Exploration of Crimes through Data Analysis: A Reviews

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Abstract-Crime is Social nuisance has paid a heavy price to our society. Any research that helps solve crime faster will pay for scientific world. Here it look at the use of clustering Algorithm for data mining methods to aid detection Crime model and speeding up the process crime. This paper study carious algorithm like k-means for clustering of data. Enhance technique could help identify the process Crime mode. The primary aim of this paper is to provide a concise review of the Data Mining applications in crime. To this end the paper reviews over one-hundred applications of Data Mining in Crime covering a substantial quantity of research to date, presented in chronological order with an overview table of many important Data Mining applications in the crime domain as a reference directory. The Data Mining techniques themselves are briefly introduced to the reader and these include Entity Extraction, Clustering, Association Rule Mining, Decision Trees, Support Vector Machines, Naive Bayes Rule, Neural Networks and Social Network Analysis amongst others. The mining association of the bases is one of the most important. The most popular data extraction technique. Mining link rules can be used efficiently in any rule-building decisions based on decision-making wizard. This article offer effective mining-based optimization techniques to create rules.

Keywords- Entity Extraction, Clustering, Association Rule Mining, Decision Trees, Support Vector Machines, Naive Bayes Rule, Neural Networks

I. INTRODUCTION

Mining of data is a method of dealing with expansive data indexes to perceive outlines and set up an association to handle issues through information examination. The devices used, allow endeavors to accept future examples. Data mining is a procedure to analyze data from an informational collection to change it into a reasonable structure for additional utilization. It predicts future patterns and also enables the organization to make the learning driven decision. Generally utilized strategies for mining of data are artificial neural networks, decision tree, rule induction, nearest neighbor method and genetic algorithm. They are applied in many fields. One such interesting application is crime investigation. A crime is an unlawful activity for which a man can be penalized by law. Crime against a person is called personal crime like murder, robbery, etc. Property crime means theft of property. Crime analysis is a law implementation task which includes an organized analysis that recognizes and determines the pattern of crime. Crime can be classified into different types but, in this paper focused on four types of crime i.e. Fraud detection, traffic violence, violent crime, web crime and sexual offense. The various techniques used for different crimes have been discussed with an introduction to the concerned crime. **[1-5]**

1.1 Crime Reporting Systems

The data for crime often presents an interesting dilemma. While some data is kept confidential, some becomes public information. Data about the prisoners can often be viewed in the county or sheriff's sites. However, data about crimes related to narcotics or juvenile cases is usually more restricted. Similarly, the information about the sex offenders is made public to warn others in the area, but the identity of the victim is often prevented. Thus as a data miner, the analyst has to deal with all these public versus private data issues so that data mining modeling process does not infringe on these legal boundaries. Most sheriffs' office and police departments use electronic systems for crime reporting that have replaced the traditional paper-based crime reports. These crime reports have the following kinds of information categories namely - type of crime, date/time, location etc. Then there is information about the suspect (identified or unidentified), victim and the witness. Additionally, there is the narrative or description of the crime and Modus Operandi (MO) that is usually in the text form. The police officers or detectives use free text to record most of their observations that cannot be included in checkbox kind of pre-determined questions. While the first two categories of information are usually stored in the computer databases as numeric, character or date fields of table, the last one is often stored as free text. The challenge in data mining crime data often comes from the free text field. While free text fields can give the newspaper columnist, a great story line, converting them into data mining attributes is not always an easy job. This paper introduce how to arrive at the significant attributes for the data mining models. **[5-10]**

1.2 Types of Crime

Fraud detection

A fraud is misdirecting or taking unfair advantage of another. A fraud incorporates any act, exclusion, or concealment, including a breach of legal or equitable obligation or confide in, brings about the damage of other. Different types of frauds include check fraud, internet sale, insurance fraud and credit card fraud etc. Check fraud means issuance of a check when enough money is not present in account; internet sale means selling fake items; insurance fraud means fake insurance claimed for automobile

damage, health care expenses and other; credit card fraud means obtaining credit card information from various means which is used for large amount of purchase without the permission of consumer. **[27]**

Violent Crime

A violent crime is a crime in which a guilty party threatens to utilize compel upon a casualty. This entails the two crime of rough act called target, for example, killing or rape. Various sorts of this crime are as follows:

- ✓Murdering of individual by other.
- ✓Murder: Deliberate slaughtering of another individual.
- ✓1st degree murder: Used to allude to a deliberate slaughtering.
- ✓2nd degree murder: Used to allude to kill accidently in which the executioner shows, outrageous detachment to life of human.

