A Study on the Existing Computer Aided Crime Analysis Tools to Handle Indian State of Affairs

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Abstract

In today's security conscious environment, the primary concern of security professionals and police departments is to protect the lives and property of citizens. Any act that causes loss of lives and harms people is called as crime. Crime analysis, a part of criminology, is a task that includes exploring and detecting crimes and their relationships with criminals. Presently there are several crime analysis tools available in the market. The main aim of this paper is to present a detailed study of the existing computer aided crime analysis software and tools available in the market. A brief discussion on the Indian status in the development of automated crime analysis tools is also discussed.

Keywords: *CrimeStat, BrainMaker, BRAINCEL, CIP Application, CrimePointWeb*

1. Introduction

The recent world attitude towards terrorism has influenced people and governments worldwide to take action and be more proactive in security issues. In reciprocation with recent security issues like September 11, 2001 attack, Indian Parliament Attack, 2001, Taj Hotel Attack, 2006 and local issues like theft, rapes, murders, has increased the need for sophisticated mechanisms that can be used to reduce crime incidences. A crime is defined as a behavior deviation from normal activity of the norms giving people losses and harms (Nath, 2007). Crimes are a social nuisance and cost society dearly in several ways.

The field of criminology is one such area that focuses on the study of crime and their behavior to help enforcement departments and criminal justice agencies to identify crime characteristics and trend. Crime analysis, a part of criminology, is a task that includes exploring and detecting crimes and their relationships with criminals (Akpinar and Usul, 2004). Crime analysis tools have become an essential tool during crime investigation and involve interrogation of large database of information held by law enforcement departments and criminal justice agencies. These databases are created by the CIA, FBI, and other federal agencies and they collect domestic and foreign intelligence information to prevent future attacks.

As the size of these crime databases are very huge, efficient tools for analysis are required. In these situations, the application of data mining techniques could discovery important knowledge about crime and criminals and can improve the most challenging decision-driven criminal investigations. It is always desirable to have a crime analysis tool that can discover the necessary crime knowledge from the huge database and aid to identify crime details accurately in a time efficient manner. The discovered knowledge can then be used for future crime pattern detection and action.

Presently, there are several crime analysis tools that help police officials and the techniques used by these tools depend on the features of the problem, the data and objective. This main goal of this paper is to discuss the current status of the available crime analysis tools with particular emphasis to Indian state of affairs. The rest of the paper is organized as follows. Section 2 presents the various existing computer aided crime analysis tools along with a short description. Section 3 discusses the automated tools available in India. Section 4 concludes the study with future research direction.

2. Existing Computer Aided Crime Analysis Tools

This section presents a brief discussion on the existing software programs designed for crime

analysis (Boba, 2003). ATAC is a tactical crime analysis software allows data entry, manipulation, and analysis. It also provides temporal analysis and a function that identifies potential crime patterns. Crime Analysis Extension is free mapping software was developed through a partnership between the U.S. government and a software vendor; it contains specific mapping functions used in crime analysis.

CrimeStat is a spatial statistical software works with GIS software to allow users to conduct analyses with various techniques using incident locations. CrimeView software links directly to an agency's CAD system or RMS and provides specific crime mapping and analysis techniques. GeoBalance redistricting software identifies the best possible arrangement of police areas (such as beats and districts) based on several statistics.

RCAGIS (Regional Crime Analysis Geographic Information System) is a crime analysis software that is intended for use by numerous agencies in a region with the same data format (all the data are linked into the software automatically). It includes various crime analysis and crime mapping functions. School COP (School Crime Operations Package) is a crime mapping software program is specifically designed to allow users to enter, analyze, and map incidents that occur in and around schools. StaffWizard crime analysis software helps to optimize the placement of current staff (patrol deployment) as well as determine staffing needs.

CrimeConnect is a secure Web-based tactical crime information sharing system that enables multiple police jurisdictions to share information such as Wanteds, Missing Persons, Sex Crime Registrants, Bulletins, etc. in real time. It also enables authorized department personnel to search the tactical crime databases and selected data from the Records Management Systems of multiple jurisdictions to enhance the police officer's ability to solve crime (Dhananjay, 2006). CrimePointWeb is a web based software solution that facilitates information sharing, analysis and management for law enforcement and public safety agencies. The idea behind CrimePointWeb is to allow agencies to share not only data, but information as well. By combining data with easy-to-use automated analysis, CrimePointWeb can take information i.e. both data and analysis to where it is needed most (Forensic Logic, 2011).

