Crime Pattern Detection Using Data Mining

Shyam Varan Nath
Florida Atlantic University/ Oracle Corporation
SNath1@FAU.edu / Shyam.Nath@Oracle.com
+1(954) 609 2402

Abstract

Can crimes be modeled as data mining problems? We will try to answer this question in this paper. Crimes are a social nuisance and cost our society dearly in several ways. Any research that can help in solving crimes faster will pay for itself. Here we look at use of clustering algorithm for a data mining approach to help detect the crimes patterns and speed up the process of solving crime. We will look at k-means clustering with some enhancements to aid in the process of identification of crime patterns. We will apply these techniques to real crime data from a sheriff's office and validate our results. We also use semi-supervised learning technique here for knowledge discovery from the crime records and to help increase the predictive accuracy. We also developed a weighting scheme for attributes here to deal with limitations of various out of the box clustering tools and techniques. This easy to implement machine learning framework works with the geo-spatial plot of crime and helps to improve the productivity of the detectives and other law enforcement officers. It can also be applied for counter terrorism for homeland security.

Keywords: *Crime-patterns, clustering, data mining, k-means, law-enforcement, semi-supervised learning*
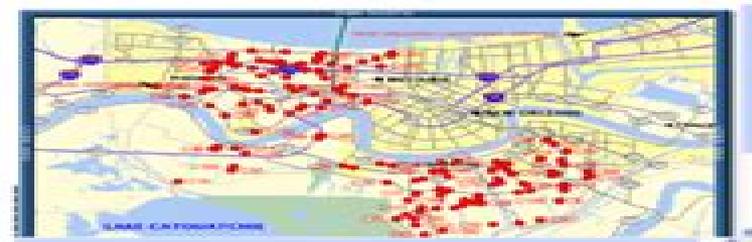
1. Introduction

Historically solving crimes has been the prerogative of the criminal justice and law enforcement specialists. With the increasing use of the computerized systems to track crimes, computer data analysts have started helping the law enforcement officers and detectives to speed up the process of solving crimes. Here we will take an inter-disciplinary approach between computer science and criminal justice to develop a data mining paradigm that can help solve crimes faster. More specifically, we will use clustering based models to help in identification of crime patterns[1].

We will discuss some terminology that is used in criminal justice and police departments and compare and contrast them relative to data mining systems. Suspect refers to the person that is believed to have committed the crime. The suspect may be identified or unidentified. The suspect is not a convict until proved guilty. The victim is the person who is the target of the crime. Most of the time the victim is identifiable and in most cases is the person reporting the crime. Additionally, the crime may have some witnesses. There are other words commonly used such as homicides that refer to manslaughter or killing someone. Within homicides there may be categories like infanticide, eldercide, killing intimates and killing law enforcement officers. For the purposes of our modeling, we will not need to get into the depths of criminal justice but will confine ourselves to the main kinds of crimes.

Cluster (of crime) has a special meaning and refers to a geographical group of crime, i.e. a lot of crimes in a given geographical region. Such clusters can be visually represented using a geo-spatial plot of the crime overlayed on the map of the police jurisdiction. The densely populated group of crime is used to visually locate the 'hot-spots' of crime. However, when we talk of clustering from a data-mining standpoint, we refer to similar kinds of crime in the given geography of interest. Such clusters are useful in identifying a crime pattern or a crime spree. Some well-known examples of crime patterns are the DC sniper, a serial-rapist or a serial killer. These crimes may involve single suspect or may be committed by a group of suspects. The below figure shows the plot of geo-spatial clusters of crime.

