Crime Data Mining: An Overview and Case Studies

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Abstract. The concern about national security has increased significantly since the 9/11 attacks. However, information overload hinders the effective analysis of criminal and terrorist activities. Data mining applied in the context of law enforcement and intelligence analysis holds the promise of alleviating such problems. In this paper, we review crime data mining techniques and present four case studies done in our ongoing COPLINK project.

1. Introduction

The concern about national security has increased significantly since the terrorist attacks on September 11, 2001. Intelligence agencies such as the CIA and FBI are actively collecting and analyzing information to investigate terrorists' activities. Local law enforcement agencies have also become more alert to criminal activities in their own jurisdictions. One challenge to law enforcement and intelligence agencies is the difficulty of analyzing large volumes of data involved in criminal and terrorist activities. Data mining holds the promise of making it easy, convenient, and practical to explore very large databases for organizations and users. In this paper, we review data mining techniques applied in the context of law enforcement and intelligence analysis, and present four case studies done in our ongoing COPLINK project (Hauck et al., 2002).

2. An Overview of Crime Data Mining

It is useful to review crime data mining in two dimensions: (1) crime types and security concerns and (2) crime data mining approaches and techniques.

2.1 Crime Types and Security Concerns

Crime is defined as "an act or the commission of an act that is forbidden, or the omission of a duty that is commanded by a public law and that makes the offender liable to punishment by that law" (Webster Dictionary). An act of crime encompasses a wide range of activities, ranging from simple violation of civic duties (e.g., illegal parking) to internationally organized crimes (e.g., the 9/11 attacks). Table 1 summarizes the different types of crimes in increasing degree of public influence. Note that both local and national law enforcement and security agencies are facing many similar challenges.

2.2 Crime Data Mining Approaches and Techniques

Data mining is defined as the identification of interesting structure in data, where structure designates patterns, statistical or predictive models of the data, and relationships among parts of the data (Fayyad & Uthurusamy, 2002). Data mining in the context of crime and intelligence analysis for national security is still a young field. The following describes our applications of different techniques in crime data mining. *Entity extraction* has been used to automatically identify person, address, vehicle, narcotic drug, and personal properties from police narrative reports (Chau et al., 2002). *Clustering techniques* such as "concept space" have been used to automatically associate different objects (such as persons, organizations, vehicles) in crime records (Hauck et al., 2002). *Deviation detection* has been applied in fraud detection, network intrusion detection, and other crime analyses that involve tracing abnormal activities. *Classification* has been used to detect email spamming and find authors who send out unsolicited emails (de Vel et al., 2001). *String comparator* has been used to detect deceptive information

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　　INTRODUCTION TO DATA MINING WITH CASE STUDIES GUPTA, G.K.,2014-06-28 The field of data mining provides techniques for automated discovery of valuable information from the accumulated data of computerized operations of enterprises This book offers a clear and comprehensive introduction to both data mining theory and practice It is written primarily as a textbook for the students of computer science management computer applications and information technology The book ensures that the students learn the major data mining techniques even if they do not have a strong mathematical background The techniques include data pre processing association rule mining supervised classification cluster analysis web data mining search engine query mining data warehousing and OLAP To enhance the understanding of the concepts introduced and to show how the techniques described in the book are used in practice each chapter is followed by one or two case studies that have been published in scholarly journals Most case studies deal with real business problems for example marketing e commerce CRM Studying the case studies provides the reader with a greater insight into the data mining techniques The book also provides many examples review questions multiple choice questions chapter end exercises and a good list of references and Web resources especially those which are easy to understand and useful for students A number of class projects have also been included 　　Advances and Innovations in Systems, Computing Sciences and Software Engineering Khaled Elleithy,2007-08-28 Advances and Innovations in Systems Computing Sciences and Software Engineering includes a set of rigorously reviewed world class manuscripts addressing and detailing state of the art research projects in the areas of Computing Sciences Software Engineering and Systems Advances and Innovations in Systems Computing Sciences and Software Engineering includes selected papers form the conference proceedings of the International Conference on Systems Computing Sciences and Software Engineering SCSS 2006 which was part of the International Joint Conferences on Computer Information and Systems Sciences and Engineering CISSE 2006 All aspects of the conference were managed on line not only the reviewing submissions and registration processes but also the actual conference Conference participants authors presenters and attendees only needed an internet connection and sound available on their computers in order to be able to contribute and participate in this international ground breaking conference The on line structure of this high quality event allowed academic professionals and industry participants to contribute work and attend world class technical presentations based on rigorously refereed submissions live without the need for investing significant travel funds or time out of the office Suffice to say that CISSE received submissions from more than 70 countries for whose researchers this opportunity presented a much more affordable dynamic and well planned event to attend and submit their work to versus a classic on the ground conference The CISSE conference audio room provided superb audio even over low speed internet connections the ability to display PowerPoint presentations and cross platform compatibility the conferencing software runs on Windows Mac and any other operating system that supports Java In addition

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Fraud Detection in White-Collar Crime Rohan Ahmed,2018-06-28 Bachelor Thesis from the year 2017 in the subject Computer Science Commercial Information Technology grade 1 3 Heilbronn University language English abstract White collar crime is and has always been an urgent issue for the society In recent years white collar crime has increased dramatically by technological advances The studies show that companies are affected annually by corruption balance sheet manipulation embezzlement criminal insolvency and other economic crimes The companies are usually unable to identify the damage caused by fraudulent activities To prevent fraud companies have the opportunity to use intelligent IT approaches The data analyst or the investigator can use the data which is stored digitally in today s world to detect fraud In the age of Big Data digital information is increasing enormously Storage is cheap today and no longer a limited medium The estimates assume that today up to 80 percent of all operational information is stored in the form of unstructured text documents This bachelor thesis examines Data Mining and Text Mining as intelligent IT approaches for fraud detection in white collar crime Text Mining is related to Data Mining For a differentiation the source of the information and the structure is important Text Mining is mainly concerned with weak or unstructured data while Data Mining often relies on structured sources At the beginning of this bachelor thesis an insight is first given on white collar crime For this purpose the three essential tasks of a fraud management are discussed Based on the fraud triangle of Cressey it is showed which conditions need to come together so that an offender commits a fraudulent act Following some well known types of white collar crime are considered in more detail Text Mining approach was used to demonstrate how to extract potentially useful knowledge from unstructured text For this purpose two self generated e mails were converted into struc tured format Moreover a case study will be conducted on fraud detection in credit card da taset The dataset contains legitimate and fraudulent transactions Based on a literature research Data Mining techniques are selected and then applied on the dataset by using various sampling techniques and hyperparameter optimization with the goal to identify correctly pre dicted fraudulent transactions The CRISP DM reference model was used as a methodical procedure *Data Mining Techniques in Grid Computing Environments* Werner Dubitzky,2008-12-22 Based around eleven international real life case studies and including contributions from leading experts in the field this groundbreaking book explores the need for the grid enabling of data mining applications and provides a comprehensive study of the technology techniques and management skills necessary to create them This book provides a simultaneous design blueprint user guide and research agenda for current and future developments and will appeal to a broad audience from developers and users of data mining and grid technology to advanced undergraduate and postgraduate students interested in this field *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

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