Spatial analysis of crime using crime harm index.

N.Z.Asiammal
Research Scholar
Department of Geography
Presidency College (Autonomous)
(Affiliated to University of Madras)
Chennai, India

Dr. N. ANBAZHAHAN
Assistant Professor
Department of Geography
Presidency College (Autonomous)
(Affiliated to University of Madras)
Chennai, India

ABSTRACT

All crimes are not equal, and counting them as if they are fosters distortion of risk assessments, resource allocation, and accountability is not accurate. The harmness caused by a petty theft is lesser compared to a crime like murder for gain. Though only a few incidents of killings happen, the weightage given to a crime like murder should be more considering the harmness associated with it. On the other hand, if the petty thefts are on the rise, then the harmness related to it will be more too. All the above-listed dilemmas can be addressed with the usage of a weighted 'Crime Harm Index (CHI) factor. This research paper aims to study the harmness of crimes and to propose proper measures for crime prevention within the suburban police jurisdictions. Integrating all crimes such as chain snatching, Ordinary Theft, House theft, Robbery*, Dacoity, and murder and prepare a harm level index for prevention and allocation of resources within the suburban police jurisdictions. The application of the Crime harm index in the Chennai suburban police jurisdiction will help in better optimization of the crime rates. The areas on the fringes of the Chennai city and the central location will be targeted for this research study to gain an overall insight.*

Key words: Crime harm index, crime harmness, optimization, prevention

INTRODUCTION

This research paper aims to classify the crime based on its intensity and harmfulness. The offense expressed in terms of the level of severity associated with the harmness within the suburban police jurisdictions. The objective of this research is to study the harmness of crimes and to propose proper measures for crime prevention within the suburban police jurisdictions. Integrating all crimes such as chain snatching, Ordinary Theft, House theft, Robbery, Dacoity, and murder and prepare a harm level index for prevention and allocation of resources within the suburban police jurisdictions. The application of the Crime harm index in the suburban police jurisdiction will help in better optimization of the crime rates. Study areas chosen for this research, along with the reasons for choosing them will be recorded in the introduction chapter. The areas on the fringes of the Chennai city and the central location will be targeted for this research study. This research will be carried out in the suburban police jurisdictions located in Poonamallee, Tiruverkadu, Manali, Kelambakkam, Vandalur, and North Beach.

1

Related work

The details related to literature which were searched and evaluated in the subject area of the topic chosen for research are listed below. This section covers the analysis of literature in the selected area of study, and the synthesis of information from literature to summary. On the whole, the review presents the details of the existing literature in an organized way.

Carson C. Calhoun et al., (2008) introduced a new tool for the Virginia law enforcement force to perform crime data analytics. The author has found through a survey that 40% of crime analysis is done without any software tools and 47% of crime analysis is done utilizing the unsuitable software. The author finally concludes on how a significant improvement in data access and analytics was achieved with WebCAT 2.2(crime analytics tool kit).

Belousova, (2016) proposes a method to analyze the root cross of crime at the macro level by considering the environmental condition. The author focuses on economic crime trend analysis and prevention methods. Dynamic factors influencing the economic crime rates are considered by the author.

Lee, (1997) analyses how shift from the traditional ways of audit to hybrid model helps in crime reduction. The author mainly focuses on the computer crimes. The author elaborates on how a flexible system aids in better decision-making and increased efficiency.

Sivaranjani et al., (2016) analyzed the crime statistics of six cities in Tamil Nadu and by implementing different clustering and classification methods on the input data. The author suggests a suitable method for crime reduction and prediction.

Lovelace et al., (2014) proposes the ways of using R algorithm effectively for analysing the spatial data. The author guides on the methods to use the R program for basic plotting, data manipulation and data visualisation by using tmap and leaflet.

Moorosi et al., (2015) discusses the challenges and ethical concerns involved in social data mining. The author proposes the need to perform crime data mining from the social data carefully. The author further elaborates on privacy issues and threat to personal safety due to crime data mining from social data.

The below authors have done researches related to the usage of data mining in crime data: Sathyadevan et al., (2014) propose various data mining techniques for prediction of crime data. Thongsatapornwatana et al., (2016) performs a survey of various crime data mining algorithms used in the crime data survey. Chen, (2004) author proposes a general framework for crime data mining.

