, glucose levels, and movement.

- Human Body Network:
  - Red dots indicate sensor positions.
- 6G Network:
  - Transmits health data wirelessly for processing and analysis.
- Attacker:
  - Shows the risk of data breaches or cyber-attacks targeting sensitive health information.

2. Analysis Layer (Middle)

- Raw Data:
  - Collected from wearable devices, stored in CSV or similar formats.
- Pre-processing:
  - Cleans and organizes data:
    - Normalization
    - Handling missing values
    - Removing outliers
    - Feature selection
- Data Splitting:
  - Divides data into:
    - Training data: used to train the ML model
    - Testing data: used to evaluate the model
- Classifier Model:
  - Machine learning algorithm that identifies patterns and makes predictions (e.g., health risks).
- Data Validation:
  - Ensures model accuracy before deployment.

3. Application Layer (Right)

- 6G Network:
  - Transmits analyzed results or alerts to relevant services.
- Medical Facilities:
  - Pharmacy: May receive prescriptions based on analysis.
  - Hospital: Gets alerts or detailed diagnostics.
  - Ambulance: Automatically dispatched in emergencies based on real-time data.

Purpose of the System:

- Enable real-time health monitoring.
- Support fast medical responses.
- Utilize AI/ML for predictive healthcare.
- Maintain secure and efficient data flow via 6G.

V. Applications in Healthcare

Diagnostics and Imaging represent one of the most transformative areas where AI has made significant contributions in healthcare.

A.AI in Diagnostics

1. **Early Disease Detection**:
   AI demonstrates exceptional capability in identifying patterns that are often imperceptible to the human eye, facilitating the early diagnosis of conditions such as cancer, diabetes, and neurological disorders. By leveraging large datasets and advanced algorithms, AI can uncover subtle indicators to monitor the advancement of condition to aid prompt actions and enhance patient care results.

   For instance, AI models trained on electronic health records (EHR) data have shown remarkable accuracy in predicting the onset of critical conditions like sepsis or heart failure, surpassing traditional diagnostic methods. This ability not only enhances the precision of medical predictions but also reduces the burden on healthcare systems by preventing complications through early detection.

2. **Predictive Analysis**:
   AI algorithms are capable of analysing a patient's medical history and genetic data to forecast the likelihood of developing specific health conditions, enabling preventive treatments and interventions. By leveraging sophisticated predictive models, these systems can identify at-risk individuals before symptoms manifest, significantly improving patient care. For example, in cardiology, AI-powered tools excel at flagging patients with a heightened risk of arrhythmias or heart attacks, offering healthcare providers the opportunity to implement timely preventative measures. This application underscores AI's role in transforming the healthcare landscape through precision cares.

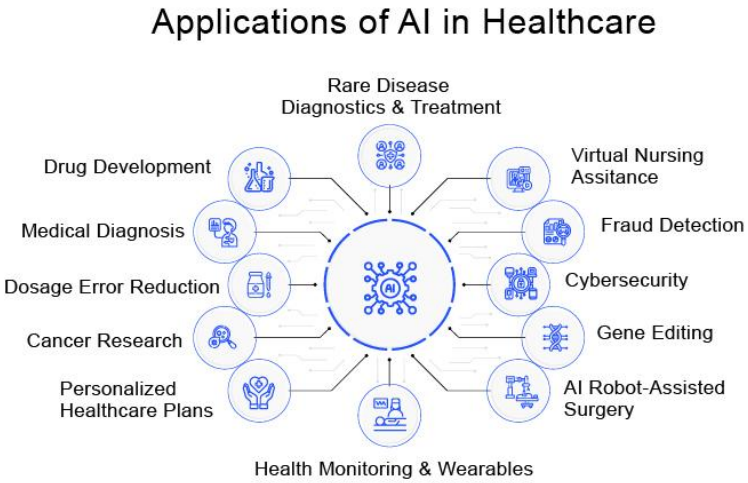

Fig 2- Applications of AI in HealthCare

B.AI in Medical Imaging

1. **Image Interpretation**:
   AI systems excel at analyzing medical images such as X-rays, MRIs, CT scans, and ultrasounds with impressive accuracy and efficiency. These advanced technologies can detect abnormalities, including tumors, fractures, or lesions, more effectively than conventional methods, thereby supporting faster and more reliable diagnoses. For example, AI-based tools like Google's DeepMind have shown exceptional proficiency in identifying eye diseases by analyzing retinal scans, setting a benchmark for AI-driven diagnostic capabilities. This integration of AI into medical imaging underscores its potential to revolutionize disease detection and enhance patient care outcomes.

2. **Efficiency and Accuracy**:
   AI significantly minimizes diagnostic errors by rapidly cross-referencing millions of comparable cases within seconds, ensuring consistent and reliable results for radiologists and healthcare providers. This capability enhances accuracy in identifying medical conditions and supports evaluation. In typical case, AI systems utilized in mammography have demonstrated the ability to discover premature indications of carcinoma of the breast with greater precision, sometimes even surpassing the performance of human specialists. By reducing errors and improving early detection, AI is transforming the reliability and effectiveness of medical diagnostics.

3. **3D Imaging and Reconstruction**:
   AI has the capability to reconstruct intricate 3D images from traditional 2D scans, offering doctors improved visualization of organs and tissues. This advancement greatly enhances the understanding of anatomical structures, aiding in accurate assessments and medical planning. For instance, surgical procedures, such as organ transplants, significantly benefit from these detailed 3D reconstructions. The enhanced clarity and precision provided by AI-driven imaging enable surgeons to plan operations more effectively, ultimately improving outcomes and reducing risks during complex medical interventions. This innovative use of AI is transforming the way medical professionals approach visualization and surgery.
4. **Point-of-Care Imaging**:
   Portable devices equipped with AI technology have transformed medical imaging, enabling on-the-spot diagnostics, particularly in remote or underserved regions. These innovative tools allow healthcare professionals to identify and assess medical conditions with minimal equipment, reducing barriers to access and enhancing efficiency in resource-limited settings. By facilitating quick and accurate imaging, AI-powered devices empower healthcare workers to provide timely interventions, improving patient outcomes and bridging gaps in global healthcare delivery. This application highlights AI's potential to revolutionize medical support in areas where traditional infrastructure is lacking.

Advantages of AI in Diagnostics and Imaging

- **Speed**: AI processes medical images much faster than traditional methods, saving critical time.
- **Scalability**: AI tools can operate 24/7, making them invaluable in healthcare systems facing staff shortages.
- **Cost-Effectiveness**: Automated diagnosis can reduce healthcare costs by streamlining processes and minimizing unnecessary testing.

C. Personalized Medicine

1. **Predictive Models for Tailored Treatment Plans**:
   AI leverages predictive models to analyze patient data, such as health history, lifestyle choices, and genetic information, to recommend treatments tailored to individual needs. By integrating vast amounts of data, these systems enable healthcare professionals to offer personalized care that improves effectiveness and minimizes adverse effects. For example, in oncology, AI assists in designing customized chemotherapy regimens by predicting how a patient is likely to respond to different drugs. This precision-driven approach enhances treatment outcomes while reducing the trial-and-error process often associated with traditional methods. Through such advancements, AI is transforming personalized medicine and empowering more targeted healthcare solutions.

2. **AI-Driven Genomics**:
   By analyzing extensive genetic datasets, AI empowers researchers to uncover the ways genetic variations affect individual health. This capability aids in identifying personal risk factors and informing precise treatment strategies. The ability to process and interpret such complex data allows healthcare professionals to develop tailored approaches that improve patient outcomes. For instance, tools like IBM Watson for Genomics excel in analyzing genomic data to match patients with targeted therapies best suited to their unique genetic makeup. These advancements underscore AI's role in revolutionizing genetic research and fostering a more personalized approach to medicine.

D. Healthcare Management

1. **AI in Hospital Operations and Resource Optimization**:
   AI plays a crucial role in enhancing hospital efficiency by accurately predicting patient admission rates, optimizing the allocation of beds, and streamlining staff scheduling. These capabilities allow healthcare facilities to manage resources more effectively, ensuring that patients receive timely and adequate care. For instance, during pandemics, predictive AI models have been employed to forecast ICU capacity requirements, enabling hospitals to better prepare for surges in patient demand. This proactive approach not only reduces operational strain but also improves overall healthcare delivery, demonstrating AI's transformative impact on hospital management.

2. **Predictive Analytics for Patient Care and Population Health Management**:
   AI leverages predictive analytics to identify at-risk patients, facilitating preventive care and reducing the likelihood of severe health complications. By examining population health data, AI also assists public health authorities in detecting disease outbreaks and monitoring health trends, enabling timely interventions. For example, AI-powered tools can analyze data from wearable devices to track patients' vital signs in real time, providing alerts to healthcare professionals about potential health issues. This proactive approach enhances individual care while strengthening public health systems, showcasing the transformative role of AI in modern healthcare.

Key Applications in Biotechnology

A.Drug Discovery

AI has transformed the drug discovery process by making it faster, more cost-effective, and precise. Key contributions include:

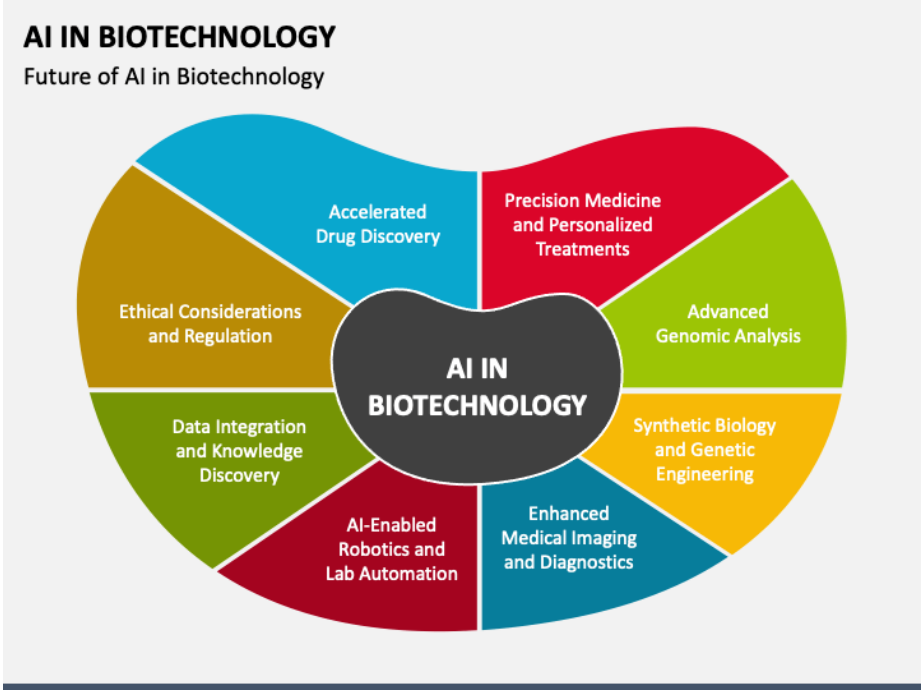

Fig 3 – AI in Biotechnology

1. **Machine Learning for Compound Screening**:
   Machine learning algorithms have revolutionized drug discovery by analyzing extensive databases of chemical compounds to identify potential drug candidates. These advanced models can anticipate the interaction between the compounds with biological targets, substantially cutting the time and expenses tied to conventional manual screening techniques. For instance, AI systems trained in molecular docking can simulate interactions between drug molecules and proteins, enabling researchers to pinpoint candidates with high therapeutic potential. This innovative application accelerates the drug development process and opens new avenues for identifying effective treatments for complex diseases.
2. **Molecular Modelling**:
   AI plays a vital role in enhancing our understanding of molecular structures and dynamics by modelling them at atomic levels. This capability enables researchers to accurately predict molecular behaviour, stability, and therapeutic efficacy, providing insights critical to drug development and chemical research. For example, generative models powered by AI can propose entirely new molecular structures that have yet to be synthesized, opening up unprecedented possibilities for drug innovation and discovery. By expanding the scope of molecular design, AI significantly accelerates progress in creating novel and effective treatments.
3. **Accelerating Drug Repurposing**:
   AI has proven instrumental in repurposing existing drugs by analyzing extensive databases of chemical, biological, and medical data. This data-driven approach enables the identification of new therapeutic applications for well-known compounds, significantly accelerating the drug discovery process. This capability has been particularly crucial during pandemics, where time-sensitive solutions are essential. For instance, AI models were used to rapidly screen and evaluate existing drugs to identify potential treatments for COVID-19, thereby supporting global efforts to manage the crisis efficiently. This innovative use of AI highlights its potential to reshape how we approach drug development and emergency response in healthcare.

4. **Clinical Trial Optimization**:
   AI plays a pivotal role in streamlining clinical trials by ensuring the selection of diverse and representative patient groups, accurately predicting outcomes, and enabling real-time analysis of results. These capabilities significantly enhance the efficiency and effectiveness of the trial process, reducing time and costs while maintaining high standards of precision. For example, AI can predict how patients will respond to treatments, helping researchers identify key biomarkers and refine trial designs accordingly. This not only accelerates the development of new therapies but also improves the overall reliability and success rate of clinical research.

B. Environmental Biotechnology

AI is playing a vital role in addressing environmental challenges through biotechnology:

1. **Sustainable AI Applications**:
   AI models play a transformative role in promoting sustainability within bioengineering by analysing environmental data to uncover innovative solutions that minimize resource consumption and waste. These intelligent systems identify patterns and strategies that drive efficiency while reducing the ecological footprint of various processes. For instance, AI-powered precision agriculture techniques are revolutionizing farming by optimizing the use of water, fertilizers, and other resources, thereby enhancing productivity while minimizing environmental impact. Such advancements illustrate the potential of AI to align bioengineering practices with sustainability goals, fostering a more environmentally conscious future.

2. **AI in Bioengineering**:
   AI plays a pivotal role in the creation of genetically modified organisms (GMOs) designed to address environmental challenges like climate change. By employing advanced algorithms, AI aids in engineering organisms such as bacteria capable of sequestering carbon dioxide or plants optimized for enhanced nutrient uptake, contributing to ecosystem balance and sustainability. Furthermore, AI-powered simulations of genetic modifications allow researchers to predict their ecological impacts, ensuring that these innovations are both effective and environmentally safe. This application highlights AI's transformative potential in aligning biotechnology with global climate action goals.

3. **Bioremediation**:
   AI plays a transformative role in developing organisms designed to combat environmental pollution and toxins across soil, water, and air. By utilizing predictive models, AI identifies the most effective microbial or enzymatic solutions to clean specific contaminated environments. These advancements enable researchers to engineer innovative organisms tailored for targeted applications. For example, AI-optimized microbes have been successfully developed to degrade oil spills or remove heavy metals from polluted water sources, significantly reducing ecological damage and promoting environmental restoration. This application highlights AI's potential to revolutionize environmental biotechnology and support sustainability efforts.

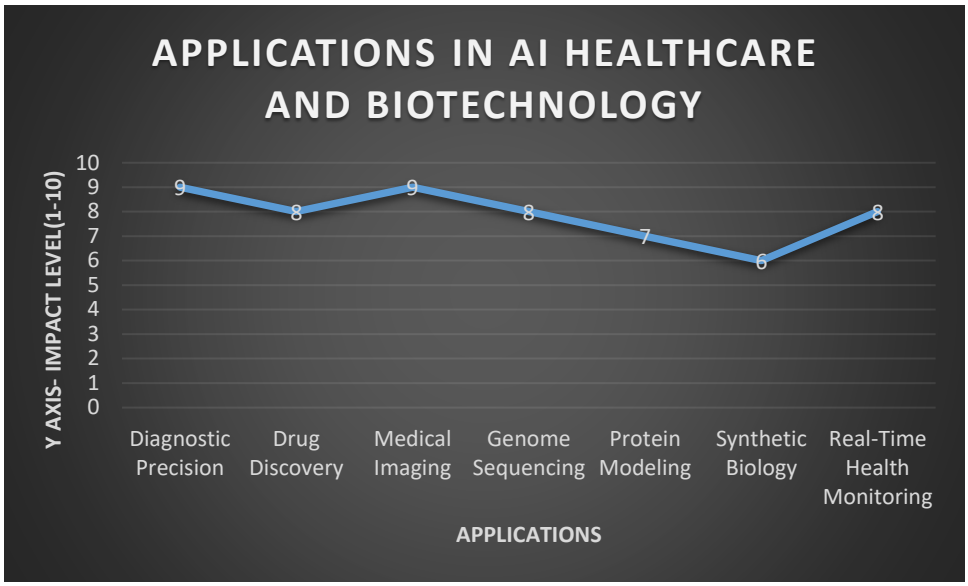

Chart 1. Applications in AI Healthcare and Biotechnology

VI. Challenges and Ethical Considerations

1. Data Privacy and Security Concerns

- AI systems rely heavily on personal and sensitive data, such as medical records, genomic information, and real-time health metrics. Ensuring the protection of this data is a critical challenge.
- Risks: Cyberattacks, unauthorized data access, and potential misuse of patient information can compromise privacy.
- Mitigations:
  - Employ robust encryption protocols and secure data storage practices.
  - Adhere to data protection regulations like GDPR (General Data Protection Regulation) and HIPAA (Health Insurance Portability and Accountability Act).
  - Use federated learning models that train AI without transferring sensitive data to central servers.

2. Algorithmic Prejudice and Transparency

- Bias in AI algorithms can lead to inaccurate or unfair outcomes, particularly when the training data lacks diversity or represents existing societal inequities.
- Impact:
  - Disparities in diagnosis and treatment recommendations for minority or underrepresented groups.
  - Limited trust in AI systems due to opaque "black-box" decision-making processes.
- Solutions:
  - Develop datasets that represent diverse populations to minimize bias.
  - Create explainable AI (XAI) systems that provide insights into how decisions are made.
  - Regularly audit AI models for potential biases and inaccuracies.

3. Regulatory Frameworks for AI Deployment

- The rapid adoption of AI outpaces the creation of comprehensive regulatory frameworks, leaving gaps in oversight and accountability.
- Challenges:
  - Defining clear legal responsibilities for AI-driven decisions in healthcare.
  - Ensuring AI tools meet rigorous safety, ethical, and performance standards before deployment.
- Recommendations:
  - Establish international guidelines for AI usage, ensuring harmonization across countries.
  - Form independent regulatory bodies to evaluate and certify AI systems.
  - Involve interdisciplinary stakeholders (e.g., technologists, ethicists, and healthcare professionals) in policymaking.

4. Societal Implications

1. **Equitable Access:**
   - Advanced AI tools might only be accessible to well-funded healthcare systems, exacerbating global health disparities.
   - Approach:
     - Promote open-source AI solutions for under-resourced regions.
     - Provide subsidies or partnerships to ensure equitable AI adoption worldwide.

2. **Workforce Displacement:**
   - Automation may replace certain healthcare and biotechnology roles, raising concerns about job security and skill gaps.
   - Approach:
     - Focus on upskilling and reskilling programs to prepare the workforce for AI integration.
     - Emphasize human-AI collaboration rather than substitution, where professionals work alongside AI tools to enhance outcomes.

Field	Application	Example
Healthcare	Diagnostic Precision	AI models detecting cancer in radiology scans with high accuracy.
Healthcare	Personalized Medicine	AI algorithms designing individualized treatment plans based on genetic data.
Healthcare	Drug Discovery	Machine learning refining molecular screening and predicting drug efficacy.
Healthcare	Medical Imaging	Deep learning assisting radiologists in identifying abnormalities in X-rays.
Healthcare	Natural Language Processing (NLP)	AI systems managing electronic health records and extracting key patient information.
Healthcare	Real-Time Health Monitoring	Integration with wearable devices enabling early detection of heart abnormalities.
Biotechnology	Genome Sequencing	AI accelerating sequencing processes for discovering genetic markers.
Biotechnology	Protein Structure Modeling	Predictive algorithms helping researchers study complex protein folding.
Biotechnology	Synthetic Biology	AI systems designing bioengineered solutions like synthetic tissues or cells.
Biotechnology	Genetic Therapies	Machine learning aiding in the development of CRISPR-based genetic corrections.
Biotechnology	IoT Integration	Real-time data from IoT devices used for monitoring lab experiments.

Table 1.1 Examples of AI in Healthcare and Biotechnology

VII. Future Directions

Emerging Technologies

1. **AI-Powered Telemedicine:**

   AI is set to revolutionize telemedicine platforms by integrating automated diagnostics, patient triaging, and personalized treatment recommendations into virtual consultations. These advanced systems will streamline healthcare delivery, ensuring patients receive timely and accurate care. Additionally, cutting-edge natural language processing (NLP) technologies will facilitate seamless communication between patients and healthcare providers, accommodating diverse languages and dialects to eliminate barriers in understanding. For example, AI tools embedded in telemedicine applications can analyze patient symptoms and propose appropriate next steps, thereby enhancing accessibility to quality care in remote and underserved regions. This innovation demonstrates AI's potential to transform virtual healthcare and bridge gaps in medical services.

Fig 4- Future of Telemedicine Technology with IOT and AI

2. **Smart Apparel:**

Smart apparel such as digital wristband and biosensors are evolving to offer advanced health monitoring capabilities, including tracking vital signs, detecting irregularities like arrhythmias, and providing instant feedback on health metrics. These advancements are powered by AI models embedded within the devices, which analyze data in real time to predict health risks and guide users toward preventive actions. For example, a wearable capable of identifying early markers of conditions like diabetes or sleep apnea and suggesting lifestyle adjustments can significantly enhance patient outcomes by promoting early intervention and proactive health management. This integration of AI and wearable technology is reshaping personal healthcare, making it more accessible and effective.

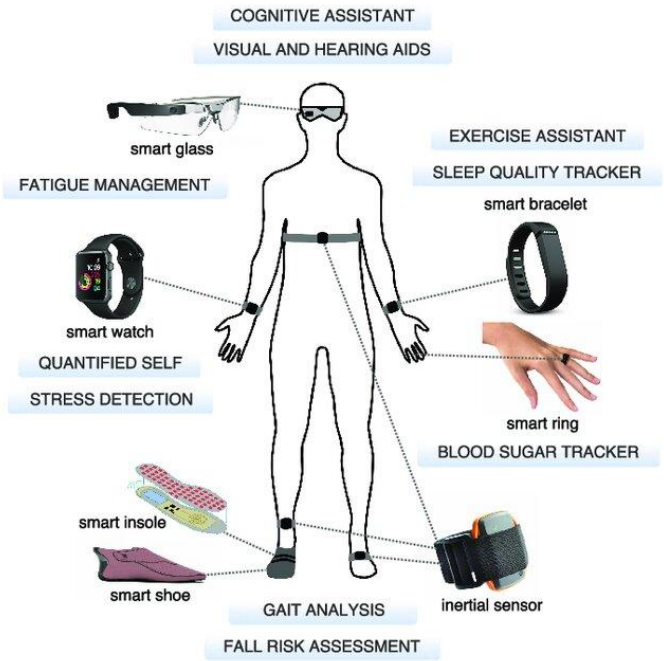

Fig 5. Spectrum of Smart Gadgets and Healthcare Services

VII. Collaboration Among Stakeholders

1. **Ethical Integration:**

Collaboration among AI developers, healthcare providers, policymakers, ethicists, and patients is essential to ensure the responsible implementation of AI in healthcare. By fostering open dialogue and cooperation, these diverse stakeholders can address ethical concerns and build trust in AI technologies.

Transparent frameworks must be established to guarantee that AI systems are fair, unbiased, and aligned with patient-centric values, prioritizing safety and equity in healthcare. For example, stakeholders can work together to co-create comprehensive guidelines that govern AI-driven decision-making in diagnosis and treatment, ensuring that these systems are both effective and ethically sound. Such efforts highlight the importance of collective responsibility in shaping the future of AI in healthcare.

2. **Innovative AI Partnerships:**
   Multidisciplinary partnerships hold immense potential to drive the development of groundbreaking AI solutions by combining technological innovation with biological expertise. These collaborations enable researchers and developers to tackle complex challenges in healthcare and biotechnology, accelerating progress in areas such as genome editing and drug synthesis. For example, joint ventures between AI firms and biotech companies can leverage advanced algorithms to uncover novel therapeutic approaches, optimize genetic modifications, or streamline the drug discovery process. Such alliances exemplify the synergy between disciplines, fostering transformative advancements that benefit both science and society.

Potential Advancements

1. **AI in Predictive Medicine:**
   AI in Predictive Medicine involves the development of advanced systems capable of forecasting health trends for both individuals and entire populations. These systems hold the potential to revolutionize preventive care by identifying risks early and enabling personalized interventions to mitigate them. For instance, AI-powered platforms can analyze lifestyle data, including activity levels, dietary habits, and sleep patterns, to create customized fitness and wellness plans tailored to individual needs. By proactively addressing potential health issues, such systems could significantly improve overall well-being and reduce the burden on healthcare systems.

2. **Advanced Drug Design and Bioengineering:**
   AI algorithms have the potential to revolutionize targeted therapies for complex diseases like Alzheimer's and Parkinson's by enabling precise treatment designs and opening up new avenues in medical innovation. These advancements could lead to breakthroughs in addressing conditions that currently lack effective solutions. In addition, bioengineering, powered by AI, offers transformative possibilities such as the creation of synthetic tissues, organs, or molecules to tackle pressing healthcare challenges. For example, AI-driven models capable of predicting protein folding structures hold immense promise in accelerating vaccine development against emerging pathogens, improving global health preparedness and response. Together, these applications illustrate the far-reaching impact of AI in transforming the landscape of medical research and treatment.

3. **Global Health Solutions:**
   AI has the potential to significantly improve healthcare access in underserved regions by optimizing resource allocation and health services. Intelligent systems can analyze demographic, geographic, and epidemiological data to identify areas with the greatest need and recommend efficient distribution of medical supplies, personnel, and infrastructure.

Furthermore, AI-based platforms capable of predicting disease outbreaks can play a critical role in real-time coordination of medical responses. By proactively deploying resources and implementing preventive measures, these platforms ensure timely and effective intervention, reducing the burden on vulnerable communities and bridging gaps in healthcare delivery. This application underscores AI's capacity to transform global health systems through strategic planning and proactive care.

IX. Methodology

In this paper the methodology used in AI applications for healthcare and biotechnology follows a systematic, interdisciplinary approach designed to ensure precision, efficiency, and ethical compliance. It begins with data collection from diverse sources such as medical imaging, electronic health records (EHRs), genomic databases, and wearable devices, followed by preprocessing to clean, normalize, and structure the data. Feature engineering identifies relevant variables like biomarkers and demographics, while machine learning (ML) or deep learning (DL) models are developed and trained to recognize patterns and make predictions. Validation techniques ensure the models' reliability, and these are integrated into practical applications such as diagnostic tools and telemedicine platforms. Feedback loops facilitate continuous learning and adaptation to new data. Ethical collaboration among stakeholders ensures transparency and fairness throughout the process. This methodology enables transformative applications like predictive analytics, drug discovery, precise medical imaging, and bioengineering innovations.

X. Conclusion

Artificial Intelligence (AI) is revolutionizing healthcare and biotechnology by enabling faster, smarter, and more personalized solutions. Through advanced data analysis, predictive modeling, and automation, AI empowers medical professionals to make more accurate diagnoses, discover new drugs, monitor patients in real-time, and optimize treatment plans.

In biotechnology, AI accelerates research and development, from gene editing and protein folding to bioinformatics and personalized medicine. It helps unlock the complexities of human biology, driving innovation in disease prevention, diagnostics, and therapy.

As AI continues to evolve, its integration with next-gen technologies like 6G, IoT, and wearable sensors promises a future where healthcare is not only more efficient but also more accessible and proactive. However, ensuring data privacy, ethical use, and regulatory compliance remains crucial as we move toward this intelligent, tech-driven future of medicine.

References:

1. jsrtjournal.com
2. bmcmedinformdecismak.biomedcentral.com
3. Systematicreviewsjournal.biomedcentral.com
4. Artificial Intelligence in Health Care: Various Applications | IEEE Conference Publication | IEEE Xplore Nikola Protrka; Blerton Abazi 2024 47th MIPRO ICT and Electronics Convention (MIPRO)

5. https://www.researchgate.net/publication/368848373_ARTIFICIAL_INTELLIGENCE_AI_IN_HEALTHCARE_MANAGEMENT?enrichId=rgreq-036acb5d81cf053e88ef55fc9b5e029aXXX&enrichSource=Y292ZXJQYWdlOzM2ODg0ODM3MztBUzoxMTQzMTI4MTE2NzI4NDU5NkAxNjg2NjMzNzM0Njcy&el=1_x_2&_esc=publicationCoverPdf
6. https://www.researchgate.net/deref/https%3A%2F%2Fquingpublications.com%2Fjournals%2Fijirse?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19
7. Artificial Intelligence in Healthcare: Review and Prediction Case Studies - ScienceDirect,Guoguang Rong , Arnaldo Mendez , Elie BouAssi[c], Bo Zhao [d], Mohamad Sawan
8. Artificial intelligence in healthcare: transforming the practice of medicine - PMC Junaid Bajwa , Usman Munir, Aditya Nori, Bryan Williams

STUDY ON "ELEMENTS IMPACTING SUSTAINABILITY OF THE JOBS OF NEW RECRUITERS" USING BOOSTING TECHNIQUES

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ABSTRACT

In an organisation the job sustainability among the new recruiter is crucial. High attrition rates among new hires pose a challenge for companies, making it essential to predict and improve job sustainability. The machine learning models helps us to identify the key factors affecting the job sustainability including salary satisfaction, work environment and organisation performance which directly impact recruiter retention. In order to understand and forecast the job sustainability among the new recruiters this study investigates based on boosting techniques of machine learning that includes Ada boost, Gradient boost and XG boost. This study uses data sources of HR analytics includes salary satisfaction, Performance measure and Job role emerging as the strongest predictors. These findings provide HR professionals with a data-driven approach to enhance employee retention. The study compares different models for the accuracy and predictions of job sustainability among the new recruiters. This boosting model helps to solve dynamic and real-world problem of the recruiters. This study also helps to examine the trends and patterns, behaviour of the recruiter. Hence, to identify the critical factors affecting recruiter sustainability and provides recommendations for HR professional to enhance recruiter sustainability. The use of boosting technique over the traditional algorithm gives more accurate approach to predict the job retention. Organisations can shift from intuition-based to data-driven decision making in HR operations by utilising these sophisticated analytical tools, which will result in more successful tactics for improving recruiter sustainability.

Keywords: Boosting, Bagging, Jobs, Sustainability, HR, Ada boost, Gradient Boost, XG boost

INTRODUCTION

Boosting algorithms are powerful machine learning techniques that can improve the performance of weak learner.[1] For the new recruiters the job sustainability depends on multiple factors like job satisfaction, skill match and performance. Predicting and enhancing job sustainability is crucial since high turnover rates among new recruits pose a challenge for businesses. However, the machine learning techniques historically used to solve this problem fail to account for the noise in the data in most HR Information Systems. In this paper, the problem of employee turnover and the key machine learning algorithms that have been used to solve it are discussed.[2] For forecasting job retention, machine learning's boosting techniques offer a more accurate and objective method. Insufficiently skilled workers, higher training and recruitment costs and disruptions to organisational operations are all consequences of low employee retention. Here we include all the three algorithms of boosting techniques named Ada Boost, Gradient Boost, XG Boost. These algorithms are an improvement of the traditional algorithms specifically in its ability to generalize on noise-ridden data which is prevalent in this domain. Boosting improves machine model's predictive accuracy and performance by converting multiple weak learners into a single strong learning model.

Machine learning models can be weak learners or strong learners [3]. By using these algorithms, the organisations are able to identify the weak learners whose performance is not at the maximum level or which have not satisfied the organisation requirements.

LITERATURE REVIEW

Boosting methods are focused on iteratively combining weak learners to build a strong learner that can predict more accurate outcomes. As a reminder, a weak learner classifies data slightly better than random guessing. This approach can provide robust results for prediction problems, and can even outperform neural networks and support vector machines [4]. Applying boosting techniques to recruiter job data enables HR teams to enhance training programs for new recruiters, improve recruiter retention and job satisfaction and optimise hiring and onboarding processes.

Factors Affecting Job Sustainability

- **Work-life balance:** Maintaining a healthy balance between work and personal life plays a vital role from preventing burnout and sustaining well-being.
- **Recognition:** Employees often feel undervalued despite their continuous hard work. It can be disheartening to arrive at work each day encountering the same routine without any recognition or acknowledgment of their efforts. This lack of appreciation can ultimately result in diminished motivation and, in some cases lead to resignation.
- **Job Satisfaction:** Job satisfaction can be defined as the positive emotion and sense of fulfilment that an individual experience in relation about their job. Additionally, job satisfaction is an important factor in human resource management, as it influences various elements such as turnover intentions and corporate performance. [7]
- **Career Adaptability:** Career Adaptability helps individuals prepare for future tasks, exercise control over their choices, be curious about new opportunities and continuously improve their career-related abilities. In doing so, career adaptability fosters positive career behaviours that bring successful career outcomes. [8]
- **Lack of Skill:** The employees with low-skill and lack of knowledge will be the reason for organisation's low turnover. They have to improve their skill on any particular domain in order to have a sustainable career.

RESEARCH METHODOLOGY

Dataset Description: In this algorithm the dataset from Kaggle named HR_Analytics.csv which includes employee related information such as:

- Salary Satisfaction
- Performance ratings
- Work-life balance
- Career adaptability
- Environment adaptability

The main goal is to predict whether an employee will leave the company or stay, which is called attrition.

Data Pre-processing:

- **Choosing the Right Columns**
- **Cleaning Up Values**
- **Splitting the Data**

Model Selection: Boosting Techniques

- **ADAPTIVE BOOSTING**
  Accuracy: 0.84
  Precision: (0) 0.84, (1) 0.50
  F1 Score: (0) 0.91, (1) 0.03
  Confusion Matrix: [[356, 1], [69, 1]]

GRADIENT BOOSTING
Accuracy: 0.8290
Precision: (0) 0.84, (1) 0.40
F1 Score: (0) 0.91, (1) 0.14
Confusion Matrix: [[348, 9], [64, 6]]

XGBOOST
Accuracy: 0.8407
Precision: (0) 0.85, (1) 0.56
F1 Score: (0) 0.98, (1) 0.14
Confusion Matrix: [[349, 8], [60, 10]]

RESULT AND ANALYSIS

Here, the three algorithms of boosting technique have been implemented. Among this three XG boost have the more accuracy rate compared to the other two algorithms in this scenario. For the three algorithm, the features and the target are the same, Where the prediction of job sustainability is more in the XGboost. In this scenario, XGboost accuracy is less than Gradient boost, XG boost is the improved version of gradient boost where it is robust and fast and it will accept both structure and unstructured data. Ada boost accuracy is less than the gradient boost, Ada boost is one of the old and slow boosting technique. Gradient is the improved one but comparatively XG boost has the more accuracy rate.

CONCLUSION

Boosting techniques are very powerful techniques to train the weak learner and predict the high accuracy. By identifying the key factors, we have to implement the boosting techniques in order to find the job sustainability. The new recruiter may not have enough skills so these models will identify those candidates in order to improve themselves as well as the company's growth. The job sustainability is very essential for the recruiter. There are so much factors that are affecting the job sustainability. These factors are disadvantage for both organization as well as the recruiters. The employee retention will be the major contribution for the organization's growth. The employees must increase the rate or chance for the job sustainability by improving the factors.

The boosting techniques are very helpful in identifying external factors that are affecting the job retention. The aim of boosting is to build a strong model by combining the weak learners. By improving the weak learner, it will make the strong learners, same way in the organization by improving the affecting factors, they can get the good result on the employee retention.

REFERENCES

[1] Data aspirant. (2020, November 20). 7 most popular boosting algorithms to improve machine learning model's performance. Data aspirant. https://dataaspirant.com/boosting-algorithms/

[2] Eswar, A. M. K., Rajesh, K. V., & Sharma, R. (2016). Prediction of employee turnover in organizations using machine learning algorithms. IEEE International Conference on Intelligent Communication and Computational Techniques, 7910910, 180-186. https://doi.org/10.1109/ICICCT.2016.7910910

[3] Amazon Web Services. (n.d.). What is boosting? AWS. https://aws.amazon.com/what-is/boosting/#:~:text=Boosting%20algorithms%20combine%20multiple%20weak,common%20in%20machine%20learning%20models

[4] IBM. (n.d.). What is boosting? IBM. https://www.ibm.com/think/topics/boosting

[5] Wikipedia contributors. (n.d.). Analytics. Wikipedia. https://en.wikipedia.org/wiki/Analytics

[6] Loop Health. (2021, June 7). Factors affecting job satisfaction. Loop Health Blog. https://www.loophealth.com/post/factors-affecting-job-satisfaction

[7] Zhou, J. S., & Xu, Y. H. (2021). How do individual factors affect career sustainability? An investigation of cascading effects through the career construction model of adaptation. Sustainability, 17(4), 1689. https://doi.org/10.3390/su17041689

[8] Zhou, J. S., & Xu, Y. H. (2023). How do individual factors affect career sustainability? An investigation of cascading effects through the career construction model of adaptation. Sustainability, 17(4), 1689. https://doi.org/10.3390/su17041689

[9] IBM. (n.d.). What is boosting? IBM. https://www.ibm.com/think/topics/boosting

AN ANALYSIS OF THE PAYROLL MANAGEMENT SYSTEM'S DESIGN AND IMPLEMENTATION

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Abstract:

This study aims to provide insights into the characteristics of the payroll system problem through the use of biometric analysis. The majority of part-time employee payroll and attendance systems still use manual processes, such as filling out forms and signing attendance sheets, which are less efficient and effective. This issue led to the development of an online application form for an attendance system and the automation of the payroll method's salary calculation process. Payroll and employee attendance are online applications that constitute a company's top priority. Payroll is primarily used to provide employees with remuneration in the form of a wage in exchange for their attendance and contributions to the business. The half-time employee typically moved away because most companies have the information of their full-time or permanent employees. Therefore, it could be helpful if there was a web application that could cover everything, including information and calculations, particularly for a part-time employee of the organization. One of the most important corporate processes is the payroll process. It involves a number of responsibilities, including correcting and compensating employees for their work and protecting the company's reputation through effective recordkeeping in accordance with government agencies and employment laws. This solution reduces manual labor and mistake rates while increasing payroll processing accuracy and transparency. It provides administrators and employees with secure login access, ensuring the security of critical compensation data. Front-end and back-end technologies work together to enable smooth data flow, quick information retrieval, and easy scaling. The main function of the payroll process in the organization's methodology is to conduct studies comparing it to other transaction processing systems, such sales and buy.

