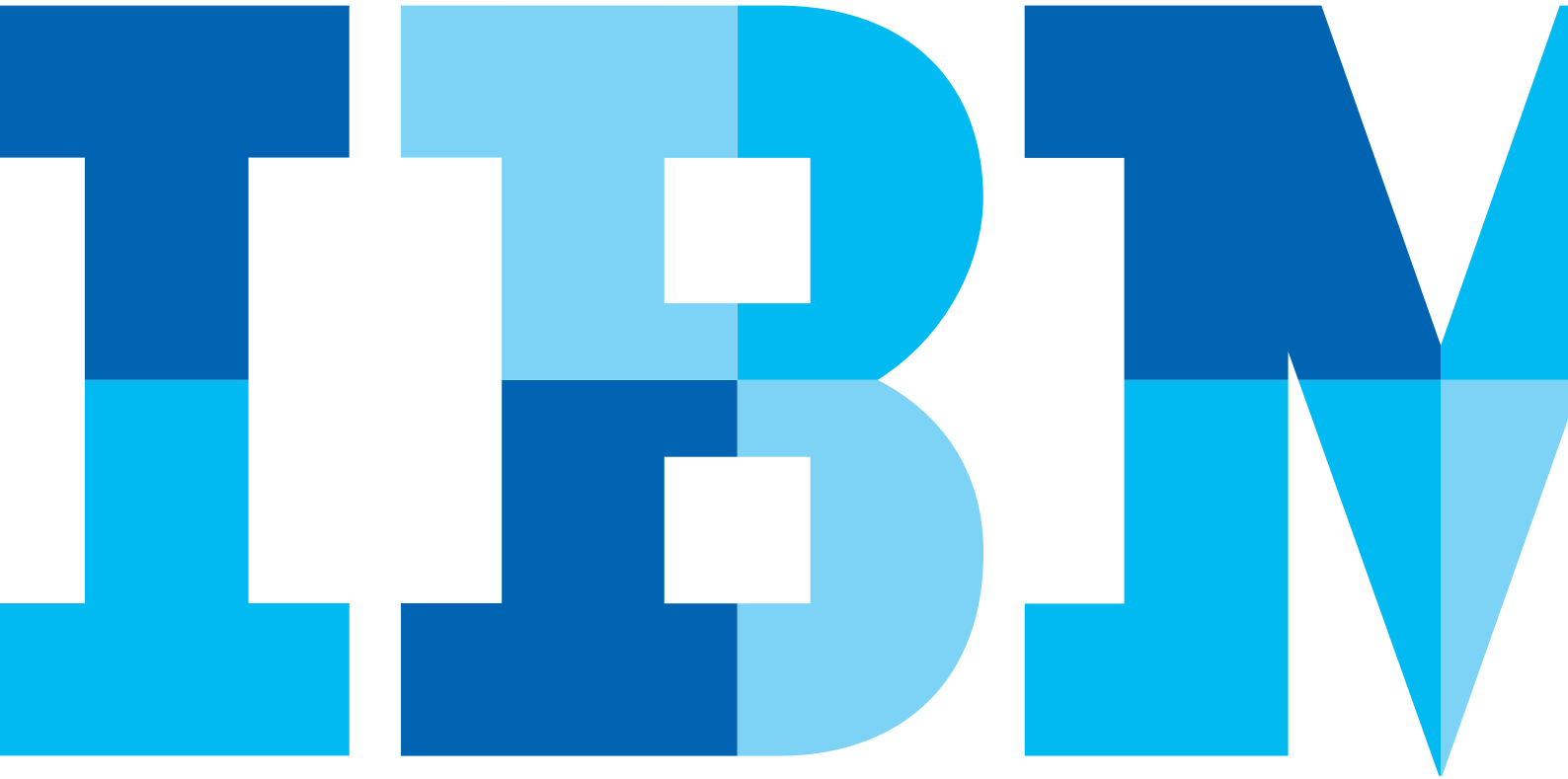# Crime prediction and prevention

A safer public through advanced analytics

IBM

Abstract

Like all government organizations, law enforcement agencies now need to do more with less. Managing under tighter policing budgets as government revenues shrink, they must continue to improve public safety and respond to stronger calls for transparency and accountability in all policing actions. With budgets cuts pressuring law enforcement agencies to fight crime using fewer resources, the use of analytics to both respond to and ward off crime is now more critical than ever.