Sherman et al., (2016) proposes that the logic of adding crimes of all kind into a distinct totality has long been termed as ambiguous. Further, he proposes that all crimes are not equal and counting them as if they are fosters distortion of risk assessments, resource allocation, and accountability is not accurate. To resolve this dilemma, he has offered a general proposal to create a weighted 'Crime Harm Index (CHI).

Mitchell et al., (2016) introduces the California Crime Harm Index (CA-CHI) and explores in what context a Crime Harm Index is a meaningful measure, comparing crime count outcomes to the CA-CH.

NEED FOR THE MODEL

The application of the Crime harm index in the suburban police jurisdiction will help in the better optimization of the crime rates. The proper measures for crime prevention within the suburban police jurisdictions can also be addressed with the help of crime harm index model.

MODEL METHODOLOGY

The research methodology will comprise of both the primary data and secondary data. The primary data collection will be through a Questionnaire Survey. The primary data will also include the prisoners' schedule and the household schedule. The secondary data will comprise the State Crime Record Bureau (2008, 2013, and 2018), Census of India (2011), Policing mechanism (2019). Post data collection; the statistical tools will be used for data analysis.

The factors such as shift and Share analysis mapping, police Jurisdiction mapping, police station Locations, mobility patterns of Prisoners, existing patrolling / beat map, Overlay, and

2

Spatial Analysis will be used for the identification of the concentration of different types of crime. The crime harm index was applied for the data collected from the Manali police station. The data collected from in Poonamallee, Tiruverkadu, Kelambakkam, Vandalur, and North Beach will be processed similar to that of the Manali data.

Figure 1
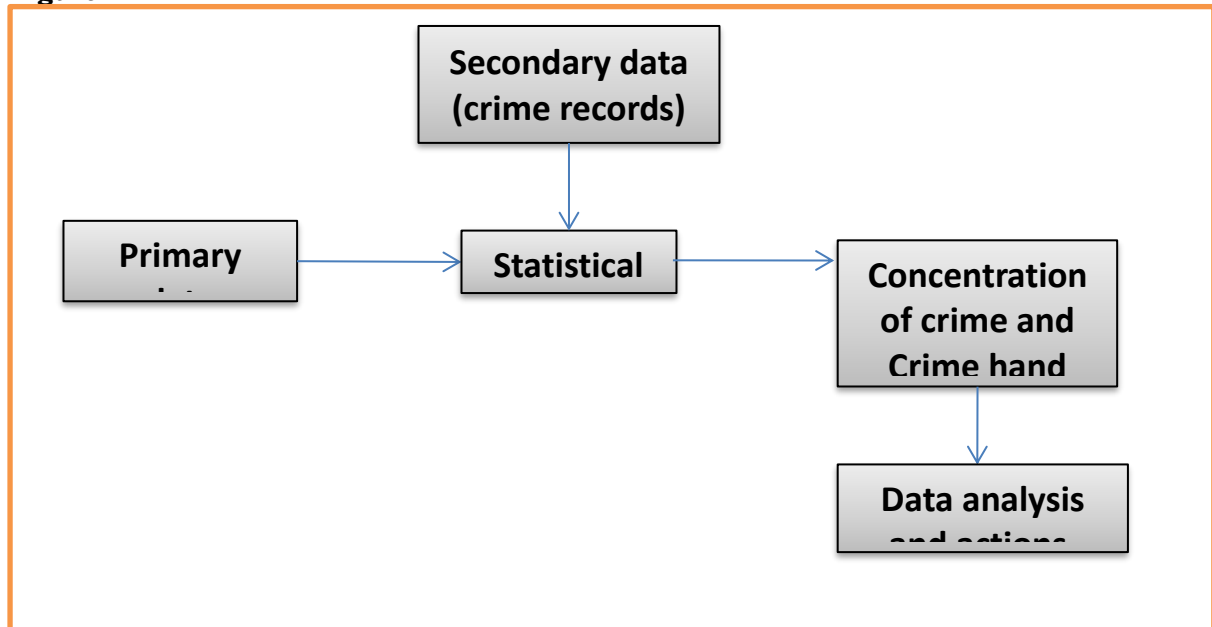
Table 1.