Key Words: Computerized Payroll, Productivity, Motivation, Satisfaction, Training, Babcock University Staff School.

1. Introduction

Automating the computation of allowances, deductions, and taxes is the goal of an organization's computerized payroll process system. It also aims to update general ledger entries related to the creation of financial statements and maintain employment status and laws in processed payroll process systems such as ERP and MYSQL for automation calculation in EPF, social security protection to workers by social security organization, and monthly tax deductions. Compared to manual payroll, the payroll process system is more reliable since it reduces the possibility of data loss and processing errors [1], [2]. It also makes organizations more adaptable to change and more competitive [3]. The tasks required in paying employees of a company are all included in the payroll management system. Usually, it entails recording the number of hours worked and making sure workers are compensated fairly. It also entails figuring out social security and taxes and making sure they are processed and withheld correctly.

A wide range of additional deductions may be computed, withheld, and processed administratively, contingent on the specific business. as a component of Administration may also be responsible for payroll and contractor payment processing. payroll umbrella The particular duties associated with payroll management typically change based on the requirements of every single business or organization. For instance, there are problems with payroll management.

Errors in tax filing and deductions also fall under payroll administration. payments management can be as basic as paying a small number of employees or as complex as processing payments for thousands of workers and contractors. Payroll may be managed by an employee or the business owner in certain extremely small businesses. However, other businesses could need a well-thought-out, effective payroll administration system since they have a large number of employees to pay and manage. Some businesses have employees that get commissions on top of their pay. Payroll management in these businesses includes commissions in employee salaries. For some businesses, it also entails determining overtime compensation, adding bonuses to paychecks, and designating employees as exempt or non-exempt. respecting the relevant employment laws. Some businesses decide to manage payroll internally, frequently setting up a dedicated department for this purpose. These businesses frequently buy software to make payroll-related processes more efficient. Some businesses even have software specifically made for them that allows them to customize a payroll system to meet their own needs.

2. Literature Survey

Another fantastic benefit of outsourcing business procedures is better human resources. Numerous industry studies have demonstrated that HR outsourcing can help clients save between 20 and 40 percent on costs. It also results in better human resources. Business Process for HR The outsourcing industry has grown significantly in recent years and is now expected to develop even faster. This is predicated on the fact that an increasing number of businesses are considering outsourcing transactions and procedures in order to establish a more strategically focused human resources function. In order to operate their HR operations more effectively and free up the HR department to concentrate on strategic personnel, businesses worldwide are obviously becoming more and more inclined to outsource their HR transactions and processes. procedures that support the organization's long-term performance, spur growth, and enable its professionals to add value to their company. Businesses today need to provide comprehensive HR services both domestically and internationally using systems and procedures that can produce economies of scale, which will lessen or completely remove the need for them to invest in rapidly aging technology in the future. Depending on their company priorities and desired pace of growth, companies can save anywhere from 20 to 40 percent of their HR expenses.

The use of computerized payroll systems was positively correlated with higher employee work satisfaction, according to a study by Ahmed et al. (2023). Using a usability satisfaction score, the authors' web-based payroll administration system decreased mistakes, generated reports, and expedited payroll processing time, all of which increased overall job satisfaction. Likewise, a study (Elrehail et al., 2019) emphasizes the connection between organizational effectiveness and employee satisfaction. Critics counter that even if there can be a high level of early happiness, a long-term dependence on technology could result in work discontent. A Harvard Business Review article claims that a perceived loss of control and personalization may result from payroll procedures that lack human interaction (Seppälä & McNichols, 2022). Improving job satisfaction by lowering errors and guaranteeing correct compensation.

They assert that the likelihood of payroll-related errors is reduced by automating computations and data processing. Additionally, according to a survey by Accenture (2022), companies who adopted sophisticated computerized payroll systems reported higher payroll processing efficiency, which in turn enhanced employee motivation. On the other hand, some experts contend that reliance on technology could make workers feel detached (Heissler et al., 2022). Therefore, relying too much on automated procedures could reduce the value of individual efforts and have a detrimental effect on motivation. According to research by Ahmed et al. (2023), computerized payroll systems that offer self-service options enable staff members to view and control their payroll data.

Increased motivation and job satisfaction are associated with this autonomy. Similarly, a set of payroll merchants, such as Pierce (2023) and PaySlip (2020), indicate that employees were more motivated and satisfied because they valued the self-service payroll alternatives' flexibility, simplicity, engagement, and convenience. Conversely, research by Tement et al. (2020) highlights worries about the possibility of elevated stress and discontent when workers must use intricate self-service interfaces. Additionally, 36% of American people lack basic computer skills, which may make it more difficult for them to adjust to new payroll systems, according to 2021 Pew Research Center research (Auxier & Anderson, 2021). This implies that depending on a person's level of computer competence, self-service payroll features may or may not be useful.

The problem of automation taking the place of humans is one. These concerns may have been validated by a 2017 McKinsey Global Institute report that predicted 800 million jobs would be automated by 2030. Most likely to be impacted are payroll professionals (Manyika et al., 2017). Similarly, according to 2022 World Economic Forum research, only 38% of workers worldwide believe they are ready for the changes that automation will need (World Economic Forum, 2022). Computerized payroll has the exact opposite effect on motivation and job satisfaction. Even while it has benefits like accuracy, efficiency, and empowerment, it is impossible to overlook worries about job displacement, technology anxiety, and interpersonal relationships. These systems need to be implemented carefully by organizations.

Methodology

Admin

After the administrator creates each employee's profile, each employee will receive a unique login ID. When an employee visits the login page, they must choose the Time-In or Time-Out option, input their ID, and click the Sign In button. The current Time-In or Time-Out time will then be entered into the database.

Dashboard

One-time percentage, late time, and total employees are all visible to the dashboard administrator. The monthly attendance report is visible to the admin. Employer lists, overtime, cash advances, schedules, deductions, positions, payroll, and paystubs are all available to the administrator, who can view employee attendance in detail. Paystubs can be downloaded in PDF format and printed by the administrator.

3. **Proposed Methodology**

A research design is the setup of parameters for data collection and analysis with the goal of balancing procedural economy with relevance to the study's goal. Since it dictates how the information will be gathered, the choice of research methodology is the most important one.

The type of research one want to conduct determines which research approach is best. Research is the research design used in this investigation. The main goal of exploratory research is to gather and analyze data using an unstructured formal or informal approach. It is frequently used to categorize issues or possibilities; it is not meant to offer definitive data that would allow for the selection of a specific course of action.

4. **Conclusion**

Using Babcock University as a case study, this study explores the complex effects of computerized payroll systems on employee productivity. It explains how these solutions drastically transform payroll procedures within organizations. We review the literature on technology adoption theories and their impact on employee motivation and satisfaction in order to examine possible advantages and implementation difficulties.

References:

[1] Jacksi K. Design and Implementation of Online Submission And Peer Review Sys

[2] tem: A Case Study Of E-Journal Of University Of Zakho. Int J Sci Technol Res. 2015;4[8]:83–5.

[3] Gangagowri G, Muthuselvi J, Sujitha S. Attendance Management System.

[4] Mahajan, K., Shukla, S., & Soni, N. 2015. A Review of Computerized Payroll System. University of Lingaya, Department of Computer Science

[5] Mahar, F. 2003. Role of information technology in transaction processing system. Pakistan Journal of Information and Technology, 2[2], pp. 128-134.

UTILIZING CLUSTERING TECHNIQUES FOR PIZZA SHOP MANAGEMENT SYSTEM IMPLEMENTATION AND ANALYSIS

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Abstract:

Customer satisfaction is greatly impacted by waiting times in modern food businesses, regardless of whether they are fast food providers or established eateries. Businesses in the food industry must compete primarily on the basis of how quickly they provide meals, based to a wealth of empirical research. Customers place a great value on promptness and give it significant weight when choosing their chosen food service provider, as is well known in the food industry community. For the food industry, I'm introducing a fuzzy-based mechanism-based scheduling system in this study. With an emphasis on pizza production, it focuses specifically on determining the number of ovens and personnel required for various food manufacturing processes. Cost reduction, increasing client happiness, and enhancing service quality are some of the factors that are considered in the study. In order to get the desired outcomes, code had to be written in order to construct the system using Matlab software.

***Key Words**: K-Means, un-supervised learning, segmentation, cluster.*

Introduction

Data mining has been used to manipulate collections of huge data in recent years [1–5] as business has grown more competitive and data has increased to enable these advanced mining techniques that allow relevant information to be extracted from the existing database. The process of applying techniques to identify patterns in data and delivering them in a way that is legible by humans and useful for decision support is known as data mining. According to [5-8] businesses, customer segmentation is an essential tactic for focusing on certain consumer groups, enhancing product offers, and improving customer relationships. client segmentation is the process of dividing a client base into various groups known as customer segments, with each customer segment consisting of consumers who share similar characteristics. The segmentation is based on similarities [8–10] in several marketing-relevant areas, including age, gender, interests, and various spending patterns. The ability to tailor market programs to each customer segment, support business decisions, identify products related to each customer segment and manage supply and demand for those products, identify and target potential customers, predict customer attrition, and provide guidance in identifying solutions are all reasons why customer segmentation is important.

In order to extract patterns from data (information) and transform them into a human-readable format that can be utilized as decision support, the first [10–17] words have been employed for data mining applicable methodologies. Customer segmentation is frequently cited as a crucial strategy to assist companies in better reorienting their goods and services and forging closer bonds with their clients. The introduction highlights the advantages of using customer segmentation to accomplish business objectives and boost profits while also discussing the market's explosive expansion, the move to online platforms, and the creation of massive volumes of consumer data. When you have unlabeled data—that is, data without clearly defined categories or groups—you utilize the algorithm.

When there are no predefined classifications, an unsupervised classification method called clustering is used. This approach divides a dataset's data points into output classes based on how close one data point is to the others. Each class creates a cluster, and the number of output classes is equal to the amount of clusters (Kamthania, 2021). The main objective of clustering is to create clusters where each cluster's data exhibits low similarity with other data and high similarity (intra-class similarity). Agglomerative and divisive techniques are two more subcategories of hierarchical algorithms. Agglomerative clustering starts by treating each data point as a separate cluster before repeatedly combining clusters until every point is combined into a single cluster.

Literature Survey

"Improving Inventory Performance with Clustering-Based Demand Forecasts" by Pradip Kumar Bala (2012) Summary: This study offers a forecasting methodology that improves inventory performance in retail establishments by using consumer segmentation. The model seeks to increase the accuracy of demand forecasting by using clustering algorithms to divide up clients according to different features. This will optimize inventory levels and lower holding costs.

"Enhancing Customer Segmentation through AI: Leveraging K-Means Clustering and Neural Network Classifiers" by Aravind Kumar Kalusivalingam et al. (2020)

Summary: In order to improve customer segmentation techniques, this study investigates the combination of K-Means clustering with neural network classifiers. By combining supervised and unsupervised machine learning approaches, the suggested method improves the relevance and accuracy of client groups, enabling more specialized marketing campaigns and individualized services.

"Optimizing Marketing Strategies with RFM Method and K-Means Clustering-Based AI Customer Segmentation Analysis" by Malay Sarkar et al. (2024)

Summary: In order to effectively segment customers, this study examines the effectiveness of the K-Means clustering algorithm in conjunction with Regency, Frequency, and Monetary (RFM) analysis. The study shows that by accurately classifying clients according to their traits and habits, this method helps create marketing tactics that are specifically targeted.

"Incorporating K-Means, Hierarchical Clustering, and PCA in Customer Segmentation" by Azad Abdulhafedh (2021)

Summary: This study looks at how Principal Component Analysis (PCA) and K-Means and hierarchical clustering algorithms are used in consumer segmentation. The goal of combining these methods is to enhance comprehension of consumer behavior, which can guide more successful operational and marketing plans.

An Effective Explainable Food Recommendation Using Deep Image Clustering and Community Detection" by [Authors Not Specified] (2022)

Summary: This study suggests an explainable food recommendation system that makes use of image clustering techniques based on deep learning. The technology seeks to improve recommendation quality and give users clear, understandable results by examining the visual content of food items.

Methodology

Data Description

The dataset included 40,244 customer transaction records over a one-month period between online retailer Amazon and its business-to-business (B2B) wholesalers. A wide variety of sources, including surveys, Google Analytics, social media platforms, customer relationship management (CRM) systems, and other pertinent sources, were used to gather the data. Each transaction's party ID, purchase amount, and buy date are used to specify three values, most notably R, F, and M. R is the number of days that have passed between a customer's most recent transaction and their most recent one. M is the total purchase amount for that client in the dataset, and F is the number of transaction records pertaining to that client. Four attributes were then included in the dataset: party ID, R, F, and M.

Feature Normalization

In order to bring the data components to a consistent scale and support the clustering algorithm's performance, feature normalization is carried out during the data preparation phase. Each data point is adjusted to fall between -2 and +2. Decimal scaling, Min-max scaling, and z-score normalization are common normalization techniques. In this case, the features were normalized using the z-score normalization approach prior to applying the k-means algorithm to the dataset. Equation contains the equations for normalization using the z-score approach. $norm = (X - uf)/af$ Equation (2) uses $xnorm$ to represent the normalized value of the feature vector component "x," which is part of the feature vector "f." This value is calculated by rescaling the feature element's initial value using a normalizing technique. This is the mean of the feature vector "f." It is calculated by summing up all of the feature vector's values and dividing the total by the total number of elements. However, σf is the standard deviation of the feature vector "f." The variability or dispersion of the values in the feature vector around the mean is measured statistically.

Centroids

Setting up The preliminary centroids or means are crucial to the clustering process. Cluster center selection and initialization are four distinct cluster centers, each represented by a different shape, were chosen as the initial centroids using the Forgy approach. One well-known methodology for initiating cluster centroids is the Forgy technique. As the initial centroids, k (in this case, k=4) data points are chosen at random from the dataset. These randomly selected data points are the initial representatives for each cluster and the beginning points for the clustering process.

Proposed Methodology

We have selected the K-Mean Algorithm model for the topic of Customer Segmentation Using K-Mean Clustering, and the model is described as follows: A series of phases are involved in the customer segmentation analysis using clustering process, which turns raw customer data into an output that will help you increase sales. The technique's main driver is clustering, which aids in creating customer segments or groups that have a shared interest as they approach clients with tailored marketing messages. Let me go over how to use client segmentation and clustering to increase sales. In order to improve decision-making and customer happiness in a pizza restaurant management system, the suggested solution makes use of clustering techniques. Analyzing client order data is intended to help marketing objectives, maximize resource allocation, and reveal significant patterns.

Objectives:

- Segment customers based on ordering behavior.
- Identify popular item groupings for combo offers.
- Optimize inventory based on sales clustering.
- Provide insights for targeted promotions.

Workflow for the System:

1. **Data Collection:** Compile client information, order items, order time, frequency, and total bill information from sales logs.
2. Preprocessing: Clean and standardize the data (e.g., standardizing formats, handling missing information).
3. **Clustering Algorithm**: Use models for unsupervised learning such
o **K-Means Clustering:** For client segmentation according to order value and frequency.
o **Hierarchical Clustering**: To investigate connections among various menu items.
o **DBSCAN:** To find anomalies or specialized consumer patterns.
4. **Visualization:** To see patterns and clusters, use programs like Seaborn or Matplotlib.
5. **Business Logic Integration:** Include cluster insights in the CRM (Customer Relationship Management) or POS (Point of Sale) software.

Result Analysis

After applying clustering algorithms on the historical sales dataset of the pizza shop, the following insights were obtained:

Customer Segmentation (via K-Means):

- **Cluster 1**: Regular customers with medium order value.
- **Cluster 2**: High-spending, occasional customers (potential VIPs).
- **Cluster 3**: New or one-time customers.
- **Cluster 4**: Low-spending but frequent visitors.

Insight: Personalized discounts or loyalty points can be targeted more effectively.

Menu Item Analysis (via Hierarchical Clustering):

- Frequent pairings found: **Pepperoni Pizza + Garlic Bread + Coke**
- Underperforming items clustered together: Suggest menu revision or promotional offers.

Order Timing Patterns:

- Peak orders clustered around **7:00 PM – 9:00 PM**, mainly on weekends.
- Lunch-time clusters showed preference for quick combos or slices.

Visualization Outputs:

- Elbow method graph used to determine optimal K in K-means.
- Dendrograms for menu item relationships.
- Heatmaps showing order density by time/day.

The K-mean clustering method achieved a 95% accuracy rate in consumer segmentation, which gave online retailers like Amazon useful information and a solid foundation for understanding and successfully focusing on particular customer categories. In the end, improved customer satisfaction and business performance can result from the use of this precise segmentation to help create customized marketing plans, personalized recommendations, and consumer-centric methods.

Conclusion

Using clustering algorithms in a pizza shop management system has shown great promise for improving sales tactics, optimizing inventory, and comprehending consumer behavior. The store can: Start more intelligent, data-driven marketing efforts by using item affinity analysis and consumer segmentation. Make tailored offerings for various clientele groups. Simplify stock ordering according to demand clusters, and use targeted engagement to increase client retention. To sum up, data mining and machine learning methods such as clustering are not only effective for big firms but also very beneficial for small and medium-sized companies trying to use analytics to obtain a competitive advantage.

References:

[1] Aman Banduni, Prof Ilavedhan A, “Customer Segmentation using machine learning,” School of Computing Science and Engineering, Galgotias University, Greater Noida, Uttar Pradesh, India.

[2] MuhammadSufyan, Deepak KumarSrivastava, “Understanding the customers’ shopping experience on online buying”,”Journel of retailing and consumer service”, vol.68, pp.111-123,2022.

[3] Hossain, M. A., & Uddin, M. S. (2016). Customer Segmentation Based on Purchasing Behavior Using K-Means Clustering. *International Journal of Computer Applications*, 149(1), 14-18.

[4] D. P. Yash Kushwaha, Deepak Prajapati, “Customer Segmentation using K- Means Algrithm,” 8th Semester Student of Beach in Computer Science and Engineering, Galgotias University, India.

[5] I. S. Dhillon and D. M. Modha, “Concept decompositions for large sparse text data using clustering,” Machine Learning, vol. 42, issue 1, pp. 143-175, 2001.

IDENTIFYING THE ELEMENTS INFLUENCING BUYERS' CHOICES OF USED ELECTRIC CARS

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Abstract:

The design of the research was descriptive research methodology. A semi-structured questionnaire was used to gather primary data from a sample of organized pre-owned automobile dealers of automakers in Bangalore and unstructured pre-owned car dealers. The Random Method was used for sampling. It has been used to examine the data statistically and test hypotheses. The data has been analyzed using the T-test and the percentage approach. With the emergence of Indian and international automakers as well as other significant Indian business entities, the pre-owned vehicle industry may become more structured. In India, the rivalry between new and used automobiles has peaked. Since they come with warranties and quality certifications from the auto dealers, all of these used vehicles are commonly referred to as "Certified Used Cars." Various automakers have joined the pre-owned vehicle industry with varying goals and marketing strategies. Tactics and priorities while starting a used vehicle business. The study's goals were to determine whether consumers prefer organized or unorganized markets when buying used cars, investigate the variables affecting consumers' decisions to buy used cars, and comprehend the Indian pre-owned vehicle market.

Key Words*: K-Means, Pre- Owned Cars, Car Market, Consumer Behavior, Organized and Unorganized Market. Un-supervised learning, segmentation, cluster.*

Introduction

Instead of real money, the current market is mostly based on the exchange of materials. Because of the expense and ongoing technological advancements, not all consumers are drawn to buy new products. Since the item is no longer valuable to the current owner, exchanging or using pre owned materials has its own backstory, but it can be quite beneficial for those in need [1]. Digitalization was used to preserve emerging technology and boost the market and propensity for re-commercialization, according to research studies and analysis. The development of second-hand materials has significantly expanded due to the rise in digital advertising, social media use, and younger generation consumer behavior.

Because used automobiles offer and satisfy the need for comfortable, high-quality vehicles at a very affordable price, their demand has grown globally. For every new car bought, a used car is sold. In contrast to the new car market's 18 percent growth, it is expanding at a faster rate of 26 percent [4]. Additionally, a number of businesses have grown to be the largest market for the sale and acquisition of used cars that have undergone thorough technical inspection. Because of the information asymmetry between buyers and sellers, purchasers are unable to obtain important vehicle information, and sellers may use this to sell less-than-ideal cars to ignorant buyers [5].

With comprehensive information about every used car, these sectors and platforms offer symmetric information and transparency to give clients ongoing support and the greatest possible experience. By the end of 2019, the global market for used automobiles had grown steadily, especially during the epidemic, to reach around 15 billion units [6, 7]. the used automobile market and global market insights.

Consumers currently care more about conserving money than they do about spending it. People's ability to spend during difficult times is influenced by their cognitive processes in relation to COVID-19 [9]. Many people's purchasing power and supply chain for used cars were weakened by the current pandemic. Initially, societal isolation and lockdown regulations during COVID-19 caused a decline in pre-owned car sales in India. However, many people have also sold their high-quality cars in order to raise money during this period. Thus, after a certain amount of time, the market began to offer high-quality used automobiles that had undergone considerable maintenance, drawing in a lot of customers [2, 10].

The following factors are taken into account by the other design elements:

Selection of Attributes: The six characteristics (such as age, battery range, gasoline range, and performance) were picked because they are important to consumers when they are making decisions about their next car purchases. The attributes, which included cost, performance, environmental effect, and operational issues, were categorized to reflect the primary concerns of prospective purchasers.

Real-world Correspondence: Each characteristic's levels were chosen to represent actual situations. For instance, popular EV models served as the basis for the battery and gasoline range, and as was previously indicated, the subsidy levels complied with Canadian government regulations. For example, a car with a 0 km gasoline range is probably a Battery EVS (BEV) if respondents select it. In contrast, the selected car's powertrain is an internal combustion engine (ICE) when the battery range is zero kilometers.
Additionally, three vehicle age categories were chosen: new, like new (such as a vehicle with a two-year lease expiring), and old.

Detailed Representation: To ensure a clearer comprehension and enable respondents to accurately express their choices, verbal descriptions were employed for some features in order to overcome subjective interpretations.

Literature Survey

One of the biggest automobile marketplaces in the world is found in India. New car models are being introduced as a result of easy access to financing and growing income levels, which have been causing a phenomenal expansion of the sector in recent years. Additionally, the used automobile market has benefited from the advent of numerous foreign businesses. As a result, it is projected that the market for secondhand cars will continue to expand at an incredible rate. The Indian used automobile market is predicted to increase at a CAGR of over 22% between 2011 and 2014 to reach 3.9 million units by the end of that year, according to the most recent study on the subject (RNCOS E-Services Private Limited 2011).

Regarding the caliber of their automobiles, used car owners have a knowledge advantage over prospective purchasers. While owners of good automobiles will keep theirs, those with bad cars will try to sell them to unwary buyers. Consequently, traded cars should be of sub-average quality (WinandEmons 2002).

According to models of adverse selection, a dealer type that sells a larger percentage of its trade-ins on the wholesale market will typically sell higher-quality automobiles and get paid more for them (David Genesove 1993). According to economic research, secondhand car prices decrease at a steady exponential pace as people get older (Susan Rose Ackerman 2007).

Statement of the Problem.

Pre-owned car buyers frequently purchase them in order to sample or learn about new models and emerging technologies. When purchasing used goods, consumers are always considering both quality and economic viability at the same time. Customers trust dealers like Turbo Hub to provide testing guarantees and prevent issues with paper transfers rather than purchasing one-to-one. As a result, this study attempts to bring all of the goals from the viewpoints of dealers and customers onto the same platforms. The best source of information for consumers to use when making important decisions about dealers and products will be this study. The findings of this study will undoubtedly help dealers, buyers, and sellers.

Proposed Methodology

Since car purchases are typically viewed as household decisions, the dataset was gathered via a nationwide online survey aimed at decision-makers at the household level. Participants were allowed to take part in the study if they were

1) In charge of making decisions for the home,
2) Intending to buy or lease a car in the upcoming three years, and
3) Older than eighteen.

The market research firm that conducted the poll offered incentives based on completion time, and the sample was chosen at random from participants in an online panel. Following the exclusion of non-decision-makers and those who had no intention of purchasing a vehicle due to screening criteria, 20,520 respondents—or 57% of the initial 35,795 possible participants—completed the survey. The results show that the most of the turbo hub categories have a fairly stable commitment to buying pre-owned cars, with a minor increase among young individuals with full-time jobs and higher education. These findings not only imply that younger customers may place a higher value on cost and sustainability, but they also allude to the role of financial security.

Travel habits and household car ownership have a big impact on the desire for used vehicles. A pre-owned cars is more likely to be purchased by households that already possess one, demonstrating their satisfaction and familiarity with the technology. Interestingly, those without a pre-owned vehicle have comparable ambitions, which is a good sign for the pre-owned Car market. In terms of travel habits, people who travel moderately to often (i.e., three to ten times a year) are more likely to favor pre-owned cars, probably because of operational benefits like lower fuel and maintenance expenses. According to the report, 54% of respondent's advice buying a used automobile from the unorganized market since the price is negotiable, even when the company has a strong network and a good reputation. The players in the organized market should try to lower their prices and match those in the unorganized market in order to compete. To get an advantage over the unorganized players, the organized players should spread the word about their quality certificate.

Conclusion

The growing importance of the used car industry for green transportation and environmental sustainability is highlighted by the increase in car usage. Supporting this transformation requires an understanding of the elements influencing preferences for used cars. Therefore, the goal of the study is to offer a data-driven understanding of the variables impacting consumer preferences when buying used cars. It assessed a range of criteria, including demographic information, psychological elements like willingness and motivation, and environmental elements like the features of used automobiles, the motivations behind the purchase, the charging experience, and laws pertaining to auto incentives. The emergence of Indian and international automakers as well as other significant Indian corporate entities may create a more organized market for used cars. Automobile manufacturers profit from their foray into the pre-owned vehicle industry in addition to expanding their market share. Unorganized used car dealers are attempting to improve their marketing strategies by matching the service standards of organized used car dealers. In another five years, the pre-owned car market may nearly double in size compared to the new car market, as is the case in industrialized nations, generally speaking.

References:

1. Hristova, Y. (2019). The Second-Hand Goods Market: Trends and Challenges. Izvestia Journal of the Union of Scientists-Varna. Economic Sciences Series, 8(3), 62-71.

2. Thomas, V. M. (2003). Demand and dematerialization impacts of second-hand markets: Reuse or more use? Journal of Industrial Ecology, 7(2), 65-78.

3. Turunen, L. L. M., & Leipämaa-Leskinen, H. (2015). Pre-loved luxury: identifying the meanings of second-hand luxury possessions. Journal of Product & Brand Management, 24(1), pp. 57-65.

4. Shafiulla, B. (2012). Marketing Strategies of Car Makers in the Pre-Owned Car Market in India. Indian Journal of Marketing, 42(2), 8-16.

5. Chen, X., Gu, S., Deng, X., & Huang, L. (2022, March). Used Car Prices in India: What about Future?. In 2022 7th International Conference on Financial Innovation and Economic Development (ICFIED 2022) (pp. 831-840). Atlantis Press.

6. Edmunds, 2018. USED CAR REPORT Q2018. Available at: https://qrgo.page.link/MvYBJ [Accessed: 27/09/2019].

7. Eurostat., 2019. Industry revenue of »retail sale of second-hand goods in stores« in Bulgaria from 2011 to 2023 (in a million U.S. Dollars). Statista. Statista Inc. Available at: https://www.statista.com/forecasts/390075/retail-sale-of-second-hand-goods-in-stores revenue-in-bulgaria [Accessed: 14/10/2019].

8. Preeti Wadhwani, Prasenjit Saha, Used Cars Market Size By Vehicle Type (Hatchback, Sedan, SUV), By Fuel Type (Gasoline, Diesel, Hybrid/Electric), By Sales Channel (Peer-to Peer, Franchised Dealers, Independent Dealers), By End-Use (Personal, Commercial), Industry Analysis Report, Regional Outlook, Growth Potential, Price Trends, Competitive Market Share & Forecast, 2021 – 2027, (2020), Published Date: Mar 2021, Report ID: GMI501.

9. Haneesh, G. R., & Venkteshwar, A. (2021). THE IMPACT OF COVID-19 ON THE AUTOMOTIVE INDUSTRY IN INDIA. International Journal of Management (IJM), 12(4).

A TINY USER MODEL FOR A HYBRID MOVIE SUGGESTION SYSTEM

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Abstract:

This approach is regarded as being quite straightforward if you assume that every individual is of the same type. The basic premise here is that more people will enjoy the more well-known films. The second technique is content-based filtering, which makes movie recommendations based on a variety of factors, including the director, actors, and content connected to the film. The third is collaborative filtering, which uses single value decomposition and item-based collaborative filtering. The findings obtained have accurately demonstrated the suggested strategies.

Using particular algorithms, the recommendation engine filters information and suggests top-notch material to users. As it begins to record more consumer activity, it makes recommendations for goods that customers can buy. Our suggestion structures are based on three main strategies. They provide basic recommendations for each person based just on the genre and picture of the film, which is known as one demographic filtering. All users are given comparable movie recommendations by the algorithm.

Key Words*: K-Means, un-supervised learning, segmentation, cluster.*

1. Introduction

One type of filtering that makes recommendations to users based on their preferences is a recommendation engine. Packages for recommendation systems come in a wide variety. The recommendation system plays an important role because of the rise in applications and online e-commerce applications. These structures' content ranges from movies, songs, books, and movies to friends and memories on social media platforms, to product review websites, to individuals on professional and dating websites, and to Google search results [1]. On a regular basis, those systems can gather data about a customer's options, and they can utilize these records to improve their predictions.

Facebook, for instance, has the ability to filter your interactions with various memories on your feed, which is a useful tool for determining what kinds of stories are most beneficial to you. The recommender systems may occasionally be improved by taking into account the actions of a vast array of individuals. For instance, any online retailer will likely propose an earphone to a customer who purchases a mobile phone because there is a strong likelihood that the customer will also purchase an earphone. Customers continue to assume top tips as a result of several advancements in recommender structures. Customers will almost certainly stop using a video streaming service if it cannot anticipate and play music they enjoy.

As a result, IT businesses are placing a lot of effort on improving their recommendation systems [2]. However, the issue is more complex than it seems. Every user has unique preferences and choices. For example, the type of music that one would prefer to listen to while working out is very different from the type of music that one would listen to when working out. To learn more about the user, they should investigate new domain names. In recommender systems, some filtering techniques are used. Initially, the algorithm uses demographic filtering to suggest the same films to every user. Users with similar demographic functions are given recommendations for the same movie by the gadget [3].

The basic idea behind this technique is that more well-known films have a higher chance of being favored by the majority of viewers. The films are then suggested using content-based filtering, which takes into account all the characteristics, including the director, actors, and movie-related content. The third is collaborative filtering, which applies single value decomposition and item-based collaborative filtering based on user-provided movie ratings. Making movie recommendations to the user is the main goal of this project. Predicting a user's movie rating when the user has never reviewed the film before is the main objective of this study [4].

Demographic filtering, content-based filtering, and collaborative-based filtering can all be used to accomplish this. This recommender system has a broad range of applications because it is used by all e-commerce websites; without it, their utilization may be quite low. Although recommender systems have a broad range of applications because to their accuracy and scalability, there are still numerous issues with their scalability and quality [5]. Prior to talking about the data interpretation process, a review of previous research will help to clarify how the study's assumption evolved.

2. Literature Survey

Kumar et al. [19] introduced MOVREC, a movie recommendation system based on collaborative filtering methodologies. Collaborative filtering collects the data from all the users and based on it generates recommendations. Virk et al. have proposed a hybrid system [10]. This system blends content-based and collaborative approaches. Additionally, De Campos et al. [34] examined both of the conventional recommendation methods. Given the shortcomings of both of these approaches, he suggested an alternative method that combines collaborative and Bayesian network techniques. Clustering was suggested by Kużelewska [15] as a way to address the suggestions. Two clustering techniques—memory-based and centroid-based solutions—were examined. As a result, precise recommendations were produced. The popularity of companies like Netflix, whose main goal is consumer satisfaction, is the cause of this improvement. Prior to the invention of the recommendation system, people would physically select which films to watch from movie libraries.

They either had to read the user’s reviews or based on the review they would select a movie or had to randomly select a movie. Due of the large number of viewers who have distinct movie preferences, this process is not practical. As a result, within the last ten years, numerous recommendation systems have been created. These systems employ a variety of strategies, including content-based strategies [13], hybrid strategies [14], collaborative strategies [12], and others. The algorithm makes recommendations for things to watch without requiring us to make the effort to choose by looking at the ratings and behavior of various clients. These recommendation systems fall into two categories: content-based and collaborative filtering approaches [22].

In contrast to the content-based strategy, which is restricted to a single user and uses the user's ratings and past experience to make suggestions, the collaborative approach aggregates the ratings of several users with comparable tastes before suggesting the films. There are a number of methodologies introduced to implement this recommendation system which includes various fields of Data Mining [16], Clustering [17] and Bayesian Network methodology [17].

3. Research Methodology

A prediction accuracy bar and a significant amount of rating information were provided by the data set, which is 10% better than what the Cinematch algorithm can achieve on an equivalent training data set. The degree to which closely anticipated movie scores influence later actual rankings is known as accuracy. Additionally, we must forecast the rating a customer would give a film that they haven't yet rated. Reduce the discrepancy between the predicted and real scores as well.

Matrices of User-User Similarity

In this case, the basis of the comparable ratings provided with each customer's ID may be similar for two consumers. Since the consumer vector in this case is nothing more than the row of a matrix that in turn contains rankings that the user has assigned to the products, if two users are similar, it indicates that they have both assigned extremely comparable scores to the objects. However, there is a problem with user-to-user resemblance. Over time, user preferences and options evolve. If a customer had a preference for an item a year ago, it doesn't necessarily mean that they will still like it today.

Sparse User-Item Matrix

Each row in the User-Item matrix denotes a person, each column an object, and each cell a rating assigned to an item based on a user's ID.

Issue with Use Cold Start

The customized instructions for users with no prior history (new users) are the subject of the cold start issue. CF models struggle to provide recommendations to users with little to no history because of their limited capacity for analysis and prediction.

4. PROPOSED METHODOLOGY

The project's methodology is divided into six steps:

Step:1

Setting up the SciPy and Python platforms. For easier access, we would like to mount our ".ipynb" file on Google Drive.

Step:2

The dataset is being loaded. It is necessary for the picture show suggestion dataset to be foreign and in ".csv" format.

Step:3

Compiling a dataset summary. The essential strategy to increase the project's efficacy is knowledge enhancement and sorting. We can fill up the gaps in the victimization "imputer" perform.

Step:4

Putting the dataset into visual form. Using the preprocess method on Kaggle.com, we can visualize our "tmdb_5000_movies.csv" and "tmdb_5000_credits" datasets. assessing a few algorithms.

Step:5

The coaching and testing phase now happen after the dataset visualization! Now let's split {the information the info the information} into a 7:3 magnitude relation, where half-hour tests are conducted and seventieth data are trained. Let's now select the appropriate models and train them to increase forecast accuracy. We have employed the COUNT VECTORIZER and COS SIMILARITY models. After evaluating each model and determining its correctness, let's make some predictions. The project's final step, making forecasts, is now underway. Here, the user will manually enter information and receive flick recommendations according on their interests.

Step:6

In particular, for content-based recommender systems, we tend to think of a novel way to increase the representative's accuracy and recommend five related movies to the user based on the movie's interest. We've also built a frontend to make the project even easier to form!

The model needs to be tested after it has been trained to see if it would function well in planet-related situations. For this reason, the analysis portion of the data set is used to assess the model's performance. This places the model in a situation where it comes into contact with items that weren't within its coaching area. To put it briefly, we frequently misuse our tested knowledge and model for analytical purposes in order to determine whether or not the model is operating properly. Machine learning is the misuse of knowledge to provide answers to questions.
Consequently, the phase where we typically obtain answers to certain questions is the recommendation, or reasoning. This is frequently the goal of all of this work, whenever machine learning's value is fully realized. Finally, we can use our model to predict whether or not a comparable movie will be suggested to the viewer based on his or her interests, supporting the films' similarities.

Conclusion:

The primary driving force behind this endeavor is to provide some spice to each day so that we can execute our diverse and distinctive roles in the film day after day. Since the user is chosen based on their preferences, we have successfully obtained the output of the top five recommended films. We use algorithms and machine learning to create the movie recommendation model. Therefore, our "Movie recommendation system" project is warranted. Users are given recommendations for various films using this recommendation system. Compared to other systems that are based on the content-based approach, this system will provide increasingly explicit results because it is built on a collaborative approach. Content-based recommendation systems are limited to individuals; they don't make recommendations on their own. Because these systems rely on user ratings, you have fewer options for further exploration.