Traffic violence

Traffic violations happen when drivers damage laws that manage vehicle operation on roads and highways. The increasing number of cars in cities causes high volume of traffic, and implies that traffic violations become more critical which can cause severe destruction of property and more accidents that may endanger the lives of the people. To solve this problem and prevent such consequences, traffic violation detection systems are needed.

Sexual assault

Criminal attack is the risk or endeavor to physically strike a man, paying little respect to whether contact is really made, insofar as the casualty knows about the peril included. Level of Sexual assaults include:

• **Simple Sexual Assault:** It includes constraining a person to participate in any type of sexual action without unequivocal assent.

• **Sexual Assault with a Weapon:** It incorporates the utilization or danger of the utilization of a weapon or damage to an outsider.
• **Aggravated Sexual Assault:** It happen when the casualty is truly injured, mangled, fiercely beaten, or in threat of passing on because of a rape.

• **Verbal assault:** It is a sort of non-physical, oral ambush that outcomes in a passionate, mental, and additionally mental damage to the casualty, instead of physical substantial damage way.

Cyber crime

Cyber-crime is the crime related to computer. It comprises of computer and a network for crime to occur. Offenses that are perpetrated against criminal process to hurt the victims by present day media transmission systems, for example, net and cell. Various types are web extortion, ATM misrepresentation, wire misrepresentation, document sharing and robbery, hacking, and so forth. Cyber-crime analysis is very important responsibility of law enforcement system in any country. It includes breakdown of protection, or harm to the PC framework properties, for example, documents, site pages or programming. **[11-13]**

II. DATA MINING AND CRIME PATTERNS

This research look at how to convert crime information into a data-mining problem, such that it can help the detectives in solving crimes faster. This have seen that in crime terminology a cluster is a group of crimes in a geographical region or a hot spot of crime. Whereas, in data mining terminology a cluster is group of similar data points – a possible crime pattern. Thus appropriate clusters or a subset of the cluster will have a one-to-one correspondence to crime patterns. Thus clustering algorithms in data mining are equivalent to the task of identifying groups of records that are similar between themselves but different from the rest of the data. In our case some of these clusters will useful for identifying a crime spree committed by one or same group of suspects. Given this information, the next challenge is to find the variables providing the best clustering. These clusters will then be presented to the detectives to drill down using their domain expertise. The automated detection of crime patterns, allows the detectives to focus on crime sprees first and solving one of these crimes results in solving the whole "spree" or in some cases if the groups of incidents are suspected to be one spree, the complete evidence can be built from the different bits of information from each of the crime incidents. For instance, one crime site reveals that suspect has black hair, the next incident/witness reveals that suspect is middle aged and third one reveals there is tattoo on left arm, all together it will give a much more complete picture than any one of those alone. Without a suspected crime pattern, the detective is less likely to build the complete picture from bits of information from different crime incidents. Today most of it is manually done with the help of multiple spreadsheet reports that the detectives usually get from the computer data analysts and their own crime logs. They choose to use clustering technique over any supervised technique such as classification, since crimes vary in nature widely and crime database often contains several unsolved crimes. Therefore, classification technique that will rely on the existing and known solved crimes, will not give good predictive quality for future crimes. Also nature of crimes change over time, such as Internet based cybercrimes or crimes using cell-phones were uncommon not too long ago. Thus, in order to be able to detect newer and unknown patterns in future, clustering techniques work better. **[14-18]**

III. BACKGROUND

Mousa Albashrawi et al. (2016), This paper aims to review to research studied conducted to detect financial fraud using data mining tools with one decade to communicate the current trends to academic scholars and industry practitioners. This fraud deceives lets some people prepay to get a quote, but once the fee is collected they do not realize the expected benefits. Second, a

decade the 10-year review may not be enough to solve this growing problem. Third, they also surveyed 65 different may not reveal the entire scope of data mining in the area of financial fraud; several online databases need to be included in the sample for more powerful presentation and analysis.

Arnab Samanta et al. (2016) propose a model to classify crimes based on their level of seriousness and will provide to criminal experts with easy to understand and analytical visualization. This model will also provide the ability for analyzing psychology of murders using clustering. Thus, this model able to classify a crime according to their level and use clustering to provide insight into the murderers of using clustering mind. This model was only proposed not implemented.