The below table projects the level of punishment for each of the offense considered for research. Table granularity is maintained at both days and years.

| Offences	Punishment in years	Punishment in days
Murder for gain	14	5110
Murder	14	5110
Attempt to Murder	10	3650
Dacoity	10	3650
Robbery	10	3650
H.B. By day	7	2555
H.B. By night	3	1095
Snatching	3	1095
Major Thefts	3	1095
Minor Thefts	3	1095

Table 2:

The below table holds the raw crime data and the crime harm indexed data for the year 2016. The CHI data was computed by considering the product of the crime and the days of punishment.

The imprisonment dates for each if the below listed crimes are available in table 1.

| Offences	2015	Offences	2015
	Report		Report(CHI)
Murder for gain	0	Murder for gain	0
Murder	0	Murder	0
Attempt to Murder	1	Attempt to Murder	3650
Dacoity	0	Dacoity	0
Robbery	0	Robbery	0
H.B. By day	0	H.B. By day	0
H.B. By night	0	H.B. By night	0
Snatching	1	Snatching	1095
Major Thefts	0	Major Thefts	0
Minor Thefts	1	Minor Thefts	1095
Total	3	Total	5840

Figure 1:

The pie chart shown below represents the raw data for year 2015.

2015 Report
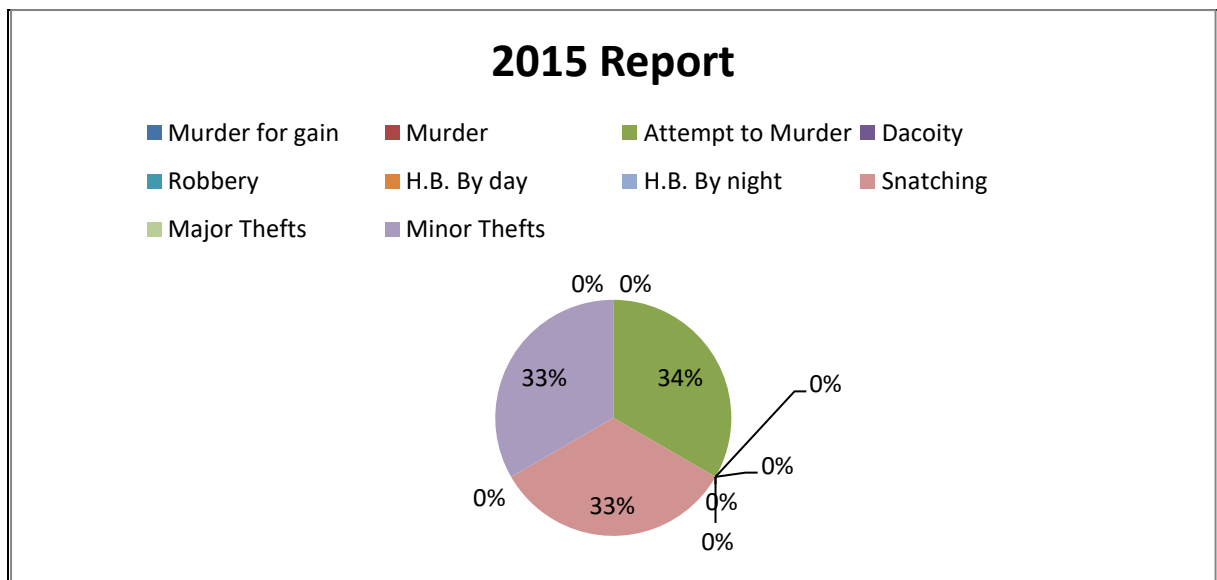
Figure 2:

The pie chart shown below represents the CHI (Crime harm indexed) data for year 2015.