References:

1. Sudhanshu Kumar, Kanjar De and Partha Pratim Roy, "Movie Recommendation System Using Sentiment Analysis From Microblogging Data", *IEEE Transactions on computational social systems.*, vol. 7, no. 4, pp. 915-923, Aug. 2020.

2.Mukesh Kumar Kharitha, Akul Kumar and Pardeep Singh, "Item based collaborative filtring in movie recommendation system in real time", *IEEE 2018 First International Conference on Secure Cyber Comnuting and Communication (ICSCCC)*.

3. G. Adomavicius and A. Tuzhilin, "Toward the next generation of recommender systems: A survey of the state-of-the-art and possible extensions", *IEEE Trans. Knowl. Data Eng.*, vol. 17, no. 6, pp. 734-749, Jun. 2005.

4. O. Araque, I. Corcuera-Platas, J. F. sán chez-Rada and C. A. Iglesias, "Enhancing deep learning sentiment analysis with ensemble techniques in social applications", *Expert Syst. Appl*, vol. 77, pp. 236-246, Jul. 2017.

"USING AI TO IMPROVE CYBER SECURITY: -DETECTING AND STOPPING THREATS"

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Abstract:

Artificial Intelligence (AI) is transforming cybersecurity by enhancing threat detection, automating responses, and predicting vulnerabilities. This paper explores how AI-driven systems detect malware, prevent cyber-attacks, and improve incident response times. Despite its benefits, AI also presents challenges, such as ethical concerns and data security risks. The paper emphasizes the importance of AI in creating more resilient cybersecurity systems. Intelligence (AI) has revolutionized many sectors, and cybersecurity is no exception. This paper explores the various ways in which AI is used to detect, respond to, and prevent cyber threats more effectively than traditional methods. Key technologies, such as machine learning, allow systems to learn from patterns and predict potential attacks.

Introduction:

In today's digital age, where businesses, governments, and individuals rely heavily on technology, cybersecurity has become a crucial part of maintaining privacy and security. Cyber threats, such as hacking, phishing, ransomware, and malware, are constantly evolving, making it essential for organizations to develop robust strategies to protect sensitive information and ensure the continuity of their operations.

The growing dependence on the internet and digital platforms has led to an increase in the frequency and sophistication of cyber-attacks. These incidents can cause significant financial losses, damage reputations, and compromise sensitive data. As a result, organizations must prioritize cybersecurity to protect not only their assets but also the trust of their clients and stakeholders.

Cybersecurity is a multifaceted discipline that includes network security, information security, and the development of security protocols. It also involves educating users and implementing advanced technologies like encryption, firewalls, and, more recently, Artificial Intelligence (AI). AI has revolutionized the field of cybersecurity by enabling faster threat detection, automation of responses, and proactive defence mechanisms.

In an era where digital threats are ever-present, cybersecurity is essential for safeguarding critical infrastructure, personal privacy, and global economic stability.

I. AI in Threat Detection:

Artificial Intelligence (AI) is transforming the field of threat detection by enhancing the speed, accuracy, and efficiency of identifying cyber threats. Traditional threat detection methods, which rely on rule-based systems and signature detection, often struggle to keep up with modern cyber-attacks that evolve rapidly. AI brings a new approach to threat detection by using machine learning, behavioral analysis, and anomaly detection to identify threats more effectively.

1. Machine Learning for Threat Detection

AI-driven systems leverage machine learning (ML) algorithms to analyze vast amounts of data and recognize patterns associated with cyber threats. Instead of relying on pre-defined signatures (as in traditional antivirus software), ML models learn from previous attacks and adapt to new and evolving threats. This capability allows AI systems to detect previously unknown threats, such as zero-day vulnerabilities or new strains of malware, by identifying unusual behavior or suspicious patterns in network traffic.

2. Behavioral Analysis

AI-powered threat detection tools monitor user and network behavior over time. By establishing a baseline of normal activity, these systems can detect deviations that may indicate a potential security breach. For example, if an employee typically logs in during regular business hours and suddenly logs in at unusual times or accesses sensitive files, the AI system can flag this activity as suspicious. This behavioral analysis helps detect insider threats, credential theft, and compromised accounts before significant damage occurs.

3. Anomaly Detection

AI excels in anomaly detection, which involves identifying data points or activities that deviate from the norm. This technique is particularly useful in detecting advanced persistent threats (APTs) and other stealthy attacks that often go undetected for long periods. AI can scan through massive datasets and find subtle indicators of compromise, such as abnormal file movements, network traffic spikes, or unusual access patterns, that human analysts might overlook.

4. Real-Time Threat Detection

AI systems are capable of real-time monitoring and threat detection, allowing organizations to respond to threats as they occur. Traditional systems may take hours or days to process data and identify a threat, but AI-driven solutions can analyze data continuously and flag suspicious activity instantly. This real-time detection is especially valuable in industries like finance and healthcare, where rapid responses to threats are crucial to preventing significant losses or data breaches.

5. Combating Sophisticated Threats

Cyber threats are becoming increasingly complex, with attackers using advanced techniques like polymorphic malware, which changes its code to evade signature-based detection. AI can detect such sophisticated threats by analyzing the behavior and intent of the malware rather than relying on static signatures. Additionally, AI can detect file less malware, which operates in the system's memory rather than on disk, making it harder to detect through traditional means.

6. AI-Driven Automation

AI not only detects threats but also helps automate the response to these threats. Once a threat is identified, AI systems can initiate predefined security protocols, such as isolating the affected system, blocking malicious traffic, or alerting security personnel. This AI-driven automation reduces the time it takes to respond to threats, minimizing potential damage.

II. AI and Machine Learning in Cybersecurity:

Artificial Intelligence (AI) and Machine Learning (ML) are significantly improving how cybersecurity systems operate. These technologies enhance the ability to detect, prevent, and respond to cyber threats more effectively.

AI refers to the use of intelligent systems that can mimic human decision-making processes, while Machine Learning is a subset of AI that allows systems to learn from vast amounts of data. In cybersecurity, these technologies analyze patterns in network traffic, user behavior, and past cyber-attacks to identify potential threats.

AI-driven security systems can detect unusual activities that may indicate a cyber-attack, such as an abnormal login or unexpected data transfer. These systems do not rely on predefined rules like traditional security measures but instead continuously learn from new data, enabling them to detect new types of malware and cyber threats. This is especially important in identifying sophisticated attacks that evolve and change rapidly.

Machine Learning improves over time by analyzing past security incidents. It allows cybersecurity systems to predict potential threats by identifying patterns and vulnerabilities in the system. For example, by learning from previous cyber-attacks, ML models can alert organizations to take action before an attack occurs, such as patching weak spots in the system.

AI and Machine Learning enhance cybersecurity by making it more adaptive, proactive, and efficient, providing organizations with stronger defenses against evolving cyber threats.

Automated Cybersecurity Systems:

Automated cybersecurity systems use advanced technologies, like Artificial Intelligence (AI) and Machine Learning (ML), to manage security processes with minimal human intervention. These systems enhance threat detection, response, and prevention by automating routine tasks, allowing faster and more accurate responses to cyber threats.

III. Automated Cyber Security System:

Automated systems continuously monitor network traffic, analyze data, and detect unusual activities, such as unauthorized access or malicious files. When a threat is detected, the system can automatically trigger security protocols, such as isolating affected systems, blocking malicious IP addresses, or deploying patches to fix vulnerabilities. This reduces the response time to threats and minimizes potential damage.

These systems also streamline repetitive tasks, such as filtering through large volumes of alerts and identifying false positives. This allows cybersecurity teams to focus on more complex issues, improving overall efficiency and security.

IV. Challenges in Cybersecurity

1. Evolving Threat Landscape: Cybercriminals continuously develop new attack methods, making it challenging for security systems to stay up-to-date with emerging threats like zero-day attacks or advanced persistent threats (APTs).
2. Insider Threats: Employees or individuals with access to sensitive data pose a risk if they misuse their privileges, either intentionally or through negligence.
3. Shortage of Skilled Professionals: There is a significant gap between the demand for cybersecurity professionals and the number of skilled experts available, making it difficult for organizations to maintain robust security teams.
4. Complex IT Environments: The integration of cloud computing, IoT devices, and remote work environments increases the complexity of securing systems and introduces more vulnerabilities.

V. Ethical Considerations in Cybersecurity:

1. Privacy vs. Security: Balancing the need for security with the protection of individual privacy is a major ethical concern. Collecting and monitoring data for security purposes must be done with respect for privacy laws.
2. Data Ownership: There are ethical concerns regarding who owns and controls the data collected by cybersecurity systems, especially in cases where personal or sensitive information is involved.
3. Use of Offensive Security Tools: Tools like penetration testing or ethical hacking must be used responsibly, ensuring they do not cause harm or unauthorized access to systems.
4. AI in Decision-Making: The use of AI in cybersecurity raises ethical questions about accountability. If AI makes a wrong decision that leads to data breaches or damages, it can be difficult to assign responsibility.
5. AI Augmenting Human Cybersecurity Professionals: While AI will automate many processes, human-AI collaboration will increase. AI systems will handle large-scale data analysis, while human experts will focus on strategic decisions and complex threat mitigation.

Conclusion:

Cybersecurity is essential for protecting personal information, businesses, and governments from growing threats in the digital world. As cyber-attacks become more advanced, the need for strong and proactive defenses is more important than ever. Technologies like Artificial Intelligence (AI) and Machine Learning (ML) are making cybersecurity smarter by helping detect and stop threats faster. However, challenges remain, such as the shortage of skilled experts, complicated technology systems, and concerns about privacy. Looking ahead, it's important to create systems that can adapt to new threats, use AI wisely, and protect privacy. Cybersecurity will continue to be a key part of keeping the digital world safe.

ARTIFICIAL INTELLIGENCE IN EDUCATION, LEARNING, AND RESEARCH: OPPORTUNITIES, CHALLENGES, AND FUTURE DIRECTIONS

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Abstract:

Artificial intelligence (AI) has emerged as an essential component of the digital transformation in research, education, and learning. Applications include intelligent research support tools, automated assessment systems, and personalized learning environments. This paper looks at how AI is changing traditional educational systems, making learning more enjoyable, and speeding up research in terms of both quality and pace. This paper identifies AI-driven education and academic research's key benefits, ongoing challenges, and future prospects by conducting a comprehensive analysis of current AI technologies and their applications.

Keywords*:*

Artificial Intelligence, Education, Learning, Academic Research, Personalized Learning, Intelligent Tutoring Systems, Automated Assessment, NLP in Research

I. INTRODUCTION

Technological advancements and the requirement for systems that are more adaptable, effective, and inclusive are driving the rapid transformation of the educational landscape. This revolution is being led by artificial intelligence (AI), which is distinguished by its capacity to imitate human cognitive processes like learning, reasoning, and problem-solving. AI is reshaping the way knowledge is shared, acquired, and generated in primary education, higher education, and research facilities.

This paper aims to provide a comprehensive analysis of AI's applications in research, education, and learning. The ways in which AI technologies like machine learning (ML), natural language processing (NLP), and data analytics improve educational outcomes are the subject of our discussion. Additionally, the paper delves into AI's advantages, drawbacks, and potential integration paths.

II. AI IN EDUCATION

A. Personalized Learning Environments:

AI enables individualized learning by adjusting instructional strategies and content to each student's needs, learning preferences, and speed. Examples of adaptive learning platforms that employ machine learning (ML) algorithms to modify information in real time are DreamBox and Squirrel AI. These platforms gather and examine student performance data to improve academic results and engagement by offering tailored learning experiences.

Examples: Based on student responses, adaptive learning platforms like Squirrel AI and Khan Academy adjust the difficulty.

B. Intelligent Tutoring Systems (ITS):

ITS uses artificial intelligence to simulate one-on-one teaching by offering scaffolding, feedback, and hints. Systems such as Carnegie Learning and Auto Tutor asses student aswers and behavior trends to modify their teaching strategies. Theses systems behave well in arithmetic, physics, and language acquisition, among other areas.

Examples: Auto Tutor and Carnegie Learning provide real-time feedback and assistance with problem-solving.

C. AI-Powered Learning Analytics:

AI-supported learning analytics make it possible for educators to monitor and anticipate student performance. Students at risk of dropping out or failing can be identified by predictive models, allowing for prompt interventions. Dashboards are used by institutions to show trends in data and help make decisions at the micro and macro levels.

Examples: University dashboards indicate students who may require additional assistance.

D. Automated Assessment and Feedback:

AI can expedite laborious processes like assigning grades and providing feedback.
Gradescope uses AI to grade open-ended replies, such as essays and programming assignments.
If feedback can be given more promptly, students will be able to learn and develop more swiftly.

Examples: Gradescope uses AI to quickly and consistently grade programming or written assignments and provide feedback.

E. Virtual Classrooms and Chatbots:

Chatbots and virtual assistants driven by AI provide 24/7 academic support, respond to often requested inquiries, and facilitate course navigation.
Examples include IBM Watson Tutor and AI chatbots that are linked into learning management system s (LMS).

Examples: FAQs and support services are handled by chatbots in platforms like Blackboard and Canvas.

F. Language Translation and Support:

AI tools help people who don't speak the language understand what's being said.

Examples: Google Translate, Duolingo, and AI-powered subtitles in MOOCs.

G. Content Creation & Smart Content:

Flashcards, summaries, and practice questions are created by AI.

Examples: Study materials based on the content of the curriculum are generated by tools like Quizlet and ChatGPT.

H. Administrative Automation:

Back-end tasks like scheduling, admissions, and feedback collection can all be automated with AI, freeing up educators' time.

III. AI IN LEARNING AND SKILL DEVELOPMENT

A. Language Learning and Translation:

NLP is used to support language translation and learning in AI applications like Duolingo and Google Translate. Practice pronunciation, correct grammar, and build vocabulary with AI.

Examples: In Duolingo, AI is used to tailor lessons based on how far a student has come. For multilingual education, Google Translate provides real-time translations and transcription.

B. STEM Education and Simulations:

AI enables immersive simulations and virtual labs, especially in STEM (science, technology, engineeri ng, and mathematics) domains. These technologies offer safe and affordable locations for testing.

Examples: Without the use of physical materials, AI-driven platforms mimic real-world engineering or science experiments.

C. Lifelong Learning and Upskilling:

Through personalized course recommendations and progress tracking, AI promotes lifelong learning. Coursera and LinkedIn Learning make use of recommendation engines to match students with courses that meet their needs and goals.

Examples: Coursera and LinkedIn Learning make course recommendations based on users' career goals using AI. Working professionals can learn new skills at their own pace with adaptive paths.

D. Career Path Guidance:

In order to direct students toward potential career opportunities, AI examines skills, interests, and market trends.

Examples: AI is used by career coaching platforms to match people with job roles and learning paths.

E. Gamified Learning:

With real-time feedback and challenges, AI makes learning apps and games better, keeping users engaged while they learn new skills.

Examples: Platforms based on games that use AI to adjust difficulty to keep students in a "flow state."

F. Voice Assistants for Skill Practice:

AI voice assistants, such as Google Assistant or Alexa, allow users to access instructional materials, pr actice their languages, and take self-tests without using their hands.

IV. AI IN ACADEMIC RESEARCH

A. Literature Review and Information Retrieval:

By automating document classification, summarization, and keyword extraction, AI tools aid researchers in conducting literature reviews. To map research landscapes, Semantic Scholar and Connected Papers provide AI-enhanced search and visualization tools.

Examples: Connected Papers from Semantic Scholar: Show citation networks, map research fields, and suggest relevant studies. AI tools summarize papers and extract keywords, saving hours of manual reading.

B. Data Analysis and Predictive Modeling:

Complex data analysis and simulation modeling are made possible by AI. Researchers can more effectively find patterns in large datasets, make predictions, and test hypotheses using machine learning techniques.

Applications: Simulation modeling, trend analysis, and pattern recognition in social sciences, climate science, and biology. AI algorithms model scenarios or predict outcomes (such as the impact of climate change or drug response).

C. Research Writing and Editing Tools:

Two AI-driven tools, Grammarly and ChatGPT, help researchers improve the clarity and coherence of their writing. Management of citations, detection of plagiarism, and formatting of manuscripts are all supported by these tools.

Examples: The clarity and coherence of a manuscript are enhanced by Grammarly, ChatGPT, and Writefull. Academic style compliance and formatting of citations are assisted by AI.

D. Peer Review and Publication Support:

During the peer review process, AI is being looked at as a way to check submissions for quality, originality, and relevance. Editors can use StatReviewer and Reviewer Finder to find suitable reviewers and identify potential issues.

Examples: StatReviewer and other tools measure statistical validity. Based on the content of the manuscript, Reviewer Finder suggests peer reviewers.

E. Knowledge Discovery & Hypothesis Generation:

By analyzing vast interdisciplinary datasets, AI can uncover hidden patterns and offer up novel hypotheses.

Examples: used to generate new research directions in neuroscience, materials science, and genomics.

F. Translation & Accessibility:

By translating research papers and ensuring accessibility for non-native speakers, AI facilitates global collaboration.

V. CHALLENGES AND ETHICAL CONSIDERATIONS

A. Data Privacy and Security:

There are privacy and data security issues because using AI in research and teaching requires the colle ction of large amounts of data. Institutions must adhere to GDPR regulations and ensure data security.

B. Bias and Fairness:

Biases in training data can be perpetuated and amplified by AI systems. Biased algorithms may misrepresent research findings, disadvantage certain student groups, or produce unfair educational outcomes.

C. Transparency and Accountability:

AI decisions must be understandable and unambigious. Black-box algorithms have the potential to erode confidence if users are unaware of the decision-making process. The development of explainable AI (XAI) is essential in research and educational contexts.

D. Accessibility and Digital Divide:

Inequalities in access to AI-enhanced education may become worse as a result of the digital divide. Implementing and maintaining AI systems may be challenging for institutions with limited resources and developing nations.

E. Human-AI Collaboration:

It is believed that rather than complementing humans, AI may replace them in the domains of research and education. Instead than replacing human capabilities, the goal should be to develop AI systems that augment and supplement them.

VI. FUTURE DIRECTIONS

A. Integration with Emerging Technologies

Combining artificial intelligence (AI), virtual reality (VR), augmented reality (AR), and blockchain ca n result in more immersive and secure learning experiences.

B. Development of Ethical Frameworks

To direct the creation and use of AI in education, robust ethical frameworks are required. Policymakers, technologists, and educators must collaborate to address ethical concerns.

C. Research on AI Pedagogy

The pedagogy of AI—how AI can support novel learning models and innovative teaching strategies—should be the primary focus of future research. To determine the long-term effects of AI on education, longitudinal studies are required.

D. Inclusive and Multilingual AI Systems

In order to guarantee global accessibility and inclusion in education and research, AI systems must support a variety of linguistic and cultural contexts.

E. Sustainable AI Infrastructure

AI systems used in education need to be ecologically sustainable and energy efficient in order to satisf y global sustainability goals.

VII. CONCLUSION

AI will have a profound impact on research, education, and learning. Because it can automate administrative work, increase research efficiency, and customize learning, it is a priceless instrument for modern university. But its use needs to be guided by moral standards and a commitment to openness and diversity. If AI is managed cooperatively and keeps innovating, it has the potential to drastically change future of scholarly advancement and global education.

References

1. B. Woolf et al., "AI Grand Challenges for Education," AI Magazine, vol. 34, no. 4, pp. 66–84, 2013.
2. H. Holmes et al., "The Role of AI in Education: A Review," Journal of Artificial Intelligence in Education, vol. 29, no. 2, pp. 153–169, 2021.
3. A. Luckin et al., "Intelligence Unleashed: An Argument for AI in Education," Pearson Education, London, UK, 2016.
4. A. Ghefaili, "Artificial Intelligence in Education: Promises and Implications," Educational Technology, vol. 55, no. 5, pp. 23–28, 2020.
5. S. Selwyn, "Should Robots Replace Teachers? AI and the Future of Education," Polity Press, 2019.

AI IN HEALTHCARE AND BIOTECHNOLOGY

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Abstract
Artificial Intelligence is taking over the field of healthcare and biotechnology ensuring the pace limit to a faster, smarter and easier ways to detect, diagnose and deliver medical solution to the level of utmost precision. The diagnosis is the major part for AI to proceed further, it enables the practitioner to go hand in hand with the technologies such as: medical imaging analysis, clinical decision making, personalized treatments according to every individual-patients' case study. This paper throws an insight on considering the healthcare industry and the field of Biotechnology, AI helps in the discovery of drugs with potential compound-consistency. It paves way to the evolution and innovation in the field of bioprocess, gene editing etc.

Key words: *Artificial intelligence, medical imaging analysis, clinical decision making, 3D/4D Organ printing, drug discovery, bioprocess*

Introduction

Practicing medicine has evolved during the ancient times even before the evolution of proper civilization. This process was slower to ensure a proper updation in its history, this paper enhances the gist whereafter the deployment of Artificial Intelligence: the time taken to discover the cause of illness was quite sooner, this paper enhances the gist of the implementation, advantages and disadvantages after the deployment of Artificial Intelligence in this respective domain.

AI in healthcare has remarkably achieved milestone, this saved time and above all the life of those individuals.

AI Biotechnology serves as the backbone in drug discovery, precision medicine, bioprocess optimization etc.

Definition of AI in Healthcare and Biotechnology:

AI in Healthcare is defined as the involvement of certain AI technologies such as the machine learning, computer vision, deep learning, natural language processing(NLP), robotic process automation etc to diagnose the medical conditions, improve patient health with minimal or no errors, prediction of the medical outcomes, 3-D, 4-D organ printing and so on.

AI in Biotechnology defines as the usage of same techniques as seen in the healthcare definition: This mainly concentrates on research work in the field of Biology and technology.

Why AI is used in Healthcare and Biotechnology?

The adaptation of AI in these sectors are used because of the following:

It detects the cause of the ailments

- It reduces the threat of losing life
- It enables in finding out the exact problem
- Predicting the occurrence of the disease in the near future

AI in Healthcare:

I. Medical Imaging in AI

Definition: This technique is defined as the involvement of AI in the field of image processing in order to assess and produce medical images with utmost precision. These imaging refers to X-Rays, CT-scans, ultrasounds etc. it is achieved by including AI, Deep Learning (DL), Machine Learning (ML) and Convolutional Neural Network (CNN).

Explanation: The medical imaging is achieved by collecting enormous amount of data and archiving it to the system called as Picture Archiving and Communications System (PACS). This is one of the main technologies used in order to diagnose the exact nature of the disease, for instance:

A) Knee Replacement Procedure: involves 15 thousand plus MRI data set
B) Thoracic Procedure: involves 13 thousand plus X-Ray data set
C) Segmentation of the Brain using CNN

ML plays a vital role in producing the image by 3-D scattering for diagnosing the possibilities of the occurrence of aliment. This enables the practitioner to plan the treatment procedure before it could end up in serious conditions.

II. Clinical Decision Making

Definition: This is defined as a framework for decision-making especially for nurses working in the clinical area aiding in precise diagnosis, and it aids the nurses/practitioner to provide the accurate treatment at that particular time.

Explanation: This field uses most of the AI techniques that was discussed in the previous topic, in addition: it also uses Expert Systems, Case-based Reasoning (CBR), Neural Networks etc. It involves two distinctive processes; one is clinical-assessment-orientation and the other is clinical-judgement orientation.

This decision making played a vital role during the pandemic time, it was able to control the widespread by using the Clinical Decision Support System (CDSS). This helped track the impact of the wide-spread and took certain measures to control within a short period of time.

Applications:

A) Emergency Room:
AI helps spot the cause of an heart attack, and alerts the practitioner/nurse before something worsens up.

B) Post-Operative care:
It helps to constantly monitor the patient's vitals, changes in their behavior and also alerts if the patient is at risk of losing their potentials. C) ICU:
This system contiguously monitors what medication has to be given during the course of time, and aids in ventilator management.

III. 3D and 4D Organ Printing

Definition: This is defined as a peculiar technique in printing a real time cell, tissues, capillaries, or even an organ in order to enable transplants during the worst-cases. Whereas 4D organ printing represents a fully functionable and viable tissues, muscles and even organs.

3D Organ Printing:

Explanation: This technique adapts AI to achieve an exact replica of the living tissues, cells, organs. The raw material used are not just plastics or metal, instead it used the Bio materials in order to print a 3-dimensional organ.

At present, they are still under research and development area, they were quiet successful in printing the animal skin, blood capillaries, cartilages etc.

Once they are printed, AI comes into picture and it role-plays the monitoring, optimization and viability. Currently they help the medical students to study the anatomy of the various organs and its functionality.

Applications:

A) Disease modelling: This helps the researches or students by giving them the true form of a malfunctional organ, such as the mutation in cancer, segmentations of the brain to identify clots etc.

B) Plan for Surgical Procedures: This paves way for the researches, practitioners as well as its students to rehearse before they could perform the procedure on a humans/animal.

4D Organ Printing:

Explanation: This 4-dimensional organ printing mainly concentrates on producing an organ that's fully functional, the main agenda is to fit and take the shape of the original organ, this is yet to be deployed at the moment as the research is going on with full swing., this is going to be the future in the medical world.

Applications:

A) Dynamic Implants: This is the nature of a 4D printed organ, its flexible and it adapts to the original form of the required organ.

B) Responsive to the Drugs: The researchers are trying to enable the organ to respond for certain changes in the body.

C) Personalized Organs: This is futuristic in nature; the main goal is to make the dysfunctional organ of any individual to repair itself to perform like a fully-functional, more adaptive and ensure longevity.

AI in Biotechnology:

I. Drug Discovery:

Definition: The improvisation of AI in the field of discovering the drug composition at minimal costs with less time consumptions using AI, ML and DL to achieve the required drug at the stipulated time.

Explanation: This leads to study the aftermath of the intake of drugs, while the drug is consumed it also informs what might happen to the metabolism and the excretion of an individual. It uses a technique called as Computer Aided Drug Discovery (CADD) and enables the valuation ensuring a positive run.

Applications:

A) Predicting the Side effects:
It predicts the side effect even before consuming, this helps to improvise the drug by eradicating the risks underneath and to produce drugs with minimal or zero side effects.

B) Generation of Molecular Biology: It undergoes a screening technique to quickly find which suits best to serve the purpose of the medicine.

C) Optimization: AI helps select the best-fit individuals to try the drug, for the purpose of analyzing the behavior of its working.

II. Bio Process:

Definition: This is an applied field of AI, ML, Process Analytical Technology (PAT) and digital twins, computer vision, A concentrating on the enhancement of Bioprocessing by taking control over the processed medicine and tending in optimization to expect better resultants.
Explanation: The Bioprocessing is a collective technique of process optimization. Predicting the nourishment of the cells, monitoring in rea-time, applies various test conditions without bothering the real specimen.

Applications:
A) Predictive Analysis: AI uses data models to check for the results even before its deployment. These models also help check the possibility of cell damages of the micro-organisms even before it happens.
B) Digital Twins: This technique creates a copy of the original cells, avoids in operating the real and tries to rehearse with the duplicate copy. This avoids discrepancies and tends to give the exact medication for the acquire problem, which is a life-saver.

Advantages and Disadvantages of AI in Healthcare and Biotechnology
Advantages:
- Accuracy in Diagnostics
- The results are faster
- Predictive Analyses
- Efficiency
- Personalized Medications
- Chatbots for automated help assistance
- Development and the discovery of new drugs
- 5G ensures remote consultations

Disadvantages:
- Privacy issues
- Less Transparency
- Always liable to the quality of Data
- Eradication of certain jobs
- Not easily affordable

Future Scope of AI in Healthcare and Biotechnology

- Virtual assistance in health: it aids in monitoring the patient condition, attends patient's queries through chatbots.
- Fully fledged robotic operative procedures: The robots will be allowed to monitor the nature and condition of the patients and proceed with operations with/without minimal human interventions.
- Hospital Administration: Maintaing the records and case summary of the patients, does billing, provides personalized medications without human intervention.
- Gene Editing: paves way to the editing of the genes, inorder to perform well, this might help in raising an individuals IQ level too!
- Agriculture and bioengineering: Helps yield crops with full nutritional values, on consuming this might help stabilize an individual's body and helps to react less for the sudden change in the medical environment.

Conclusion

To summarize the entire paper, AI is helping the healthcare industry to eradicate languishing diseases such as cancer, diabetes etc.

AI doesn't just help in maintaining one's vitals but it also alarms the dangers of what might happen in the near future. This enlightens the patient to proceed with the prescribed medication and helps avoid intaking high dosages of medical drugs.

AI encourages to to maintain an individuals vital statistics by showing the calories burnt, oxygen level, and proceed with a good cardio lifestyle.

While it comes to the field of Biotechnology, AI once again plays a greater role in drug discovery, helps maintain a digital twin which is quiet cost effective.

AI manifests 3D organ orienting to replicate the originals to avoid mishaps, and gives a good opportunity for the students, researchers. If correctly applied, AI will be easily acquainted with all seeking for healthcare assistant in the medical world.

References:

1. Hyun Jin Yoon , Young Jin Jeong ,(2019). Medical Image Analysis Using Artificial Intelligence
2. Maggie Sque, Cax chipulu, Debra Mcgonigle, (2014). Clinical decision making
3. Ramnarayan P, Tomlinson A, Rao A, et al. ISABEL (2003). a web-based differential diagnosis aid for paediatrics:
results from an initial performance evaluation.

AI vs HUMAN: DATA-DRIVEN INSIGHTS IN THE FIELD OF FORENSIC PSYCHOLOGY

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Abstract

Forensic psychology is a part of forensic science that helps to understand and solve legal issues using the principles of human psychology. In Forensic psychology, the psychology of offenders is analyzed deeply to find and prove the crime. It can be called legal psychology, which is best worked out by psychiatrists (with a Doctor of Medicine degree (MD)) or a psychologist (with a Doctor of Philosophy (PhD) specializing in clinical or counselling psychology). However, in the era of Artificial Intelligence, when all jobs are performed efficiently by AI models, can AI work with the same efficiency in forensic psychology, or will it fail and prove that there are such activities that only humans can do? This study includes data-driven insights to infer whether AI or Humans are better at predicting or understanding the psychological behavior of the offender to help provide justice to the victim. Let us see if it would be the right act to give responsibility to AI for detecting crime or if human insights play a major role in understanding the behavioral psychology of the offender.

Keywords

*Forensic psychology, human, Artificial Intelligence, data, metrics, mode*l

Introduction

Forensic psychology is the unique intersection of forensic science and human psychology that provides critical insights and evidence for legal proceedings. In recent years, Artificial Intelligence (AI) has rapidly expanded to various fields, including forensic psychology. Its ability to process large datasets, identify patterns, and deliver faster results has increased the efficiency of many tasks. The use of AI in forensic psychology, especially for understanding the behavioral aspects of offenders, lie detection, and criminal profiling, can potentially make evaluations quicker and more data-driven. However, while AI can offer accurate outcomes and assist in decision making, it still lacks the deep contextual understanding that human professionals possess. According to a survey I conducted among professionals from different backgrounds, most agreed that AI can be a valuable tool if used under proper human supervision. Although AI helps to speed up processes, there are chances of misinterpretation if decisions are left solely to machines. This study aims to explore the effectiveness, reliability, and limitations of both AI and human judgment in forensic psychological assessments, identifying how each can contribute to more informed and ethical practices.

Literature review

According to the Department of Human Neuroscience, Sapienza University of Rome, Rome, Italy et al. To explore current studies on the use of AI and neuroimaging in predicting violent behaviour within forensic psychiatry, focusing on practical uses, challenges, ethical concerns, and regulatory needs.

Badal Mavry et al. discussed how AI technologies are transforming forensic psychological assessments by improving the accuracy of lie detection, behavioral analysis, and risk prediction through tools such as AI-based neuroimaging and predictive models. It also emphasizes the need to address ethical concerns such as bias, consent, and transparency before fully integrating these technologies into criminal justice and forensic practice.

According to the Department of Criminology et al. Recent literature emphasizes the growing role of AI in psychological profiling, where machine learning and natural language processing are used to analyze behavioral patterns and uncover the motivations behind criminal actions. Studies also integrate criminological theories to improve the precision of profiling while highlighting ethical concerns such as algorithmic bias, privacy, and transparency that must be addressed for responsible implementation in judicial and investigative contexts.

Galante et al. (2023) explored the current applications of artificial intelligence in forensic sciences, highlighting its potential to enhance the accuracy, efficiency, and predictive capabilities in criminal investigations. This paper discusses both benefits, such as improved evidence analysis and crime pattern detection, and its limitations, including ethical concerns, algorithmic bias, and the need for rigorous validation of AI systems. The authors also emphasized the prospects of AI in advancing forensic science and its integration into legal processes.

Bhattacharya and Khan (2024) examined the admissibility and relevance of artificial intelligence in forensic psychiatry by focusing on its application in courtrooms. This paper discusses the potential of AI to enhance psychiatric evaluations and assist in determining the mental state of defendants while addressing legal challenges regarding the reliability, transparency, and ethical concerns of using AI-driven assessments in judicial settings.

Objectives

- To do a comparative study of efficiency of AI and Human in the field of forensic psychology and to draw insights leading to make decisions on whether or not AI can be independently used for forensic psychology.
- To evaluate the predictive accuracy of AI models versus human judgment in forensic psychological assessments.
- To identify the strengths, weaknesses, and ethical concerns associated with using AI in understanding offender behaviour.
- To explore how a collaborative framework between AI tools and human expertise can enhance decision-making in forensic psychology.
- To evaluate the ethical considerations and risks involved in relying on AI for psychological evaluations in legal settings.
- To gather real-world insights from professionals on the role and impact of AI in forensic decision-making.

Methodology

This study adopts a mixed-methods approach to compare the effectiveness of Artificial Intelligence (AI) and human decision-making in forensic psychological analysis. Two primary sources of data were used: a custom-generated dataset derived with the help of OpenAI's ChatGPT for modelling and analysis and a small-scale survey designed to capture professional opinions on the role of AI in forensic psychology.

The dataset used in this study simulates real-world forensic psychological attributes such as anxiety levels, social behavior scores, and lie detection indicators. Although synthetically created using AI tools, the data closely mirror common traits observed in forensic psychological evaluations. This allowed for the development and testing of supervised machine learning models for predictive tasks. Models were evaluated using statistical performance metrics, including accuracy, precision, recall, F1 score, R-squared, and Mean Squared Error (MSE). Additional checks, such as the Variance Inflation Factor (VIF), were employed to test multicollinearity and ensure reliability in the regression analysis.

To complement this, a short survey was conducted to gather insights from real individuals from different professional backgrounds. Five respondents participated, including a legal professional, science teacher, psychology student, and chemist. The survey asked about their perceptions of AI in decision making, ethical concerns, and the extent to which AI should be integrated with human supervision in forensic settings. Despite the small sample size, the responses offered valuable qualitative insights that helped balance technical findings with real-world human perspectives.

Combining synthetic modelling with authentic human feedback enabled this study to highlight both the strengths and limitations of AI in forensic psychology. The methodology was structured to reflect not only the analytical accuracy of AI, but also the human elements—context, emotion, and ethics—that remain essential in sensitive legal and psychological domains.

Discussion

Model Evaluation: AI vs Human Predictive Approaches in Forensic Psychology

To evaluate the efficacy of predictive modelling in forensic psychology, a comparative analysis was conducted between two distinct models:

- AI Model: A machine learning-based approach trained on features derived from psychological datasets.
- Human Model: A rule-based or expert-driven model grounded in psychological theory and manual classifications, possibly developed with input from trained psychologists.

1. Classification Performance Overview:

A range of performance metrics were assessed to determine the effectiveness of each model classification based on psychological insights. The results are summarized as follows:

Metric	AI Model	Human Model	Superior Model
Accuracy	42.86%	60.00%	Human
Log Loss	0.8626	0.7199	Human
ROC AUC Score	0.3818	0.5000	Human
Cohen's Kappa	-0.156	0.130	Human
Matthews Corr. Coef.	-0.159	0.134	Human

- Accuracy: The human model was notably more accurate, with a 60% prediction success rate compared with the AI model (42.86 %).
- Log Loss: The AI model demonstrated more confident but incorrect predictions, leading to higher penalties.
- ROC AUC: While the human model hovered near random guessing, the AI model performed worse than chance, indicating model confusion.
- Cohen's Kappa and MCC: These more balanced metrics confirmed the human model's greater consistency and reliability in prediction, even when accounting for chance and class imbalance.

Interpretation: The human model outperformed the AI model across all classification metrics. The AI system not only produced lower accuracy, but also exhibited poor confidence calibration, which is particularly concerning in forensic applications where predictive errors carry high consequences.

2. Class-Wise Evaluation (Classification Report):

Further insights were obtained through detailed class-level analysis.