Crime prediction and prevention analytics from IBM helps agencies make the best use of the people and information at hand to monitor, measure and predict crime and crime trends. Analysis of police data provides insight that lets officers track criminal activities, predict the likelihood of incidents, effectively deploy resources and solve cases faster.

Overview

To keep the public safe, law enforcement officers have always relied on their instincts and the information available to them. But combating crime and rising gang violence with limited or shrinking resources is becoming more difficult day by day. Meeting this challenge is now a matter of working smarter—making sure that every effort counts and no effort is wasted.

To work smarter, many policing organizations are making better use of the information they generate and store, both structured (such as crime and criminal data) and unstructured (such as audio and image data from communications and surveillance). When brought together and made available for analysis, these volumes of data can contribute to an understanding not just of what happened in the past, but (based on patterns) of what is likely to happen in the future.

Using such data as historical crime incidents, profiles, maps and typology, as well as enabling factors such as weather and trigger events such as holidays or paydays, police officials can:

- Identify areas typically frequented by violent criminals
- Match trends in regional or national gang activity with local incidents
- Profile crimes to identify similarities and match the crimes to known offenders
- Identify the conditions most likely to trigger violent crime, and predict when and where these crimes may occur in the future
- Determine the likelihood of recidivism.

More reliable and widespread information lets law enforcement agencies improve intelligence gathering, investigation, resource planning, case management, operations and enforcement. With this insight, crime prevention becomes a science.

Elusive data

So what is preventing every law enforcement agency from becoming data driven? The reality is that many crime-fighting organizations still rely on manual paper-based processes for much of their work. Of those with crime information systems, many are decades old and support only limited reporting and analysis.

What's worse, a great deal of information is siloed within departments and agencies. With information in many places and no ability to bring it together, it is next to impossible to determine patterns across crimes and suspects and effectively deploy personnel, let alone predict future criminal activity and provide real-time feedback to law enforcement officers and supervisors.

And finally, not only are agencies stuck with manually analyzing data that resides in many places, they also lack any kind of predictive capability. All decisions, such as where to deploy resources, are based on historical and anecdotal information. Predictive modeling does not make the assumption that what has happened in the past will continue into the future. Instead, the model combines analysis of past events with a higher level of logic to determine the arc of events—such as criminal behaviour or crowd patterns or the evolution of organized crime structures.

It is for these reasons, and likely many others, that law enforcement agencies are challenged to drive decisions and manage operations on the basis of facts.

Proactive law enforcement

The IBM Crime Insight and Prevention solution addresses this information deficit by delivering a flexible and reliable information environment that allows more proactive, pre-emptive law enforcement and policing.

Agencies can move beyond retaining physical records and into keeping an electronic history of every important piece of information: incidents, individuals, times, tactics, evidence and so on. The solution brings together a wide range of data, including unstructured data, for analysis, modeling and prediction. It lets agencies uncover hidden relationships within the data and draw out insights. It provides clearer hindsight and sharper foresight.

Within this information environment, analysis becomes second nature. Employees at any level have ready access to usable information that helps them make decisions grounded in data. Better decisions, based on insight as well as foresight, helps officers predict future incidents, prevent crime, respond faster and improve operations.

The following seven areas are common ways in which the IBM Crime Insight and Prevention solution can be applied.

Force deployment

Sometimes a precinct captain or shift commander will base resource deployment decisions on past experience, sending more officers to known hotspots. But in general, deployment decisions tend to be more reactive. Patrols are sent after an incident occurs. But what if a commander had broader and more data-driven insight into the likelihood of incidents, based on patterns in geography, time, weather and external events? With this knowledge, a commander can proactively manage force deployment decisions in advance for every dispatch area. A stronger police presence will deter the anticipated crime; fewer officers will idle where no crime is expected: the force is better used.

Patrol officer preparation

Just as the experience and instinct of commanders can be supplemented with real-time data from the system, so patrol officers can be prepared with data to determine the best patrol routes within their deployment area and where to use extra caution. Data may suggest that a certain type of armed robbery in a certain area is likely to escalate into an assault, for example. Weather conditions, seasons, time of day, paydays, holidays: all of these factors may contribute to a higher likelihood of crime or accidents.

