

COPLINK Knowledge Management for Law Enforcement: Text Analysis, Visualization and Collaboration

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Crime and police report information is rapidly migrating from paper records to automated records management databases. Most mid and large sized police agencies have such systems that provide access to information by their own personnel, but lack any efficient manner by which to provide that information to other agencies. Criminals show no regard for jurisdictional boundaries and in fact take advantage of the lack of communication across jurisdictions. Federal standards initiatives such as the National Incident Based Reporting System (NIBRS, US Department of Justice 1998), are attempting to provide reporting standards to police agencies to facilitate future reporting and information sharing among agencies as these electronic reporting systems become more widespread.

As sharing of police records information becomes more commonplace, the problems of knowledge management that exist in business, science, industry, and other facets of government will only become more prevalent in law enforcement. Ease of capture, retrieval and access is increasing, thus information overload increases proportionately. Large textual collections exist in police records in the form of report narratives and statements that can be used for the development of textual mining and linguistic analysis applications.

In law enforcement, knowledge about criminal activities or specific groups and individuals tends to be learned by officers who work in specific geographic areas. The information is often lost with personnel changes and has to be reacquired by new officers. Valuable information is often stored in police databases, but the tools necessary to retrieve and assemble it do not yet exist or are insufficiently refined for the specific task. Solving problems by analyzing and generalizing current criminal records is a function of the daily routine of many crime analysts and detectives. Potent intelligence tools can be useful in the analysis of available criminal records and aid in the investigation of current cases by alleviating the crime analysts information overload and reducing information search time.

Funded by the National Institute of Justice and the National Science Foundation, the University of Arizona's Artificial Intelligence Lab has teamed with the Tucson Police Department (TPD) and the Phoenix Police Department (PPD) to develop the COPLINK application to address these problems faced by the law enforcement community.

The COPLINK project aims to develop knowledge management systems technologies and methodology that are appropriate for capturing, analyzing, visualizing, and sharing law enforcement related information in social and organizational contexts. The basis of such research will be grounded in information retrieval, computational linguistics, information visualization, artificial intelligence, multimedia systems, multi-agent systems, and telecommunications.

We also study the organizational, social, cultural and methodological impacts and changes that organizations need to make to maximize and leverage on a law enforcement agency's investments in information and knowledge management. The academic foundation for such research is based on social informatics, decision theory, communication theory, cognitive psychology, and managerial and organizational research [Hauck & Chen 1999].

We integrated platform-independence, stability, scalability, and an intuitive graphical user interface to develop the COPLINK system, which is currently being deployed at Tucson Police Department (TPD). User evaluations of the application allowed us to study the impact of COPLINK on law enforcement personnel as well as to identify requirements for improving the system and extending the project. We are currently in the process of extending the functionality of COPLINK in several areas. These include textual analysis, collaboration, visualization and geo-mapping.

Textual Analysis is being performed on narratives contained within Phoenix Police Dept. cases (incidents). This will provide functionality to the user, which is otherwise not available or is difficult to achieve. The user will be able to search for narratives that contain a given name or keyword. This functionality will be similar to a typical Web search engine. The user will also be able to search for narratives based on case details. The system will allow the user to identify relationships among different objects by searching for terms that are related to a given keyword. This means that the user can look for entities that are highly related to each other (for example, names or vehicles that always appear in the same incident). The system will also allow the user to browse a map that classifies all the narratives related to a particular search, into categories. This map will provide a summary of the findings of a search. These capabilities will be achieved through techniques such as noun phrasing [Tolle & Chen 2000], entity extraction, self-organizing feature maps (SOM) [Kohonen 95, Lin et al. 99], concept space (or automatic thesaurus) [Chen et al. 95, Chen et al. 96], and search engines.

We are in the process of integrating better visualization in COPLINK. Relationships between different entities (people, vehicle, location, organization) are represented using a hyperbolic tree. The user can search all entities having a relationship with a given search term (using the concept space technique) and view the relationships in the form of a hyperbolic tree as well as in a hierarchical tree structure. In the area of geo-mapping, we are using software such as ArcIMS and MapObjects from ESRI, to display a map of the city of Tucson and locate various incident types on the map. The user is able to visualize on the map, the occurrence of various incidents and their location. The user can zoom in and out on the map depending on whether a more detailed view is desired. Starting with the incident types shown on the map, the user can select an incident and view the case details related to that incident.

We are also in the process of developing a monitoring and collaborative environment among the users on top of the current COPLINK system. The main focus is to enhance COPLINK to allow users to monitor changes in the database and to share useful information with other users in an intelligent manner. The prototype of this system (called COPLINK Collaboration) will allow data search on the COPLINK database, while allowing different databases to be added in future developments [Chau et al. 2001]. In order to understand the major requirements of the users, user requirement studies were performed. These studies showed that detectives and crime analysts, frequently need to monitor different data sources to see whether there is new data about a particular suspect or vehicle in an incident. This task will be automated and the user will be alerted when new data is available. There are numerous data sources that contain valuable information for law enforcement. For example many websites and databases are

available on the Internet. Users will be allowed to access these information sources in an integrated fashion. The system will also assist users in locating these data sources. In addition, the system will automatically match users having similar job functions and investigation interests.

The COPLINK Collaboration project will improve knowledge management and information sharing in the organization. Users will be able to exchange ideas and share information sources, such as useful web sites, through the system. In order to provide better usability, the system will be customizable by each user to provide a personalized interface. Because of the high sensitivity of the data involved, high security must be enforced by the system so that unauthorized users will be prevented from accessing the system. Therefore, encryption should be used when data is transferred over the Internet. In addition, different users have different access levels for accessing the data. Some data are only accessible by a certain group of users or only by certain individuals. The system will be able to handle these different access levels. The system will be designed and implemented in such a way that it can be easily generalized to domains other than law enforcement by making the domain-specific details separate from the core architecture.

COPLINK is currently being deployed at the Tucson Police Department. A prototype is also being developed for the Phoenix Police Department. With enhancements in the areas of textual analysis, collaboration, visualization and geo-mapping, COPLINK will be an even more powerful investigative tool for law enforcement. Our poster and demo will describe the research framework, features and current status of COPLINK.

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