

City of Lancaster takes a predictive approach to policing



Enhancing operational planning with deep insight into crime data

Smart is...

Using predictive geanalytics to forecast the occurrence of crime events and focus policing resources on high-risk areas.

As cities grow, their crime-rate tends to rise with them. The City of Lancaster wanted to find a way to analyze the root causes of serious crimes and work more effectively with the Los Angeles County Sheriff's Department to police the metropolitan area.

The City implemented a Crime Prevention and Prediction solution deployed on the IBM Government Industry Framework. This solution integrates data from the Sheriff's Department and 911 emergency response systems, maps it geographically, and uses IBM® SPSS® Modeler to forecast the areas of the City that are likely to require the most policing over the forthcoming month.

Lancaster, the fifth-largest metropolis in Los Angeles County, California, was incorporated in 1977 and has since become one of the fastest-growing cities in the United States, with 156,633 inhabitants. The city is located in the Antelope Valley at the western edge of the Mojave Desert; the area is home to many of the country's largest aerospace companies, which play an important role in the City's economy.

Between 2000 and 2010, the city's population increased by more than 30 percent, and as is typical with cities undergoing rapid growth, its crime rate rose too. The City authorities were particularly concerned by the increased incidence of 'Part I' crime events – violent crimes or crimes against property. Seeking to investigate the root causes of these crime events, the City brought in a consultant, who recommended recruiting a full-time analyst to work with the Sheriff's Department. Jim Kobolt, at that time Associate Professor of Criminal Justice at Winona State University, was hired as the City's first Senior Criminal Justice Analyst.

"I was brought in to research the causes of crime and help to formulate strategies to combat it throughout the City," explains Kobolt. "The first challenge was to find out what data we had on Part I crime events, bring it together in one place, and start working out what the significant factors might be – not just to analyze patterns in historical data, but also to look at current data and see if we could use it to better guide our law enforcement operations."

Contract law enforcement

Like more than 40 other cities in Los Angeles County, Lancaster has a contract with the County Sheriff's Department to provide law enforcement services. Lancaster Sheriff's Station is one of the largest in the County, with more than 230 deputies and 100 civilian personnel; it covers not only the city itself but a patrol area of more than 600 square miles across the northeast corner of the County. The station has its own crime lab capable of processing almost any kind of evidence including fingerprints, drug/chemical testing, polygraphs, and crime scene photography. In 2009, the station was named Los Angeles County's first research and development station, providing



Business Benefits

- Delivers predictive insight into probable crime event patterns, helping to deploy Sheriff's Department resources more effectively across the City.
 - Uses intuitive graphics to help everyone from senior officials to police officers on the beat understand crime analyses at a glance.
 - Enables detailed analysis of current and historic crime data to understand root causes and support the creation of crime prevention campaigns.
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opportunities to try out new ideas and technology to determine effectiveness in fighting crime, such as vehicles equipped with automatic license plate recognition (ALPR) technology.

“Lancaster Sheriff's Station is a tremendous resource, not just for the City but for the whole of northeast Los Angeles,” comments Kobolt. “Its status as a center for research and development means that it is very open to working with us on innovative methods of policing – and when we began our predictive analytics initiative with IBM, the station got on board with the idea 100 percent.”

Getting the data together

The first challenge was to build a unified picture of crime events within the city, which involved integrating data from the Sheriff's Department crime reports system with the 911 emergency response database and several of the City's own data sources.

“One of the key considerations was to ensure that we were only looking at data relating to crimes within the metropolitan area – which was a challenge because of the large size of the Lancaster Sheriff Station's patrol area,” explains Kobolt. “We used Esri's ArcGIS solution to plot all the data geographically, and then filtered it to exclude everything that occurred outside the city limits. This also gave us valuable insight into exactly where crime events were happening within the city, and where the hotspots were.”

Data-mining and modeling

Next, the relevant data was imported into IBM SPSS Modeler, which uses sophisticated data-mining and modeling techniques to reveal patterns and trends.

“I had used IBM SPSS Statistics software in several of my previous roles, and as far as statistical analysis of large data-sets is concerned, I knew it was one of the most powerful and sophisticated tools available,” says Kobolt. “I was new to IBM SPSS Modeler, but IBM provided

Smarter Public Safety

Predicting crimes and analyzing their causes



Instrumented

Data is automatically collected from crime reports, arrest records and 911 emergency response systems into a central database.



Interconnected

The data is mapped geographically and imported into a set of complex statistical models that use time series analysis to forecast crime events over the forthcoming month.



Intelligent

Crime forecast maps help the City and the Sheriff's Department identify districts where crime frequency is likely to be highest and allocate policing resources accordingly – helping to create a safer community.

Solution Components

Software

- IBM® SPSS® Modeler

Services

- IBM Software Services for SPSS

IBM Business Partner

- Esri
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— Jim Kobolt, Senior Criminal Justice Analyst,
City of Lancaster

excellent support. I worked closely with an SPSS Modeler specialist to examine the data and decide on the best approaches for modeling the occurrence of crime events across the city. We looked at what other law enforcement organizations and cities were doing, and tried to find a model that worked well for Lancaster.”

