

# Data Mining and Crime Analysis in the Richmond Police Department

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## Highlights:

Data mining tools such as IBM SPSS Modeler enable law enforcement agencies of all sizes to enhance their decision-making and analysis capabilities.

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## Introduction

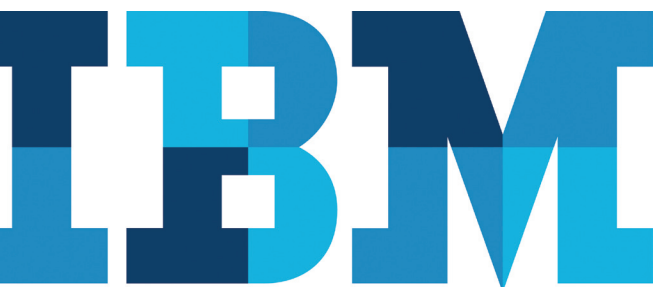
As information science and technology progress, sophisticated data mining and artificial intelligence tools are increasingly accessible to the law enforcement community. Once reserved for large federal agencies and research centers, data mining tools are now available to enhance decision-making and analysis at the state and local levels. Many of the software packages available today are extremely fast, powerful and easy to use, which makes them appropriate for live environments, such as task forces or operational planning sessions.

The Richmond Police Department chose IBM® SPSS® Modeler\* from SPSS, an IBM Company, as its data mining tool. The ability to actively work cases or brainstorm with live data enables operational and analytical personnel to put more science (and less fiction) into analytical, operational and policy decisions.

Under the leadership of Colonel Andre Parker, the department uses data mining for a variety of law enforcement and intelligence applications, including tactical crime analysis, risk and threat assessment, behavioral analysis of violent crime, analysis of telephone and Internet records, and deployment strategies.

As all public safety organizations attempt to address the challenges associated with staggering increases in available information, new tools and a different approach to analysis are required. In the department's experience, data mining tools are the answer. Used extensively in the business community, the newer data mining tools do not require huge IT budgets, specialized personnel, or advanced training in statistics. These products are highly intuitive, relatively easy to use, PC-based and very accessible to state, and even local, law enforcement agencies.

\* IBM SPSS Modeler was formerly called PASW® Modeler.



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The latest data mining tools enable agencies to easily and economically clean, characterize and analyze data from a variety of disparate sources to identify actionable patterns and trends.

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Some data mining software products even enable analysts to create and save queries, giving agencies full-time access to crime analysis. Data mining tools also enable users to merge and analyze data resources that do not traditionally coexist. This type of value-added analysis is a huge asset and allows the analyst to see and describe the “big picture” in related incidents or data resources, providing a more complete view of events or activities.

The data culling, management and descriptive analysis features offered by commercially available data mining packages are extremely valuable to crime and intelligence analysts. Much of the data analyzed in the public safety arena was not created or maintained in a format conducive to analysis, and is less than perfect in many ways. In the department’s experience, users can clean, characterize and analyze data from a variety of sources in a data mining environment, resulting in the identification of actionable patterns and trends.

The Richmond Police Department uses data mining in a variety of analytical applications, including the examples outlined on the following page.

### **Tactical crime analysis and deployment**

Personnel resource costs typically represent a large percentage of any law enforcement agency budget. The ability to efficiently allocate and deploy these resources using an information-based decision process is not only cost effective but also provides enhanced public safety. Traditional tactical crime analysis generally involves creating a model – representing a crime or series of crimes – which is used to link cases, identify and apprehend suspects, and/or prevent future crimes. Data mining, when applied to tactical crime analysis, is a knowledge discovery tool that can be used to review extremely large datasets and incorporate a vast array of variables, far beyond what a single analyst, or even an analytical team or task force, can accurately review. It also does this work in a timely fashion, which is critical to apprehending suspects before they can commit additional crimes. The ability to generate and save queries enables agencies to further automate the analytical process, which ultimately saves time and personnel resources, while further enhancing public safety.