AI Model Performance:

Class	Precision	Recall	F1-Score
0 (No Insight)	0.38	0.30	0.33
1 (Insight)	0.46	0.55	0.50

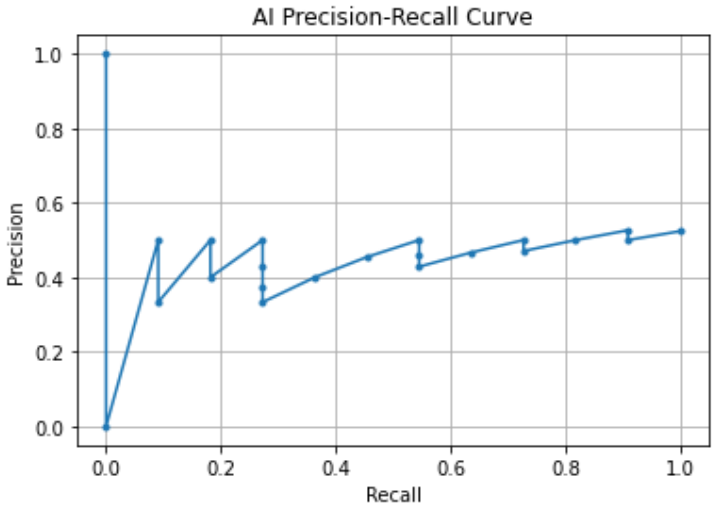

Fig:1.1. AI precision-recall curve

Human Model Performance:

Class	Precision	Recall	F1-Score
0 (No Insight)	0.5	0.38	0.43
1 (Insight)	0.64	0.75	0.69

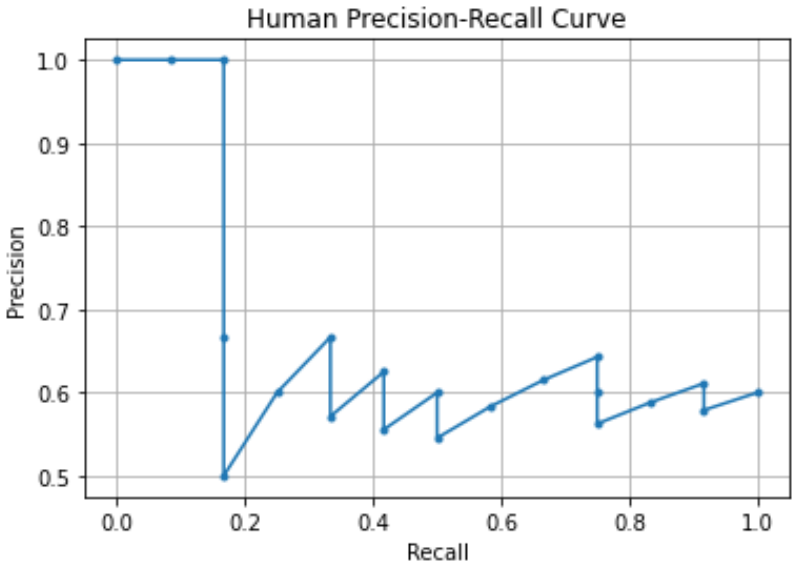

Fig: 1.2. Human precision-recall curve

The human model displayed significantly better recall and F1-score for the high-priority class (Class 1), which is essential in forensic psychology, where identifying psychological insight is often the primary goal. In contrast, the AI model struggled particularly with Class 0 and showed overall instability in classification.

3. Logistic Regression Fit:

A logistic regression analysis highlighted further differences in statistical behavior:

- AI Model: Failure to converge during training, likely owing to high variance, presence of outliers, or numerical instability.
- Human Model: Successfully converged, indicating a more stable model fit.

Statistical diagnostics showed that the intercept in the human model was significant, suggesting meaningful baseline prediction. One feature, related to false negatives, approached statistical significance, indicating the potential for deeper insights with more data.

4. Multicollinearity Check (Variance Inflation Factor):

Both models passed the multi-collinearity test.

Model	Max VIF
AI Model	1.13
Human Model	1.12

All VIF values were well below the standard threshold of 5, indicating no redundancy among the input variables and validating the integrity of the feature selection.

5. Model Stability and Warnings:

- AI Model: Encountered serious stability issues such as convergence failure, undefined coefficients, and numerical overflows. These results indicate poor data preprocessing or the need for regularization.
- Human Model: Showed no warnings or anomalies, with clean coefficients and smooth optimization behavior.

Summary & Final Verdict:

Evaluation Aspect	Winner	Notes
Classification Metrics	Human	Consistently better across all scores
Model Fit (Logistic)	Human	AI failed to converge
Feature Significance	Tie	No strong predictors yet
Model Stability	Human	AI displayed numerical issues
Feature Independence (VIF)	Both	No multicollinearity issues

Results

So, if we rate their performance:

Evaluation Aspect	HUMAN	AI
Classification Metrics	10	5
Model Fit (Logistic)	9	3
Feature Significance	5	5
Model Stability	9	3
Feature Independence (VIF)	10	10

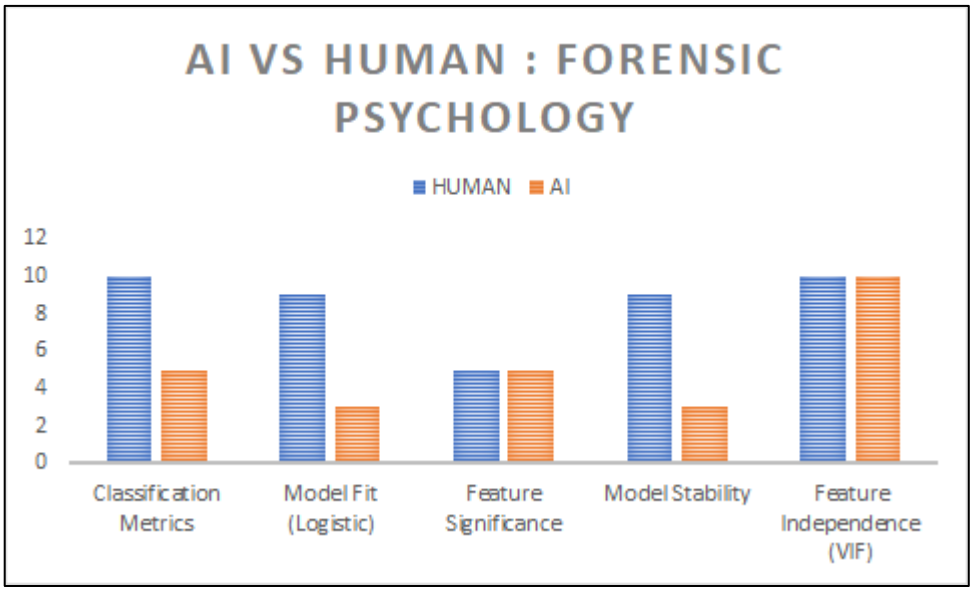

Fig: 1.2. Ratings according to the interpretations

Scope of the Study

- Integrating hybrid systems that combine AI speed and consistency with human empathy and context awareness.
- Expanding datasets with real-world psychological cases to improve model training and reliability.
- Enhancing ethical frameworks to address concerns like algorithmic bias, transparency, and accountability in judicial applications.
- Collaborative AI tools that serve as intelligent assistants to forensic psychologists, rather than replacements, thus encouraging a human-AI partnership in the legal domain.
- Longitudinal studies to observe the evolving role of AI in mental health assessments, risk evaluations, and courtroom testimonies over time.

Conclusion

The comparative analysis between the AI model and the human-driven model reveals a compelling insight: human judgment consistently surpassed artificial intelligence in the context of forensic psychological assessment. From classification accuracy to statistical dependability and model stability, the human model demonstrated superior performance across all critical metrics. This outcome highlights the inherent complexity of interpreting human behavior—particularly in legal and psychological domains—where abstract reasoning, emotional nuance, and contextual understanding are essential. These are areas where current AI technologies, especially when trained on limited or synthetic datasets, fall short.

Although AI offers potential advantages in terms of speed and data processing, its inability to consistently replicate human intuition and psychological insight emphasizes its current limitations. In high-stakes environments such as forensic psychology, misinterpretation or over-reliance on data-driven models without contextual understanding could lead to flawed conclusions and ethical concerns.

Therefore, this study affirms that while AI can serve as a valuable support tool, the central role must remain with trained human professionals. When integrated thoughtfully, AI can augment human efforts—enhancing efficiency without compromising ethical and psychological depth. The ideal approach is not to replace humans with machines, but to establish a collaborative framework in which AI operates under human supervision. This synergy holds the promise of delivering faster, fairer, and more informed outcomes in the pursuit of justice.

References

1. Tortora, L., Meynen, G., Bijlsma, J., Tronci, E., Ferracuti, S. (2020). Neuroprotection and AI in forensic psychiatry and criminal justice: A neurolaw perspective. *Frontiers in psychology*, *11*, 220.

2. Mavry, B., Aseri, V., Nagar, V., Rai, A. R., Jain, D., Sharma, A., ... & Parihar, K. (2024). Artificial Intelligence in Forensic Psychology. In *Artificial Intelligence in Forensic Science* (pp. 130-141). CRC Press.

3. Cekic, E. (2024). The impact of artificial intelligence tools on criminal psychological profiling. *International Journal of Academic Research in Psychology*, *11*(1), 1-13.

4. Ai, M. (2024). Forensic Psychology. In *The ECPH Encyclopaedia of Psychology* (pp. 1-4). Singapore: Springer Nature Singapore.

5. Galante, N., Cotroneo, R., Furci, D., Lodetti, G., & Casali, M. B. (2023). Applications of artificial intelligence in forensic sciences: Current potential benefits, limitations, and perspectives. *International journal of legal medicine*, *137*(2), 445-458.

6. Parmigiani, G., Meynen, G., Mancini, T., & Ferracuti, S. (2024). Applications of artificial intelligence in forensic mental health: Opportunities and challenges. *Frontiers in Psychiatry 15*, 1435219.

7. Bhattacharya, R., Khan, A. (2024). Artificial intelligence in forensic psychiatry: Admissibility and relevance before courts. *International Journal of System Assurance Engineering and Management*, *15*(5), 1638-1649.

8. Bhardwaj, J., Goyal, K., Narula, A. (2025). Revolutionizing forensic science: The role of Artificial Intelligence in evidence analysis. *International Journal of Interdisciplinary Approaches in Psychology*, *3*(1), 101-116.

BLOCKCHAIN & CRYPTO CURRENCY IN THE FUTURE OF WORK

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Abstract

Blockchain is one of the most powerful technologies that we have now. The immutable ledger allows the transactions to be decentralized, it makes it unique and has huge potential when it comes to future demand, it can fixes the problems faced by different job sectors which is due to lack of transparency. there are different sectors that blockchain can be implemented such as financial services, Real estate, Creative fields, IOT so on…However there are many challenges such as scalability, security problems. This paper represents different job aspects which blockchain can be implemented that lead to future trends.

1 INDRODUDCTION

Nowadays blockchain and crypto currency are the one most of important words in the industry and tech world. Big MNC's like Meta, google, binance, apple etc. are hiring large no of people with blockchain knowledge and blockchain developers why? Because blockchain and crypto have potential for something big. Its unique features—decentralization, transparency, and immutability—are reshaping how businesses operate, creating new opportunities, and addressing long-standing challenges. From revolutionizing financial systems to enabling secure data sharing in healthcare and improving supply chain transparency, blockchain is proving to be a game-changer.

2 CRYPTO CURRENCY, BLOCKCHAIN, SMART CONTRACT

2.1 CRYPTO CURRENCY: is a type of digital money that exists only online. Unlike traditional money (like dollars or euros), it isn't controlled by banks or governments. Instead, it uses a technology called **blockchain** to keep track of transactions securely and transparently. People can use cryptocurrency to buy things, invest, or send money to others without needing a middleman. The most well-known cryptocurrency is **Bitcoin**, but there are thousands of others, like **Ethereum** and **Dogecoin**. It's like internet cash which is decentralized.

2.2 BLOCKCHAIN: **Blockchain** is like a digital notebook that everyone can see but no one can cheat or a network for anything that exists inside blockchain (like crypto currencies, nft's etc.). Imagine it as a giant, shared spreadsheet that lives on thousands of computers around the world. Every time someone sends or receives cryptocurrency, the transaction is recorded as a "block" of data and added to a chain of previous blocks—hence the name "blockchain."

2.3 SMART CONTRACT is like self-executing digital agreements that run on blockchain networks, such as Ethereum. Imagine a vending machine: you put in money, select a snack, and the machine automatically gives you what you paid for without needing a person to help. Smart contracts work the same way—they automatically carry out the terms of an agreement when certain conditions are met. Smart contracts are written in code and stored on the blockchain, making them transparent, tamper-proof, and trustless (meaning you don't need to trust the other person—just the code). They're used for things like decentralized finance (DeFi), insurance, supply chain tracking, and even voting systems. In short, smart contracts are the building blocks of a more automated and efficient digital world!

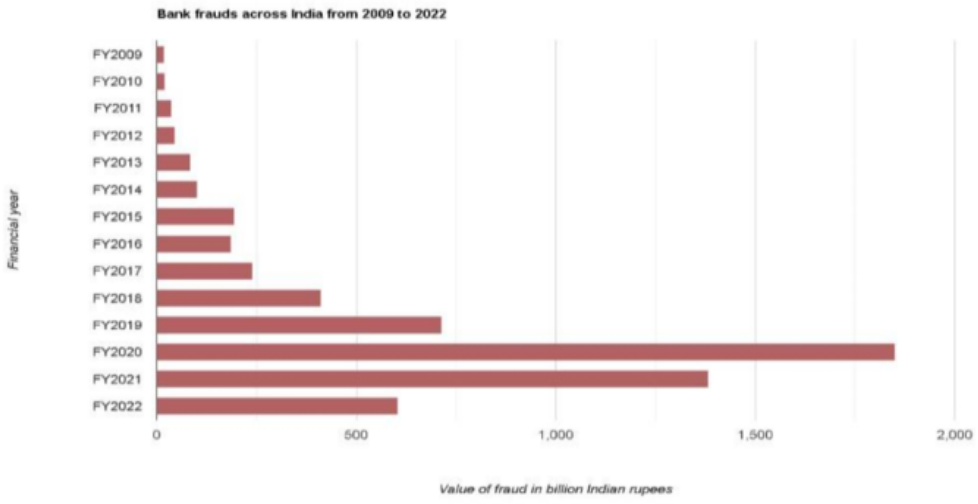
3 BLOCKCHAIN APPLICATIONS AND EMERGING JOB SECTOR

- Financial services 3.1
- Corporate governance 3.2
- Creative Industries 3.3
- Supply Chain & Logistics 3.4
- Healthcare 3.5
- Gaming & Entertainment 3.6
- Education 3.7

3.1 FINANCIAL SERVICES (DEFI)

When it comes to the financial sector imagine giving all our money to a centralized institution and letting them handle our money and allowing them to use our money for their needs by blindly trusting them that it is safe there. This centralized intuitions are Banks .Bank creates money by issuing loan without backing them with real assets this increases the money supply and reducing the currency value this leads to economical inflation (fig 1.1) (for example**: 2008 financial crisis**-banks gave risky loans and it lead to housing market collapse and recession happened).banking sector creates plenty of trust issues due to fraud, scams, corruption ,robbery and cyber security threads (happening (for example: **Wells Fargo Fake Accounts Scandal (2016):** Bank employees created millions of fake accounts to meet sales targets).

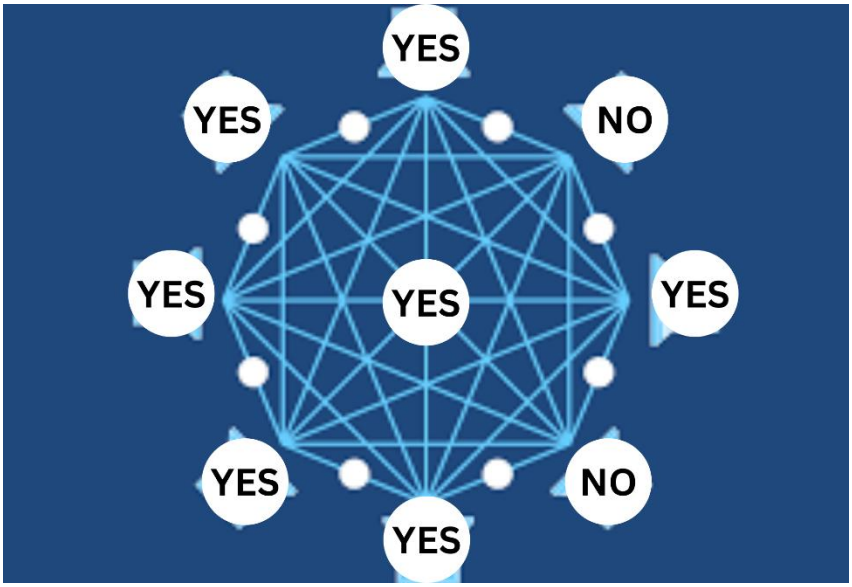
Here Is where **DEFI** (dencentralized finanace) comes into role. DEFI refers to financial operating ecosystem that operates without influence of banks, brokers or insurance companies, instead it relies on smart contracts (it is self-executing code. Which is like a contact which is decentralized and digital) it automates lending, borrowing, trading and asset management. The aim of DEFI is to be open, permissionless and transparent financial system that is accessible to anyone with a internet connection.en



3.2 CORPORATE GOVERNANCE (DAO)

Before we discuss about **corporate governance**, let's see what's wrong with the **traditional government system** (which includes banks, corporations, or governments, etc.). Whatever decisions are made in this type of government are made by some men in power, like a few board members or government officials. The decision-making in this is **not transparent**, and most of the members don't have access to their decision-making process. Additionally, these systems still require **multiple principles of approval**, which leads to **implementation delays**, and people in power may mislead for their **personal gains**.

This is why **DAOs (Decentralized Autonomous Organizations)** exist. These DAOs follow **corporate governance**, which refers to decentralized decision-making where power and control are distributed among participants rather than being centralized among a few individuals. This is made possible through an algorithm that is present in the blockchain. Decisions are made through voting by token holders or community members, and the majority vote is taken into action or decision. All decisions made are recorded on the blockchain, which is publicly accessible and able to be audited. Smart contracts help the DAO to execute automatically once they are approved.



Pictorial representation of DAO decision making

3.3 CREATIVE INDUSTRIES (NFT)

Imagine you are a digital artist who posts artwork on social media and wants to sell it. But what if someone copies your art? Does that mean they own it?

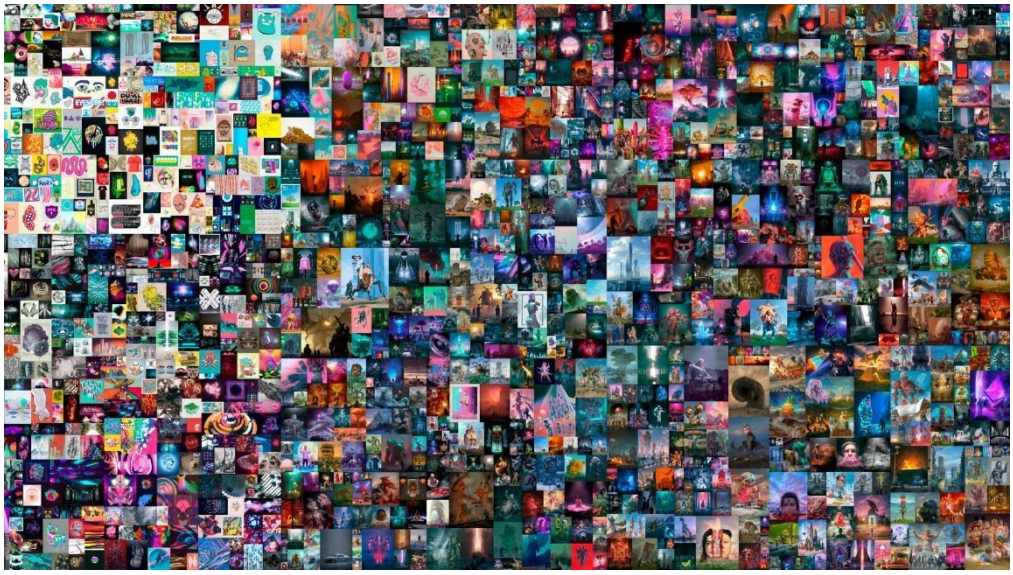
This is one of the biggest problems digital creators face today. We don't truly own the content we upload on social media because we are posting it on someone else's centralized platform. Whether it's art, videos, or any other form of content, the platform benefits first, not the creator.

Take YouTube, for example—content creators spend hours making high-quality videos, but once uploaded, YouTube has control over distribution, monetization, and even who gets to see the content. If YouTube decides to take down a video or demonetize a channel, the creator has little control.

This highlights the need for decentralized platforms where artists and content creators have full ownership and control over their work

This is where **NFT** (Non -Fungible Token) comes. **NFT**s have revolutionized the creative industry by fixing long term problem faced by artists through opening up new opportunities to artists, musicians, writers, and other creators. **NFT i**s a type of digital asset that represents ownership or proof of authenticity of a unique item or piece of content, using blockchain technology**.** It provides a verifiable and immutable record of ownership for digital assets. This solves the problem of duplication and piracy, as the original work can be easily distinguished from copies. Artists can prove they are the original creators of a piece, which is especially valuable in the digital world copying is easy.if you are artist you can list your NFT in the marketplaces (like Open SEA market place) for price it can be sold for the price and you will automatically receive the amount the person who bought the art piece will art piece by changing the ownership of that art to their collection. There are many great NFTs sold for millions of dollars and some the NFTs give exclusive access to their club if you own their NFT (like APE YAHT CLUB NFT).

(This NFT sold for 69 Millon dollars created by a artist named BEEPLE)



3.4 Supply Chain & Logistics

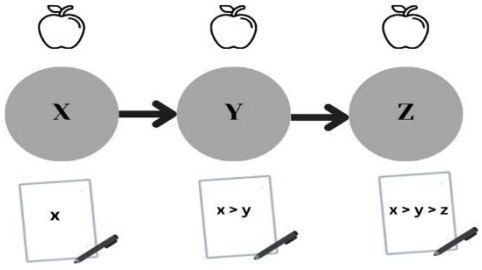
The current global supply chain system, while highly advanced, faces several significant challenges that impact efficiency, transparency, sustainability. these problems are increased in past years due to globalization, technological changes, and pandemic like COVID 19. Supply chain is consisting of different aspects like suppliers, manufacturers, distributors, retailers across different regions, making it difficult to track the origin and movement of goods. This lack of visibility can lead to issues like counterfeiting, unethical sourcing, and difficulty in identifying the source of problems (e.g., contaminated food or defective parts). For this we need to track this supply from manufacturer to retailer, many supply chains rely on disconnected systems and processes, with each stakeholder using their own software or methods to manage data.

3.5 HEALTH CARE

When it comes to health care the most important part is patients' data. most of the hospitals use digital data's mostly their own local servers. here is there is a risk of data loss and security threat. we

can can't risk a patient's data or corruption of data, this making it difficult to share data securely between healthcare providers. Centralized databases are vulnerable to hacking and data breaches, risking patient privacy and Healthcare billing and insurance claims are often plagued by errors, fraud, and delays.

This can be fixed using blockchain. Blockchain can create a decentralized, tamper-proof ledger for storing and sharing medical records. Each record is encrypted and linked to the patient, ensuring data integrity and security. It provides a universal framework for data exchange, allowing different systems to communicate seamlessly. Blockchain can track the entire supply chain of medications, from manufacturing to delivery. Each step is recorded on the blockchain, ensuring authenticity. And for the insurance. Blockchain can automate claims processing using smart contracts, which verify and approve claims based on predefined rules.



The current state of gaming is dominated by traditional models where players spend money to buy games, in-game items, or subscriptions, but they rarely have the opportunity to earn real-world value from their time and effort. Even though most of them spent their time in these games. what if we get incentivised by playing these games?

- This where a concept called **P2E** (play to earn). this are type of game that are built on blockchain platforms (e.g., Ethereum, Binance Smart Chain, Polygon, or Solana). In-game assets, such as characters, items, or land, are represented as NFTs, which are unique and owned by the player. Players truly own their in-game assets (NFTs) and can trade, sell, or use them across different games or platforms. Players earn cryptocurrency or NFTs by completing tasks, winning battles, or participating in the game's economy. Players can convert their earnings into fiat currency (e.g., USD, INR) through cryptocurrency exchanges.

3.7 EDUCATION

The education system today has some big problems. It's hard to check if someone's degree or certificate is real, and records are often scattered or lost. Schools and employers spend a lot of time and money verifying qualifications, and many people can't access good education because it's too expensive or not available where they live. Plus, skills learned outside of traditional schools—like online courses or work experience—often go unrecognized. These issues make the system feel outdated and unfair for many.

JOB ROLES IN BLOCKCHAIN

Job Title	What They Do	Skills Required
Blockchain Developer	Design and build blockchain-based applications and smart contracts.	Programming (Solidity, Rust, Go), blockchain protocols, cryptography, problem-solving.
Smart Contract Engineer	Develop and audit smart contracts for decentralized applications (dApps).	Solidity, Vyper, security best practices, debugging, Ethereum/blockchain knowledge.
Blockchain Architect	Design the structure and framework of blockchain systems.	System design, blockchain protocols, consensus mechanisms, cryptography, scalability.
Cryptographer	Develop cryptographic algorithms to secure blockchain networks.	Advanced mathematics, cryptography, programming, security protocols, research skills.
Blockchain Analyst	Analyze blockchain data to identify trends, risks, and opportunities.	Data analysis, blockchain tools (e.g., Etherscan), SQL, Python, financial knowledge.
Blockchain Consultant	Advise businesses on how to integrate blockchain into their operations.	Blockchain knowledge, business strategy, communication, problem-solving, industry trends.
dApp Developer	Build decentralized applications on blockchain platforms.	Web3.js, React.js, Solidity, blockchain APIs, frontend/backend developmen
Blockchain UX Designer	Design user-friendly interfaces for blockchain applications.	UI/UX design, Figma/Sketch, blockchain basics, user research, prototyping.
Tokenomics Designer	Design the economic models for tokens and blockchain ecosystems.	Economics, game theory, blockchain knowledge, data analysis, financial modeling.
Blockchain Security Expert	Identify and fix vulnerabilities in blockchain systems and smart contracts.	Cybersecurity, penetration testing, Solidity, cryptography, risk assessment.

CHALLENEGES TO ADOPTION

The adoption of blockchain technology across industries has been slower than expected due to several significant challenges. Even though blockchain offers more potential. Blockchain technology is complex and requires specialized knowledge to develop and implement. Most blockchain networks, especially public ones like Ethereum, struggle with scalability, limiting the number of transactions they can process per second. Implementation of blockchain can be more costly due to shortage of developers. And regulatory issues from government because it's a evolving technology

CONCLUSION

Blockchain and cryptocurrency are changing the way we work, trade, and interact with technology. Industries like finance, real estate, gaming, and healthcare are already seeing big revolutions, with new job opportunities emerging in areas like DeFi, DAOs, and NFTs.

ARTIFICIAL INTELLIGENCE IN MODERN NETWORKING: ENHANCING PERFORMANCE, SECURITY, AND AUTOMATION

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Abstract:
The exponential growth of data traffic and the increasing complexity of modern networks have necessitated the adoption of intelligent solutions to manage and secure network infrastructure. Artificial Intelligence (AI) has emerged as a transformative force in networking, enabling proactive management, dynamic optimization, and enhanced security. This paper explores the integration of AI in networking, focusing on its applications in performance optimization, security, self-healing capabilities, and future network architectures such as Software-Defined Networking (SDN), 5G, and beyond. Challenges and ethical considerations are also discussed, along with future directions for AI-driven networks.

1. Introduction

The digital transformation across industries has resulted in complex and high-demand network environments. With the proliferation of IoT devices, cloud services, and real-time applications, traditional networking approaches are no longer sufficient. AI offers a paradigm shift by providing capabilities such as real-time decision-making, pattern recognition, and automation. This paper investigates how AI is reshaping network design, management, and security, with an emphasis on next-generation networking technologies.

2. Evolution of Networking and the Role of AI

Traditional networking systems were static and rule-based, making them inadequate for dynamic and complex environments. The shift toward virtualized, software-defined, and intent-based networks requires intelligent systems that can adapt and respond autonomously. AI plays a vital role in automating configuration, monitoring, and troubleshooting, thereby improving overall network efficiency and responsiveness.

3. AI for Network Performance Optimization

AI enhances network efficiency through predictive analytics, intelligent traffic routing, and congestion control. Machine learning (ML) models analyse historical and real-time data to forecast congestion points and pre-emptively reroute traffic. Reinforcement learning, a subset of ML, allows networks to dynamically adjust routing paths and resource allocations based on feedback and environmental changes. These approaches improve Quality of Service (QoS), reduce latency, and enhance user experience.

3.1 Case Studies and Tools

- Google's B4 SDN uses AI for congestion-aware routing.
- Cisco’s AI Network Analytics provides insights to optimize enterprise networks.

4. AI in Network Security

Network security is a critical domain where AI has significant applications. Traditional security systems rely on signature-based detection, which is limited against zero-day and evolving threats. AI-based security systems use anomaly detection, behavior analysis, and natural language processing to detect and mitigate cyber threats in real-time.

4.1 Deep Learning for Threat Detection

Deep learning models such as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) can process large volumes of network traffic data to identify subtle anomalies indicative of threats.

4.2 Real-World Implementations

- Darktrace uses AI for threat detection and autonomous response.
- IBM QRadar incorporates machine learning for SIEM (Security Information and Event Management).

5. Self-Healing and Autonomous Networks

AI enables self-healing networks that can detect, diagnose, and fix issues automatically. This reduces human intervention, enhances reliability, and minimizes downtime. Intent-Based Networking (IBN) translates high-level business intents into low-level network configurations using AI.

5.1 Predictive Maintenance

Predictive models forecast hardware failures or network bottlenecks, allowing proactive remediation. AI can identify hardware degradation or software bugs based on log data, performance metrics, and usage patterns.

6. Applications in SDN and NFV

Software-Defined Networking (SDN) and Network Function Virtualization (NFV) are foundational technologies for AI-enabled networking.

6.1 SDN and AI

AI enhances SDN controllers by optimizing routing policies based on real-time analytics. For example, AI can prevent DDoS attacks by automatically reconfiguring network flows.

6.2 NFV and AI

AI improves virtual function placement, orchestration, and scaling in NFV environments. This reduces latency and ensures efficient resource use across data centres and edge nodes.

7. AI in Wireless and Mobile Networks

Mobile and wireless networks benefit from AI in managing spectrum usage, handover decisions, and load balancing.

7.1 5G and AI

5G networks use AI for network slicing, ultra-reliable low-latency communication (URLLC), and massive machine-type communication (mMTC). AI models help allocate resources dynamically based on application requirements.

7.2 AI at the Edge

Edge AI enables real-time analytics close to the data source, reducing backhaul traffic and latency. Use cases include smart cities, autonomous vehicles, and remote monitoring systems.

8. AI-Driven Network Design and Simulation

AI is increasingly being used in the planning and simulation phase of network design. Tools like NS-3 and Mininet now integrate ML algorithms to test various configurations and predict performance under different scenarios.

8.1 Digital Twins

A digital twin of a network is a virtual replica that uses AI to simulate behavior and optimize performance before deployment.

9. Challenges and Ethical Considerations

Despite its promise, AI in networking presents several challenges:

- **Data Privacy:** AI models often require access to sensitive user and network data.
- **Model Interpretability:** Black-box models lack transparency.
- **Bias and Fairness:** AI systems can inherit biases from training data.
- **Computational Cost:** High-performance computing resources are needed for training and deployment.

Addressing these issues requires robust ethical frameworks and regulations to guide responsible AI adoption.

10.Future Trends and Research Directions

The future of AI in networking is poised for further innovation:

- **AI in 6G networks**: With goals of ultra-high-speed and ultra-low-latency, 6G will rely heavily on AI for real-time decision-making.
- **Federated Learning**: This privacy-preserving ML approach allows training on decentralized data.
- **Quantum AI in Networking**: As quantum computing evolves, it will influence routing algorithms, cryptographic protocols, and AI model training.
- **Sustainable Networking**: AI can help optimize power consumption and reduce the carbon footprint of network infrastructure.

11.Conclusion

AI is transforming the landscape of modern networking. From enhancing network performance and security to enabling self-healing and autonomous systems, AI technologies are integral to the development of future-ready networks. Despite current limitations, continued research, innovation, and ethical foresight will ensure that AI-driven networks are efficient, secure, and sustainable.

References:

1. Cisco Systems. "AI Networking Solutions." https://www.cisco.com/
2. IBM. "QRadar SIEM." https://www.ibm.com/security/security-intelligence/qradar
3. Darktrace. "Cyber AI Platform." https://www.darktrace.com/

A STUDY ON ONLINE EDUCATION USING AI IN INDIA

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Abstract
AI is the rapidly increasing technology in the current century where it is used commonly in all the application fields such as business, education, social media etc. This paper views the importance of AI in online education in India. The paper discusses the framework of AI understanding the positive and negative scenarios on online education. And also investigate the implementation of AI in online education along with advantages and disadvantages associated with the uses. Through secondary data, the paper finds how online learning through online platforms is improving the learners for Indian students.

Keywords: *Artificial Intelligence, Online Education, E-Learning.*

I. Introduction

In this current 21st century the world is transmitting from manual to digital. AI helps to change things rapidly along with features of technology. AI is a branch of computer science that creates an intelligent machine to perform tasks similar to the human.

Online education uses machine intelligence and algorithms to improve the various aspects of the learning process. The AI tool in online education provides benefits to the educators and students for improving in the learning process such as learning experiences, tutoring system. The primary goal of AI in online education is to enhance the quality and provide effectiveness of teaching and learning. AI in online education aims to evaluate the result grading, scheduling the class. Allow the educators to focus more on instruction and student support.

The Fast Advancement of AI is making more interactive learning, easy accessible and more efficient in the online education of India. AI as done lot of transforming in the education of students engaging in the learning content, teachers delivering the contents and institutions managing the virtual mode of education.

II. Implementation of Online Education using AI

There are six stages to develop an online education platform using AI tool:

Step 1: *Study an existing solution from the Online education Platforms without AI*
Step 2: *Consider the online education platform components to have both interesting part and interactive.*
Step 3: *Find the Requirements to develop the Online education application using AI tool.*
Step 4: *Test the Online education application. From unit testing to Integrated testing*
Step 5: *Promote the Online education application and get the feedback from end-user after its release.*
Step 6: *Online education application should be updated regularly.*

Initially online education developer should analysis on the existing solutions in depth and add new features to the current solution of the online education platform. Study the innovative ideas and prefer the useful components from various sources such as universities, colleges, teachers etc. During development of the application the goals should be clarified.
Create a simple version of online education platform at the start up and later based on feedback and reviews from the end-users the platform should be updated on a regular basis adding extra features.

III. AI's Role in Online Education in India

1. **AI-Based Student Monitoring:** AI tool helps to monitor the student attendance, learning participation and progress in the online education. And also helps in detecting and alert the teachers during disengagement of the classes.
2. **AI-Enabled Adaptive Learning Platforms:** AI helps the students in the study plan. It is and adaptive learning platform which analyse the student behaviour, engagement level and performance.
3. **Enhanced Administrative Processes:** AI maintain the streaming of administration tasks such as scheduling, admissions, communication where students can have query with the admin related to fees, courses etc. And also, workload of teachers can be managed.
4. **AI-Powered Exam Proctoring:** The online examinations use the AI tool to detect the student behaviour, prevent cheating, provide the fairness assessment during the online exam.

IV. Positive Scenarios Online Education in India:

- **Personalized Learning:** Online education with help of AI solution allows for personalized learning experiences such as students can learn more effectively and ensure the teaching concepts very easily
- **AI-Powered Tutoring:** Online Education with AI helps in answering queries, providing explanations and some suggestions based on individual learning progress.
- **Accessibility:** All students in India or globally can access the online education application easily using AI. The AI contributes different learning opportunity to the student. Virtual tutors provides 24/7 assistance to all students.
  Example: speech-to-text, text-to-speech and translation features etc.
- **Automated and Efficient Grading:** AI tool is an evaluation system will assess the student performance and provide feedback by specifying the areas needed to be improved. AI in Online education will help both students and teachers to take off the burden by using automation grading process. The teacher can save time in evaluating the test papers and AI automatically gives remarks about the student performance.
- **Adaptive Learning Platforms:** AI tool provides an adaptive learning in the online education platforms adjust content based on students' performance.
- **Smart Content Creation:** AI tools in online education will helps in developing educational content, which includes the interactive video, quiz etc. This helps in improvement in teaching resource.

V. Negative Scenarios Online Education in India:

- **Cost:** In online education the advanced AI tool will be used which is very expensive.
- **Job Displacement:** Since the AI in online education as automate task, hence in further traditional education will be replaced by Automate Education and their will not be job for Physical educators.
- **Data Privacy Concerns:** AI online education consists of a large amount of data, hence student privacy data is a significant concern. Privacy concerns arise when student or teacher sensitive data is misuse
- **Overreliance on Technology:** When we are more dependent on AI. Our skills and thinking will be reduced. Even for simple task the students will be dependent on the technology.
- **Lack of Emotional Connection:** Since AI is Non-living hence the Automate educator does not include empathy or understanding of student feelings, no supportive or encouragement. AI tool will assist only learning aspects; it lacks in emotional connections with students.

VI. Future of AI in Online Education in India

- **AI in Gaming:** Gamification in online education is most popular because AI makes more interactive learning and provides AI-driven simulation for games to make the concepts easy to understand and increased the student involvement.
- **AI in Special Education:** AI tools in online education are helping disability students by providing personalized assistance such as speech-to-text or text-to speech, sign language interpreters.
- **Voice Assistants for Learning:** AI-tool voice assistant's helps in the learning platforms. Where the students can ask queries and get the explanation response, students can access study materials through voice commands, making learning more convenient.
- **Predictive Analytics for Student Success:** AI-driven Future analytics can help teachers to identify the students at below average in studies. By analysing the patterns and performance of the students, AI will ensure student success and retention.