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Proceedings of Data Analytics and Management Abhishek Swaroop,Zdzislaw Polkowski,Sérgio Duarte Correia,Bal Virdee,2024-01-02 This book includes original unpublished contributions presented at the International Conference on Data Analytics and Management ICDAM 2023 held at London Metropolitan University London UK during June 2023 The book covers the topics in data analytics data management big data computational intelligence and communication networks The book presents innovative work by leading academics researchers and experts from industry which is useful for young researchers and students The book is divided into four volumes *Handbook of Critical Incident Analysis* Richard W Schwester,2014-12-18 Critical incidents all too often explode onto the social conscious and challenge our sense of security This comprehensive handbook brings together a range of experts who provide a foundation for the field of critical incident analysis by examining specific incidents9 11 the Virginia Tech massacre the H1N1 pandemic the BP oil spill and more through various methodological and disciplinary lenses This groundbreaking book develops a new organizational theory derived from ideas in statistics and psychometrics The author s core premise is that errors known to occur in social science research must also occur when managers look at their data and seek to make inferences about cause and effect Statistico organizational theory uses methodological principles to predict when errors occur and how great they will be Expanding on this concept The Meta Analytic Organization offers new theoretical propositions about organizational strategy and structure with wide application to human resource management international business and more *Progress in Artificial Intelligence and Pattern Recognition* Yanio Hernández Heredia,Vladimir Milián Núñez,José Ruiz Shulcloper,2021-11-03 This book constitutes the refereed proceedings of the 7th International Workshop on Artificial Intelligence and Pattern Recognition IWAIPR 2021 held in Havana Cuba in October 2021 The 42 full papers presented were carefully reviewed and selected from 73 submissions The papers promote and disseminate ongoing research on mathematical methods and computing techniques for artificial intelligence and pattern recognition in particular in bioinformatics cognitive and humanoid vision computer vision image analysis and intelligent data analysis Applications of Artificial Intelligence in 5G and Internet of Things Vinod M. Kapse,Lalit Garg,Pavan Kumar Shukla,Varadraj Gurupur,Amit Krishna Dwivedi,2025-04-30 This is the proceedings of the 1st International Conference on Applications of AI in 5G and IoT ICAAI5GI2024 It brings together ground breaking research and practical insights into integrating Artificial Intelligence within 5G and the Internet of Things IoT This compilation highlights the latest advancements and innovative solutions emerging at the intersection of AI 5G and IoT technologies It also delves into a wide array of topics including the role of AI in enhancing 5G network efficiency the development of intelligent IoT devices and the creation of smart environments powered by these cutting edge technologies It further showcases key findings on AI driven applications in 5G for seamless communication improved connectivity and advanced data processing techniques along with IoT solutions for smart cities industrial automation healthcare and beyond It

would be a valuable read for researchers engineers and professionals in AI 5G IoT and related fields It serves as an essential resource for those seeking to stay at the forefront of technological advancements in these rapidly evolving domains   Big Data Analytics V. B. Aggarwal,Vasudha Bhatnagar,Durgesh Kumar Mishra,2017-10-03 This volume comprises the select proceedings of the annual convention of the Computer Society of India Divided into 10 topical volumes the proceedings present papers on state of the art research surveys and succinct reviews The volumes cover diverse topics ranging from communications networks to big data analytics and from system architecture to cyber security This volume focuses on Big Data Analytics The contents of this book will be useful to researchers and students alike   *Crime Pattern Detection Using Data Mining* Shyam Varan Nath,2011   **Forthcoming Books** Rose Arny,1998-04   **Dissertation Abstracts International** ,1985   Yearbook of Science and the Future ,1984   **Index to IEEE Publications** Institute of Electrical and Electronics Engineers,1978 Issues for 1973 cover the entire IEEE technical literature   *Who's who in Frontiers of Science and Technology* ,1985   *Books in Print Supplement* ,1985   *A Data Mining Approach to Identify Perpetrators* Li Ding,2010 Data mining and social network analysis have been widely used in law enforcement to solve crimes Research questions such as strength of ties in social networks crime pattern discovery and prioritizing offenders have been studied in this area However most of those studies failed to consider the noisy nature of the data The techniques they proposed only have been applied to small scale data sets Therefore it is an important task to design a framework that can work on large scale data sets and tolerance noisy data In this dissertation we built an integrated crime detection framework that combined two data mining techniques decision tree and genetic algorithm and graph theories to solve the problems we pointed out Our crime pattern analysis is based on all offenders of the state of Alabama in the past 50 years Our constructed social network contains all Alabama residents It allows us to fully evaluate the proposed models Two case studies have been conducted to evaluate the framework One is based on 625 inmates released from Madison county jail in 2004 Our experimental results show that our recommended risk level has strong correlation in predicting future offense Another case study is based on the 100 real police reports The experimental results show that the median ranking of arrestees remains at the top 3% of the return list   **Data Mining Trends and Applications in Criminal Science and Investigations** Isafiade, Omowunmi E.,Bagula, Antoine B.,2016-06-20 The field of data mining is receiving significant attention in today s information rich society where data is available from different sources and formats in large volumes and no longer constitutes a bottleneck for knowledge acquisition This rich information has paved the way for novel areas of research particularly in the crime data analysis realm Data Mining Trends and Applications in Criminal Science and Investigations presents scientific concepts and frameworks of data mining and analytics implementation and uses across various domains such as public safety criminal investigations intrusion detection crime scene analysis and suspect modeling Exploring the diverse ways that data is revolutionizing the field of criminal science this publication meets the research needs of law enforcement professionals data