Finding a model that fits

“Our results were interesting. To take one example, in a lot of other cities, weather variations are a major factor in crime frequency. In Lancaster, the weather wasn't significant. This is probably a result of Lancaster's location in a semi-arid region, with very stable weather all year round. After ruling out a number of other possible factors, we discovered that time series analysis provided the best fit with actual criminal activity in the City.”

Predicting crime events

The model not only helps the City and the Sheriff's Department gain more insight into the locations and causes of earlier crimes – it also allows them to estimate how many crimes there will be in different areas of the city in forthcoming months.

“I like to use the word ‘forecast’ in this context, because it gives people a familiar way to think about what we do,” explains Kobolt. “We use a combination of current and historical crime data to predict the timing and location of crimes, much as a meteorologist uses weather data to forecast temperatures and rain patterns. Each month we present a map to the Sheriff's Department and City officials that shows the likely crime-rate in different areas of the city for that month, and they use this as a guide to where their resources ought to be deployed.”

This map is now available to be viewed on the city webpage under Public Safety; Crime Maps and Information.

Intuitive presentation of data

One of the keys to understanding the data is the geospatial capability provided by ArcGIS, which enables Kobolt to plot the results of the IBM SPSS Modeler analysis on a map of the City and present the findings in an intuitive graphical report.

“In the report, areas of the City where 0-10 crimes are predicted are displayed in one color, areas where 11-20 crimes are expected in a second color, and so on,” explains Kobolt. “Everyone can understand the report at a glance, which means that our results really get taken on board. You can do the best research in the world, but if you can't present it in a way that decision-makers appreciate, it's worthless. This is where our solution is so strong.”

To simplify the interaction between SPSS Modeler and Esri ArcGIS, Kobolt uses CrimeView, an ArcGIS plug-in developed by The Omega Group for law enforcement analysts.

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“CrimeView really gives me a shortcut in navigating through ArcGIS, which is a complex product,” says Kobolt. “It allows me to focus on the SPSS Modeler analysis and just use the geospatial features that I need, without having to become an expert ArcGIS user. Overall, the combination of IBM SPSS Modeler, ArcGIS and CrimeView is ideal for this type of analysis, and I’d certainly recommend it to other cities in our position.”

Results

Since November 2006, the City of Lancaster has seen a steady decline in the frequency of Part I crime events. The use of IBM SPSS Modeler has helped Kobolt gain a better understanding of why the crime rate peaked at this point – and suggests that Lancaster’s perceived crime problem in the mid-2000’s might not have been what it seemed.

“At one point in the middle of the decade, our crime-rate seemed to be increasing much faster than you would expect, even for a city that was growing significantly,” he comments. “But when you map the crime data against markers of population change such as the number of building permits, vacant houses, traffic counts and so on, it suggests that there may well have been a significant population spike during that period and a decline afterwards. If, as seems likely, Lancaster’s population in the mid-2000s was actually around 180,000, then the crime-rate would have been quite normal compared to other cities of that size.”

The reduction in crime-rate since 2006 may be partly the result of population decline, but Kobolt also gives credit to the Sheriff’s Department for stepping up enforcement activity and embracing innovative methods.

“The predictive modeling that we do is just one part of how we’re working with the Sheriff’s Department to improve law enforcement in Lancaster,” he comments. “Modeler also gives us a really strong methodology for analyzing the root causes of crime. For example, our analyses revealed that a large proportion of property-related crimes in the City were really what you might call ‘crimes of inattention’ – people forgetting to lock their cars, leaving their garages open, and so on. We used this insight to create a set of public information campaigns to encourage people to avoid these behaviors and stop giving criminals an easy ride.”

Looking to the future

For Lancaster, the current IBM SPSS Modeler solution is just the beginning.

“Now that we have the models in place, the only brake on progress is the availability of data,” says Kobolt. “If we can start to get crime report data in closer to real time, we can start providing weekly, daily, or shift level crime forecasts. Thinking back to the weather forecast

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comparison, a monthly forecast might be useful for farmers or other people who are interested in a long-term view, but it wouldn't tell you if you should wear a raincoat tomorrow. Likewise, monthly crime forecasts are useful for high-level planning, but we'd like to get to a stage where we can make decisions on law enforcement deployment right down to the level of individual shifts.

“The Sheriff's Department is looking at introducing mobile crime computers that will allow officers to submit arrest reports while they're still out on the beat, instead of typing them up at a later date; if this plan goes ahead, we could potentially get the data input we need to do some very interesting near real-time analyses. From an operational perspective, this could really be the start of a smarter approach to law enforcement.”

About the IBM Government Industry Framework

This solution was delivered as an IBM Government Industry Framework implementation. This approach gives clients access to pre-integrated software, hardware and industry-specific extensions delivered by world-class implementation services according to industry best practices. With this approach, clients get a faster return on their investment and reduced risk. They benefit from best practices developed by IBM and its partners on engagements with other leading government agencies, and are able to extend their solutions to address future needs.

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