AC^2 is a user-friendly and powerful system that supports all aspects of Data Mining. It provides a comprehensive set of tools to access, select, prepare, and manipulate data. AC^2 is based on an Object-Oriented language. It allows the user to structure the data and enrich this structure with the user's domain knowledge. AC^2 knowledge discovery engine is based on the state-of-the-art inductive techniques - builds predictive models automatically. These are displayed in the form of decision trees. One can easily test and validate the models and deploy them in areas such as segmentation, classification, estimation, and prediction. AC^2 is a comprehensive toolkit that allows one to perform advanced Data Mining tasks and develop powerful decision support systems step-by-step. Its intuitive and user-friendly interface makes it easy for data owners and IT specialists alike to build and maintain their own Data Mining Systems.

CART is a robust, easy-to-use decision tree tool that automatically sifts large, complex databases, searching for and isolating significant patterns and relationships. This discovered knowledge is then used to generate reliable, easy-to-grasp predictive models for applications such as profiling customers, targeting direct mailings, detecting telecommunications and credit card fraud, and managing credit risk. It has an excellent pre-processing complement to other data analysis techniques. For example, CART's outputs (predicted values) can be used as inputs to improve the predictive accuracy of neural nets and logistic regression.

BRAINCEL is an easy to use Excel add-in that enhances forecasts with the power of neural networks. Knowledge of neural network, mathematic or statistics is not required to use it. One supplies both input data and desired output (target) data in rows and columns on a spreadsheet. It is almost as simple to use as Excel's standard regression tool, but more powerful. It has a BESTNET option that directs the program to find the best neural net size and shape. It will vary both the number of layers and number of processing modules at each layer.

BrainMaker Neural Network Software lets one use their computer for business and marketing forecasting, stock, bond, commodity, and futures prediction, pattern recognition, medical diagnosis, sports handicapping etc. It lets to watch the network learn and easily finds a network that test well. It uses the Back Propagation algorithm it shows Network Progress Display graphically and shows how well the network is learning. It helps to determine the accuracy level.

CrimeStat III is a spatial statistics program for the analysis of crime incident locations, developed by Ned Levine & Associates under grant from the National Institute of Justice. The program is Windows-based and interfaces with most desktop GIS programs. The program provides supplemental statistical tools to aid law enforcement agencies and

criminal justice researchers in their crime mapping efforts. It is being used by many police departments around the country as well as by criminal justice and other researchers. The new version is 3.0 (CrimeStat III) and is available free of charge. The program inputs incident locations (e.g., robbery locations) in 'dbf', 'shp', ASCII or ODBC-compliant formats using either spherical or projected coordinates. It calculates various spatial statistics and writes graphical objects to ArcView, MapInfo, Atlas*GISTM, Surfer for Windows, and ArcView Spatial Analyst (Bangar, 2011).

In addition to these commercially produced programs, many police departments have created their own software to perform crime analysis. Different software is used to create the tool. They range from the simplest (Microsoft Access) to advanced computer program (Java / .NET). Often, in spite of the growing commercial and open-source software tools, crime analysts and agencies find it difficult to find an off-the-shelf software to fit with their data. The need and requirement changes from country-to-country, sometimes even state-to-state. As a result, research in finding a sophisticated solution still is on-going and solutions that are tailor-made that provide the functionality they require is the current demand of the market.

3. Computer Aided Crime Analysis Tools in India

In India, police enforcement is a critical component in civil administration and law enforcement. India is a vast country with more than one billion populations and has a police force of 1.5 million. Indian constitution assigns responsibility for maintaining law and order to the states and territories, and almost all routine policing, including apprehension of criminals, is carried out by state-level police forces. The police functioning have remained a constant area of governmental concern and efforts to improve it upon further and further (Chaudhary, 2003; Krishnamorthy, 2003). Way back in 1986, the Government of India created National Crime Record Bureau (NCRB). To give right impetus to the National Crime Record Bureau, State Crime Record Bureaux (SCRBx) at States and District Crime Record Bureaux (DCRBx) at Districts followed.

In the background of enormous environmental changes and challenges before the police, information control and distribution became a major issue. This task typically consumes time and is not available in time of need. Thus, it is increasingly becoming apparent that a meaningful crime analysis tool is needed for sophisticated investigation.