VII. Comparison of AI E-Learning and Non- AI E-Learning

AI E-Learning	Non- AI E-Learning
In the Teaching approach the teacher is centralized.	In the Teaching approach the students is centralized.
Content is static and slow distribution	Content is Dynamic and fast distribution
Limited access by resource and location	Global access and available 24/7
Role of teachers is sole authority	Role of teachers is supported by AI tool
Learning phase is uniform for all students	Learning phase is non-uniform for all students
It is engaged with textbook and lecture	It is engaged with interactive
Libraries and Textbooks are used as Knowledge access	AI-powered search and online databases are used as Knowledge access

Conclusion

AI is revolutionary change and transformative role in Online Education in India, AI is providing smart educators and smart classes to make more efficient ways in learning methods. The AI online education is more personalized, accessible, and effective to the students and teachers. AI evolution will be continued in online education by shaping the future of learning in India. Our future online education in AI will grow their students with technology. The main aim of AI in online education to work with an educator easier but not to replace them.

Reference

[1] Mohan, L. (2014). Integration of Skill with Higher Education. Asian Journal of Research in Business Economics and Management, 4(4), 27-37.

[2] Mukhopadhyay, M. (2016). Quality management in higher education. Publications India.

[3] https://edumentonline.com/the-role-of-ai-in-online-education-in-india

[4] https://medium.com/towards-artificial-intelligence/artificial-intelligence-in-education-benefits-challenges-and-use-cases-db52d8921f7a

[5]https://emerj.com/ai-sector-overviews/examples-of-artificial-intelligence-in-education/

[6]https://www.e-pspl.com/blog/role-of-artificial-intelligence-in-improving-education-sector

ARTIFICIAL INTELLIGENCE-BASED SOLUTIONS FOR CLIMATE CHANGE: A REVIEW

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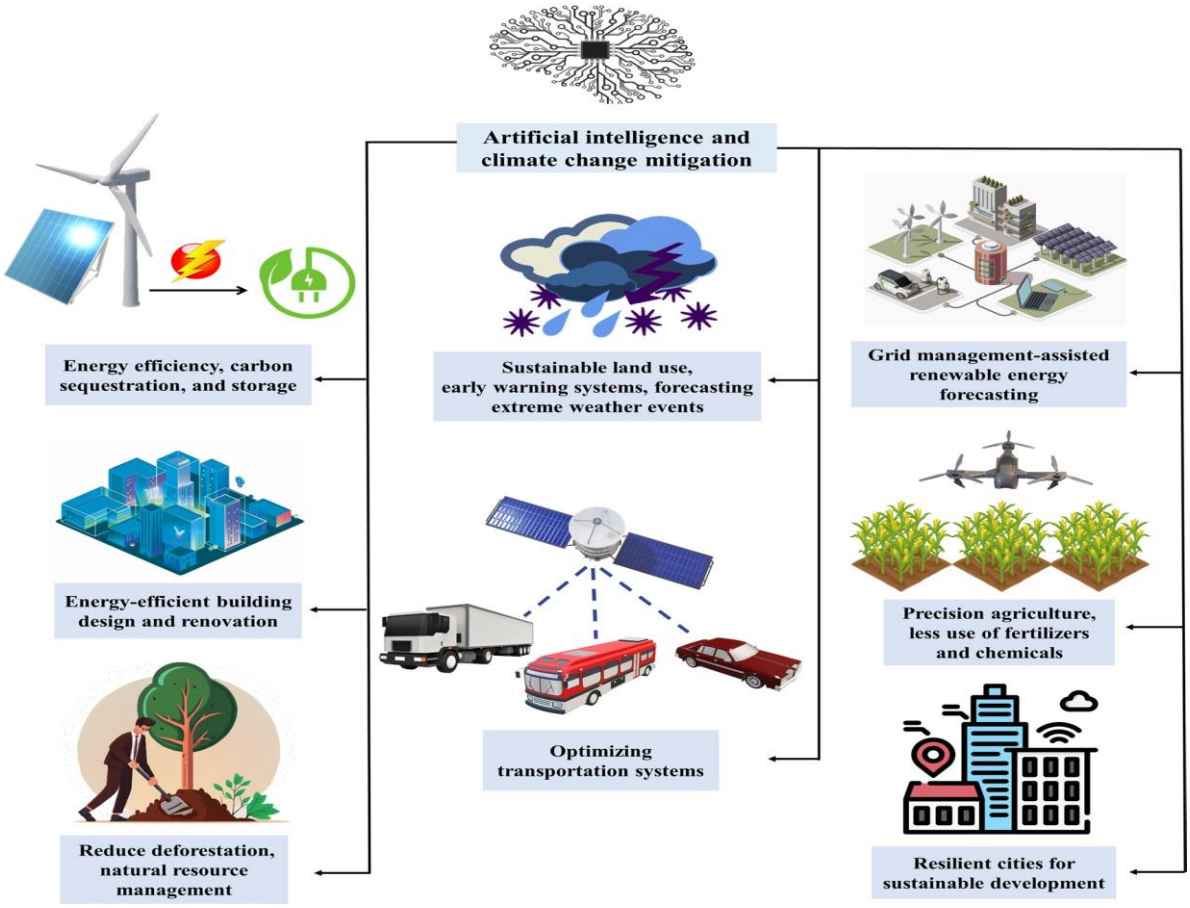
Abstract

Climate change poses a significant threat that already leads to system damage in natural and urban systems, and causes worldwide economic losses exceeding $500 billion. Such problems may partly be addressed by artificial intelligence since artificial intelligence combines internet resources to provide immediate recommendations from precise climate change forecasts. Here we discuss recent studies and applications of artificial intelligence in reducing the negative impacts of climate change, including energy efficiency, carbon sequestration and storage, weather and renewable energy forecasting, grid management, building design, transportation, precision agriculture, industrial processes, deforestation reduction, and resilient cities. We discovered that improving energy efficiency can play an important role in minimizing the effects of climate change. Smart manufacturing can cut energy use, waste, and carbon emissions by 30–50% and, specifically, can save energy in buildings by 30–50%. The natural gas industry worldwide uses artificial intelligence technologies to improve the accuracy and reliability of weather forecasting in approximately 70% of the cases. Merging smart grids with artificial intelligence has the potential to maximize the efficiency of power systems, thus lowering electricity bills by 10–20%. Intelligent transportation systems can cut down carbon dioxide emissions by about 60%. Further, natural resource management and city design using artificial intelligence can further enhance sustainability. Keywords Artificial intelligence · Climate change · Energy efficiency · Sustainability ·Sea level increase, the occurrence of natural calamities more and more frequently, the decrease of crop production capabilities, and bio diversity loss all have a high degree of linkage with climate change. The extensive use of fossil fuels in production processes is the major cause of the widespread carbon dioxide release Thus, energy saving, green energy development, and energy efficiency improvement are necessary for mitigating climate change. Shifting from a fossil fuel-based society to an electricity-based society can have a positive impact on environmental conservation. Artificial intelligence is capable of accomplishing automated discovery, distribution, and transmission operations using deep neural networks with minimal energy consumption. With the growing intensity of cli mate change problems, artificial intelligence is widely claimed to be a solution for climate change challenges. Artificial intelligence technology can potentially merge the growing possibilities presented by the internet of things (IoT) and renewable energy into the energy sector. It can contribute significantly to energy supply, improving decision-making processes, and autonomous software control, hence acting as a major driving force in the energy sector. Besides, artificial intelligence has also played a crucial role in solar radiation modeling, optimization and simulation of renewable energy systems, urban power load forecasting, and urban building heat load forecasting.

Artificial intelligence has the capacity to help curtail climate change in various means, including enhancing extreme weather conditions forecasting, developing energy efficient and green smart buildings that gather data and sense data while forecasting thermal comfort, building models of nutrient cycling and crop yields to curtail the use of fertilizers, adopting efficient and accurate sustainable forest management measures to curb deforestation, developing smart waste management, and making smart resilient cities. Nowadays, the artificial intelligence and climate change review is mainly technical in nature, without any discussion on how artificial intelligence can be used in different fields affected by climate change. As shown in Fig. 1, this review separates the effect of climate change on human social production and life into eight parts, each of which explores the application of artificial intelligence in resource management, green energy efficiency, and sustainable development. In addition, the prospect of artificial intelligence's sustainable development in the context of climate change was explored. In brief, artificial intelligence could change the way we are addressing climate change mitigation by bringing new tools and insights to help us create a more sustainable world. Applying artificial intelligence to energy efficiency, carbon sequestration, and storage Energy efficiency In today's modern society, energy issues have risen to become among the biggest issues in the world. As the world economy continues to grow steadily and the population keeps on increasing, there has been an explosive rise in energy demand.

At the same time, the wise use of energy and achieving sustainable development has been a growing formidable challenge. To satisfy the increasing energy requirement and check harmful environmental effect, effective measures have to be adopted to improve energy efficiency and reduce energy waste.Artificial intelligence technology has increasingly been seen as a new technical tool in the energy field with new opportunities and challenges to enhance energy efficiency and achieve sustainable development. In the field of energy, artificial intelligence implementation can increase the effectiveness of energy use by forecasting energy demand, balancing energy generation and consumption, and achieving intelligent control, thereby reducing energy expenses, mitigating environmental pollution, and promoting sustainable development. Consequently, the energy efficiency-artificial intelligence relationship has been a topic of intense debate within the research community, drawing interest from various scholars and businesses as well. In addition, it is argued that deploying artificial intelligence technology wisely can lead to concrete improvement in energy efficiency, promote sustainable development, and open up a brighter future for human society.



Utilization of artificial intelligence in reducing the impact of climate change. This figure outlines various artificial intelligence applications in energy efficiency, including carbon sequencing, storage, and renewable energy forecasting. Furthermore, artificial intelligence optimizes transportation systems, precision agriculture, and natural resource management. The technology is also employed in energy-efficient building design and retrofitting, weather forecasting, and industrial process optimization. Consideration is given to the discourse surrounding the implementation of sustainable and resilient urban centers and their potential implications in the upcoming era. The discussion focuses on implementing sustainable and resilient urban development oxide sequestration through site monitoring. Moreover, artificial intelligence can accelerate the development of pioneering carbon storage techniques efficiency, outlining the present status and efficacy of its deployment in the energy sector.

Artificial intelligence has lately transformed the energy industry, which has become a revolutionary technology device providing new opportunities and challenges for improving energy efficiency and achieving sustainable development An in-depth analysis presented has found that artificial intelligence has been successfully used in many fields of energy efficiency, including fault detection and diagnosis, thermal comfort prediction and control, demand response, and energy storage optimization. Artificial intelligence these areas has shown promising outcomes in promoting energy efficiency, minimizing energy wastage, and enabling sustainable growth. Still, the deployment of artificial intelligence in energy efficiency is a process that is still ongoing. Its performance largely depends on the precision of input data and the appropriate choice of artificial intelligence algorithms.

Based on the results reported in Table 1, studies in Italy and Japan indicate that the application of artificial intelligence technologies in energy management systems has been prevalent and has yielded positive results. Equally, the study done in the UK indicates that though the application of artificial intelligence in predictive maintenance is in its initial stages, it has been effective. Furthermore, in other nations, for example, China and India, artificial intelligence applies to fault detection and diagnosis as well as integrating renewable energy and demand response. Generally, the discussion offered indicates that the majority of the applications of artificial intelligence across different areas of energy efficiency are yet in their infancy stages, and their effectiveness should be investigated further. Accordingly, further research should be undertaken to determine the effectiveness of such applications.

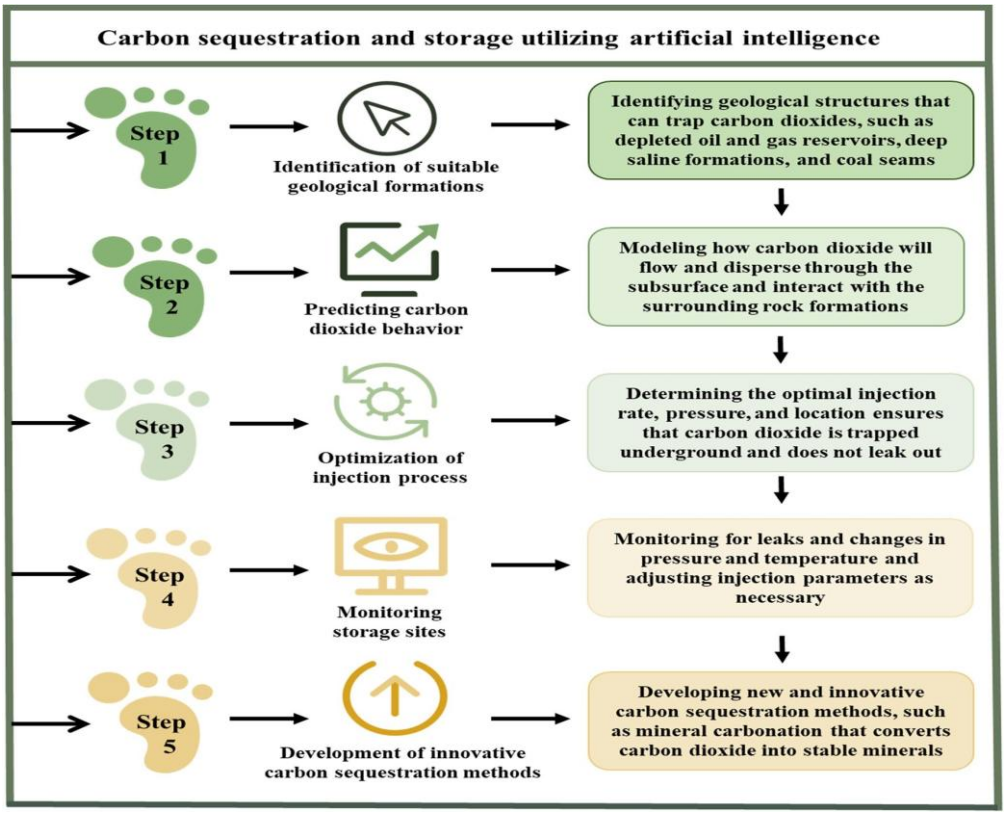
It is argued by some researchers that the high price of artificial intelligence technology is one of the primary hindrances to its use in energy efficiency This is owing to the fact that designing and deploying artificial intelligence-powered systems require large capital investment, which can surpass the financial strength of certain organizations. Furthermore, the lack of data and skilled professionals in artificial intelligence is a major hindrance to its universal application in energy efficiency. Nevertheless, despite these challenges, it is anticipated that the application of artificial intelligence technologies in energy efficiency will grow due to the increasing demand to save energy consumption, cushion the environment against pollution, and attain sustainable development. This section expounds on utilizing artificial intelligence-based technologies to achieve energy efficiency. The results clearly show that artificial intelligence is a useful tool used to improve energy efficiency and achieve sustainable development. Artificial intelligence has proven effective across many fields despite its potential that needs to be assessed. It is limited by the lack of expertise and lack of funds. However, in the future, there is more potential for maximizing the use of artificial intelligence when it comes to energy efficiency. Carbon sequestration and carbon storage are core components of strategies to combat climate change. Application of artificial intelligence can meaningfully enhance the efficacy and effectiveness of these operations. Artificial intelligence-led technologies can be utilized to identify suitable geological structures for carbon storage and predict carbon dioxide behaviour once injected into storage reservoirs. Additionally, artificial intelligence can streamline the injection process and track storage reservoirs to confirm carbon dioxide is trapped securely underground. Artificial intelligence can also speed up the creation of new and innovative carbon sequestration methods, like mineral carbonation, which transforms carbon dioxide into stable minerals.

In conclusion, the use of artificial intelligence in carbon sequestration and storage can advance climate goals and sustainable development. Figure 2 illustrates the step-by-step

stages of integrating artificial intelligence technology in carbon sequestration and storage and its ability to support the achievement of climate goals and sustainable development. With the use of artificial intelligence, it is possible to mitigate greenhouse gas emissions and mitigate the effects of climate change, accelerating the achievement of carbon neutrality.

In recent years, the utilization of artificial intelligence in carbon sequestration and storage has increased significantly.

Fig. 2 Carbon sequestration and storage utilizing artificial intelligence. Five distinct phases are depicted in the figure above for incorporating artificial.



However, as technology advances and becomes more accessible in the future, the usage of artificial intelligence in carbon sequestration and storage is anticipated to increase. Therefore, ensuring that artificial intelligence technology is implemented ethically and responsibly is crucial, aiming to achieve sustainability goals and carbon neutrality. Moreover, further research and development must address al intelligence into carbon sequestration and storage. It also highlights artificial intelligence's critical role in achieving climate goals suitable formations for carbon storage and in predicting the behavior of carbon dioxide upon injection at storage sites. In addition, it demonstrates how artificial intelligence can improve the efficiency of the injection process to maximize carbon storage while ensuring the security of underground carbon dioxide sequestration through site monitoring. Moreover, artificial intelligence can accept the development of pioneering carbon storage technology

Reference

[1] Kumari, N., & Pandey, S. (2023). Application of artificial intelligence in environmental sustainability and climate change. In Visualization techniques for climate change with machine learning and artificial intelligence (pp. 293-316). Elsevier.

[2] Leal Filho, W., Wall, T., Mucova, S. A. R., Nagy, G. J., Balogun, A. L., Luetz, J. M., ... & Gandhi, O. (2022). Deploying artificial intelligence for climate change adaptation. Technological Forecasting and Social Change, 180, 121662.

[3] Amiri, Z., Heidari, A., & Navimipour, N. J. (2024). Comprehensive survey of artificial intelligence techniques and strategies for climate change mitigation. Energy, 132827.

[4] Chauhan, D., Bahad, P., & Jain, J. K. (2024). Sustainable AI: Environmental Implications, Challenges, and Opportunities. Explainable AI (XAI) for Sustainable Development, 1-15.

ARTIFICIAL INTELLIGENCE IN HEALTH CARE

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ABSTRACT

"Artificial Intelligence in Healthcare: Revolutionizing patient care and Outcomes "

Artificial intelligence (AI) has transformed the entire healthcare system in recent days. Personalized healthcare treatment diagnostics. Ai in analysing MRI Scans, CT scans, and X-rays. AI helps in analysing Patient records like heart rate, BP, and Mental health to know the problem and detect the early symptoms of the disease. AI Checks the previous health records and predicts the future health issues outcome with the existing records. Artificial Intelligence Maintains a unique health record based after analysing the old health records based on the physical and mental health of the patient. It also helps in optimizing the medicine usage and dosage of a particular one. By validating their records. Nowadays the health care trend is turning its head towards the Artificial health care because of lack of time, reducing the human mistakes. Educating the patient about his health. Where WHO (World Health Organization) published the quality ethical standard for the usage of AI and its tools in the use of healthcare to ensure privacy, security, and trust for public users. Discovering new drugs for the patient by keeping their early records. Artificial intelligence Applications in today's medical field study the patient's end-to-end records in detail and suggest with new prescription drug tools like IBM Watson for Oncology, Google Deep Mind for Kidney related issues, IDx-DR-early Diabetic Detection by keeping existing records.

KEY POINTS: Features, Impacts, Advantages, Disadvantages, AI tools, Applications, Advancements and Development of AI

INTRODUCTION

AI (Artificial intelligence) it's a rapid growing technology in computer science & its application where it focuses to create a smarter and efficient dynamic future for next generation with its implementation. On technology in today's fast-moving world. It also been used in Health care in a different way. Health care is a highly Complex & huge challenge in today's world. Where plenty of problems arise due to improper guidance and maintenance of proper health. AI changed many fields in that Health Sector & medical field is also one among. where it focuses on personal health care and healthy quality life in early detection of diseases by keeping previous records .AI plays a smarter, Secure & Successful role in the personalized health care with clinical practice, where it can be implemented and maintained with essential knowledge and various AI tools. In AI there are various tools like ANL (Artificial Neural Network), NPL (natural Processing Language), LLM (large Language Models), DL (Deep Learning), ML (Machine learning).and various AI algorithms are used to preview large set of data records.

APPLICATIONS OF AI IN HEALTHCARE

1. **Medical Imaging and Diagnostics:** AI can analyze medical images such as X-rays, MRIs, and CT scans to detect diseases like cancer, tumors, fractures, and infections with high accuracy. It helps radiologists identify issues faster and more precisely.

2. **Disease Prediction and Prevention:** AI models can analyze patient data to predict the risk of diseases such as diabetes, heart conditions, and even mental health issues. This allows for early intervention and preventive care.

*3. **Personalized Treatment:** AI can suggest personalized treatment plans based on a patient's medical history, genetics, and lifestyle. This helps doctors make better decisions tailored to individual patients.*

*4. **Drug Discovery and Development:** AI accelerates drug research by identifying potential compounds, predicting how drugs will behave, and reducing the time and cost of clinical trials.*

*5. **Virtual Health Assistants:** AI-powered chatbots and virtual assistants provide 24/7 support, answer health-related questions, remind patients to take medication, and even schedule appointments.*

*6. **Robot-Assisted Surgery:** AI-enabled surgical robots can perform complex procedures with precision and minimal invasiveness, leading to quicker recovery and fewer complications.*

*7. **Electronic Health Records (EHRs) Management:** AI helps organize and interpret large volumes of patient data, making it easier for doctors to access and understand patient histories.*

*8. **Remote Patient Monitoring:** Using AI and wearable devices, healthcare providers can monitor patients' vital signs and health status in real time, even from a distance.*

*9. **Pandemic and Outbreak Prediction:** AI models analyze global health data to detect patterns and predict the spread of diseases like COVID-19, helping in timely response and containment.*

WHY TO USE AI AND TOOLS IN HEALTHCARE

AI have High Level Sensors in health industry such as, Sensor/Smart watches, Pressure Sensor, these Sensor help patients to identify their issues with personalized care.

1. Smart watch: Monitor complete heartrate, oxygen level with the help of sensor in it.
2. Pressure Sensor: it's used to monitor the Blood pressure in real time.
3. Bio-chemical Sensor: it gives Environmental protection and food safety.
4. Co2 Sensor: it helps in measuring the carbon dioxide gas in the air.
5. Physiological Sensor: It measures the Continuous glucose monitoring in body, body temperature, blood oxygen and respiratory rate
6. Thermal Sensor: it used to measure degree of heat in major surgery to maintain hotness during surgeries like open heart surgery and brain surgery

It also uses a few algorithms to predict the problems in health such as

1. Diagnostic algorithm: it helps in confirming the disease by symptom and medical history.
2. Decision tree algorithm: it gives prediction about the diagnosis, and suggests various treatments in the tree.
3. Reasoning algorithm: used in analysing health records.
4. SVM (Support vector machines) algorithm: used to know treatment response by limited data.
5. Naive Bayer algorithm: mainly used in medical diagnosis to detect heart disease & cancer
6. KNN (K-Nearest Neighbour) algorithm: used to know the probability of disease occurrence
7. ML (Machine learning algorithm): used in EHRs (Electronic health records) such as ring & watch
8. Data mining algorithm: used for early detection and enhancing treatment accuracy

`EXISTING SYSTEM

AI (Artificial Intelligence) has many existing applications and tools in the field of health sector for diagnosis, treatment and personalized patient monitoring such as.

1. **AI in Diagnosis & Medical Imaging**
   a) IBM Watson Health: this AI is used for early detection of cancer and its treatment recommendation with drugs.
   b) Google Deep Mind health: AI tool that helps to detect eye problems & breast cancer in early stages.
   c) Zebra Medical Vision: AI tool used in radiology such as CT-scan & X-ray.
   d) Aidoc &Qure.AI: Detects abnormalities in medical images such as MRIs scans, CT & X-ray scans.
2. **AI Chatbots in health care**
   a) Babylon Health: AI chatbot helps in symptom checking & telecall health services.
   b) Ada Health: it's a symptom checker for early detection.
   c) Woebot: AI chatbot designed for mental health checking.
3. **Drug discovery and personal treatment**
   a) Benevolent AI: used to find new drugs by replacing the existing ones.
   b) Atowise AI: AI tool to develop new drug.
   c) Insilico Medicine: Drug discovery AI tool.
4. **Wearable AI Tools**
   a) Apple & Fitbit Health: use AI to monitor BP (blood pleasure), sleep time and heart rate.
   b) Smart ring / Smart band: Monitor walking speed, blood pleasure, sleep time.
5. **AI in robotic surgery**
   a) Da-Vinci-Surgical System: AI robotics in Massive major surgery.
   b) Mazor-X: AI robotics in spinal cord surgery.
   c) Hugo RAS (Robotic Assistant surgery): AI robotics surgery.
6. **AI in predictive analysis in health sectors**
   a) Epic System & Cerner: AI tool for analysing EHR (Electronic Health Record).
   b) Qvents: Ai tool for reducing waiting time and booking appointments in hospitals and health sectors.

PROPOSED SYSTEM

The integration of AI (Artificial Intelligence) in health care has important role in patients care, hospital Management.AI application & its tools help to improve accuracy and efficient accessibility in health sector.

The proposed system's aims to support AI in enhancing increased efficiency for disease detection, personalized patient treatment, and best health care outcomes.

- Full body scan diagnostic with accuracy & early disease detection.
- Personalized treatment & change in drug based on the stage of disease.
- High response during the emergency.
- Analysing lab records and quick detection of cancer, heart disease, and neurological disorder with high perfection
- Efficient robotics in surgery to minimise human error and speedy recovery of patients.

- Analysing drug molecular structure, predicting the suitable drug for the patient and identifying the treatment.
- Faster and more accurate diagnosis.
- Reduce the workload of healthcare working professionals.

BENEFITS OF AI IN HEALTHCARE

1. **Faster and More Accurate Diagnoses**
2. **Improved Patient Outcomes**
3. **Increased Efficiency**
4. Cost Reduction
5. **24/7 Availability**
6. Personalized Medicine
7. Enhanced Drug Development
8. Better Resource Management
9. Remote and Rural Access

UPCOMING CHALLENGES

PROBLEM FOUND AND OVERCOME

AI (Artificial Intelligence) is a next-level healthcare solution. But its implementation and adoption come with huge challenges such as.

1. Data privacy & Security related issues

Problem: AI Collects massive amount of patient's data, which relates to cause cyber threats, breaching of data, Accessing of unauthorized person.

Solution: HIPAA protects the confidentiality & security of health information but AI fails to accept this sometimes.

- Implementing encryption technology to safeguard data.
- Implementing Blockchain technology for secure data Management.

2. Bias in AI Algorithm

Problem: AI Systems produce unfair disadvantage results. The present training data leads to inaccurate diagnoses in treatment.

Solution: The AI (Artificial intelligence) Model should be regularly trained & updated with the required database of health records.

- Regular audits should be done
- Implementing explainable AI techniques to make decisions.

3. Less Transparency

Problem: AI tools like deep learning help in complex decisions that are difficult to break in which makes a lack of trust among the healthcare professionals.

Solution: Develop an AI model that gives clear explanations & decision-making.

- Replacing humans with explainable AI models that give a clear image of health.
  Implementation Cost

4. Implementation Cost

Problem: Adopting AI requires a huge investment in maintenance & infrastructure.

Solution: Using cloud storage in AI tools.

- The government should provide financial support for implementing AI in health sectors.
- Focusing on long-term expenditure.

5. Integrating with existing health care system

Problem: Many hospitals and health sectors old method of maintaining records where they fail to implement AI Applications in their works.

Solution: Providing training for working professionals in health sectors.

REAL TIME APPLICATION

1. **H2o.ai**: it's an AI platform to analyse large datasets of patient information, It also helps in predicting the future disease where H2o.ai is used to figure out the genetic disease. This AI application also provides smooth operation. Making the health sector to work smarter
2. **Path AI**: very highly efficient AI used in pathology, Path AI is used in drug discovery for chronic diseases like cancer, it also assists the pathology doctor in analysing tissue samples, reducing errors of cancer-causing agents.
3. **Viz.ai:** this AI model is used to detect and diagnose stroke, and its treatment, the goal of this AI is to detect the early stage of stroke using machine learning algorithms
4. **360 Leads FWA (Fraud, Waste, Abuse):** this AI tool is used to detect the fraud works which takes place in health insurance companies, where FWA use strong algorithm to detect fraud. The health sectors which use this tool works smarter.
5. **NDIVIA for healthcare:** its an AI powered tool used for, medical imaging, drug discovery, also used to study medical records in rapid, it can understand NL (Natural language), helps in quick diagnosis and treatment plan.

CONCLUSION

AI (Artificial intelligence) is efficient in diagnosis, treatment, clinical trials, drug discovery, reducing human faults, and maintaining huge patient personal records, AI tools like ML (Machine Learning) algorithm, NLP (Natural processing language), robotics in surgery performs smarter and efficient compared to health care professionals. The most efficient AI contribution to the field of the health sector is it has the efficiency to detect the early stage of disease, reducing the death rate and increasing the survival rate using AI-powered tools like X-rays, MRIs, and CT scans with higher accuracy than the old method of treatment, which reduce money, time, human errors, less treatment. AI chatbots are efficient in providing the result 24/7 for patients it has a capability of accepting natural human language collects the data and detect the disease outcomes, AI frame work stores the data in safe and secure manure, few

AI tools are adapted towards cloud storge apart then the physical server storage to safe guard the personal health records of the patients.In the future AI (Artificial Intelligence) is expected to be very smarter and still more efficient, where all the health services will reach to humans in need on time accessible will be easy, and implanting will be easy, and affordable to patients, it also challenges the health professionals.AI have a potential to replace doctors completely in next generation.

REFERENCE

- Abhishek Parashar, Yukti Mohan and Sayoni Ghosh, "AI-DOC: a Mini Healthcare Assistant for the Digital World", January 2022.
- Dr Meera, Vishal Kumar and Vivek Kumar, "IntelliDoctor – AI based Medical Assistant", 2019.
- Dora Gondocs and Viktor Dorfler, "AI in medical diagnosis: AI prediction & human judgment", January 2022.
- Chetan Bulla, Chinmay Parushetti, Akshata Teli, Samiksha Aski and Sachin Koppad, "A Review of AI Based Medical Assistant Chatbot", June 2020.
- Mahmoud nasr , Md. Milon Islam , Shady Shehata , Fakhri Karray , and Yuri Quintana, "Smart Healthcare in the Age of AI: Recent Advances, Challenges, and Future Prospects", November 2021.
- Binggui Zhou, Guanghua Yang, Zheng Shi, and Shaodan Ma, "Natural Language Processing for Smart Healthcare", September 2022.

EDUCATION TECHNOLOGIES AND E-LEARNING

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ABSTRACT

This paper examines the Transformative Impact of Advanced Technologies on Modern Education, focusing on the integration of Cloud Computing, Artificial Intelligence (AI), Virtual Reality (VR), Augmented Reality (AR), and Big Data Analytics within E-Learning Environments. It explores how these technologies facilitate Adaptive Learning, create Immersive Virtual Classrooms, and enable Real-Time Assessments, ultimately enhancing Student Engagement and Academic Performance. Furthermore, the paper addresses the critical role of Cybersecurity, Data Privacy, and AI-Driven Solutions in establishing a Secure and Effective Digital Learning Ecosystem. By analysing Current Trends and Practical Applications, this study offers valuable insights into the Dynamic Evolution of E-Learning and its profound influence on Students, Educators, and Educational Institutions.

Keywords*: Educational Technology, E-Learning, Online Learning, Virtual Classrooms, Learning Management Systems (LMS), Cloud-Based Education, Adaptive Learning, AI in Education, Digital Learning, Remote Learning, Gamification, Virtual Labs, Blended Learning, Ed-Tech, Cybersecurity in E-Learning.*

INTRODUCTION

From chalkboards to coding boot camps and online universities, the story of **Educational Technology** *and* **e-learning** is a narrative of constant innovation, forever reshaping how we learn and teach.

The evolution of educational technology and e-learning can be traced through several distinct phases. The earliest forms of distance learning emerged in the 1840s with Isaac Pitman's correspondence courses. Early innovations also included the invention of the first testing machine in 1924.

A significant turning point arrived in 1960 when the University of Illinois pioneered online education, setting the stage for the digital learning revolution.

The 1970s and 1980s saw the increasing integration of computers into education, notably through computer-assisted instruction (CAI) programs, which provided interactive and personalized learning experiences. This period also saw the development of tools like The Learning Manager (TLM), which broadened institutional access and management of educational technology, and the establishment of international collaborations like the Intercultural Learning Network.

The 1990s and 2000s witnessed the widespread adoption of virtual learning environments and the emergence of Massive Open Online Courses (MOOCs), which initially found application in corporate training settings. This era also gave rise to new terminology reflecting the evolving nature of the field, such as mobile learning, gamification, and social e-learning.

More recently, augmented reality (AR) and virtual reality (VR) technologies have entered the educational mainstream, becoming accessible through readily available devices like smartphones, tablets, and affordable headsets. These technologies offer the potential for even more immersive and engaging learning experiences.

IS EDUCATIONAL TECHNOLOGY AND E-LEARNING EFFECTIVE? MEANINGFUL DOMAINS FOR RESEARCH

Online learning

Online learning offers significant benefits, including increased access and flexibility, personalized learning experiences, enhanced engagement, cost-effectiveness, and the development of digital skills. These advantages have fuelled its rapid growth and solidified its role in modern education. Furthermore, online learning drives innovation within the EdTech sector, expands the market for educational technologies, promotes accessibility, facilitates research and development, and fosters a dynamic ecosystem of collaboration, all contributing to the continuous evolution of EdTech and e-learning.

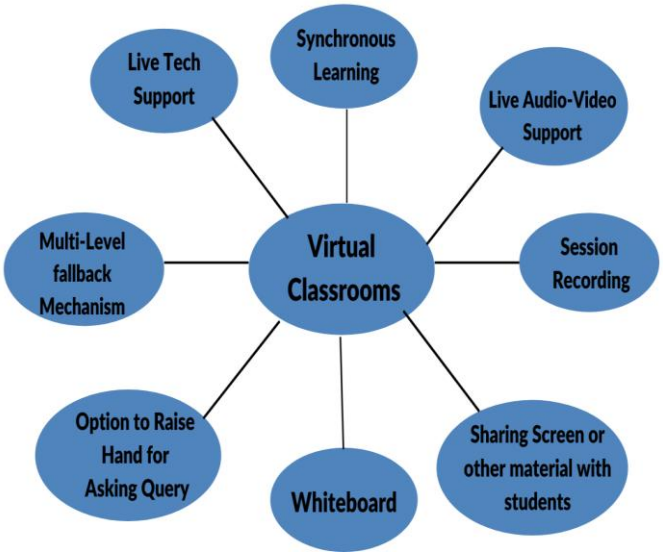
- **Early Stages (1960s-1990s):** Early computer-based training and distance learning; growing accessibility via personal computers and the nascent internet.
- **Rapid Expansion (2000s-2010s):** LMS platforms (Blackboard, Moodle), MOOCs, open resources, and mobile learning (m-learning) emerge.
- **Acceleration and Mainstreaming (2020s-Present):** Pandemic (COVID-19) driven adoption; continued growth; blended/hybrid models; advanced technologies (AI, VR, AR) enhance learning.

Digital Learning, Remote Learning Virtual Classrooms

Digital learning, the broad use of technology in education, encompasses various approaches. Remote learning, a subset of digital learning, specifically refers to education where the learner and instructor are separated by distance. Virtual classrooms are a *prime example* of remote digital learning, providing online environments that simulate traditional classrooms through features like synchronous learning, live audio-video support, session recording, screen and material sharing, interactive whiteboards, and communication tools like a "raise hand" option. These features bridge the distance inherent in remote learning, leveraging digital tools to create engaging and accessible educational experiences. Furthermore, technical support and fall back mechanisms ensure the reliability and continuity of these virtual learning environments, making them a robust and increasingly important part of modern education.

Connections:

- All virtual classrooms are examples of both digital learning (because they use technology) and remote learning (because they happen at a distance).
- Not all digital learning is remote learning (e.g., students using educational apps in a traditional classroom are doing digital learning, but not remote learning).
- Not all remote learning uses virtual classrooms (e.g., someone taking a self-paced online course without any live interaction is doing remote learning, but not using a virtual classroom).



Virtual classrooms are more than a temporary fix; they're a fundamental change in how we learn and teach. With ongoing technological advancements and evolving teaching methods, virtual classrooms will become increasingly central to education's future, making learning more accessible, personalized, engaging, and effective globally. While not intended to completely replace traditional education, they offer a powerful and growing alternative and supplement, suggesting a future where both approaches blend, with virtual classrooms playing a key and expanding roles like:

- **Accessibility:** Breaks down geographical barriers, accommodates diverse needs, provides flexibility for busy individuals.
- **Flexibility & Convenience:** Offers scheduling flexibility, location independence, and pace control.
- **Scalability & Cost-Effectiveness:** Reaches larger audiences, reduces costs, allows easy content updates.
- **Engagement & Interaction:** Integrates multimedia, offers collaborative tools, enables personalized learning.

AI in Education

The popularity of Artificial Intelligence in online education has surged dramatically and is expected to transform educational practices in the near future. With its potential to offer the best- quality and personalized learning experiences, AI technology benefits educators and learners likewise. However, we cannot blindly trust this new world of revolutionizing online education in a better way.

AI is already impacting online learning by offering personalized recommendations, quick answers, efficient grading, and dropout prevention through predictive analytics. While valuable in subjects like languages and math, AI's role in fostering creative thinking and emotional intelligence is also crucial for preparing learners for an automated future. Despite the benefits, AI implementation in online education is still in its early stages and requires further research, experimentation, and careful consideration of ethical implications, especially regarding data usage transparency. The evolution of AI writing tools like ChatGPT and Bard demonstrates the ongoing need for updates to mitigate potential negative consequences.

➢ **Future Scope:**

- **AI-Driven Adaptive Learning Platforms:** More sophisticated adaptive learning systems that go beyond adjusting content difficulty to personalize learning pathways, recommend resources, and provide tailored feedback based on individual student needs and learning styles.
- **Automated Personalized Feedback:** AI tools that can provide detailed and personalized feedback on student work, going beyond simple grading to offer specific suggestions for improvement.
- **Predictive Analytics for Personalized Interventions:** AI systems that can predict which students are at risk of falling behind or dropping out and proactively suggest personalized interventions and support.