analysts investigators researchers and graduate level students **Pattern Recognition Algorithms for Data Mining** Sankar K. Pal,Pabitra Mitra,2004-05-27 This valuable text addresses different pattern recognition PR tasks in a unified framework with both theoretical and experimental results Tasks covered include data condensation feature selection case generation clustering classification and rule generation and evaluation Organized into eight chapters the book begins by introducing PR data mining and knowledge discovery concepts The authors proceed to analyze the tasks of multi scale data condensation and dimensionality reduction Then they explore the problem of learning with support vector machine SVM and conclude by highlighting the significance of granular computing for different mining tasks in a soft paradigm **Crime Pattern Detection Using Multi-Model Data** 蔡文浩,2020 **Data Mining for Intelligence, Fraud & Criminal Detection** Christopher Westphal,2008-12-22 In 2004 the Government Accountability Office provided a report detailing approximately 200 government based data mining projects While there is comfort in knowing that there are many effective systems that comfort isn t worth much unless we can determine that these systems are being effectively and responsibly employed Written by one of the most Investigative Data Mining for Security and Criminal Detection Jesus Mena,2003-04-07 Investigative Data Mining for Security and Criminal Detection is the first book to outline how data mining technologies can be used to combat crime in the 21st century It introduces security managers law enforcement investigators counter intelligence agents fraud specialists and information security analysts to the latest data mining techniques and shows how they can be used as investigative tools Readers will learn how to search public and private databases and networks to flag potential security threats and root out criminal activities even before they occur The groundbreaking book reviews the latest data mining technologies including intelligent agents link analysis text mining decision trees self organizing maps machine learning and neural networks Using clear understandable language it explains the application of these technologies in such areas as computer and network security fraud prevention law enforcement and national defense International case studies throughout the book further illustrate how these technologies can be used to aid in crime prevention Investigative Data Mining for Security and Criminal Detection will also serve as an indispensable resource for software developers and vendors as they design new products for the law enforcement and intelligence communities Key Features Covers cutting edge data mining technologies available to use in evidence gathering and collection Includes numerous case studies diagrams and screen captures to illustrate real world applications of data mining Easy to read format illustrates current and future data mining uses in preventative law enforcement criminal profiling counter terrorist initiatives and forensic science Introduces cutting edge technologies in evidence gathering and collection using clear non technical language Illustrates current and future applications of data mining tools in preventative law enforcement homeland security and other areas of crime detection and prevention Shows how to construct predictive models for detecting criminal activity and for behavioral profiling of perpetrators Features numerous Web links vendor resources case studies and screen captures illustrating the use of artificial

intelligence AI technologies   <u>Pattern Recognition and Data Mining</u> Sameer Singh,Maneesha Singh,Chid Apte,Petra Perner,2005   <u>Pattern Recognition and Data Mining</u> Sameer Singh,Maneesha Singh,Chid Apte,Petra Perner,2005-08-18 The two volume set LNCS 3686 and LNCS 3687 constitutes the refereed proceedings of the Third International Conference on Advances in Pattern Recognition ICAPR 2005 held in Bath UK in August 2005 The papers submitted to ICAPR 2005 were thoroughly reviewed by up to three referees per paper and less than 40% of the submitted papers were accepted The first volume includes 73 contributions related to Pattern Recognition and Data Mining which included papers from the tracks of pattern recognition methods knowledge and learning and data mining topics addressed are pattern recognition data mining signal processing and OCR document analysis The second volume contains 87 contributions related to Pattern Recognition and Image Analysis which included papers from the applications track and deals with security and surveillance biometrics image processing and medical imaging It also contains papers from the Workshop on Pattern Recognition for Crime Prevention

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