Anisha Agarwal et al. (2016) examine the use of frequent pattern data mining and association rule data mining to analyze the various criminal activities committed by criminals and to predict the likelihood that criminals will commit crimes again. Where criminals are most likely to commit a crime, this analysis can help domestic law enforcement agencies make more accurate decisions or help protect specific areas. They concentrate on the A-priori algorithm and associated rule mining techniques to achieve the result.

Anshu Sharma et al. (2013) describes a data mining based approach for extracting key patterns from reports gathered from the city police department. The report is written in simple plain text. The plain texts is converted into the format understandable by the tools. Then, exiting data mining techniques are applied to get patterns of crime data and a new algorithm is proposed to improve the accuracy of the crime pattern detection system. The various data mining techniques, such as clustering and classification, are used to get the patterns of crime data.

A. Malathi et al. (2011) studied on the Algorithmic crime prediction Model Based on criminal population analysis. According to them, crime is a behavioral disorder that is an integrated of social, economic and environmental factors. This research work focus on the use of various data mining techniques to develop crime analysis tools for Indian scenarios that help law enforcement department to agencies effectively handle criminal investigations. The proposed tool enables agencies to easily and describe to analyze crime data simply and economically to identify possible models and trends. The proposed tool, for applying crime data can be used as a knowledge discovery tool to review very large datasets and incorporate methods for accurate handling of security issues.

Umair Saeed et al. (2015) Studied on application of Machine Learning Algorithms in Crime Classification and Classification Rule Mining. Crime is one of the main threats facing our government today. Extensive research has been conducted in criminology, with a focus on scientific research on criminology and criminal behavior. Data mining technology Applications are one of the most important areas that produce fruitful results. Data mining has been used to simulate crime detection and classification problems. Manually dealing with the large number of crimes being committed makes security strategies time-consuming and complex. In this paper, they use data mining technology to predict crime and criminality. They apply machine learning algorithms to criminal activity datasets to predict attributes and event outcomes. It also compares to analyzes various to different classification methods.

M. Sree Devi (2018) Studied on the review of crime analysis and forecasting using data mining techniques. The main purpose is not to pay attention to the cause of the crime but to focus on the crime factor. By using the concept of data mining, she can extract previously unknown useful information from unstructured data. Build data mining programs to help solve crimes quickly between computer science and criminal justice. Offenders can also make predictions based on crime data. This article uses several data mining techniques to illustrate different types of crime analysis and crime prediction.

Malathi. A et al. (2011) Studied on an intelligent Analysis of Urban Crime Data Based on Data Mining. In this paper, they use clustering/classification-based models to predict criminal trends. Data mining techniques are used to analyze urban crime data from police department. The results of this data mining may be used to reduce and even prevent crime in the coming years.

Ilamvaluthi Joseph. S (2017) studied on A Survey of data mining techniques to analyze Crime Patterns. This article reviews the literature on various data mining applications, particularly those that apply to crime. The survey also revealed research gaps and challenges in crime data mining. In addition, this article provides insights on data mining, finds the right patterns and trends in crime, and assists beginners in crime data mining research.

Mehmet Sevri et al. (2017) Studied on a-priori algorithm crime analysis based on association rules. The purpose of this study was to clarify the relationship between the attributes of independent criminal histories. The NIBRS database contains US criminal records recorded in 2013 for use in this survey. Association rules created by the A-priori algorithm have been used to extract relationships between features of criminal histories. Experimental results show that the relevant rules created by the A-priori algorithm can be used for crime analysis. This survey reveals the relationships between different criminal record attributes and allows authorities to establish relationships between new and old incidents.

Chhaya Yadav et al. (2017) purpose of this white paper is to classify collective crimes according to the frequency of

occurrence for different years throughout the data mining process. Data mining is used to analyze, investigate, and discover different crime patterns for women. They connected hypothesis models based on information mining strategies, such as grouping and characterization of actual crime data sets recorded by OGD. K-means clustering, KNN algorithms, decision tree algorithms, and future prediction methods are used for crime classification and clustering.