➢ **Immersive and Experiential Learning:**

- **Advanced VR/AR Environments:** More realistic and interactive VR/AR experiences that simulate real-world scenarios and provide hands-on learning opportunities in a virtual environment.
- **Virtual Labs and Simulations:** Highly sophisticated virtual labs that allow students to conduct experiments, explore complex systems, and learn by doing in a safe and engaging way.

➢ **Collaboration and Community Building:**

- **Virtual Collaboration Spaces:** Enhanced virtual spaces that facilitate group projects, peer learning, and knowledge sharing, mimicking the dynamics of a physical study group or collaborative workspace.
- **AI-Powered Mentorship and Peer Support Systems:** Platforms that connect students with mentors or peer tutors based on their learning needs and interests, fostering a supportive learning community.

Learning Management Systems (LMS) & Cloud-Based Education

Learning Management Systems (LMS) and Cloud-Based Education are closely intertwined concepts that are revolutionizing how education is delivered and managed. Cloud computing hosts and delivers Learning Management Systems (LMS). This makes LMS platforms accessible anywhere, scalable to handle more users, more cost-effective, and easier to maintain, fuelling the growth of online learning. Essentially, the cloud provides the infrastructure that makes modern LMS platforms possible.

The combination of LMS and cloud computing has significantly impacted education by:

- **Democratizing Access:** Making online learning more accessible to students worldwide.
- **Promoting Flexibility:** Supporting various learning models, including online, blended, and flipped classrooms.
- **Enhancing Efficiency:** Streamlining administrative tasks and improving communication.
- **Driving Innovation:** Creating opportunities for new educational technologies and approaches.

Gamification

Gamification uses game design elements in non-game settings to boost engagement and motivation. In education it involves incorporating game design elements into the learning process to make it more engaging, motivating, and effective. It's about leveraging the psychology of games to enhance learning outcomes

- **Focusing on Student Experience:**

- Gamification: Engaging Students for Better Learning
- Making Learning Fun: The Power of Gamification
- Motivating Students with Gamification
- Creating a Positive Learning Environment with Gamification

Virtual Labs

Virtual labs are a leading tool in modern online learning, offering students the freedom to experiment anytime, anywhere—a stark contrast to the limitations of traditional labs. They employ various teaching methods to enhance students' understanding of theoretical concepts.

A virtual lab is a digital learning space that recreates a real-world lab environment using virtual reality. It provides a safe, controlled, and immersive setting for students to observe equipment and conduct experiments, individually or collaboratively.

Beyond lectures, virtual labs offer clear, step-by-step instructions for complex procedures. Students can experiment without risk of accidents and repeat experiments as often as needed until they achieve mastery.

- **Virtual labs offer several key advantages**:

- **Realistic Simulations:** They mimic real-world lab environments, including equipment and procedures.
- **Interactive Experiments:** Students actively conduct experiments and collect data.
- **Safe Exploration:** They eliminate risks associated with hazardous materials.
- **Wide Accessibility:** They're available anywhere with an internet connection.
- **Cost-Effective Solution:** They reduce expenses on materials and equipment.
- **Flexible Learning:** Students can repeat experiments and explore scenarios.
- **Data Analysis Tools:** They provide tools for data collection and analysis.
- **Visualizations & Models:** They aid in understanding complex concepts.

Blended Learning, Ed-Tech,

Blended learning is the *educational strategy* of combining online and in-person instruction, while EdTech encompasses the *tools and technologies* that make this blended approach possible EdTech is *essential* for enabling and implementing blended learning. Think of it this way: blended learning is the *strategy*, and EdTech provides the *means* to carry it out. Without EdTech, blended learning would be very difficult, if not impossible, to achieve effectively.

- **EdTech tools power blended learning**:

- **LMS:** Manages online content, assignments, communication, and tracks progress.
- **Virtual Classrooms:** Provide live online interaction and instruction.
- **Multimedia:** Enriches online learning with various formats.
- **Adaptive Platforms:** Personalize learning paths and feedback.
- **Collaboration Tools:** Facilitate student and instructor communication.
- **Assessment Tools:** Track student progress and identify areas for improvement.

Cybersecurity in E-Learning

Cybersecurity is essential for e-learning. Protecting data and ensuring a safe online learning environment is paramount due to the sensitive information stored and the potential for disruption. Here's why and how:

- **Why Cybersecurity Matters:**
- **Data Protection:** E-learning platforms hold personal and financial data, making them targets for identity theft and financial loss.
- **Platform Integrity:** Attacks can disrupt or corrupt platforms, hindering learning and undermining credibility.
- **Student Trust:** Breaches erode trust, impacting student recruitment and retention.
- **Academic Honesty:** Robust security is needed to prevent cheating and plagiarism.
- **Intellectual Property:** Course materials and research data must be protected.

- **Key Threats:**

- **Phishing:** Deceptive tactics to steal credentials.
- **Malware:** Malicious software that can steal data or disrupt systems.
- **Ransomware:** Encrypting data and requiring payment for its decryption.
- **DoS Attacks:** Overwhelming platforms with traffic, causing them to crash.
- **Data Breaches:** Unauthorized access leading to data theft.

- **Essential Measures:**

- **Strong Authentication:** Passwords and multi-factor authentication.
- **Data Encryption:** Protecting data even if a breach occurs.
- **Regular Audits:** Identifying and addressing vulnerabilities.
- **Software Updates:** Patching systems against known weaknesses.
- **Firewalls/Antivirus:** Protecting against malware.
- **Cybersecurity Training:** Educating users on best practices.
- **Incident Response:** Planning for and mitigating attacks

CURRENT TRENDS AND PRACTICAL APPLICATIONS IN EDUCATIONAL TECHNOLOGY AND E-LEARNING

- **The Continued Growth of Online Learning:**
  - **Real-world Example:** The COVID-19 pandemic accelerated the adoption of online learning, and many institutions are now offering fully online degree programs.
  - **Emerging Trend:** The increasing recognition of online learning credentials by employers and higher education institutions.
- **AI in education**:

- **Examples:** Duolingo personalizes language learning; Khan Academy recommends practice exercises.
- **Trend:** AI virtual tutors supplementing human instructors.

- **The Importance of Cybersecurity:**

- **Real-world Example:** Universities are implementing multi-factor authentication for student accounts and investing in cybersecurity training for faculty and staff.
- **Emerging Trend:** The use of block chain technology to create secure and verifiable digital credentials for online learning achievements.

CHALLENGES AND LIMITATIONS OF EDTECH AND E-LEARNING

A. The Digital Divide and Equitable Access

- **Limited Internet Access:** Many students, especially in rural and low-income areas, lack reliable internet connectivity, preventing access to digital learning resources.
- **Device Availability:** Not all students own personal computers, tablets, or smartphones, which are essential for online education.
- **Economic Disparities:** The high cost of hardware, software, and internet services creates barriers to equitable learning.
- **Accessibility for Disabled Learners:** Many e-learning platforms still lack proper accommodations for students with visual, auditory, and motor impairments.

B. Teacher Training and Professional Development

- **Lack of Technical Skills:** Many educators are not trained to integrate AI, VR, and adaptive learning tools into their teaching.
- **Resistance to Change:** Traditional educators may be hesitant to adopt digital platforms due to unfamiliarity or scepticism.
- **Need for Continuous Training:** Constant technological advancements require ongoing professional development, which can be time-consuming and resource-intensive.

C. Cost, Infrastructure, and Sustainability

- **High Implementation Costs:** Establishing AI-driven, cloud-based, or VR-enhanced learning environments requires significant financial investment.
- **Infrastructure Challenges:** Developing regions may lack the necessary technological foundation for digital learning.
- **Long-Term Viability:** The ongoing maintenance and updating of digital learning platforms require sustained financial and technical support.
- **Cybersecurity Risks:** Institutions must continuously invest in protecting student data from cyber threats and breaches.

D. Ethical Considerations in Educational Technology

- **Data Privacy Concerns:** AI-driven platforms collect student data, raising concerns about privacy, consent, and misuse.
- **Algorithmic Bias:** AI-based assessments and content recommendations may reinforce biases, leading to unfair learning experiences.
- **Over-Reliance on Technology:** Excessive dependence on digital tools may impact students' critical thinking, problem-solving, and social interaction skills.
- **Academic Integrity:** AI-generated content and digital assessments increase the risks of plagiarism and dishonest practices.

FUTURE OUTLOOK: GROWTH, INNOVATION & SOLUTIONS

✓ Opportunities & Innovations Driving EdTech's Future

1. **Global Accessibility:** Expansion of low-cost internet and mobile learning will help bridge the digital divide.
2. **AI-Enhanced Learning Outcomes:** Personalized learning paths will improve student engagement and success.
3. **Workforce-Aligned Education:** More job-specific, skill-based courses will better prepare students for evolving industries.
4. **Automation in Administration:** AI-driven tools will streamline grading, scheduling, and other administrative tasks, reducing educator workload.
5. **Sustainability:** Digital learning reduces reliance on physical materials, making education more eco-friendly.
6. **Secure & Ethical AI in Education:** Stricter regulations and transparent AI use will address privacy concerns.

✓ **ADDRESSING EXISTING CHALLENGES WITH EMERGING SOLUTIONS**

1. **Bridging the Digital Divide:** Governments and private organizations are working on affordable internet initiatives and device accessibility programs.
2. **Reducing Implementation Costs:** Open-source learning platforms and cloud-based solutions are making EdTech more affordable.
3. **Strengthening Cybersecurity:** Advanced encryption, blockchain-based credentialing, and multi-factor authentication are improving data security.
4. **Enhancing Teacher Training:** Schools and universities are investing in digital literacy programs to upskill educators.
5. **Balancing Technology Use:** Hybrid learning models will ensure that traditional learning methods remain integral, reducing over-reliance on digital tools. **Future Research Directions AI in Adaptive Learning** – Enhancing personalized learning through AI-driven analytics. **Cybersecurity in E-Learning** – Developing stronger frameworks to protect student data. **Impact of Virtual Learning**–Assessing VR/AR effects on engagement and cognitive retention. **Ethical AI & Bias** – Identifying and mitigating bias in AI-based assessments. **EdTech Sustainability** – Ensuring cost-effective digital learning in developing regions.

RECOMMENDATIONS

➢ **Bridging the Digital Divide & Accessibility**

1. Expand affordable internet access and device distribution programs.
2. Ensure inclusive design features for disabled learners.

➢ **Teacher Training & Professional Development**

1. Invest in digital literacy programs for educators.
2. Promote continuous learning through workshops and certifications.

➢ **Cybersecurity & Data Privacy**

1. Implement strong encryption, multi-factor authentication, and transparent AI policies.
2. Conduct regular security audits and educate students on safe digital practices.

➢ **Sustainable & Cost-Effective EdTech Adoption**

1. Encourage open-source LMS and cloud-based solutions.
2. Foster public-private partnerships for funding low-income institutions.

➢ **Balancing Technology & Human Interaction**

1. Blend digital tools with traditional teaching methods.
2. Promote social interaction, collaboration, and critical thinking in virtual classrooms.

CONCLUSION

The rapid advancement of Educational Technology (EdTech) over the past **two decades** has fundamentally transformed the landscape of learning by integrating AI, VR, AR, cloud computing, and big data analytics into modern e-learning environments. These technologies have significantly enhanced adaptive learning, virtual classrooms, real-time assessments, and overall student engagement. However, despite these benefits, challenges such as the **digital divide, lack of teacher training, high implementation costs, cybersecurity concerns, and ethical considerations** must be addressed to ensure equitable and sustainable digital education.

As EdTech continues to evolve in the **2020s and beyond**, the future of education will be defined by **greater personalization, immersive experiences, and AI-driven innovations**. By **2030**, advancements in **5G connectivity, block chain for credentialing, and met averse-based learning** could further redefine the digital education landscape. However, achieving its full potential requires **collaborative efforts from governments, educational institutions, technology developers, and educators** to create an inclusive and secure digital learning ecosystem. By overcoming existing challenges and leveraging emerging opportunities, EdTech has the potential to **revolutionize global education by 2040**, making learning more **accessible, engaging, and future-ready** for generations to come.

REFERENCES

- Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richter, O., & Kerres, M. (2020). Mapping research in student engagement and educational technology in higher education: A systematic evidence map. International Journal of Educational Technology in Higher Education, 17(2), 1-30. https://doi.org/10.1186/s41239-019-0176-8
- Bozkurt, A., Jung, I., Xiao, J., Vladimirschi, V., Schuwer, R., & Egorov, G. (2020). A global outlook to the interruption of education due to COVID-19 pandemic: Navigating in a time of uncertainty and crisis. Asian Journal of Distance Education, 15(1), 1-126. https://doi.org/10.5281/zenodo.3778083
- Khalil, M. A., & Ebner, M. (2022). Online learning: From formal education to the workplace. Education and Information Technologies, 27(5), 6471-6490. https://doi.org/10.1007/s10639-022-10931-4
- Picciano, A. G. (2021). The great upheaval: Higher education's past, present, and uncertain future in the age of COVID-19. Routledge.
- Selwyn, N. (2019). Should robots replace teachers? AI and the future of education. Polity Press.
- Siemens, G., Gašević, D., & Dawson, S. (2015). Preparing for the digital university: A review of the history and current state of distance, blended, and online learning. Athabasca University. https://linkresearchlab.org/PreparingDigitalUniversity.pdf

ARTIFICIAL INTELLIGENCE IN HEALTHCARE AND BIOTECHNOLOGY

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INTRODUCTION

Artificial Intelligence (AI) is a combination of computer science, physiology and philosophy.

AI is a broad topic, consisting of deficient fields, from machine vision to expert systems. John McCarthy in 1965 defined AI as "the science and engineering of making intelligent machines". Many changes and new features are implemented to program machines with more advancements so that they can mimic and behave as humans effectively and efficiently. Machine Learning is the subset of AI, which is used to make machines learn through data so that they can solve problems. Deep Learning is the subset of Machine Learning that uses vast volumes of data and complex algorithms to train a model. Experts regard AI as a factor of production, which has the potential to introduce new sources of growth and change the method of work in various industries. AI is used in almost all industries, providing a technological edge to all companies integrating AI at a large scale.AI is getting updated day to day with new features and advanced technologies improving the existing process across industries and applications and also helping in developing new solutions to problems that are overwhelming to deal with manually. In the future AI will become increasingly rooted in our daily lives, according to predictions. As AI technology advances and gets more sophisticated, it permeates many aspects of our lives. While AI may result in the loss of certain employment, it will also open up new career paths and opportunities in the fields of data science, AI development and data analytics.

USES OF AI IN HEALTHCARE

1.Error Reduction: AI in healthcare is to reduce humanoid errors. It is proved that AI gives more specific and accurate predictions based on the models developed when compared to doctors.

2. Reduction in Expenses: Artificial intelligence applications can reduce the cost of treatment plan selection and pathology screening. These processes require expertise and expensive equipment that are not available in most hospitals, especially in rural or isolated areas. AI can also help predict the spread of microorganisms that cause disease in a given area.

3. Increased Accessibility: One key benefit of using AI in healthcare is the accessibility of healthcare services. A common application of this is a conversational bot integrated with a website for instant support. One such bot is the multilingual "AapkaChikitsak" bot. It was developed on the Google Cloud Platform to provide free medical education and advice in response to COVID-19 restrictions without actually going to the hospital.

4. Educating Healthcare Professionals: In the future, AI will make the most important adjustments in the process of surgical procedures. It can offer robot-assisted surgical procedures and end up beneficial to reinforce the scientific workforce.

5. Accurate Cancer Diagnosis: PathAI is a biotechnology company in Boston that offers one of the best Machine Learning and Artificial Intelligence tools in healthcare that allows pathologists to make

accurate diagnoses. PathAI reduces errors during the process of cancer diagnosis and offers a range of new techniques for individual medical treatment.

6. Virtual Health Assistants: This virtual assistant helps healthcare by quickly responding to the queries of routine patients through calls and emails, managing the medical information of the patients and protecting sensitive data, scheduling appointments. It offers a personalized experience to the patients in terms of managing their health and helps the patients avoid frequent visits to the hospital, this avoids the infection and transmission of contagious diseases or viruses.

7. Management of Medical Records: Healthcare is one of the Big Data frontiers that need to be tamed. Healthcare organizations need to maintain proper significant and valuable records of patients, AI offers the management of this huge data provides a backup facility and makes sure that the data is not lost.

8. Robot-assisted Surgery: AI designs and develops robots integrated with mechanical arms, cameras, and required surgical instruments to augment doctors' knowledge, skills, and experience and create a new form of surgery. This allows surgeons to sit in front of a computer and control the robot's mechanical arms.

Artificial intelligence (AI) is revolutionizing the healthcare and biotechnology sectors in numerous ways, such as:

1. *Disease Diagnosis*: AI systems can scan medical images and patient information to diagnose diseases more effectively and efficiently.

2. *Personalized Medicine*: AI can assist in personalizing treatment protocols for patients based on their genetic makeup, medical history, and lifestyle.

3. *Predictive Analytics*: AI-driven predictive analytics can assist in identifying high-risk patients and forecasting disease progression.

4. *Clinical Decision Support*: Clinical decision support systems powered by artificial intelligence can offer real-time recommendations and guidance to healthcare professionals.

5. *Patient Engagement*: Virtual assistants and chatbots powered by artificial intelligence can assist patients in their health and wellness.

6. *Medical Research*: Artificial intelligence can speed up medical research by analyzing big data and recognizing patterns and trends.

7. *Healthcare Operations*: Artificial intelligence can assist healthcare operations optimization, including scheduling, staffing, and resource allocation.

Types of AI in Healthcare and Biotechnology

1. *Machine Learning*: Machine learning algorithms are able to learn from data and get better over time.

2. *Deep Learning*: Deep learning algorithms are able to learn intricate patterns in data, like images and speech.

3. *Natural Language Processing (NLP)*: NLP allows computers to comprehend, analyze, and create human language.

4. *Computer Vision*: Computer vision allows computers to interpret and comprehend visual information from images and videos.

Advantages of AI in Healthcare and Biotechnology

1. *Enhanced Accuracy*: AI can execute tasks with high accuracy, minimizing errors and enhancing quality.

2. *Better Patient Experience*: AI-based systems can deliver customized patient care and assistance.

3. *Improved Efficiency*: AI can automate processes, minimizing human labor and maximizing productivity.

4. *Competitive Advantage*: Medical and biotechnology firms that implement AI can gain a competitive edge over firms that do not.

5. *Cost Savings*: Healthcare and biotechnology firms can save costs through the automation of processes and increased efficiency using AI.

Challenges of AI in Healthcare and Biotechnology

1. *Data Quality*: AI needs high-quality data to perform optimally.

2. *Talent Acquisition*: Medical and biotechnology firms must attract and retain AI talent.

3. *Regulatory Compliance*: Healthcare and biotechnology firms need to comply with regulations on AI, like data protection laws and privacy laws.

4. *Ethics*: Healthcare and biotechnology firms need to take the ethical aspects of AI into account, like bias and transparency.

5. *Integration*: AI systems need to be integrated with current systems and processes.

Artificial intelligence (AI) is increasingly applied to healthcare and biotechnology for enhanced patient outcomes, research and development, and operation streamlining. Some of the most significant applications of AI in healthcare and biotechnology are:

1. *Disease Diagnosis*: Medical images and patient data can be diagnosed more rapidly and accurately using AI-based systems.

2. *Personalized Medicine*: AI has the ability to personalize treatment regimes for patients according to their genetic makeup, medical history, and lifestyle.

3. *Predictive Analytics*: Predictive analytics powered by AI can assist in identifying high-risk patients and anticipating disease progression.

4. *Clinical Decision Support*: AI-driven clinical decision support systems can offer real-time advice and recommendations to healthcare professionals.

5. *Patient Engagement*: AI-driven chatbots and virtual assistants can assist patients in managing health and wellness.

6. *Medical Research*: Medical research can be sped up using AI by studying large amounts of data and picking out patterns and trends.

7. *Healthcare Operations*: AI can be used to streamline healthcare operations like scheduling, staff, and resources.

Future of AI in Healthcare and Biotechnology

1. *Increased Adoption*: AI will become increasingly prevalent in healthcare and biotechnology, with increased adoption by companies of AI-powered systems.

2. *Advancements in AI Technology*: AI technology will continue to evolve, with enhancements in machine learning and natural language processing.

3. *Rising Need for AI Professionals*: There will be an increasing need for AI professionals, with more biotechnology and healthcare firms looking to recruit AI specialists.

4. *Greater Emphasis on Ethics*: Healthcare and biotechnology firms will have to emphasize ethics and transparency in applying AI.

In general, AI can revolutionize the healthcare and biotechnology sectors in many aspects, ranging from disease diagnosis to patient experience. Nevertheless, companies should also take into account the risks and challenges of AI, including data quality and ethics.

Finally, artificial intelligence (AI) is revolutionizing the healthcare and biotechnology sectors in many ways, ranging from disease diagnosis to patient experience. AI systems are able to analyze patient data and medical images to identify diseases more accurately and faster, tailor treatment to individual patients, and forecast disease progression. AI can also be used to optimize healthcare operations like scheduling, staff allocation, and resource management.

The advantages of AI in healthcare and biotechnology are better accuracy, improved patient experience, greater efficiency, competitive differentiation, and cost reduction. It has challenges as well, including data quality, talent sourcing, regulation compliance, ethics, and integration.

As technology with AI evolves further, it should become more pervasive in biotechnology and healthcare and more businesses incorporate AI systems into their operations. More companies should hire AI personnel, and companies will have to prioritize transparency and ethics when employing AI.

In general, AI can transform the healthcare and biotechnology sectors, enhancing patient care, improving research and development, and streamlining operations. Nevertheless, the challenges of AI must be addressed, and its application must be ethical, transparent, and responsible.

A STUDY ON WHY ARTIFICIAL INTELLIGENCE IS VITAL TO SOCIAL MEDIA MARKETING SUCCESS

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Abstract:

Social media is at the heart of modern digital marketing strategy. The number of global social media users is predicted to reach 4.41 billion by 2025. People use these platforms to communicate, share ideas, engage with brands, and find inspiration for purchases. With the rush to gain a competitive advantage on social, AI software and social media applications are seeing tremendous growth. The AI in the social media market is expected to achieve a CARG of 28.77% over the next five years, reaching a value of USD 3,714.89 million by 2026. Artificial intelligence (AI) is vital to make sense of the data social media creates and being there with the right messaging and content when your customers choose to engage with your brand.

Keywords: social media, chatbots, AI algorithms, content creation, scheduling

Introduction

Artificial intelligence (AI) is the term used to describe the emulation of human intellectual functions by machines, such as learning, self-correction, and reasoning. Several industries, including social media marketing, are being transformed by AI. The term "social media marketing" (SMM) implies the use of social media websites to advertise a brand, product, or service. It entails producing material for social media platforms, sharing it there, interacting with followers, and examining social media metrics. Currently, AI is being used extensively in SMM. AI algorithms are used to analyse social media data and generate insights that can be used to optimize SMM strategies. AI-powered chatbots are being utilized to provide customer service on social media platforms, while AI-generated content is being used to create personalized content for social media users. Social media platforms are also using AI to improve user experience. For instance, Facebook uses AI to curate users' newsfeeds and suggest friends to connect with Instagram uses AI to recommend posts and accounts for users to follow.

Moreover, AI is being used to improve social media advertising. AI algorithms are used to target ads to specific demographics and optimize ad placement. It is also being used to analyse social media metrics and generate reports that can be used to improve social media advertising strategies.AI is having a profound impact on SMM. By leveraging the power of AI, Social media marketers can analyse vast amounts of data and gain valuable insights that can be used to optimize marketing strategies. It is also being used to create personalized content for social media users, provide customer service, and improve user experience. One of the key benefits of utilizing AI in SMM is the capability to target ads to specific demographics. Its algorithms can analyse user data to determine which users are most likely to engage with a particular ad and then target the advertisement to those users. This can result in higher engagement rates and more effective advertising campaigns. Another benefit of using AI technology in SMM is the ability to automate tasks such as content creation, scheduling, and analysis. This allows social media marketers to focus on more strategic tasks, such as developing marketing strategies and building customer relationships. There are many successful examples of AI-powered SMM campaigns. For instance, Coca-Cola used AI to analyse social media conversations and identify trending topics, allowing them to create personalized content that resonated with its target audience.

Similarly, Sephora used AI-powered chatbots to provide customized product recommendations and improve customer service.

Review of Literature:

According to Ravi Bandakkanavar (2023) AI has significantly impacted social media marketing by providing advanced tools and platforms that efficiently analyse user data and create targeted campaigns. AI also offers opportunities for automation and personalization, enabling marketers to get their target audience more effectively. However, there are ethical considerations to keep in mind when using AI technology in social media marketing, such as the potential for bias and the importance of protecting user privacy.

Shikha Khatri (2023) says social media marketing is a must for any business looking to succeed in the digital world. But with billions of users and endless content, it's tough to stand out. That's where artificial intelligence and machine learning come in. By leveraging these technologies, businesses can automate processes, gain valuable insights, and provide personalized Experiences to their customers.

Objectives of the study

1. To find out the awareness of AI in social media marketing
2. To analyse the impact of AI on people's life
3. To find out which is the most important social media platforms for marketers worldwide
4. To understand the best aspects as well as challenges of AI in social media marketing

Hypothesis of the study

H1- Artificial Intelligence is vital for the success of social media marketing
H0- Artificial Intelligence is not vital for the success of social media marketing

Research Methodology Primary data: The primary data has been collected by providing questionnaire to different users of social media by source of Google forms. Secondary data: The secondary data has been collected by referring to various case studies, websites, interview and other sources.

➢ Population and Sampling technique: The Population of the study to consist the 30 Viewers. The sampling method adopted is Random sampling.

➢ Research Design: The study is Analytical and Descriptive in nature. Data is analysed as

It is clearly evident that people believe that AI can help the marketers become more creative, while 33.3% are of the view that AI can give you back valuable time to take on new and more impactful tasks, while 6.7% found the Hyper personalised user experience the best aspect of AI in social media marketing. And AI would also help in saving time.

Recommendation systems are used by E-commerce sites to suggest products to their customers and to provide consumers with information to help them decide which products to purchase. The products can be recommended based on the top overall sellers on a site, on the demographics of the consumer, or on an analysis of the past buying behaviour of the consumer as a prediction for future buying behaviour. Amazon currently uses item-item collaborative filtering, which scales to massive datasets and produces high quality recommendation systems in real time. This system is a kind of an information filtering system which seeks to predict the "rating" or preferences which user is interested in.

Challenges and Limitations

AI has enhanced social media user experiences, but it also faces several limitations. The possibility of algorithmic bias, which may result in the unjust treatment of particular groups of individuals, is one of the major issues.

Additionally, the rapid technological advancement means that regulatory frameworks and ethical guidelines still have to catch up, leaving AI developers and social media companies to confront complex ethical and legal issues alone. Another growing concern is the effect of AI on social media jobs in the future. With the development of AI, many tasks currently carried out by humans could be automated, altering the nature of work. Addressing these concerns will require proactive initiatives to create new training programs and support for workers in affected fields, along with policies to guarantee that the benefits of AI are distributed more broadly across society.

Suggestions and Conclusion

Artificial intelligence is the future and present of social media. Machine learning, automation, and AI-powered analytics help marketers make sense of the enormous amount of data that social media creates and put those insights into action to drive business performance. With consumer expectations higher than ever before, brands need to leverage AI to be there with the right messaging at the right time and on the right platform. Marketers can use

the insights drawn from customer data to inform strategy and quickly react to trends in consumer behaviour. According to the data collected and analysis done it would conclude that Artificial Intelligence is very much vital to social media marketing success, so the H1 gets accepted and

H0 is rejected in the above case.

References

1. Rem Darbinyan, (16 March 2023), “How AI Transforms Social Media”, Forbes, https://www.forbes.com/sites/forbestechcouncil/2023/03/16/how-ai-transforms-social-media/?sh=128053571f30
2. Shikha khatri (April 23, 2023), “Major brands using AI/ML in social media marketing and achieving success”, linkedIn,https://www.linkedin.com/pulse/major-brands-using-aiml-social-media-marketing-achieving-khatri/
3. Ravi Bandakkanavar (March 18, 2023), “The Impact of AI In Social Media Marketing”,

INTEGRATION OF ARTIFICIAL INTELLIGENCE AND QUANTUM COMPUTING

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Abstract:

The recent advancements in the field of technology have paved way for the integration of Artificial intelligence and quantum computing, often referred to as Quantum AI (QAI). It integrates the power of AI with the incredible processing capabilities of quantum computers. Quantum computing represents a huge leap forward in processing power. Quantum computing's principles, such as superposition and entanglement, boost AI capabilities in machine learning and predictive analysis. By offering vast computational resources and the ability to solve complicated optimization problems, quantum computing could enable AI systems to analyze large datasets and identify patterns far beyond the capabilities of classical computers. The synergy between quantum computing and AI could accelerate the discovery of new algorithms and realization of high machine intelligence, giving rise to a new era of technological advancement. This paper explores the integration of artificial intelligence and quantum computing, how AI drives quantum computing forward, how quantum computing advances AI, the strategic actions that we should consider to implement these technologies effectively. The convergence of AI and quantum computing holds immense potential, but realizing this potential requires careful planning and strategic investment. By understanding these technologies, their implications, and the ethical considerations they raise, large scale businesses can position themselves to thrive in the next wave of technological innovation.

Keywords: Artificial intelligence, Quantum computing, Machine learning, Predictive analysis, Artificial neural networks, Optimisation, Superposition.

1. Introduction

Quantum computing and artificial intelligence (AI) are two of the most transformative technologies of the 21st century. While AI is already reshaping industries and daily life, quantum computing promises to revolutionize the very foundations of computing. The combination of these two technologies holds the potential to solve problems previously deemed unsolvable, offering unprecedented advancements in various fields.

1.1 Understanding Quantum Computing and Artificial Intelligence

Quantum computing is an area of science and technology that focuses on the development of computers based on the principles of quantum theory. Quantum computing uses the unique behaviors of quantum mechanics to solve problems that are too complex for classical computing. Quantum mechanics is the branch of science that deals with the behavior of particles on an atomic and subatomic level. Unlike classical physics, which explains the macroscopic world, quantum mechanics describes phenomena that occur at the smallest scales, such as the behavior of electrons, photons, and other elementary particles.

Quantum computers harness the principles of quantum mechanics to process information in fundamentally different ways from classical computers. While classical computers use bits as the smallest unit of data, quantum computers use qubits. Qubits are the fundamental unit of quantum information, qubits can be realized through various physical systems such as photons, electrons, and atoms.

Their ability to represent multiple states simultaneously (superposition) and to be entangled with other qubits underpins quantum computing's power. Unlike classical bits, which can be either 0 or 1, qubits can exist in a state of superposition, where they can be both 0 and 1 simultaneously. This property allows quantum computers to perform many calculations at once. Superposition is the principle that allows a qubit to be in a combination of states, enabling parallelism in computation. A quantum computer with multiple qubits can process a vast number of possibilities simultaneously.

When qubits become entangled, the state of one qubit becomes dependent on the state of another, regardless of the distance separating them. This is called as entanglement. This interconnection allows for coordinated processing and information transfer at speeds beyond classical limits. Entangled qubits maintain a shared state such that the state of one directly influences the state of another, regardless of distance. This phenomenon is essential for quantum communication and error correction, contributing to the robustness and efficiency of quantum computations.

Artificial intelligence (AI) is the simulation of human intelligence processes by machines, especially computer systems. The rapid advancements in AI and quantum computing are shaping the trajectory of the technological industries, providing transformative solutions to complex industrial challenges. As we delve deeper into the Fourth Industrial Revolution, it becomes evident that these technologies will play a pivotal role in determining the future of manufacturing, production, and service delivery.

2. Literature Survey

As we stand on the brink of a new era in artificial intelligence, the journey from traditional AI to generative AI and, ultimately, to quantum AI is symbolic of the fast advancement of technology and its significant effects on society. The foundational concepts of AI have laid the groundwork for innovative applications that not only enhance productivity but also challenge our understanding of creativity and intelligence itself. Generative AI, with its ability to create content, solve complex problems, and augment human capabilities, marks a significant leap forward, demonstrating the transformative potential of machine learning algorithms and neural networks.

Quantum computing has made significant strides in recent years. Firstly, it was Google Research, which announced the launch of Quantum AI lab in a blog post on May 16, 2013. On October 10, 2013, Google released a short film describing the current state of the Quantum AI Lab. On October 18, 2013, Google announced that it had incorporated quantum physics into Mine craft. In January 2014, Google reported results comparing the performance of the D-Wave Two in the lab with that of classical computers. On 2 September 2014, it was announced that the Quantum AI Lab, in partnership with UC Santa Barbara, would be launching an initiative to create quantum information processors based on superconducting electronics.

In 2019, Google claimed to have achieved quantum supremacy, where their quantum processor, Sycamore, performed a specific task faster than the world's most powerful supercomputers. Significant progress in quantum error correction techniques, essential for maintaining the stability and reliability of quantum computations. The research on developing new quantum algorithms, such as Shor's algorithm for factoring large numbers and Grover's algorithm for database searching, demonstrating quantum computing's potential to outperform classical approaches. On December 09, 2024 Google Introduced Willow, describing it as the world’s fastest chip.

Several other organizations have invested heavily in quantum computing research and development. With its IBM Quantum Experience, IBM offers cloud-based quantum computing platforms, enabling researchers to experiment with quantum algorithms. Microsoft, through its Azure Quantum platform, Microsoft integrates quantum computing with cloud services, providing tools for quantum algorithm development. Rigetti Computing, a pioneer in hybrid quantum-classical computing, Rigetti offers quantum cloud services and develops superconducting qubit-based quantum processors.

3. Integration of AI and Quantum Computing: Quantum Artificial Intelligence (QAI)

AI, with its subsets like machine learning, deep learning, and neural networks, has already made significant inroads into the modern applications. AI-driven systems can process vast amounts of data in real time, providing valuable insights to optimize production processes, enhance product quality, and reduce operational costs. With AI-driven demand forecasting, companies can optimize inventory, streamline logistics, and improve customer satisfaction. Quantum computing can revolutionize areas such as materials science and optimization problems. For instance, simulating new materials for better product performance or environmental sustainability, which would take classical computers years, can potentially be achieved in mere hours or days with quantum computers.

The intersection of AI and quantum computing is particularly exciting. Quantum-enhanced machine learning algorithms can analyze and process datasets that are too complex for classical algorithms. This means more accurate AI models, faster training times, and the ability to handle problems that are currently beyond our reach. For industries, this convergence can lead to innovations like drug discovery processes where quantum machines can simulate complex biochemical interactions, or in financial services where they can optimize trading strategies by analyzing multifaceted datasets in real time. While AI provides immediate applications and tangible results, quantum computing represents the vast, untapped potential of the future. Together, they signify a potent combination, heralding a new era of efficiency, innovation, and growth in the industrial sector.

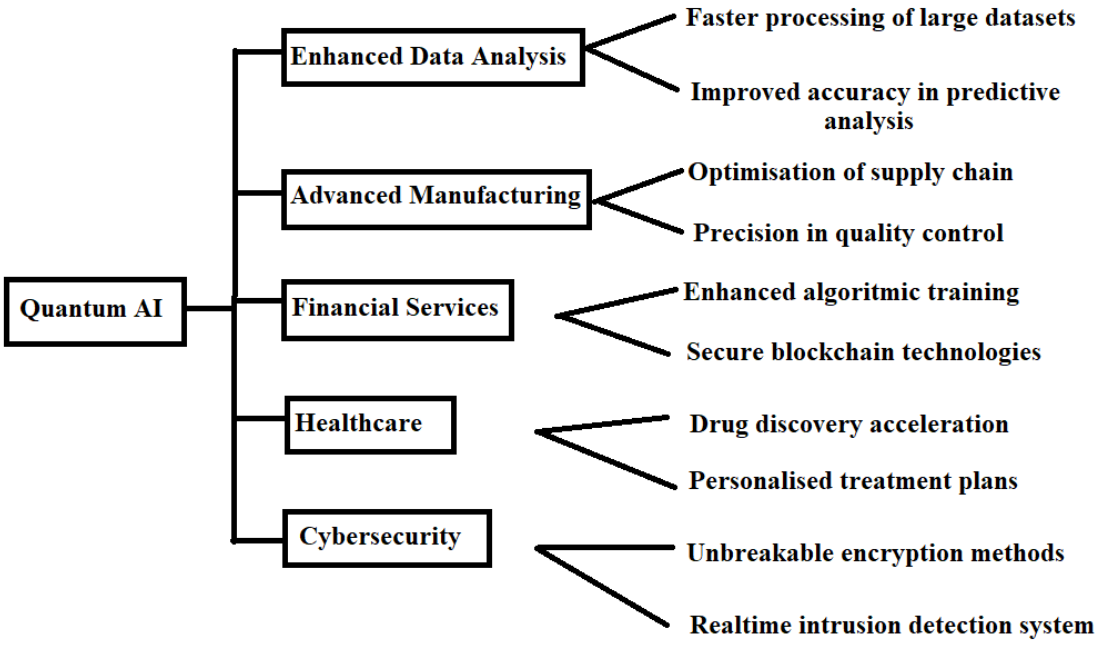

Fig 1: Overview of the potential influences of quantum AI

3.1 Quantum AI Hardware and Software

Building a functional quantum computer involves both hardware and software. Hardware includes various physical implementations of qubits, including superconducting qubits, trapped ions, topological qubits, and photonic qubits. Each approach has its advantages and challenges in terms of coherence time, scalability, and error rates. Software: Quantum programming languages and frameworks, such as Qiskit (IBM), Cirq (Google), and Q# (Microsoft), are being developed to facilitate the creation and execution of quantum algorithms. These tools are crucial for researchers and developers to harness the power of quantum computers effectively.