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The Richmond Police Department uses IBM SPSS Modeler for several tactical crime analysis tasks, including risk and threat assessment, violent crime behavioral analysis, and Internet and phone data analysis.

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For example, the department recently used IBM SPSS Modeler to address the increase in citizen complaints of random gunfire traditionally associated with New Year's Eve. By analyzing historical data and incorporating recent trends, the department proactively deployed officers to areas associated with an increased risk of random gunfire. Using this strategy of risk-based deployment, the department was able to significantly increase public safety, as measured by a 47 percent reduction in citizen complaints about random gunfire and a 246 percent increase in weapons recovered. Further highlighting the value of data mining in deployment decisions, this increase in public safety was realized with 50 fewer officers than originally planned, resulting in a savings of \$15,000 in personnel costs alone during the eight-hour initiative. Building on this successful foundation, the Richmond Police Department continues to use Modeler to determine how best to proactively deploy its resources and keep Richmond's residents safe.

#### **Risk and threat assessment**

The ability to identify and characterize events or attributes associated with an increased threat level or risk gives agencies an analytical "crystal ball" to use for strategic deployment, crime prevention, special operations and protective details, threat assessment, and forecasting. The department has used data mining to identify and characterize crime patterns and events associated with an increased risk of escalation or violence. Identifying a crime or series of crimes associated with an increased risk of escalation can guide deployment and resource allocation decisions, thereby facilitating timely apprehension of the suspect, and possibly interrupting a crime series before serious escalation occurs.

#### **Behavioral analysis of violent crime**

Data mining is also used to analyze and model violent crime. The department has employed many descriptive techniques and some advanced statistics to characterize drug-related homicides, a pattern of offending that has low case clearance rates, but relatively homogeneous victimology and behavioral characteristics. Rapid development of a motive can, in many cases, facilitate suspect identification and apprehension before a case grows cold. The department is also exploring the use of this approach with serial sex crimes and stranger rapes.

#### **Internet, Weblog and telephone data**

Data mining is an essential tool for analyzing Internet and Weblog data. Monitoring and characterizing "normal" activity can help to rapidly identify unusual or suspicious events in large datasets, providing actionable patterns for use in subsequent analysis and surveillance. Using data mining, the department identifies, characterizes and analyzes unusual and suspicious activity in Weblog data. This includes the

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Data mining enables law enforcement agencies to quickly and easily analyze large volumes of information to identify patterns and trends and accurately inform strategic decisions.

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identification and characterization of extremely rare events, anomalies, and patterns in relatively large datasets. The department also uses many data culling and descriptive features to analyze complex series of phone calls and linked conference calls.

### Summary

Sophisticated data mining and artificial intelligence tools are now available to the law enforcement community. These tools are extremely powerful, fast and relatively easy to use. Data mining supports enhanced decision-making and analysis, and is a powerful tool that can be used to address the large volume of information currently facing all agencies. Data mining tools increase not only the speed of analysis, but also the depth. By mining the essential nuggets of information, analysts are able to fully explore existing datasets and identify actionable patterns and trends. The examples listed in this paper represent only a small fraction of the potential for this approach in the public safety and intelligence arena.

### About SPSS, an IBM Company

SPSS, an IBM Company, is a leading global provider of predictive analytics software and solutions. The company's complete portfolio of products - data collection, statistics, modeling and deployment - captures people's attitudes and opinions, predicts outcomes of future customer interactions, and then acts on these insights by embedding analytics into business processes. IBM SPSS solutions address interconnected business objectives across an entire organization by focusing on the convergence of analytics, IT architecture and business process. Commercial, government and academic customers worldwide rely on IBM SPSS technology as a competitive advantage in attracting, retaining and growing customers, while reducing fraud and mitigating risk. SPSS was acquired by IBM in October 2009. For further information, or to reach a representative, visit [www.spss.com](http://www.spss.com).



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