Xingan Li et.al. (2014) Study on application of data mining method based on international data source in crime investigation. The purpose of this paper is to apply data mining method to crime comparison research based on international data source. Crime prevention is the foundation of modern social welfare, stability and development. Crime occurs in a complex of surrounding factors and usually goes beyond government, society or citizen control. These environmental variables form the geographical distribution of crimes at the international level, influence the occurrence and characteristics of particular crimes in particular jurisdictions, and have a visible or almost invisible role in providing it can be roughly divided into population, economic and historical factors.

Devendra Kumar Tayal et al. (2015) Studied on crime detection and crime identification in India using data mining technology. This paper presents a method to design and implement urban crime detection and crime identification in India using data mining technology. Their approach is divided into six modules: data extraction (DE), data preprocessing (DP), clustering, Google map representation and classification, WEKA implementation. The first module DE extracted unstructured crime data sets from various crime network resources between 2000 and 2012. The second module, DP, organizes, unifies and integrates the extracted crime data into smaller structured 5,038 crime cases. They use 35 predefined crime attributes to represent these instances in order to protect the accessibility of the crime database. The remaining four modules are used for crime detection, crime identification and prediction, and crime verification. Crime detection is analyzed using k-means clustering, which repeatedly generates two crime clusters based on similar crime attributes. Google Maps has improved visualization to k-means. KNN classification is used for analysis of crime identification and prediction. The verification accuracy was 93.62 and 93.99% when the formation of two criminal groups was used using the selected crime attribute. Their approach helps to improve society by helping criminal investigations and criminal identification, thereby reducing crime rates.

K. S. N. Murthy et al. (2017), write an article on how to analyze crime data using data mining. The A-priori and FP development calculations are the most famous calculations that can be used for frequent pattern mining. His paper shows a variety of studies on frequent pattern mining and rule mining calculations that can be used for crime pattern mining. Survey analysis provides data on work done in the same area, current trends, and other relevant areas. Frequent pattern mining has three important methods: candidate generation method, no candidate generation method and vertical layout method. It also explains how to connect to different areas with different frequent pattern calculations and identifications that are specially designed incorrectly. This article helps researchers to think clearly about the application of frequent pattern mining algorithms in different areas.

Prajakta Yerpude et al. (2017) Studied on research on Crime Data Predictive Modeling Based on Data Mining In this whitepaper, data mining techniques are applied to crime data to predict characteristics that affect high crime rates. This paper summarizes the random forest classifier and shows the most balanced results in terms of accuracy, precision, recall and F1 score among the three models that prediction of "per capita violent crime" features. Although linear regressions show the lowest values for these performance measurements, the data do not fit well with the straight lines considered by the target and the remaining features. The high accuracy value of the model's dirty data compared to the clean data indicates that the regression requires continuous data including sparse values. The random forest classifier takes into account multiple trees and produces an average result to prove that this kind of data is complete. Naive Bayes has proven to balance this crime data as this value is close to the random forest classifier.

R. Bulli Babu et al. (2016) Studied on detection of learn criminal investigations using unsupervised learning techniques. The main purpose of this article is to solve the crime problem in a short time. There are many ways to do this, but this article focus on solve the easily and reduce the time in solving the case. With crime data, clustering technology plays an important role in crime investigations and helps to easily resolve unresolved crime issues. By grouping data with similar objects, you can easily resolve unresolved criminal issues. Partition clustering algorithms are one of the best ways to find affinity objects. Finding similar words and grouping them into clusters has been observed to help in crime analysis. In this article, they consider clustering methods and measurement of similarity in crime data.

Vrushali Pednekar et al. (2018), Studied on Crime Rate Prediction using KNN. Crime is one of the most important and shocking aspects of our society, and prevention is an important task. Crime analysis is a systematic approach to investigating and investigating criminal patterns and trends. Therefore, it is necessary to examine the different causes, factors, and relationships between the different crimes that have occurred and find the most appropriate way to manage and avoid more crimes. The main purpose of this project is to classify cluster crimes based on the frequency of occurrence each year. Data mining is widely used to analyze, investigate, and discover different crime patterns.

In this study, various data mining clustering methods are used to analyze crime data. K-nearest neighbor (KNN) classification is used for crime prediction. The proposed system can predict areas likely to be criminalized and can predict areas prone to crime. Political hate etc. concentrates mainly on criminal factors rather than the criminal background of the crime such as the cause of the crime.