AI hardware is rapidly evolving to keep up with the ever-increasing complexity and scale of AI applications. Hardware—from the old-style CPUs and GPUs to more specialized ones like TPUs, FPGAs, and ASICs—lays a critical foundation in the advancement of AI technologies. Exciting possibilities lie ahead as trends—ranging from quantum computing to edge AI and neuromorphic computing—are set to further boost the performance, efficiency, and accessibility of AI, it is important to be familiar with the strengths and limitations of different AI hardware to make an informed decision that aligns well with specific application needs and the future goal, this is because in just such a way that artificial intelligence continues to integrate deeper and deeper into various industries, so the demand for optimized hardware solutions will only increase, driving forward more innovative development in the field.

The minimum hardware requirements of quantum AI are a Processor which should be i5 (2nd generation or later) with frequency of 3.2GHz or higher. The minimum memory requirement is 3 GB RAM and 8GB or more is recommended for local simulations. Hard Disk should be 250 GB or larger. With Display of 17" VGA with a minimum resolution of 1280 x 1024. For GPU (Graphical Processing Unit) based quantum simulations on Google Cloud, it is essential to install GPU drivers and the CUDA toolkit. Quantum Computing Infrastructure requires access to a quantum computing platform (e.g., a cloud-based service or on-premise hardware). Python, with its vast library support and ease of use has become one of widely used programming languages in quantum AI. Specifically using Qiskit, a popular Python library developed by IBM for quantum programming. Qiskit is the world's most popular software stack for quantum computing, which is used for building circuits, control Qiskit functions, transpire with AI tools, and execute workloads in an optimized runtime environment.

4. Advantages of Quantum AI

- Fast calculations at unprecedented speeds: Quantum Computers can perform calculations exponentially faster than classical computers. They harness the principles of quantum mechanics to process information in parallel, allowing for rapid execution of complex algorithms.
- Efficient data storage and retrieval capabilities: Quantum Computing offers efficient data storage and retrieval capabilities through quantum memory systems. Quantum bits, or qubits, can store and manipulate vast amounts of data in quantum states.
- Resolves complicated problems: Quantum Computing solves intricate problems involving complex mathematical calculations, optimization, and simulation. Quantum algorithms utilizes the unique properties of quantum mechanics to find optimal solutions to optimization problems, simulate quantum systems with high accuracy, and solve cryptographic challenges efficiently.

- Better privacy standards: Quantum Computing offers better privacy standards through advanced encryption and cryptographic techniques. Quantum cryptography uses the rules of quantum mechanics to create safe ways to send messages that are very hard for others to spy on or hack into. This enhances privacy and data security in digital communication networks, safeguarding sensitive information from unauthorized access and interception.

5. Challenges in implementing QAI

- Complex to Implement: Developing algorithms for Quantum Computers requires a deep understanding of quantum mechanics and specialised expertise. This is a significant challenge for researchers and developers, as Quantum Computing concepts can be complex
- Requires extremely low temperatures: Quantum Computers operate using qubits, which are highly sensitive to external disturbances such as temperature fluctuations and electromagnetic interference. To maintain the intricate quantum states of qubits, Quantum Computers require extremely low temperatures close to absolute zero (-273.15°C or 0 Kelvin). Achieving and maintaining these ultra-low temperatures using cryogenic systems which adds complexity and cost to Quantum Computing infrastructure, limiting scalability and accessibility.
- Limited accessibility: Quantum Computing resources are limited and primarily available to academic institutions, research laboratories, and large technology companies. Accessing Quantum Computers for experimentation and research purposes can be challenging for individuals and smaller organisations due to cost constraints and limited availability. This lack of accessibility impedes widespread adoption and hinders innovation in Quantum Computing.
- Navigation challenges in Internet security: Quantum Computing potentially threatens existing cryptographic systems used to secure digital communication and data storage. Quantum algorithms like Shor's can factor large prime numbers efficiently, compromising widely-used encryption methods like RSA and ECC. Addressing this challenge requires the development of quantum-resistant cryptographic algorithms and deploying quantum-safe encryption technologies to ensure cyber security in the quantum era.
- Scalability Building scalable and reliable quantum computers remains a significant challenge, with current systems limited by qubit coherence times and error rates.
- Regulation and Governance: Developing frameworks to regulate the use and development of quantum AI technologies, ensuring they align with ethical standards.

6 Applications of Quantum AI

Drug Discovery: Quantum computing can simulate molecular interactions with very high accuracy, aiding in the discovery of new drugs and materials.

Climate Modeling: Enhanced computational power can improve climate models, providing more accurate predictions and aiding in the development of strategies to combat climate change.

Cryptography: Quantum AI can both break existing cryptographic codes and develop new, more secure encryption methods.

Public Engagement: Involving the public in discussions about the implications of quantum AI, fostering transparency and trust.

Collaborative Efforts: Encouraging international collaboration to address the global challenges posed by quantum AI, ensuring that benefits are broadly shared.

7. Future Prospects of QAI

Quantum AI is poised to transform numerous sectors like Healthcare, finance, energy sector, manufacturing etc. To Prepare for a Quantum-AI future, it is essential to fully realize the potential of quantum AI. Technologists must take proactive steps which include education and training, investing in education and training programs to equip the workforce with the necessary skills for a quantum-AI future. It is necessary to implement research and development, supporting research initiatives to overcome current technical challenges and drive innovation in quantum computing and AI, policy and regulation, establishing policies that promote ethical development and deployment of quantum AI technologies, ensuring they benefit society as a whole.

8. Conclusion

The integration of quantum computing and artificial intelligence represents a huge leap forward in technological capability. By unlocking new levels of computational power and intelligence, this synergy holds the potential to address some of the most important challenges of our time. However, it is important to navigate the path ahead with caution, ensuring that the advancements we make are guided by ethical principles and a commitment to the greater good. By embracing this integration of quantum computing and AI with responsibility and foresight, we can expect to achieve unprecedented innovation and progress.

9. References

[1] V. Kasirajan, Fundamentals of Quantum Computing. Berlin, Germany: Springer, 2021.
[2] D. P. DiVincenzo, “The physical implementation of quantum computation,” Fortschritte der Physik, vol. 48, no. 9–11, pp. 771–783, 2000.
[3] C. D. Bruzewicz, J. Chiaverini, R. McConnell, and J. M. Sage, “Trapped-ion quantum computing: Progress and challenges,” Appl. Phys. Rev., vol. 6, 2019.
[4] L. Henriet et al., “Quantum computing with neutral atoms,” Quantum, vol. 4, 2020.
[5] C. Hempel et al., “Quantum chemistry calculations on a trapped-ion quantum simulator,” Phys. Rev. X, vol. 8, 2018.
[6] E. P. Gale, Z. Mehdi, L. M. Oberg, A. K. Ratcliffe, S. A. Haine, and J. J. Hope, “Optimized fast gates for quantum computing with trapped ions,” Phys. Rev. A, vol. 101, 2020.
[7] I. Georgescu, “Trapped ion quantum computing turns 25,” Nature Rev. Phys., vol. 2, 2020.
[8] K. R. Brown et al., “Single-qubit-gate error below 10–4 in a trapped ion,” Phys. Rev. A, vol. 84, 2011.
[9] L. R. Schreiber and H. Bluhm, “Quantum computation: Silicon comes back,” Nature Nanotechnol., vol. 9, no. 12, 2014.
[10] J. J. Pla et al., “A single-atom electron spin qubit in silicon,” Nature, vol. 489, no. 7417, 2012.

TRANSFORMING PCOS MANAGEMENT: AI, CLOUD COMPUTING AND THE FUTURE OF PERSONALIZED, NON-PHARMACEUTICAL CARE

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Abstract
Polycystic Ovary Syndrome/Disease (PCOS/PCOD) is a prevalent hormonal disturbance affecting women that requires prolonged care and lifestyle interventions. However, contemporary research reports areas of deep concern, including the absence of organized long-term lifestyle interventions, insufficiency of data on the sustained impact of non-pharmaceutical techniques, and importance placed on personalized follow-up. The central area of the paper would be how AI and Cloud computing type of technologies could contribute to solving these deficits. These technologies have the potential to offer predictive analytics, remote monitoring, and personalized care algorithms to create a sustainable environment for the improvement of PCOS/PCOD management. In this regard, this paper details the proposed AI-powered cloud-based system framework for supporting individual care and long-term tracking to eventually modulate the standard PCOS/PCOD care model.

Keywords
PCOS/PCOD, Artificial Intelligence (AI), Cloud Computing, Lifestyle Intervention, Non-Pharmaceutical Approaches, Personalized Health Care and Follow-up Consistency.

Introduction

Polycystic Ovary Syndrome/Disease (PCOS/PCOD) affects anywhere between 3 to 10% of women of reproductive age across the globe, frequently tied to irregular cycles, insulin resistance, and infertility. Standard care is more effective if a patient is motivated for lifestyle changes and encouraged to begin medication, but hard skills exist in maintaining long-term adherence and evaluating efficiency.

There has been more recent interest in three significant areas of deficit within PCOS/PCOD:

1. No long-term structured lifestyle intervention studies exist with any semblance of consistent follow-up.
2. For the longest time, not much has been said about the sustained impact of other interventions, including diet and exercise.
3. There is an urgent requirement for personalized adaptive interventions with variable follow-up.

With the availability of AI and Cloud Computing, there is an opportunity to fill these gaps. Such technologies would enable the real-time collection of data, prediction of the patient's behavior and remote health coaching, thus facilitating the smooth transition from the present model of PCOS/PCOD care toward one that embraces a lot of flexibility and responsiveness.

Literature review

In the last decade, the management of Polycystic Ovary Syndrome/Disease (PCOS/PCOD) has progressed tremendously since lifestyle therapies were considered more seriously and included some evidence-based intervention, personalized medicine, and technology into the care models.

Teede et al. (2018) developed the internationally recognized evidence-based guidelines for assessment and management of PCOS which are endorsed by the Endocrine Society of Australia. The guidelines propose a holistic approach, identifying that lifestyle intervention is the suggested first option, but lack evidence of structured long-term studies and problems with patients maintaining a lifestyle change. The guidelines highlight that the patient's future care should be personalized and require ongoing review to promote an effective outcome. (Clinical Guidelines of PCOS Management).

According to the World Health Organization (2020), PCOS is one of the most common endocrine disorders in women of reproductive age with estimates that up to 10% of women globally could be impacted. The WHO fact sheet talks about the overall health burden of PCOS and indicates the necessity for a comprehensive care model that incorporates metabolic and reproductive care, yet they also identified that evidence about long-term, non-pharmaceutical interventions is limited, particularly in undeveloped countries. (Global Health Context).
Binns and Lee (2021) conduct a systematic review of lifestyle interventions for PCOS management (diet, exercise, behavioral therapy), and their effects on insulin resistance, hormonal balance, and mental wellbeing. The authors conclude the lifestyle-based interventions demonstrated positive effects on the clinical symptoms of PCOS, but there were multiple challenges in relation to methodology, data collection, and the overall lack of rigor in study design afforded poor reproducibility and real-world applicability. The limitations of the studies reviewed highlight an excellent opportunity for digital health technology to standardize these methods and assist with monitoring. (Lifestyle Intervention Overview).

Rajkomar et al. (2019) outline how machine learning has the potential to fundamentally change the future of medicine. They describe examples of how artificial intelligence (AI) algorithms can be used to both predict health outcomes and support clinical decisions through automated diagnostic and predictive analysis of data. Their paper outlines the necessary steps to explore the use of AI to enhance the care of people with chronic conditions, such as PCOS/PCOD because large amounts of lifestyle, biological, and behavioral data can support dynamic health care plans. (AI in Health Care).

Cloud computing platforms can provide a means to aggregate and analyze health data in real-time, securely, and inexpensively. For example, Amazon Web Services' Health Lake (2023), can enable healthcare providers to utilize various health data for interoperability, predictive modeling, and scalable data storage, which are critical for managing chronic conditions like polycystic ovary syndrome (PCOS) or polycystic ovarian disease (PCOD), where data must be gathered continuously from multiple sources (wearable devices, patient logs, or clinician inputs). (Cloud health infrastructure).

The goal of the 2019 book, Deep Medicine, by Eric Topol provides an argument for human-and community-level transformation of medicine with artificial intelligence. Topol writes, "The future use of AI will be to augment the clinician's role does not usurp it" in the pursuit of the patient-clinician relationship within the context of design thinking (Topol, 2019). In the context of PCOS/PCOD, this philosophy reflects our own intention of providing AI-enabled solutions to create supportive, adaptive care while providing ownership of their health to patients within the structure of a health-technology.

The review has identified emerging consensus within both clinical and technological literature; while lifestyle intervention remains core learning in care for PCOS/PCOD, sustained outcomes will require structure, personalization, and technology enabled solutions. AI and Cloud platforms provide an acceptable and affordable option to address the identified clinical-patient care gaps through scalable, patient-centered, and data-enhanced healthcare innovation.

Objectives

- To explore the existing gaps regarding lifestyle intervention strategies and follow-ups in the care of women suffering the ill effects of PCOS/PCOD diagnosis.
- To evaluate the current non-pharmaceutical approaches meant for managing PCOS/PCOD without providing significant outcomes regarding long-term data.
- To investigate the scope for Artificial Intelligence (AI) to prescribe personal treatment and monitoring programs for the patient who suffers from PCOS/PCOD.
- To determine by cloud computing, real-time storage, processing, and access of health-related information of patients.
- To present cyber-model for the remote tracking of interventions on nutrition, exercise, sleep, and stress.
- Develop a continuous, adaptable follow-up system which modifies intervention based on patient progress and feedback.
- Wearable mobile app data integrated into the cloud platform for management of all aspects of PCOS/PCOD.
- Establish critical health indicators for the AI model to predict symptoms, complications, or relapses of patients with PCOS/PCOD.
- Enhance patient engagement and adherence toward lifestyle modification via an AI-mediated feedback mechanism and its alerts.
- Testing of feasibility for real-world applicability of AI and cloud solutions in PCOS/PCOD clinical and self-care environment.

Methodology

This study utilized conceptual and mixed-methods methodology to explore the role of Artificial Intelligence (AI) and Cloud Computing in addressing overarching gaps in managing Polycystic Ovary Syndrome/Disease (PCOS/PCOD). To do so, the three reaction impacts were included as key-indicators in developing and validating a prototype framework for managing PCOS/PCOD in new and improved non-drug, long-term, and personalized ways. The research focuses on stakeholder views, simulated healthcare data while modelling for predictors, and comprehensive literature review.

Data Simulation and Collection

They built a simulated dataset using artificial intelligence tools to reflect key lifestyle and health factors as they exist in PCOS/PCOD patients. Many key parameters were included such as insulin resistance ratings, sleep quality, levels of physical activity, mood recording, and eating patterns. All these parameters were developed to act as data input comparable to what get collected from wearables, mobile health apps, and random self-surveys.

Using this dataset, several supervised machine-learning models were built and were used to predict effectiveness of interventions, symptom variation and adherence over time. They evaluated the performance of the models against evaluation metrics depending on the model type including Mean Squared Error (MSE), R-Squared, and F1 score. They made sure performance metrics reflected accuracy and reliability based on the medical fitness and requirements.

Survey of Stakeholder Perceptions

To bridge the gap between technical modeling and practical knowledge, I employed a qualitative questionnaire with a group of stakeholders (limited in number). I interviewed five stakeholders, including a gynaecologist, a nutritionist, a personal fitness coach, a medical student, and a cloud infrastructure engineer. The purpose of the questionnaire was to obtain their thoughts regarding the application of artificial intelligence in human patient health, the ethical implications regarding the privacy of health data, and to uncover the implied need for personalization and monitoring patients with chronic diseases such as polycystic ovary syndrome (PCOS).

Even with the limited stakeholder sample size, responses provided context; one shared belief was that hybrid systems—machine intelligence leveraged with human oversight—would be an ethically conscious means of providing care that is sensitive to emotional dimensions of care.

Framework Development

The findings of both syntactic modelling and stakeholder survey were used as a basis to conceptualize an AI-cloud system for the management of PCOS/PCOD. The proposed system would include:

- Real-time entries of patient data
- AI-assisted analysis of patient data to provide patient-specific recommendations
- Cloud structure to allow data sharing, where stakeholders can update interventions in real-time.
- The ability for the system to learn about the patient by utilizing a feedback mechanism as it tracks the patient's progress and then sends an updated care plan/reminder to both patient and health worker.

Ethical Issues

Recognizing the sensitivity of health data, the framework emphasizes data security, replacement and transparency of algorithms within the section. In addition, educational architecture attempts to conform to today’s standards, including HIPAA and GDPR so that privacy and ethical boundaries are at the forefront of any future implementation.

Discussion

The findings from this study underscore the pressing need for innovation in the management of PCOS/PCOD, particularly in areas where traditional healthcare systems fall short—long-term lifestyle tracking, non-pharmaceutical data collection, and personalized care delivery. By conceptualizing an AI and cloud-powered model, this study offers a forward-thinking response to those unmet needs.

Comparing Traditional vs. AI-Cloud-Based PCOS/PCOD Care:

Aspect	Traditional Care	AI & Cloud-Based Care (Proposed)
Approach	Episodic, reactive care focused primarily on symptoms and medication	Continuous, proactive care integrating real-time data and adaptive recommendations
Personalization	Generic treatment plans based on broad categories	Tailored interventions using patient-specific data and AI-driven insights
Monitoring	Limited to clinic visits and patient self-reporting	Continuous tracking via wearables, apps, and cloud-synced health logs
Intervention Updates	Static, often reviewed only during appointments	Dynamic and updated in real time based on behavioral and physiological feedback
Follow-up Consistency	Inconsistent due to logistical and systemic gaps	Automated reminders, digital coaching, and AI-scheduled check-ins ensure consistency
Data Collection	Scattered, manual, and prone to loss or error	Centralized, secure, and accessible via cloud platforms
Patient Engagement	Passive: patients often feel disconnected from the process	Active; patients are partners in their health journey with access to insights and goals
Outcome Tracking	Difficult to measure long-term non-pharma impact	AI models can analyze trends over time and measure sustained improvements

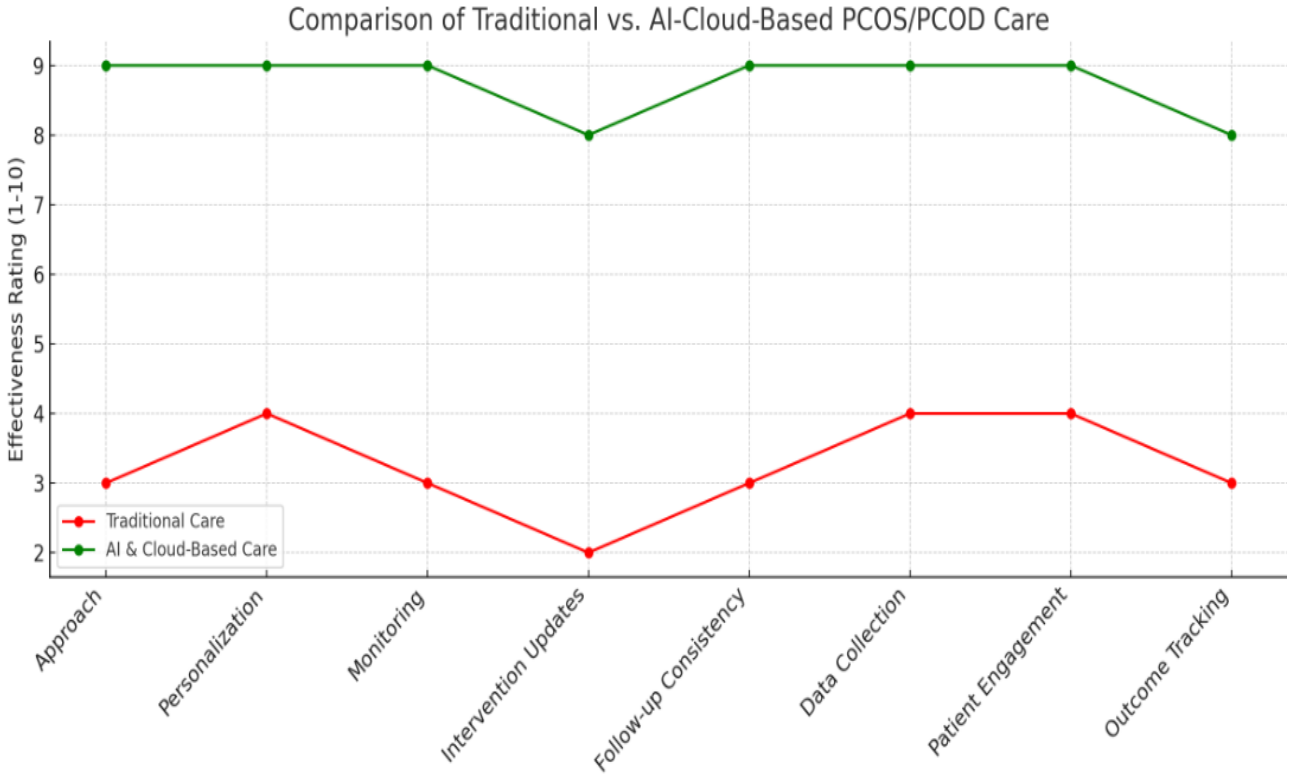

Fig: 1.1. Comparison of Traditional vs. AI-Cloud Based PCOS/PCOD Care

For Example, A patient named Ananya, 27years old women, diagnosed with PCOS,

Aspect	Traditional Care (Ananya's Experience)	AI & Cloud-Based Care (Proposed Experience)
Approach	I visit a gynecologist every 6 months. Receives emotion and general advice.	Uses an app that tracks daily symptoms, menstrual cycles, and lifestyle changes. Receives adaptive AI feedback.
Personalization	One-size-fits-all plan: weight loss advice and hormone pills.	AI recommends meals, exercise routines, and mindfulness sessions based on Ananya's mood, sleep, and vitals.
Monitoring	Self-monitored, mostly forgotten after the initial visit.	Syncs wearable (e.g., Fit bit) data to cloud: steps, heart rate, sleep, and ovulation tracked continuously.
Intervention Updates	Adjusted only during clinic visits.	Interventions updated weekly via AI after analyzing new data trends.
Follow-up Consistency	Follow-ups were missed due to scheduling delays and work stress.	AI schedules virtual check-ins; sends nudges if key metrics (like sleep or mood) decline.
Data Collection	Manually written records, often incomplete or lost.	All inputs are securely stored and accessible on cloud for long-term trend analysis.
Patient Engagement	Feels overwhelmed, disengaged, and unsure if improvements are happening.	Gets visual dashboards showing progress; motivational insights keep her involved.
Outcome Tracking	No real measurement beyond subjective reporting.	AI reports improvement in sleep regularity, cycle predictability, and reduced acne based on weekly analysis.

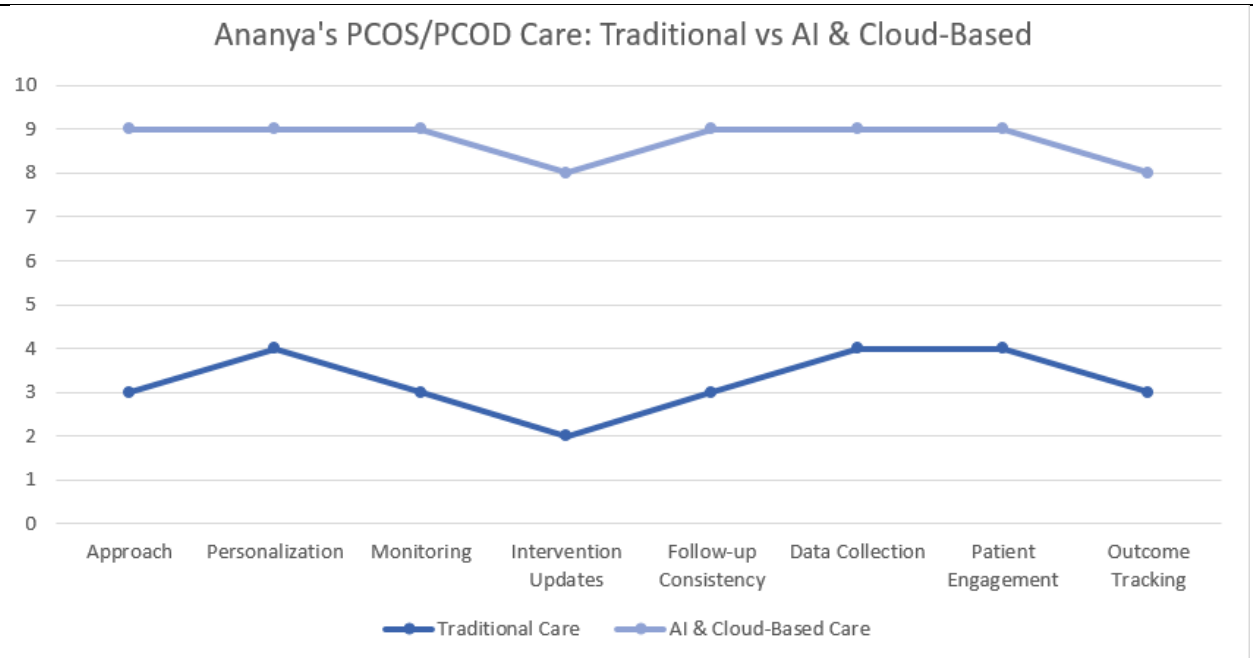

Fig: 1.2. Ananya's PCOS/PCOD Care: Traditional vs AI & Cloud-Based

Key Takeaways and Considerations

The contrast certainly highlights that the current systems are inadequate to meet the rapidly changing needs of their PCOS/PCOD patients - particularly those looking for sustainable lifestyle-based management. Many motivated patients fall through the health care systems regarding follow up, intervention, or support tools when they are not consistent, or evidence informed. We establish again here how incorporating AI and cloud computing transforms this path, as it provides:

• Consistency: with scheduled and automated digital health intervention and follow-up via digital diaries and reminders + use of previous automated assessments

• Personalization: with a digital, AI support tool the care recommendations can change, and adaptation can occur via evolving evidence based - something static clinical guidelines cannot do efficiently.

• Further reflections and options for data driven responses: the health trends identified in health diaries are seen in whatever is worsening or improving in the health self-management domain and the development of new and sustained healthy behaviors can be seen over time.

Ethical and Practical Considerations

While it is clear through the above knowledge that our model has a lot of tangible benefits, we must recognize the ethical considerations that need to be addressed before proceeding to implementation stage. There may be ethical concerns regarding privacy of data, algorithmic risk and accountability and patient safety regarding clinical responsibilities and ethical and legal professional global standards. Our cloud infrastructure needs to ensure patient data is made under best practice standards (i.e. achieved via HIPAA, GDPR etc.) as well supports the need to demonstrate the transparency and interpretability of data driven models for clinicians. Further, we need to ensure that clinical decisions are emphasized on human and professional judgment and individual helpful interactions. AI in support of and not as as replacement for clinician decision making. Reproductive planning, wellbeing and mental health support, and patient counselling require a human connection and sense of caring and experience.

Scope of the study

This study focuses on how Artificial Intelligence (AI) and Cloud Computing can be used to address critical gaps in the long-term management of PCOS and PCOD. Specifically, the study involves,

- Assessment of Existing Gaps: We will explore the limitations of existing PCOS/PCOD care, especially the absence of long-term HRQL studies, limited non-drug care options, and inconsistencies in personalized care and follow-up.

- Application of Artificial Intelligence and Cloud Platforms: We will explore the use of AI powered analytic and Cloud-based platforms for creating more personalized interventions, improving adherence measures, and continuous monitoring.

- Development and Assessment of Model: We will explore simulating and applying AI models on synthetic/real-world health databases to assess their capabilities of predicting and evaluating the effectiveness of lifestyle-based PCOS interventions.

o Integration with Patient-Centric Models of Care: We will explore digital solutions using mobile apps, wearables, or cloud interfaces to enable patients to have more ownership in their care, receive real-time feedback, and adherence with longer-term health plans.

o Assessment of Current Gaps: We will identify gaps in current care of PCOS/PCOD, including the lack of longitudinal HRQL studies or reported on, limited non-drug options for care or treatment, and the inconsistencies of individualized care and follow-up with standardized models.

o Application of Artificial Intelligence and Cloud Platforms: We will assess, and exploit AI powered analytic and Cloud-based platforms to develop more individualized interventions, explore adherence measures, and continue routine monitoring.

o Development and Evaluation of Model: We will explore how to simulate and apply AI models on synthetic/real world health databases to assess their ability to predict and evaluate lifestyle-based interventions in females with PCOS.

- Integration into Person-Centered Models of Care: We will investigate digital solutions to do this through mobile applications, wearable devices, and/or cloud interfaces that shift ownership of care to the patient and will facilitate feedback, monitoring, and adherence to their health plan in a sustained longer period.

Results

The model we proposed has the potential to provide:

- Tracking Lifestyle: The automated inputs from wearables and mobile app for tracking lifestyles allow for protractive tracking of one's lifestyle.
- Personalized Recommendations: AIs adapting the intervention based on the user's input, with progress-based interventions to maintain user compliance.
- Cloud- computing: real time storage of the data allows patients and clinicians to have easy access to the dashboard and continuity of follow up.
- Behavioral Insights: Predictive models identify risk patterns (i.e. points of prolonged inactivity or stress clutter triggers) so that timely interventions are provided.

Future scope of the study

Since digital health technologies are advancing, the incorporation of Artificial Intelligence (AI) and cloud computing into the PCOS/PCOD care facilitates opens various ways for future studies, clinical innovations, and patient engagement to be done. This study is the first step, but a few options are still open for the exploration of new subjects:

1. Development of Real-Time, Patient-Specific AI Models: In the future, it will be possible to produce and test AI models which give continuous learning of individual patient data over time as the focus of the campaign. These models evolve into patient behavior, with self-regulation of predictions and suggestions being the major cause of the emergence of ultra-personalized care.

2. Integration with Wearables and IoT Devices: Devices like fitness bands, smartwatches, and biosensors can continuously get the real-time physiological and behavioral data of the users and transfer them to the cloud system. In the coming days of research, we might see how this continuous data providing PCOS/PCOD symptoms can be detected in the early stage and the intervention can be exercised.

3. Global Cloud-Based PCOS/PCOD Data Repositories: Through cloud platforms to enable, distribute among the data lakes the future finds research about the provision of large-scale, global analysis of the PCOS/PCOD trends across populations, ethnicities, and geographies by means of the data and the replenishing of it to make more comprehensive understanding and culturally sensitive care models possible.

4. AI-Powered Decision Support for Clinicians: By employing AI, the clinicians may assist healthcare providers to come up with the correct diagnosis, the most fitting treatment plans, and risk assessment, thus reducing variability and promoting decision-making based on evidence. Through the phase of research, alternative models may be introduced, and in such circumstances, healthcare providers can develop multifaceted and evidence-based decision-making Clinical Decision Support Systems (CDSS), whereas the AI-based application of the relevant data scientists is also minimally utilized. The Clinical Decision Support Systems (CDSS) perform a relatively more modest function in directing the process of diagnostic treatment planning for the doctors, as they largely carry out their own primary functions without much more additional assistance.

5. Integration of Mental Health Care and Hormonal Health: With such comorbid disorders as anxiety and depression becoming frequent companions to PCOS/PCOD, mental health care and hormonal and metabolic monitoring should converge to anticipate the future systems fully, which in turn will set the stage for a very holistic health care system.

6. Longitudinal Lifestyle Studies: The study may result in the commencement of AI-propelled lifestyle intervention trials of long duration that follow and evaluate non-drug outcomes for several years - finally solving the problem of lack of sustainable data in this field.

7. Voice and Conversational AI Interfaces: Incorporating voice technology on AI chatbots (e.g., using mobile apps or virtual assistants) can make it easier for patients to access services, especially for those who are not literate or do not know how to use technology effectively.

8. Policy-Driven Health Systems Transformation: Lessons from future research can have an impact on the introduction of public health policies that give rise to the use of AI-based cloud models in the management of chronic diseases on a large scale, with PCOS/PCOD as the specific problem/illness.

9. Ethical AI Research and Explainable Models: For the safe use of AI in the future, new research can attempt to create models for the explanation of AI in the health sector that not only clearly show patients and clinicians why certain predictions or recommendations were made but can be easily understood by them.

10. Cost-Benefit Analysis and Scalability: Another important sector is estimating the financial viability and scalability of the implementation of these AI-cloud systems in both advanced and developing healthcare environments which can sustain equity in innovation.

Conclusion

Polycystic Ovary Syndrome (PCOS) and Polycystic Ovary Disease (PCOD) are not as simple as diseases that a doctor can cure with a prescription. These diseases are multifaceted conditions for which it is necessary to have not only medicines but also a long-term lifestyle change, personalized care, and regular follow-up checks. Because of resource shortages, the lack of a structured non-pharmaceutical therapeutic approach, and a scarcity of data about long-term non-pharmaceutical outcomes, traditional medical systems have mostly been unable to meet these requirements.

The study sets out further that data reveals that Artificial Intelligence (AI) and cloud computing when used in controlled settings could be instrumental in overcoming these critical gaps in healthcare delivery. The AI and the cloud-based solutions that can provide for both aspects of the healthcare system such as general practitioners or patients, directly by offering them a chance to control their PCOS/PCOD in a more personalized manner, that will be the effect of the real-time monitoring, personalized treatment ways, and continuous patient engagement, when triggered by patients' health status changes are explained.

It is evident from the study that technology is not a replacement for humans. However, it serves as a powerful support system. Artificial Intelligence can be used to study a big amount of data and display which therapy will be the best solution for the patient while cloud infrastructure provides the data that is enough to handle, take care of safety and it is a highly secure-health data system. The two of them can combine to be the way through which one can take care of his/her own problems, data-driven and patient-centric applications will become real.

However, not everything is so bright data protection and privacy, the exclusion of some categories, and other matters that must be solved remain as major challenges. Integrating AI and cloud-based computing can become one of the most critical components in women’s health. Women who experience this research have the potential to create a roadmap for future studies, accompanying deeper discovery, the pursuit of clinical validation, and broader adoption of the technologies in healthcare.

References

1. Teede, H. J., Misso, M. L., Costello, M. F., Dokras, A., Laven, J., Moran, L., ... & Norman, R. J. (2018). Recommendations from the international evidence-based guideline for the assessment and management of polycystic ovary syndrome. Human reproduction, 33(9), 1602-1618.

2. World Health Organization. (2021). WHO fact sheet on infertility. Global Reproductive Health, 6(1), e52.

3. Al Wattar, B. H., Hussain, N. M., & Khan, K. S. (2022). Lifestyle interventions in women with polycystic ovary syndrome: A scoping systematic review of randomized evidence. Medicina de Familia. SEMERGEN, 48(3), 186-194.

4. Rajkomar, A., Dean, J., & Kohane, I. (2019). Machine learning in medicine. New England Journal of Medicine, 380(14), 1347-1358.

AI IN BUSINESS AND INDUSTRIAL TRANSFORMATION

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Abstract

Artificial intelligence (AI) is driving an intense transformation in business and industries. It is reshaping the traditional models and enabling the increase of efficiency, adaptability and innovation. In business, AI upgrades decision-making through predictive analytics, automates tasks, and in industries, it personalises customer experiences with the help of natural language processing and machine learning. Industries use AI in their organizations for optimizing supply chains, smart manufacturing, and reducing downtime and costs. AI-powered robotics and IoT incorporation enables real-time data analysis, promotes agile production systems. AI facilitates the shift toward sustainable practices by improving resource management. The organizations that adapt AI gain competitive advantages, but in spite of its aggressive advantages, it also faces challenges like workforce reskilling and ethical challenges, and digital infrastructure demands to fully equip to remain potential and transformative. AI is completely revolutionising various industries with new advancements, such as finance and banking, healthcare, transportation, logistics, education and e-commerce.

This study explores the sophisticated role of AI in reshaping the landscape of modern industry and business, ensuring its transformative and strategic requirements for successful implementation.

Keywords: Machine Learning, Industrial automation, Smart manufacturing, Data-Driven decision making, Predictive analytics, Supply chain optimisation, Adaptability and Innovation.

Introduction

Artificial intelligence focuses on building programs and machines that can replicate tasks performed by humans. In other words, AI is a technique to give the ability to act or mimic human behaviour, which includes tasks like learning through models, recognising patterns, making decisions and solving problems. AI allows organisations to transform their old traditional processes, enhance the ability of decision-making and create new value propositions. In business, AI optimizes operations, streamlines supply chains and personalised customer experiences, whereas in industrial settings, it enables predictive maintenance, smart manufacturing and resource optimization. AI offers sophisticated analysis based on predictive

AI in Business

AI helps the business concerns in several ways

1. **Automation:** Reduces costs and saves time by streamlining repetitive tasks like inventory management, data entry, and chatbot-assisted customer support.

2. **Personalisation:** Encourages recommendation engines (like Flipkart and Amazon) to customise goods and services, which boosts client happiness and revenue.

3. **Data Analysis:** A large amount of data is processed through data analysis to identify trends, predict consumer behaviour, and optimise pricing or marketing tactics.

4. **Making decisions:** Using real-time analytics and predictive models, it facilitates supply chain optimisation, risk management, and forecasting

5. **Customer service:** Improves response time and user experience by providing round-the-clock assistance through a chatbot and virtual assistant driven by AI.