Profiling

Agencies can use historical data to perform predictive modeling on crimes and criminals. Patterns emerge from past crimes that can be used to profile criminal types and associations, and detect crime patterns and geographical or temporal hotspots or clusters. Criminal career scoring models can help agencies calculate repeat offender risk, information critical to district attorneys and parole or arresting officers. A case assignment officer can analyze *modus operandi* typology leading to a serial crime profile. A crime scene assessment model can help CSI resource planners predict the likelihood of evidence at different kinds of crime scenes to inform decisions on whether to send an officer. Predictive results will become more precise as data volume and richness grows.

Case resolution

The ability to bring information together across multiple departments and districts can also help analysts compare tactics or other characteristics of seemingly unrelated cases and identify those common to all of them. They can perform post crime analysis to gain insight into cold cases. And they can develop more effective action plans to uncover leads and solve cases with greater accuracy and speed.

Public safety

Forewarned is forearmed. Better access to information can inform planning for a better police presence where necessary. The ability to predict and act, rather than sense and respond, allows pre-emptive action, heading crime off at the pass and resulting in safer cities.

Program and facilities management

Statistical modeling can also help agencies decide where to locate new emergency command centers based on the frequency and location of crimes, fires and accidents. It can inform forecasting for correctional facility needs based on trends in crime rates.

Recidivism and rehabilitation

Predictive modeling can reduce recidivism, another way of preventing crime. When the rehabilitation effort is well matched to the criminal's issues and risk of re-offense, the success of the program is much more likely. Risk of re-offense is closely related to a number of key predictors such as past offense history, family background and peer associations. Criminals at higher risk can be placed in more focused programs that address substance abuse or mental health issues as needed. Lower risk individuals would attend a less restrictive program tailored for their specific needs. Such models help criminals become and remain law-abiding citizens.

Richmond Police Department

Crime prediction prevents incidents, lowers cost and allows more effective force deployment

Using the IBM Crime Insight and Prevention solution, the Richmond, Virginia police department compiled huge, previously incompatible data sets, including incident reports, crime tips and service calls. This allows them to identify patterns, predict trends and make more effective decisions. Based on actionable data from the system, the RPD can now

- Pinpoint hot spots
- Deploy officers and tactical units to where they are most needed
- Identify minor crimes likely to escalate into violence
- Determine whether or not a threat is real
- Accelerate the criminal investigation process.

The area has seen an almost 30 percent decrease in violent crime and homicides over a 12-month period.

Crime insight and prevention

The IBM Crime Insight and Prevention solution is based on proven technologies—IBM Cognos Business Analytics and IBM SPSS Advanced Analytics, as well as SpotOn and ESRI mapping. This solution provides all of the capabilities required for proactive policing.

Better data mining and predictive modeling let agencies anticipate incidents, profile crimes and criminals, improve solved crime rates and optimize resource use. Real-time data access and updates mean that insight is actionable, allowing agencies to be one step ahead of criminals. Scorecards and dashboards let officials monitor and respond quickly to the metrics they consider important.

Planning tools allow law enforcement organizations to analyze spending history, set goals and build execution plans. Reports guide users to the issues to be resolved quickly to improve service and ensure public safety. Consistent information across departments makes collaboration easier, improving response to inquiries, requests for service and investigative actions.

Three steps to insight

With IBM's analytics software, you can start small and address the area most in need of insight. Or you can move your entire information system over at once and begin making decisions on the basis of end-to-end information. Either way, the system offers rapid return on your investment through administrative and policing cost savings. Three steps let you begin benefiting from the insight contained within your data: capture, predict and act.

Capture: Gather and input data

Law enforcement agencies gather a wide variety of data. The IBM system accepts both structured and unstructured data. Examples include:

- Historical crime incidents: location, crime type, severity, victims, suspects, convictions, criminal behaviours and attributes
- Enabling factors: weather, temperature, time of year, month or week
- Trigger events: holidays, festivals or paydays
- Unstructured data: images, audio, video and text contained in incident reports, witness statements, suspect interviews, tip information, calls for service, e-mail and chat room activity (This information is critical for analyzing interactions and uncovering the attitudes, desires and motivations of criminals to get at the reasons behind crimes. Understanding the "why" helps prediction go beyond assuming that past actions and behaviors will dictate future ones.)