2015 Report(CHI)
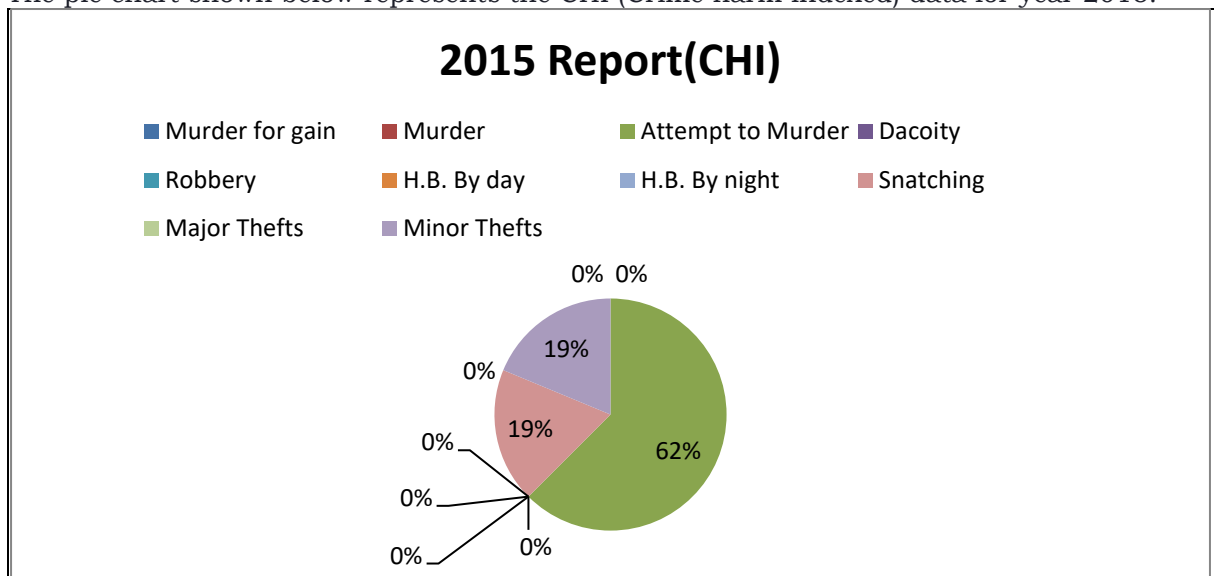
Observation:

- Figure 1 shows the pie chart representing the raw crime data for year 2015.
- Figure 2 shows the pie chart representing the crime harm indexed data for year 2015.
- The attempt to murder crime contributes to 34% of the crime but the harmness value associated to it is 62%.
- The minor thefts and snatching contributes to 66% of the total crime but the harmness value associated to it is 38%.
- From the above two facts its can be inferred that attempt to murder crime has more impact with regards to harmness, whereas minor thefts and snatching has less impact with regards to harmness.

5

Table 3:

- The below table holds the raw crime data and the crime harm indexed data for the year 2016.
- The CHI data was computed by considering the product of the crime and the days of punishment.
- The imprisonment dates for each if the below listed crimes are available in table 1.

| Offences	2016	Offences	2016
	Report		Report(CHI)
Murder for gain	0	Murder for gain	0
Murder	0	Murder	0
Attempt to Murder	0	Attempt to Murder	0
Dacoity	0	Dacoity	0
Robbery	2	Robbery	7300
H.B. By day	3	H.B. By day	7665
H.B. By night	2	H.B. By night	2190
Snatching	1	Snatching	1095
Major Thefts	1	Major Thefts	1095
Minor Thefts	4	Minor Thefts	4380
Total	13	Total	23725

Figure 3:

The pie chart shown below represents the raw data.
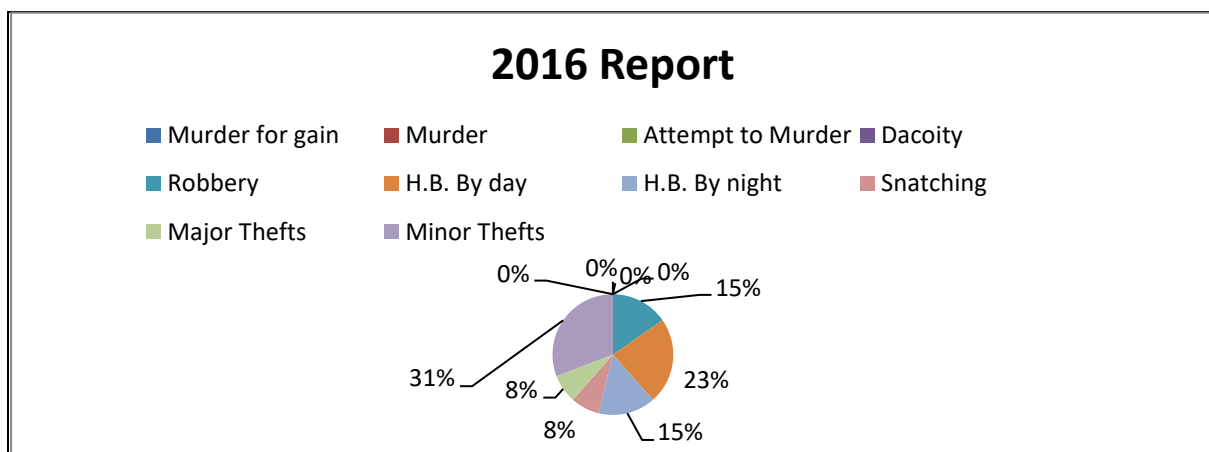
Figure 4:

The pie chart shown below represents the CHI (Crime harm indexed) data.
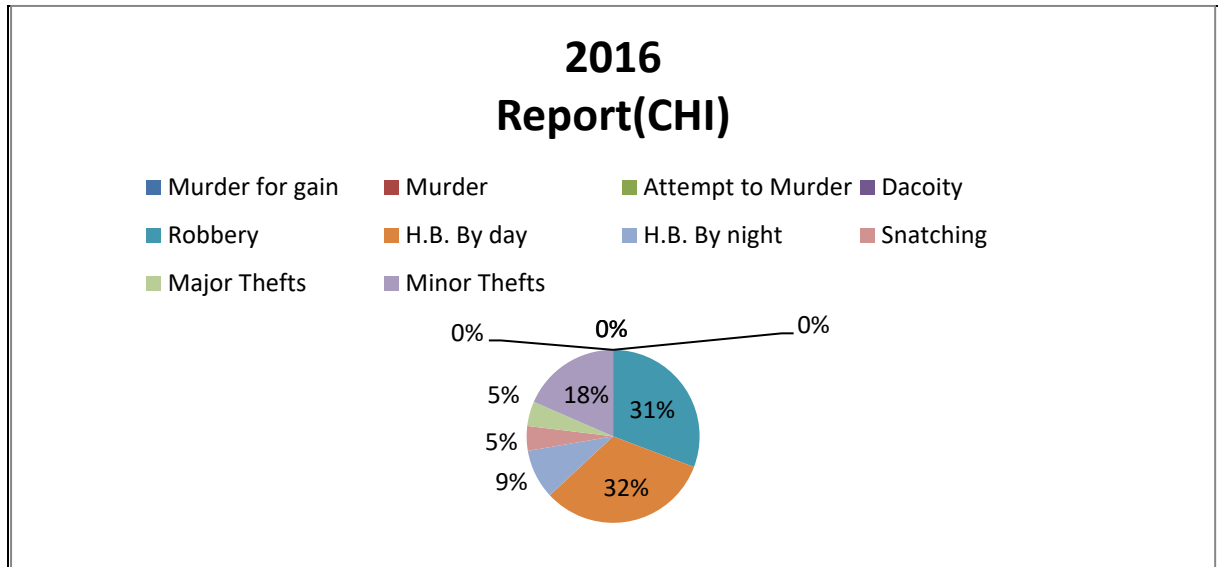
Observation:
- Figure 3 shows the pie chart representing the raw crime data for year 2016.
- Figure 4 shows the pie chart representing the crime harm indexed data for year 2016.
- The major theft offense contributes to 8% of the crime but the harmness value associated to it is 5%.
- The minor theft offense contributes to around 31% of the total crime but the harmness value associated to it is 5%.
- The snatching contributes to around 8% of the total crime but the harmness value associated to it is 5%.
- H.B by day contributes to around 23% of the total crime but the harmness value associated to it is 32%.
- H.B by night contributes to around 15% of the total crime but the harmness value associated to it is 9%.
- Robbery contributes to around 15% of the total crime but the harmness value associated to it is 31%.
- From the above two facts its can be inferred that robbery , H.B. by day has more impact with regards to harmness, whereas minor theft, snatching and H.B by night has less impact with regards to crime harmness.