R. G. Uthra et al. (2014) Studied on data mining technology to analyze crime data. In data mining, crime management is an interesting application that plays an important role in dealing with crime data. Criminal investigation plays a very important role as a police system in every country. Crime rates have increased significantly in recent years. With the rapid spread of the Internet, crime information held in the network is increasingly rampant. In this paper, They analyze Web data using data mining technology. This paper conducted a detailed study on classification and clustering. Classification is the process of classifying the type of crime. Clustering is the process of grouping data objects into groups. Constructing a scene involves extracting attributes and relationships in a web page and rebuilding a data crime mining.

Nikhil Dubey et al. (2014), A survey paper of investigative reporting on crime prediction techniques based on data mining Crime prediction is an attempt to identify and reduce future crimes. Crime prediction uses historical data to predict future crimes by location and time after analyzing the data. As ongoing crime cases are occurring rapidly, it is a difficult task to accurately predict future crimes with better performance. Data mining techniques are very useful for solving crime detection problems. Thus, the purpose of this white paper is to study the various computing technologies used to predict future crimes. In this paper, they compare and analyze data mining methods for future crime detection and prediction.

Vineet Pande et al. (2016), Studied on research criminal investigations using data mining. Law enforcement agencies face new challenges as crime rates rise daily. They must inform their units of signs of criminal activity. This may cost more for their resources. Thus, law enforcement agencies may increase or decrease crimes, such as murder, rape, theft, or the number of crimes that may occur in a particular month, year, particular region, or any period, or in the future. It should be able to predict the trend. Total number of crimes committed in one country in a year, or any other forecast or forecast of future crime statistics. First, our system recommends extracting data from the criminal records repository, and they will use to data mining. Data classification and regression algorithms then facilitate prediction and prediction by first training the set and then applying the training set to the test set to determine the predicted output. Using this, law enforcement agencies can better understand the pattern of crime in a region or time interval and use that data. This will save them a lot of time, money and effort. It is recommended to mine this data and run an algorithm that is appropriate for that data. The predicted output can also be presented to the user in the form of clusters using data visualization algorithms such as K-means clustering algorithms. Thus, the final end product can be a system for forecasting the future by training the crime data set and can be visualized to make it easier for users to understand

Cuicui Sun et al. (2014) Studied on detection survey used a classification algorithm to detect the type of crime. According to them, criminal activity reflects the characteristics of the offender. Guessing the types of unidentified offenders from a large number of different criminal characteristics is an important part of criminal activity analysis. Using a classification algorithm to classify offenders is a good solution. This paper analyzed crime data sets using three typical classification algorithms including C4.5 algorithm, Naive Bayes algorithm and K-nearest neighbor (KNN) algorithm. However, a significant number of missing data values can seriously affect classification accuracy. Therefore, a missing data replenishment method is used to fill missing data based on Gray Relational Analysis (GRA) theory. Experimental results from crime data sets show that higher classification accuracy can be achieved using this missing data filling method.

IV. CONCLUSION

This review paper begins with a brief introduction into the evolution of crime and the importance of Data Mining for crime detection, analysis and prevention. Given the vast amount of funding that is allocated for defense related expenditure around the globe, it is clear that considerable savings could be attained through the correct application of Data Mining techniques which are primarily aimed at uncovering hidden relationships in Big Data. Following a thorough research we are able to present a list of Data Mining techniques as the most frequently adopted at present for crime analysis. These include Entity Extraction, Clustering, Association Rule Mining, and Classification Techniques like Decision Trees, Support Vector Machines, Naive Bayes Rule, Neural Networks and Social Network Analysis. As opposed to providing a review of applications alone, this paper goes a step further and provides a concise introduction to these Data Mining techniques as well as a brief summary of specific functions of each technique in crime analysis, and thereby enables the readers from different backgrounds to obtain a much richer understanding of the underlying process whilst guiding them to the relevant articles for a more detailed description. This review itself is unique as it captures over one-hundred applications and is the most up-to-date and thorough review of Data Mining applications in crime to date. This find strong evidence based on number of applications, to conclude that classification techniques are the most popular form of Data Mining in crime. This is interesting as there exists a major difference between the findings from Data Mining in Official Statistics and our findings here. This paper notice that SVM, Neural Networks and Association Rule mining are seldom used for mining Official Statistics, whereas in

crime Data Mining these methods are extremely popular and well exploited. This further highlights the institutional and cultural differences that exist between National Statistical Institutes and organizations engaged in analyzing crime. **[20-34]**

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