In order to make use of the information technology, Government of India approved the design, development and implementation of a 'Government to Government (G2G), model called the Crime Criminal Information System (CCIS). The CCIS was designed to create computerized storage, analysis and retrieval of crime criminal records. The Crime Criminal Information System today is in operation in all the States. In CCIS, the information is collected at district level not at basic unit of police administration i.e. the police station. Common Integrated Police Application (CIPA) was developed with objective of automation the processes (workflow) at police station and to provide inputs for building CCIS. Till date, CCIS is only collecting the information and creating a huge crime database and there is no analytical tool for analysing huge building database. Absence of crime analysis tool made it somewhat 'standalone' system. Therefore, there is need of support systems (Chen et al., 2003; Amarnathan, 2003) as crime analysis tool based on current technologies to meet and fulfill the new emerging responsibilities and tasks of the Police (Chaudhary, 2003). This section presents the existing Indian Police Crime Information Systems as given by Gupta *et al.*(2011) and Woldu (2003).

Crime Criminal Information System (CCIS) is a national project of sharable database on crime and criminals at district, state and national level for assisting investigating and supervising officers and police planners to formulate crime-control strategies. It has been upgraded to CCIS MLe in the year 2005 as multi-lingual application with facility for different local languages i.e. Marathi, Gujarati, Tamil, Kannada and Gurmukhi besides English and Hindi. The application has been web-enabled so that field level investigating and supervisory officers can access the CCIS databases at national and State levels through internet anywhere – anytime. CCIS is perhaps one of the biggest police application in the world implemented at 35 States and UTs, 727 police districts and at national level. In CCIS, the information is collected at district level not at primary source of information i.e. the police station. Common Integrated Police Application (CIPA) was developed with objective of automation the processes (workflow) at police station and to build a Crime & Criminal Information System. CIPA is described in the subsequent section of the paper. Absence of intelligent decision support system made it somewhat 'standalone' system and no analytical tools for analysing huge building database.

Common Integrated Police Application (CIPA) aims at automation of all functions carried out at primary source of information itself the police stations. CIPA software has been designed and developed by NIC in English language with multilingual interface

developed for Indian languages. This project is aimed at building in a planned manner infrastructure and mechanism to provide the basis for evolution for Crime and Criminal Information System (CCIS) which is uniform across the country from police station level onwards. CIPA was developed for planned induction of Information Technology towards better management of public order and criminal activities. The software is a total work-flow system having the following three major modules along with reports and queries viz., Registration, Investigation and Prosecution. In the first phase the FIR registration process would be computerized and after familiarity in working with computers the staff would be gradually made to computerize further processes including investigation. Implementation of CIPA Project would make all the police stations work more efficiently and effectively thereby improving accessibility, transparency and accountability in the functioning of the Police Department in the State.

Currently both CCIS and CIPA are being implemented by NIC and coordination and monitoring is being done by NCRB. Initially Registration Module has been taken up. Implementation of CIPA project at police stations is being done in phases. 10% Police Stations (about 1400 Police Stations) are being covered throughout the country in the first phase by 2007. Thirty per cent of police stations (Approximately 3,700 police stations) will be covered in second phase and remaining in final phase. It has been implemented in all the Police Stations of Delhi.

4. Conclusion

Crime data globally and in India is increasing in very large quantities, which is motivating professionals to use advanced and efficient techniques for analysis and identification of crime. Data mining as an analysis and knowledge discovery tool has immense potential for crime data analysis. As is the case with any other new technology, the requirement of such tool changes, which is further augmented by the new and advanced technologies used by criminals. All these facts confirm that the field is not yet mature and needs further investigations. Another point noted is that the crime rate is increasing and crime prevention has become an upheaval task. The legal force departments around the world are required to remain ahead in the eternal race between law breakers and law enforcers. Various software discussed in this paper has all been adapted for use in crime analysis but were not created specifically for that purpose. These applications designed specifically for crime analysis have been created to perform functions that are not available in other existing software. For example, the ATAC (Automated Tactical Analysis of Crime) software was created to provide users with techniques specific to tactical crime analysis because these functions were not available previously in one comprehensive program. Thus, it can be understood that, even though several solutions to solve the problem has been proposed it can be seen that a perfect solution to each city, state and country is still elusive. Moreover, usage of existing data mining techniques is extensive in creating crime analysis tools. As research in improving data mining techniques like clustering and classification is still active, the tools developed can also be improved by improving the underlying data mining techniques. In future a general framework that can be used to suit Indian scenario is to be designed.

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