6. **Product Development:** Uses digital twin simulations, prototype testing, or market needs analysis to accelerate innovation.

7. **Fraud detection:** Identifies irregularities in transactions or operations, enhancing e-commerce and financial security, among other things.

AI in Industrial Transformation

AI is transforming every major industry. Here are some of the significant industries that have been impacted

1. **Manufacturing:**
   • AI Use: Intelligent robotics, quality assurance, and predictive maintenance. Reduced downtime, increased efficiency, and fewer flaws.

   • Siemens, for instance, uses AI to anticipate equipment failures and optimise production lines.

2. **Healthcare:**
   • Applications of AI include robotic surgery, personalised medicine, drug development and diagnostics. Better patient outcomes and faster and more accurate diagnoses.

   • For instance, medical image and record analysis is aided by AI systems like IBM Watson.

3. **Automobile:**
   • AI Use: Intelligent manufacturing, in-car assistants, and driverless cars. Production efficiency and smarter, safer automobiles.

   •Waymo and Tesla use AI to power their autonomous vehicles.

4. **Agriculture:**
   • AI applications include self-driving tractors, predictive analysis, and crop monitoring. Increased yield and improved use of resources (fertilisers, water).

   •John Deere optimises planting and harvesting by using AI-driven machinery.

5. **Finance:**
   • Applications of AI include credit scoring, algorithmic trading, fraud detection, and customer support. Improved risk assessment and quicker, safer transactions.

   •AI detects odd transaction patterns to prevent fraud instantly.

6. **E-commerce & Retail:**
   • AI applications include chatbots, inventory management, and personalised recommendations. Supply chain optimization and enhanced customer experience.

   •Amazon uses AI to customise shopping and suggestions according to our tastes.

7. **Logistics and Transportation:**
   • AI Use: Fleet management, warehouse automation, and route optimisation.

   • Impact: Shorter delivery times and lower expenses.

   • UPS and FedEx use AI to create delivery routes that are efficient.

8. **Construction:**
   • AI applications include risk analysis, project planning, and automated machinery. Reduced expenses, fewer delays, and safer workplaces.

   •AI-powered drones monitor construction site safety and activity.

9. **Education:**
   • AI applications include virtual teaching assistants, automated grading, and personalised learning. Less administrative labour and more individualised instruction.

   • Coursera and Duolingo use AI to enable adaptive learning.

1. **Lack of Talent:**
   • Most businesses lack the resources or are unable to locate or hire the best talent to deploy and maintain AI systems; skilled AI specialists (data scientists, ML engineers, etc.) are in high demand.

2. **Transparency and Explainability:**
   •This transparency issue is a major barrier in

   regulated sectors (e.g., insurance, finance)

   • Black-box models make it hard to explain

   how decisions are being made.

Reference

AI for Everyone

Authored by Sridhar Seshadri and Shreeram Iyer, this book explores the complex concepts of AI and provides a solid foundation of understanding AI.

Applications of AI in Business and Finance 5.0

Authored by Richa Goel, Vikas Garg and Michela Floris, this book provides a valuable overview of how AI applications are transforming global business and financial organisations.

Industrial Transformation

Authored by Om Prakash Jena, Sudhansu Shekar Patra, Mrutyunjaya Panda, Zdzislaw Polkowski and S. Balamurugan, this book focuses on industrial development and transformation using AI, Machine learning, Big Data Analysis, and Internet of Things

FUNDAMENTALS OF AI

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Abstract
Artificial Intelligence (AI) is a rapidly evolving field that simulates human intelligence in machines. The fundamentals of AI involve a comprehensive understanding of key concepts such as problem-solving, knowledge representation, machine learning, natural language processing, and reasoning. This abstract explores the core principles and foundational techniques used in AI systems, including search algorithms, logic-based models, and neural networks. It also discusses the role of data, algorithms, and computational power in enabling intelligent behaviour. The goal is to provide a basic yet robust understanding of how AI works, its applications in real-world scenarios, and the ethical considerations surrounding its use. As AI continues to influence industries ranging from healthcare to finance, a strong grasp of its fundamentals is crucial for future innovations and responsible implementation.

Keywords: Artificial Intelligence, Machine Learning, Knowledge Representation, Problem Solving, Neural Networks, Natural Language Processing, Reasoning, Algorithms, Data-driven Models, Ethical AI, Intelligent Systems, Deep Learning, AI Applications, Computational Intelligence.

Introduction:

Fundamentals of Artificial Intelligence

Artificial Intelligence (AI) is one of the most transformative technologies of the 21st century. It refers to the simulation of human intelligence in machines that are programmed to think, learn, and make decisions. From virtual assistants and recommendation systems to self-driving cars and medical diagnostics, AI is increasingly shaping how we live and work. The fundamentals of AI involve understanding how machines can perceive their environment, reason through data, learn from experience, and act accordingly. This field draws from computer science, mathematics, neuroscience, and cognitive science to build systems capable of performing tasks that typically require human intelligence. Key components of AI include machine learning, natural language processing, computer vision, robotics, and expert systems. Each of these areas contributes to building smarter applications and solving complex problems across various industries. As we explore the fundamentals of AI, we will examine its core principles, important techniques, real-world applications, and the ethical considerations that guide its development. Understanding these basics is essential for anyone looking to engage with or contribute to the future of intelligent systems.

Why We Use AI Fundamentals:

We use the fundamentals of AI to build intelligent systems that can:

- Automate Tasks: Replaces repetitive manual work with smart systems (e.g., customer service bots).
- Decision Making: Assists in making data-driven decisions (e.g., fraud).
- Personalization: Powers recommendation engines (e.g., Netflix, Amazon).
- Scalability: AI systems can handle huge volumes of data and tasks without tiring.
- Innovation: Opens doors to smart assistants, self-driving cars, healthcare diagnostics, and more.

Literature review:

AI literature reviews often take a narrow approach, focusing on specific problems within particular research domains. While these literature reviews have contributed valuable insights into their respective fields, they often focus on specific application areas.

Findings:

The findings of AI fundamentals research highlight that AI is not a single entity but a collection of techniques and algorithms focused on enabling machines to perform tasks typically requiring human intelligence. Key areas of AI focus on learning from data, reasoning, and problem-solving. Machine learning, natural language processing, and computer vision are important subfields that leverage AI's capabilities. Ethical considerations and societal impact are also crucial aspects of AI development and deployment.

Applications of AI Fundamentals in Real-World Scenarios

This paper explores how the core concepts of Artificial Intelligence — including machine learning, natural language processing, computer vision, and reasoning — are being used in real-life applications. The aim is to highlight how basic AI fundamentals translate into impactful solutions across various sectors such as healthcare, finance, transportation, education, and more.

1. Machine Learning (ML)

- Fundamental: Supervised, unsupervised, and reinforcement learning
- Applications:
    - Email spam detection
    - Recommendation systems (Netflix, Amazon)
    - Fraud detection in banks

2. Natural Language Processing (NLP)

- Fundamental: Language understanding and generation
- Applications:
    - Chatbots and virtual assistants (e.g., Siri, Alexa)
    - Sentiment analysis on social media
    - Language translation tools (Google Translate)

Real-World Sectors Using AI:

Sector	AI Application
Healthcare	Disease prediction, robotic surgery
Finance	Algorithmic trading, credit scoring
Education	Personalized learning, grading automation
Transportation	Self-driving cars, traffic prediction systems
Agriculture	Crop monitoring, smart irrigation

Upcoming challenges

- **Bias and Fairness**: AI systems may perpetuate existing biases present in training data, leading to unfair outcomes.
- **Explainability**: Many AI models operate as "black boxes," making it difficult to understand their decision-making processes.
- **Data Privacy**: AI's reliance on vast datasets raises concerns about the protection of personal and sensitive information.
- **Ethical Concerns**: The deployment of AI in areas like surveillance and decision-making poses significant ethical dilemmas.

- **Regulatory Challenges**: The rapid advancement of AI technologies outpaces the development of comprehensive regulatory frameworks.
- **Job Displacement**: Automation through AI threatens to displace jobs across various sectors, impacting employment rates.
- **Security Risks**: AI systems can be vulnerable to adversarial attacks, leading to potential misuse or unintended consequences.
- **Environmental Impact**: Training large AI models consumes significant energy, raising concerns about environmental sustainability.

Problem found and overcome

- **Data Availability**: AI needs vast amounts of data to train models effectively. Overcoming this requires creating high-quality datasets, using data augmentation techniques, and leveraging transfer learning to adapt models to new tasks with fewer data.
- **Bias and Fairness**: AI models can inherit biases from the data they are trained on. Overcoming this involves using techniques such as bias detection, data preprocessing, and fairness-aware algorithms to ensure fairer outcomes.
- **Interpretability**: Many AI models, especially deep learning, are considered "black boxes." Overcoming this challenge requires developing explainable AI (XAI) methods that provide insights into how models make decisions, ensuring better transparency and trust.
- **Generalization**: AI models can struggle to generalize to unseen data or tasks. Techniques like regularization, cross-validation, and few-shot learning help AI systems generalize better across different scenarios.
- **Computational Power**: Training AI models, especially deep neural networks, requires significant computational resources. Overcoming this involves using cloud computing, specialized hardware like GPUs/TPUs, and optimizing algorithms to reduce computational demands.

Real time applications

- Personal Assistants (NLP)
- Healthcare Diagnostics (Machine Learning)
- Self-Driving Cars (Computer Vision)
- Recommendation Systems (Collaborative Filtering)
- Fraud Detection (Anomaly Detection)

Conclusion

The fundamentals of AI, including machine learning, natural language processing, computer vision, and data analysis, drive innovative solutions across various industries. By overcoming challenges like data availability, bias, and computational power, AI continues to revolutionize fields such as healthcare, finance, and autonomous systems, offering efficient, intelligent, and scalable applications.

AI IN EDUCATION

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Abstract

Artificial Intelligence (AI) is rapidly transforming the educational landscape, offering innovative tools to personalize learning, automate administrative tasks, and enhance educational accessibility. Key applications such as intelligent tutoring systems, adaptive learning platforms, and AI-powered assessment tools are analyzed for their potential to support both educators and learners. Artificial Intelligence (AI) is changing the way we teach and learn by making education more personalized, efficient, and accessible. This paper explores how AI is being used to understand students' learning styles, identify their strengths and weaknesses, and deliver customized learning experiences that adapt in real time. AI tools like chatbots, virtual tutors, and automated grading systems are helping teachers save time and focus more on student interaction and creativity. These technologies also open new doors for students with special needs, remote learners, and those in under-resourced areas. However, the growing use of AI raises important questions about data privacy, fairness, and the role of human teachers in an AI-supported classroom. This presentation highlights both the benefits and challenges of using AI in education and suggests ways we can use it responsibly to create a future where technology and human values go hand in hand.

Keywords: Artificial Intelligence, Education, Personalized learning, Intelligent tutoring systems, Adaptive learning platforms, AI-powered assessment tools AI-powered assessment tools, Student learning styles, Automated grading, Chatbots, Educational Accessibility, AI- supported classrooms, Creativity, Educational technology. Human values.

Introduction

AI in education refers to using technology to address cognitive, physical, academic, social and emotional factors that impact learning. Examples of AI in education for students include grammar checking software, text-to-speech platforms and flash card software. Information technologies, particularly artificial intelligence (AI), are revolutionizing modern education. AI algorithms and educational robots are now integral to learning management and training systems, providing support for a wide array of teaching and learning activities. "Artificial Intelligence," a rapidly advancing class of foundational capabilities which are increasingly embedded in all types of educational technology systems and are also available to the public. We will consider "educational technology" (edtech) to include both (a) technologies specifically designed for educational use, as well as (b) general technologies that are widely used in educational settings. Recommendations in this report seek to engage teachers, educational leaders, policy makers, researchers, and educational technology innovators and providers as they work together on pressing policy issues that arise as Artificial Intelligence (AI) is used in education. The process of developing an AI system may lead to bias in how patterns are detected and unfairness in how decisions are automated. Thus, educational systems must govern their use of AI systems. This report describes opportunities for using AI to improve education, recognizes challenges that will arise, and develops recommendations to guide further policy development.

Applications of AI in education

Personalized Learning

It can provide a personalized learning experience to every student along with analyzing the student's learning pattern, strengths, and weaknesses.

Chatbots

AI chatbots assist in providing information and supporting students anytime, especially useful in remote learning programs.

Content creation

Content creation or content creative is the act of producing and sharing information or media content for specific audiences, particularly in digital contexts.

AI in examinations

AI software systems can be actively used in examinations and interviews to help detect suspicious behavior and alert the supervisor. The AI programs track each.

Student engagement

Improved student engagement and motivation. AI creating immersive learning experiences also can result in boosting student engagement.

CHALLENGES OF ARTIFICIAL INTELLIGENCE IN EDUCATION

Data Privacy and Security:

AI systems in education often require access to vast amounts of personal data, including students' academic records, learning habits, and even biometric information. This raises significant concerns about data privacy and security. If this data is not properly protected, it could be vulnerable to breaches, leading to unauthorized access or misuse of sensitive information. Ensuring robust data protection measures and adhering to privacy regulations are crucial to maintaining the trust of students, parents, and educators.

Lack of Human Interaction:

Education is not just about knowledge transfer; it is also about fostering social and emotional development. Over-reliance on AI in education could reduce face-to-face interactions between students and teachers, which are crucial for developing communication skills, empathy, and critical thinking. While AI can assist in many aspects of education, it cannot fully replace the human elements of teaching, such as mentorship, encouragement, and personalized feedback. Striking a balance between AI and human interaction is essential to maintaining a well-rounded educational experience.

Cost and Accessibility:

Implementing AI in education can be expensive, requiring significant investments in technology, infrastructure, and training. This can create a digital divide, where only well-funded schools or institutions can afford to integrate AI, leaving underfunded schools and students from low-income backgrounds at a disadvantage. Ensuring that AI in education is accessible to all students, regardless of their socio-economic status, is a critical challenge. There is a need for policies and initiatives that promote equitable access to AI-powered educational tools.

Teacher Resistance and Training:

Many educators may resist the adoption of AI due to concerns about job displacement, a lack of understanding of the technology, or skepticism about its effectiveness. Additionally, teachers need proper training to effectively integrate AI tools into their teaching methods. Without adequate professional development, the potential of AI to enhance education may not be fully realized. Overcoming resistance and providing comprehensive training are necessary steps in ensuring that AI is successfully integrated into the educational system.

Content Quality and Relevance:

AI systems are only as good as the content they deliver. Ensuring that the educational content provided by AI tools is accurate, up-to-date, and relevant to the curriculum is a significant challenge. There is also the risk of homogenization, where AI might promote standardized content at the expense of diverse perspectives and critical thinking. Educators must carefully curate and monitor the content used by AI systems to maintain educational quality.

What are the advantages and disadvantages of artificial intelligence in education?

There's no shortage of pros and cons of AI in education. AI in education offers several advantages. It can automate administrative tasks, reducing the burden on educators and allowing them to focus on teaching. AI-powered analytics enable institutions to gain insights into student performance and tailor curricula accordingly. Moreover, AI facilitates the creation of adaptive learning resources, adjusting to diverse learning styles.

However, challenges accompany these advantages. One concern is the potential loss of human interaction in the learning process, as AI may not fully replace the nuanced dynamics of teacher-student relationships. Ethical considerations arise, such as data privacy concerns and algorithmic biases influencing educational decisions. Additionally, the cost of implementing and maintaining AI systems can be a barrier for some institutions. Striking a balance between harnessing the benefits of AI and preserving the human element in education is crucial to ensure a well-rounded and ethical learning environment.

Conclusion

AI will change education in a variety of ways, from the way students learn to the way teachers teach. AI-based tools will allow students to learn faster, with more personalized instruction tailored to their individual needs. AI can also help teachers track student progress, allowing them to intervene in learning when necessary and provide more effective instruction. AI can also provide valuable insights into student performance and help teachers develop better teaching methods. AI will also help schools become smarter, with more efficient use of resources and better decision-making. Ultimately, AI can help create a more equitable, effective, and enjoyable learning environment for all students.

While we are making broad predictions, imagine if every person had access to supportive AI technology that was designed with equity, access, privacy and learners at the core. ChatGPT and its successors, built on these premises, will radically change the education landscape – sooner than we think. In an increasingly distracted and disconnected world, perhaps AI can provide more quality educational access to more people in a more efficient manner to give time to collaboratively tackle some of the world's greatest challenges.

Though skepticism if not trepidation about AI in education exists, it's superficial and diminishing in time as more beneficial technology proves its worth in our workflows. The promise for solving some of the most universal issues such as recovering scarce or lost instructional time, providing intelligent prompts to all roles, and increasing engagement with learning activities are too attractive if not necessary for the field's collective success.

We must make sure that the upcoming generations learn relevant skills that will set them and our planet up for success.

References

Akgun, S., Greenhow, C. (2022). Artificial intelligence in education: Addressing ethical challenges in K-12 settings. AI Ethics, 2, 431–440. https://doi.org/10.1007/s43681-021- 00096-7

Aleven, V., McLaughlin, E. A., Glenn, R. A., & Koedinger, K. R. (2016). Instruction based on adaptive learning technologies. In Mayer, R.E. & Alexander, P.A., Handbook of research on learning and instruction, 522-560. ISBN: 113883176X

Baker, R.S., Esbenshade, L., Vitale, J., & Karumbaiah, S. (2022). Using demographic data as predictor variables: A questionable choice. https://doi.org/10.35542/osf.io/y4wvj

Black, P. & Wiliam, D. (1998). Inside the black box: Raising standards through classroom assessment.

Phi Delta Kappan, 92(1), 81-90. https://kappanonline.org/inside-the-blackbox-raising-standards-through-classroom-assessment/ Black, P., & Wiliam, D. (2009).

Developing the theory of formative assessment. Educational Assessment, Evaluation and Accountability, 21(1), 5-31.

IMPACT OF ARTIFICIAL INTELLIGENCE ON HUMAN RESOURCE

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ABSTRACT

This article explores about the advent and integration of AI in Human Resources how AI has been tremendously transformed the Human Resources with the increasing adoption of automation technology, understanding a relationship between AI implementation and job displacement has become crucial for policy makers and industry leaders Artificial Intelligence has streamlined recruitment processes enhanced talent management and improved employee engagement this research explores the profound impact of AI on Human Resources examining both the Merits and Demerits of AI adoption in HR. This research aims to investigate the correlation between AI adoption and Human Resources. AI is an ability of machines to exhibit intelligence. It has emerged as a transformative force in modern technology. Our analysis reveals AI powered in HR system has improved efficiency reduced cost, bias reductions, Chabot's and virtual assistant, recruitment and hiring and enhanced employee experiences whereas we also discussed challenges associated with AI in HR such as data privacy, job displacement bias in AI algorithm it also contains applications like healthcare, predictive maintenance, workforce planning and analytics compliance and risk management and image /speech recognition etc. It also can also perform tasks that typically require human intelligence such as problem solving and decision making. AI is making HR more efficient, data driven and employee-centric but HR leaders must balance automation with ethical consideration and human oversight. The findings of this study provides valuable insights into the effect of AI on employment and contribute to the development of strategies for mitigating job displacement.

INTRODUCTION

AI is a whole of modern technology which imitates human action using machines. It is an immense technology, and it is an amalgamation of computer science, physiology, and philosophy. Is a wide subject comprising incomplete fields from machine vision to expert systems. The central aspect that areas of AI share is the development of machines that can "think". Here, to label machines as "thinking", intelligence has to be defined. Artificial Intelligence is present when a machine is capable of possessing human-centered skills like learning, reasoning, and problem-solving. Artificial intelligence has two words artificial and intelligence, where artificial is "man-made", and intelligence is "thinking power", so AI is "a man-made thinking power". With artificial intelligence, you do not have to preprogram a machine to accomplish some work; in spite of that, you can build a machine with Programmed algorithms which can cooperate with your own intelligence, and that is the wonder of AI. It is believed that AI is not a new technology, and people claim that, according to Greek myth, there were mechanical men in the early days who could work and behave like humans.

What is HR?

The human resources(HR) of the organization includes all individuals who execute its activities. In a way, all the decisions that impact the workforce relate to the organization HRM functions.

BIRTH OF AI IN HR

The arrival of AI in human resources has revolutionized the manner in which organizations deal with recruitment, employee engagement and experiences has been a huge advantage to human resources development and talent management and decision-making have also been simplified The arrival of Artificial Intelligence (AI) in Human Resources (HR) has revolutionized the manner in which organizations deal with recruitment, employee engagement, talent management, and decision-making. AI has transformed HR by automating mundane tasks, providing data-driven insights, and increasing overall efficiency.

Early Origins of AI in HR: Early on, AI was confined to basic automation and data management. In the beginning, HR departments began applying software tools to process payroll, attendance, and employee records. But these systems were rule-based and could not learn or improve from data. As technology improved, AI's applications in HR became more advanced, fueled by breakthroughs in machine learning (ML), natural language processing (NLP), and predictive analytics.

Early Developments of AI in HR

AI was restricted to basic automation and information management in the beginning. In the early years, HR departments began implementing computer programs to automate payroll, attendance, and employee records. These were rule-based systems and were unable to learn or adjust from data. With further development of technology, AI's application in HR became more complex, supported by the growth of machine learning (ML), natural language processing (NLP), and predictive analytics. AI in Talent Acquisition and Recruitment One of the earliest notable effects of AI on HR was in recruitment. AI-based software now helps to screen resumes, schedule interviews, and even hold preliminary interviews using Chabot's. Through analyzing huge datasets, AI systems can determine the most suitable candidate for a job based on experience, skills, and cultural fit. This automation not only accelerates the hiring process but also decreases bias, allowing for a more objective and unbiased recruitment process. AI has also advanced in the area of improving employee engagement and retention. AI in Employee Engagement and Retention Through analyzing employee feedback, surveys, and performance data, AI tools can assist HR teams in recognizing patterns and trends that could potentially signify issues. Through these insights,

organizations can identify potential concerns before they arise and take proactive steps to address them, improve workplace culture, and increase overall job satisfaction.

AI for Learning and Development: In the context of employee learning and development, AI is used to provide personalized training experiences. AI algorithms have the ability to measure an employee's skills and learning style, and then suggest individualized training modules to fill skill gaps This assists in developing a more efficient and effective learning environment, which ultimately enhances the productivity and career growth of employees. Performance Management and Decision-Making through AI has completely transformed performance management by bringing data-driven insights to enable decision-making by managers. AI technologies process performance scores, peer evaluations, and other sources of information to provide a more fact-based picture of an employee's performance. Through these insights, managers are able to select high performers, future leaders, and areas requiring improvement, thus enabling them to make more focused better career opportunities and improved development possibilities.

The Future of AI in HR

Future growth of the role of AI in HR will only increase with its future advancements. More advanced AI technologies might emerge in the future to not only predict the employee turnover rate, streamline the workforce planning process, and provide greater diversity and inclusion support but also integrate with the strategic decision-making of the HR department in the future to enable organizations to establish more efficient, responsive, and agile workplaces. Implications of AI on HR Artificial Intelligence (AI) is now an indispensable part of the change in Human Resources (HR) practices, with enormous improvements in efficiency, accuracy, and decision-making. The implication of AI on HR can be seen in numerous facets of the work environment, from recruitment to staff growth. This is a brief summary of the way AI is revolutionizing HR activities.

1. Improved Recruitment and Talent Sourcing: AI transforms the hiring process by streamlining how organizations identify and evaluate talent. Conventional approaches to hiring may be time-consuming and susceptible to biases, but AI relies on algorithms to scrutinize resumes, compare candidates with job descriptions, and even conduct preliminary interviews using chatbots. This automated process of screening allows HR teams to concentrate on applicants who fit the job requirements, thereby speeding up the recruitment process and improving the quality of hires. AI also helps minimize unconscious biases, ensuring a more inclusive hiring process.

2. Efficient Employee Onboarding: AI-driven onboarding platforms can provide personalized experiences for new hires. These systems can automate administrative tasks such as filling out forms, setting up accounts, and providing new employees with the necessary training materials. Additionally, AI tools can guide new hires through their initial days at the company, helping them integrate smoothly into the organizational culture, which leads to higher employee satisfaction and faster ramp-up times.

3. Data-Driven Decision-Making: AI enables HR professionals to leverage vast amounts of data to make more informed decisions. AI tools can analyze employee performance, turnover rates, engagement levels, and other key

metrics, allowing HR teams to spot trends and patterns that might not be immediately visible. With AI, HR leaders can base their decisions on data rather than intuition, helping to align HR strategies with business objectives.

4. Improved Employee Engagement: AI can monitor employee sentiment and engagement in real time by analyzing feedback, surveys, and communication patterns. Sentiment analysis tools can provide insights into employee morale and highlight potential issues within the workplace. By understanding how employees feel, HR can take proactive steps to enhance job satisfaction, address concerns, and boost overall morale, leading to higher productivity and retention.

5. Personalized Learning and Development: AI plays a vital role in employee training and development by offering personalized learning paths. AI systems can assess an employee's current skill level, career goals, and learning style, and recommend training programs that are specifically tailored to meet those needs. This personalized approach to learning helps employees grow their skills more effectively and stay motivated in their professional development, resulting in a more competent and engaged workforce.

6. Predicting Employee Turnover and Retention: One of the most significant benefits of AI in HR is its ability to predict employee turnover. By analyzing historical data and employee behaviors, I can identify patterns that signal potential attrition.

Merits

Effective recruitment: AI AI-driven can process large numbers of resumes rapidly and efficiently, selecting the best candidates and employees. This dramatically cuts time-to-hire and enables HR teams to concentrate on the best candidates.

Informed decisions: AI enables HR professionals to make better-informed decisions by scrutinizing employee data. For example, AI can recognize trends in employee performance and enable HR teams to anticipate issues and act preventatively.

Cost savings: Through the automation of time-consuming administrative work, AI has the potential to cut operational expenses in HR departments by quite a margin. It also maximizes the utilization of resources, boosting productivity overall.

Talent development: Through the identification of skill gaps and the suggestion of customized training programs, AI ensures that employees get the proper development opportunities, boost career progress and per performance.

Demerits:

Lack of human touch: can be devoid of emotional intelligence and the capacity to handle complex and complicated programs and human feelings HR tends to handle delicate matters like conflict resolution or individual employee issues.

Data privacy and security: There is always the threat of data breaches, and if AI systems are not secured appropriately, confidential employee information may be leaked or exploited.

Limited creativity and judgement: AI does not possess the creative, problem-solving, and judgment capabilities that human HR professionals own. While can perform repetitive work or analyses but perhaps not respond to conflicts or make subjective judgments on employee performance.

Inadaptability: Solutions are built for a particular purpose and might find it difficult to adjust to changing conditions or new problems.

JOB DISPLACEMENT

AI in HR is an advanced technology, but it is generating the threat of automation and unemployment in the industry. With continues to change the employment sector and employment landscape, peoplemust change to remain current and competitive in their careers' the effect of Ai on rates of unemployment The overall economy is an open debate while AI is opening up new job opportunities. The effect of job loss can result in unemployment and financial security. However, technology can also transform the character of work but at a greater degree of job displacement.

Overuse of technology: If a company relies too much on AI to make decisions in HR it can lead to the loss of the human touch it can give a sense of a less personal workplace employees may feel like they are being tested.

Lack of transparency: AI used in decision making and problem solving activities can be complex and very opaque it possesses high security risk and biased algorithms therefore AI in HR can lack transparency in work Examples of jobs that can be replaced by AI.

Manufacturing: AI possesses immense ability for manufacturing the products by the automation repetitive tasks in manufacturing.

Customer service: The AI plays the main role in customer services such as Chabot's and virtual assistants can answer all the customer questions and aid.

Data entry: the machine learning the problem solving algorithms can process a very large amount of data more quickly and efficiently.

Conclusion

In conclusion, the birth of AI in HR has transformed the way organizations manage their most valuable asset—people. Through automation, data analysis, and personalized experiences, AI is assist HR professionals in making better-informed decisions, enhance employee engagement, and encourage a culture of ongoing improvement. AI is reshaping HR by making processes more effective, data-driven, and tailored. But its success hinges on ethical application, adequate governance, and weighing automation against human compassion. Companies that harness AI effectively will create stronger, more engaged, and future-ready workforces.

REFERENCES

● **Human Resource Management**: authored by H. John Bernardlin. This book examines the detailed information of HRM.

● **Artificial intelligence (AI)and its impact on technology**: authored by Dr. Sanjay Prasad, Dr punit kumar dwivedi.

● **Artificial intelligence for all:** authored by . This examines the transforming every aspect of our life.

DIGITAL INNOVATION IN BUSINESS AND ECONOMY

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ABSTRACT

Digital innovation is transforming business and the economy by enhancing efficiency, creating new markets, and redefining consumer experiences. Many digital innovations have transformed the business by automation and AI. Business uses AI-driven chatbots and virtual assistants to streamline online operations, and it improves productivity, reduces costs, and optimizes operations. Most of the businesses have transformed from offline to online business; that is, e-commerce online platforms are Flipkart, Amazon, Ajio, etc., and most businesses have adopted digital payment. Most of the business work can be done from home with a good Wi-Fi connection. Digital innovation in business is helping to improve the environment and sustainability, and AI is helping businesses to go green. Digital innovation in the economy has increased productivity. Automation and AI reduced human labor costs and improved efficiency; new business models and markets have given rise to the economy. The gig economy, like Uber and Ola, provides flexible work opportunities. E-commerce and digital payments have expanded global trade. Digital innovation fuels economic growth. It creates new jobs in emerging economies. Digital transformation is a global effort, but its impact varies across the countries.

KEYWORD: Automation and AI, AI-driven jobs, digital economy, gig economy, digitalization.

INTRODUCTION

Digital innovation is transforming the way businesses operate and economies function in the modern world. It uses digital technologies such as artificial intelligence, block-chain, cloud computing, big data, and the Internet of Things to create new business models, improve efficiency, and help in economic growth. Digital innovation enhances productivity, streamlines operations, and also improves consumer experiences.

The companies that have embraced digital transformation have gained a competitive edge by leveraging automation, data-driven decision-making, and digital marketing strategy and digital innovation on economic growth by providing entrepreneurship, creating new job opportunities, and also increasing the market.

Governments and many organizations have invested in digital infrastructure to support the digital economy, leading to enhanced global trade, financial inclusion, and smart public services. Governments and businesses increasingly recognize the role of digital innovation in driving economic growth. Policies that also support digital infrastructure, data security, and digital skill development. Digital innovation is a key driver of modern business success and economic development Organizations and also economies have adapted to technological advancements. It will help to grow in the digital period, shaping the future of industries, business, global trade, and global markets

ROLES OF DIGITAL INNOVATIONS IN BUSINESS AND ECONOMY

Digital innovation plays a crucial role in transforming businesses and economies.

1. Enhancing Business Efficiency: Automation of repetitive tasks has reduced costs and improved the productivity of businesses. AI, machine learning, and data analytics have optimized decision-making.

2. Driving Economic Growth: Digital technologies have been creating new industries and job opportunities, and e-commerce has been expanding the market's access to business, and boosting economic activity.

3. Enabling Business Model Innovation: Subscription-based models, like Netflix and Amazon Prime, have been providing new revenue streams and also helped economic growth globally. Platform-based businesses such as Uber and Airbnb connect supply and demand efficiently.

4. Strengthening Global connectivity: Digital platforms enable businesses to expand globally with lower costs. Remote work technologies have improved workforce flexibility and global talent access.

5. Enhancing Financial Inclusion: Mobile banking and digital wallets gave unbanked populations access to financial services. Block-chain-based solutions provide secure and transparent financial transactions.

6. Encouraging Sustainable Development: Smart grids and IoT have improved energy efficiency in industries; also, digital transformation has reduced paper usage and optimized resource management.

AUTOMATION IN BUSINESS AND ECONOMY

AUTOMATION IN BUSINESS

Manufacturing: With the help of robotics and AI, production has increased the speed of manufacturing by reducing human error.

Finance: Automatic fraud detection, connected trading, and financial advice on banking and investments.

Healthcare: Automation in healthcare is where the surgeries are done by robots. AI-powered diagnostics also reduce expenses and improve the patient’s outcome.

Retail and E-commerce: automatic detailed management, AI The powered customer service and self-checkout system improves the operations and enhances the shopping experience for customers.

Marketing and sales: Automation in marketing and sales helps in advertisement and personalized customer experience. Automation in marketing and sales has revolutionized the way businesses interact with customers.

AUTOMATION IN BUSINESSES AND ECONOMY IN FUTURE

In the future, we may face business impacts like increased productivity by reducing manual labor by depending on automatic systems. Artificial intelligence and robotics will increase the efficiency.

Companies will save on labor costs and reduce manual labor, while automation may replace jobs in the future. It may create advanced roles in robotics and artificial intelligence. It will enhance the customer's experience by nesting the expectations and the needs of the customers. The economic impact in the future is that there will be a shift towards artificial intelligence specialists. There will be income inequality; automation in the future might widen the income gap between the lower-skilled people who struggle to learn new roles.

Trends of automation in business and economy in the future Businesses will use more artificial intelligence for automation, from finance, manufacturing, retail, and e-commerce sales and marketing to healthcare. Automation in the future will make more common use of robotic assistance. Transactions will be blindly done, which smooths the operations of finance in business. Faster data processing will give real-time automation and artificial intelligence-powered solutions, system mobility, and green technology automation in the future. It will help to only use the energy, and it will also help to reduce the waste.

DIGITAL BUSINESS AND DIGITAL ECONOMY

DIGITAL BUSINESS

Businesses are increasingly depending on e-commerce and online presence to be in touch with global markets. e.g., Amazon and McDonald's. With the use of social media websites, we make advertisements to reach the customer, which makes a strong digital presence. To store and access the data securely. We use cloud-based solutions. Example: Google, Microsoft, etc. the use of artificial intelligence automation in business improves customer experience. And helps to save time and cost by automating Though repetitive tasks for robots, digital payments help us to do countless payments and block-chain-based transactions. It is becoming normal with increased digitalization, business fraud, and cybersecurity solutions to help direct and prevent fraud.

The future of digital in business is said to be driven by rapid cloud computing and software-as-a-service solutions. The solution for scalability and flexibility is cloud computing and software as a service, as businesses carry large amounts of important information; it requires strong security to secure the data. The Internet of Things will further combine smart technology into supply chains.

DIGITAL ECONOMY

Digital economies play a major role in global economic growth by transferring industries, businesses, etc., by adopting digital technologies and e-commerce as forward with online shopping, mobile payments, and digital wallets becoming normal. Providing new employment and new opportunities and arranging flexible work through the gig economy, which is powered by digital platforms. Banking and transactions Have become easy with financial technologies like digital payments, where you can do a large number of transactions.

In the present digital economy, the government and businesses prefer digital policies more related to digital to increase the growth of the economy, which is accessible to all, as technology continues to become more advanced. By the time the economy and businesses in digital are expected to keep growing. With the advanced technology.

The future of economy in digital will grow with the advanced technology in artificial intelligence, automation, blockchain, and the expansion of SG and the Internet of Things, as the government and businesses increasingly include digital transformation to improve economic activities with time. Smart cities are provided by the Internet of Things.

Artificial intelligence with intensity, economic productivity, and block chain technology with further improved security to make it more secure. In financial systems to avoid any kind of fraud. However, challenges such as digital inequality, income inequality, and cyber security fraud will need to be addressed to ensure the sustainable growth of the economy. The digital economy will continue to evolve the structure of the future of global commerce, employment, and innovation over time

AI IN BUSINESSES AND ECONOMY

AI has been playing a crucial role in driving digital transformation across businesses and the economy by enhancing efficiency and automation and improving decision-making with data analytics. AI analyzes large datasets to identify trends and forecast future outcomes, machine learning models help businesses to make data-driven decisions. AI also enhances customer support by personalizing the experience; AI-powered assistants have been answering client questions around-the-clock. The emergence of AI-driven companies and new sectors, such financial advising services and health diagnostics, contributes to economic expansion. By stopping and identifying attacks in real time, artificial intelligence (AI) improves security and fortifies cybersecurity. AI powers is a digital platform that links companies and consumers globally, facilitating cross-border transactions and the expansion of the global digital economy.

ECONOMIC CHANGES CAUSED BY DIGITAL TRANSFORMATION

Digital transformation has changed the economies worldwide by altering the industries, labour markets and consumer behaviour . technology advanced businesses have distinguished themselves from enemies, seizing the control of increasingly crowded markets , and earning from the new technologies .the labour markets has been increased from lower-level skill to middle-level skill which as affected the wages and employment possibilities . due to the new technologies the business outcome and higher level skill , distribution of capital and labour income has increased uneven and income has been migrating from labour to the capital. To provide new technology and opportunities to workforce and small firms the digital economy must be developed.

CONCLUSION

Digital innovation has become a driving force in reshaping businesses, industries and economies worldwide. It has enhanced the efficiency and customer experience and created new market opportunities. Technologies like artificial intelligence, block-chain, and cloud computing enable businesses. From an economic perspective, digital innovation has contributed to productivity growth, job creation, and new industry formation. It rises globalization by breaking geographical barriers and fostering the digital ecosystem Digital innovation is important for business transformation and economic development. Companies and economies that embrace digital transformation are more likely to remain competitive Policymakers and business leaders should collaborate to promote digital literary, and infrastructure development.

REFERENCES

YOO, Y. HENFRIDSSON, O.& LYYTINEN K. (2010): “THE NEW ORGANIZING LOGIC OD DIGITAL INNOVATION”

HARADWAJ A, EL SAWY, O.A., PAVLOU, P.A., & VENKATRAMAN N(2013): “DIGITAL BUSINESS STRATEGY:TOWARDS A NEXT GENERATION OF NSIGHT”