Evaluations of past predictions and actions should also be captured. Some predictions will be more and less accurate, some actions more and less successful, some reports and dashboards more and less used. A feedback loop lets your predictive models grow smarter and helps you focus effort in the areas with the biggest payback.

Edmonton Police Services
Improving performance and public communications

The police service in Edmonton, Alberta needed a way to improve both its service and its communication with the community. Rich in data—including service calls, crime frequency and location and internal metrics such as response times—it was nevertheless unable to find patterns and improve metrics because data was highly siloed.

The IBM Crime Insight and Prevention solution has helped the EPS become more efficient and effective. From an internal point of view, EPS has increased accountability, established performance measurements to reach organizational goals and improved communication with commanders and with the public.

Better operations through IBM analytics have let the EPS better serve the city by:

- Staying on top of criminal activities
- Accelerating response time
- Identifying crime and incident hot spots
- Reducing crime rates.

Predict: Statistics and modeling for crime analysis

Creating an analysis and scoring model to predict the likelihood of incidents requiring police attention will drive confidence in your data and decision-making and bring repeatability to your processes. Some examples of modeling and reporting include:

- Data mining to uncover hidden relationships in data—key predictors of what is likely to happen
- Text analytics to extract and categorize concepts from qualitative, unstructured data including crime record notes, call logs, surveillance and communications data
- Visualizations, reports and management dashboards for real-time risk analysis
- Key performance indicators and key performance predictors

Act: Deploy to operations and collaborate

Insight is only useful when those who need it can access it quickly and easily. The unique deployment technologies and methodologies of the IBM Crime Insight and Prevention solution maximize the impact of analytics within your operation. Collaboration tools help deliver more effective analytical results and deploy them into operational planning and daily decision-making. Automation of analytical processes improves orchestration and discipline. GIS applications to display predictions allow the force to interact with data that's easy to understand and use. Since law enforcement is 24/7, systems must be available to all personnel at all hours.

Growth areas

With predictive analytics, you can move from counting crime after it has occurred to preventing crime before it happens. In this realm, there are any number of possible applications not yet mentioned, including:

• Cyber crime profiling
• Forensics analysis
• Open source intelligence analytics
• Internal and external terrorist threats
• Traffic risk profiling
• Suspect vehicle identification
• Material maintenance predictions
• Inclusion of citizen feedback.

Return on investment

With the IBM Crime Insight and Prevention solution

• 94 percent of customers achieved a positive ROI
• Average payback was 10.7 months
• Over 90 percent of users attributed an increase in productivity to IBM analytics
• 81 percent of projects were deployed on time
• 75 percent of projects were on or under budget.

"This is one of the highest ROI scores Nucleus has ever seen in its Real ROI series of research reports."

— Rebecca Wettemann, VP of Research, Nucleus Research

Conclusion

Your law enforcement teams are experienced and intuitive. But combating crime, gangs and terrorism requires a combination of instinct and the kind of insight that comes from the rigorous analysis of multiple types of data.

Automated analysis is complete, methodical, unbiased and consistently outperforms human experts. Models can bring insights not immediately apparent to humans simply because the nature or method of a crime may fly in the face of rationality.

Making decisions and drawing conclusions based on fact builds confidence among staff and with the public. Facts back decisions, provide arguments and present a clear picture of conditions in time to take action. They help officers without the experience or intuition in a particular area to make the best decisions.

The IBM Crime Insight and Prevention solution provides visibility into information across the organization and gives you a glimpse into where and when crimes are likely to happen. Public safety and security organizations can make better decisions and better allocate and redeploy resources to meet evolving goals. They can assess and mitigate risk in real time. They can reduce operational and IT costs through user self-service reporting and analysis, which benefits taxpayers. And they can fight crime and increase public safety by making good use of the data they already collect.

About IBM Business Analytics

IBM Business Analytics software delivers complete, consistent and accurate information that decision-makers trust to improve business performance. A comprehensive portfolio of business intelligence, advanced analytics, financial performance and strategy management and analytic applications gives you clear, immediate and actionable insights into current performance and the ability to predict future outcomes.

Combined with rich industry solutions, proven practices and professional services, organizations of every size can drive the highest IT productivity and deliver better results.

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