Table 4:

- The below table holds the raw crime data and the crime harm indexed data for the year 2017.
- The CHI data was computed by considering the product of the crime and the days of punishment.
- The imprisonment dates for each if the below listed crimes are available in table 1.

| Offences	2017	Offences	2017
	Report		Report(CHI)
Murder for gain	0	Murder for gain	0
Murder	0	Murder	0
Attempt to Murder	1	Attempt to Murder	3650
Dacoity	0	Dacoity	0
Robbery	2	Robbery	7300
H.B. By day	0	H.B. By day	0
H.B. By night	1	H.B. By night	1095
Snatching	3	Snatching	3285
Major Thefts	0	Major Thefts	0
Minor Thefts	9	Minor Thefts	9855
Total	16	Total	25185

Figure 5:

The pie chart shown below represents the raw data.
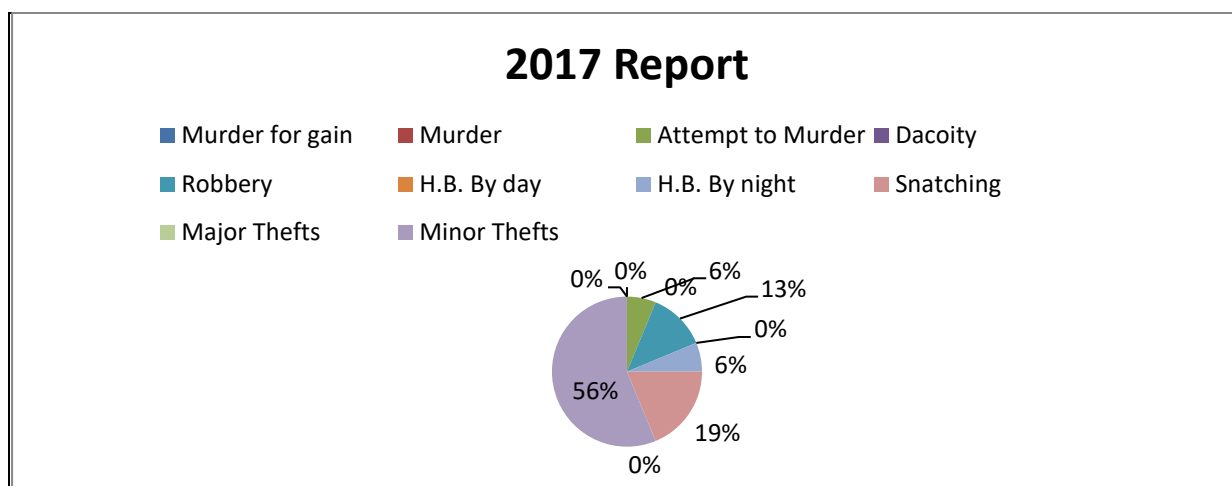
Figure 6:

The pie chart shown below represents the CHI (Crime harm indexed) data.
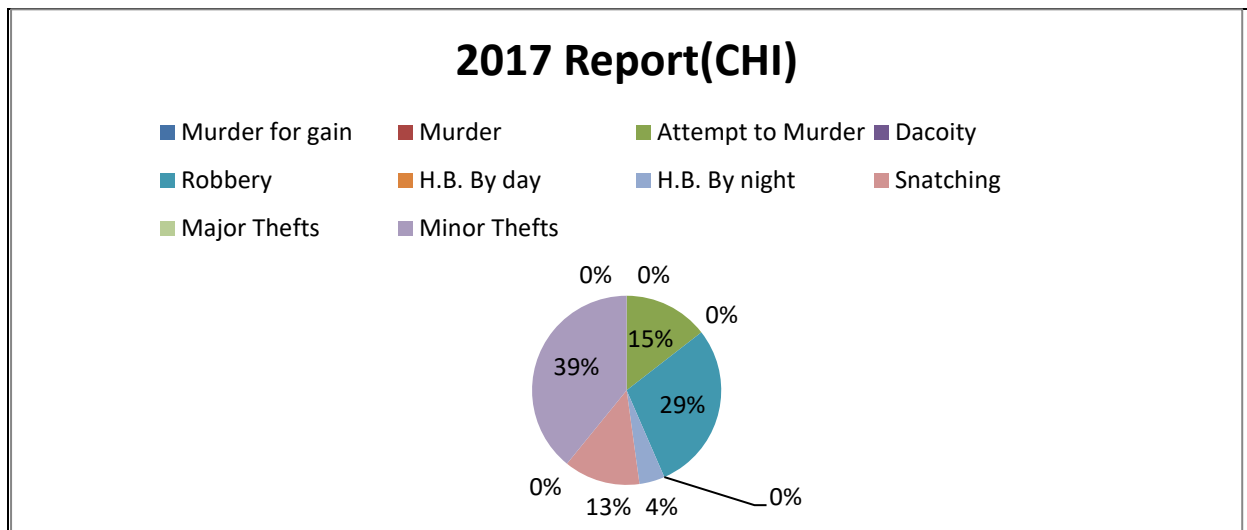
Observation:

- Figure 5 shows the pie chart representing the raw crime data for year 2017.
- Figure 6 shows the pie chart representing the crime harm indexed data for year 2017.
- The attempt to murder crime contributes to 6% of the crime but the harmness value associated to it is 15%.
- The minor theft contributes to around 56% of the total crime but the harmness value associated to it is 39%.
- The snatching contributes to around 19% of the total crime but the harmness value associated to it is 13%.
- Robbery contributes to around 13% of the total crime but the harmness value associated to it is 29%.
- H.B by night contributes to around 6% of the total crime but the harmness value associated to it is 4%.
- From the above two facts its can be inferred that attempt to murder crime has more impact with regards to harmness, whereas minor theft, robbery, snatching and H.B by night has less impact with regards to harmness.

Table 5:

- The below table holds the raw crime data and the crime harm indexed data for the year 2018.
- The CHI data was computed by considering the product of the crime and the days of punishment.
- The imprisonment dates for each if the below listed crimes are available in table 1.

| Offences	2018	Offences	2018
	Report		Report(CHI)
Murder for gain	0	Murder for gain	0
Murder	1	Murder	5110
Attempt to Murder	0	Attempt to Murder	0
Dacoity	0	Dacoity	0
Robbery	0	Robbery	0
H.B. By day	3	H.B. By day	7665
H.B. By night	5	H.B. By night	5475
Snatching	1	Snatching	1095
Major Thefts	0	Major Thefts	0
Minor Thefts	6	Minor Thefts	6570
Total	16	Total	25915

Figure 7:

The pie chart shown below represents the raw data for year 2018.
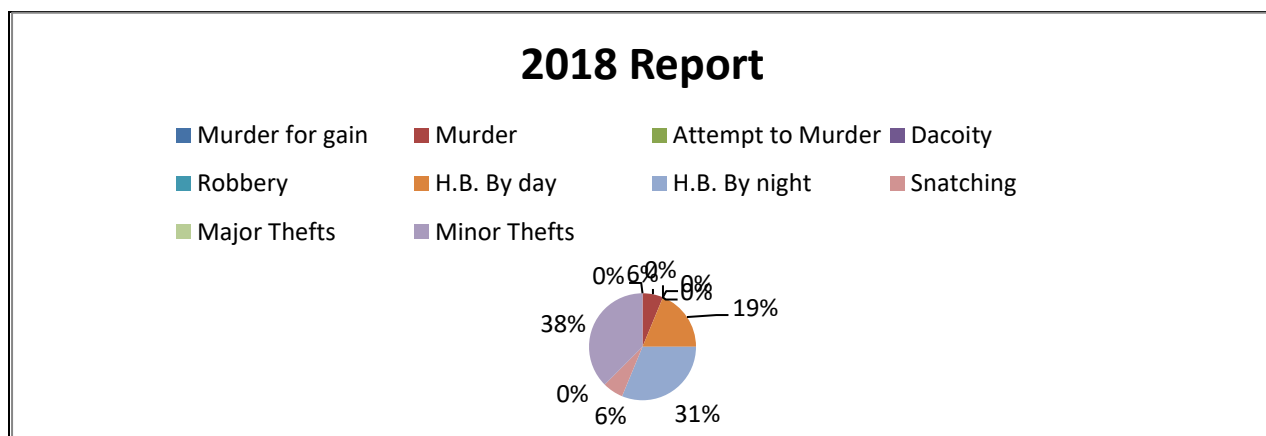
Figure 8:

The pie chart shown below represents the CHI (Crime harm indexed) data for year 2018.
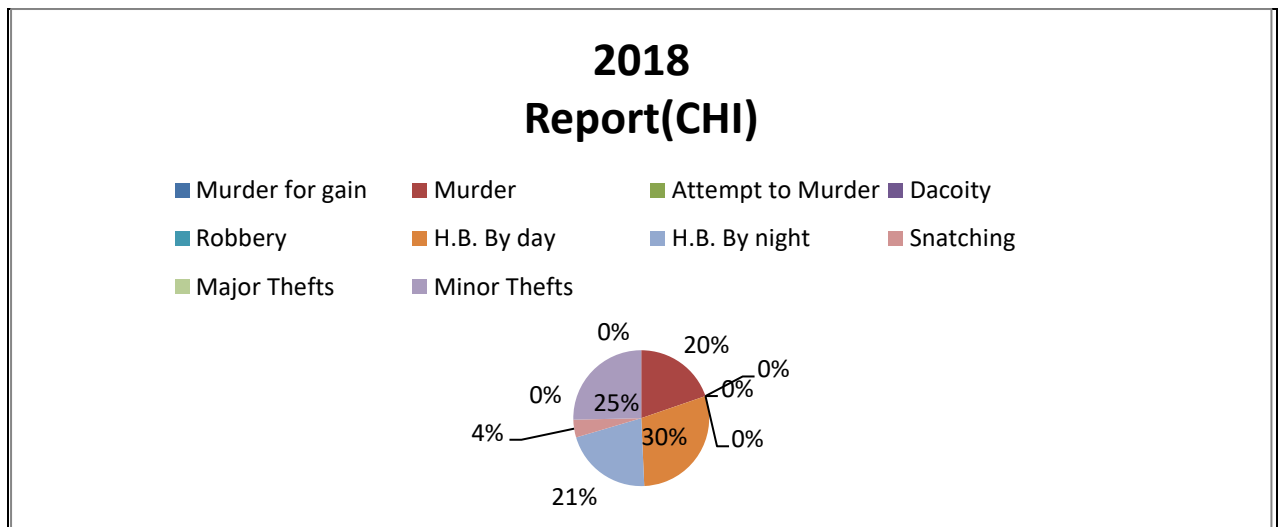
Observation

- Figure 7 shows the pie chart representing the raw crime data for year 2018.
- Figure 8 shows the pie chart representing the crime harm indexed data for year 2018.
- The murder offense contributes to 6% of the crime but the harmness value associated to it is 20%.
- The minor theft contributes to around 38% of the total crime but the harmness value associated to it is 25%.
- The snatching contributes to around 6% of the total crime but the harmness value associated to it is 4%.
- H.B. by day contributes to around 19% of the total crime but the harmness value associated to it is 30%.
- H.B. by night contributes to around 31% of the total crime but the harmness value associated to it is 21%.
- From the above two facts its can be inferred that attempt to murder crime, H.B. by day has more impact with regards to harmness, whereas minor theft, snatching and H.B by night has less impact with regards to harmness.

CONCLUSION

Crime harm index is focused on uprooting the ambiguity and channelizes the process in a comprehensible course. This model involves using technology to aid crime detection by arriving at harmness levels of crime. Further, practical usage of technology and historical crime patterns will help in predicting the crime harmness patterns. The data from the past and current will act as critical indicators to arrive at feasible solutions and trends. Further, the data about harmness gives a new dimension for problem-solving—the inference from the past data aids in decision making. Once the current crime patterns are predicted, practical actions can be prescribed. The key idea behind the concept is to build a system with integrity, which will, in turn, scrape down the ambiguity in all the stages involved in crime handling. Effective demarcation and benchmarks can be inducted to remove the contingency involved in the system. The streamlining of processes and substantiation of a robust monitoring and control system can be achieved using a crime harm index methodology. Technology can be used in designing and implementing a foolproof system in place for developing an automated CHI system to get an effective outcome.

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