Using Artificial Intelligence on Crime Prediction: PREDPOL

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ABSTRACT

PREDPOL is nothing more than police operations based on predictions of crime. Predicting crime is difficult, however, the police have an abundant source of big data on past crimes. Combining artificial intelligence (AI) and big data with sophisticated algorithms, the police is able to predict crimes. PredPol might enable the police to apprehend people before they have committed the crime.

There is ample evidence to suggest that the crime can be predict, part of that is because criminals commit crimes in their "comfort" zone such as areas they know or areas where they had success with in the past. PredPol enables the police to be present at locations where, based on the data they have and the artificial intelligence of the algorithms, the probability of a particular incident is greatest so they can prevent the crime.

1. Introduction

Crime prediction or predictive policing refers to the usage of mathematical, predictive and analytical techniques in law enforcement to identify potential criminal activity. Crime prediction methods fall into four general categories:

- Methods for forecasting places and times that crimes will occur
- Methods for predicting which individuals will commit a crime (offenders)
- Methods for predicting perpetrators' identities
- Methods for predicting victims of crime

Crime prediction uses data on the times, locations and nature of past crimes, to provide insight to police strategists concerning where, and at what times, police patrols should patrol, or maintain a presence, in order to make the best use of resources or to have the greatest chance of deterring or preventing future crimes. Crime prediction methods are not a crystal ball: they cannot foretell the future. They can only identify people and locations at increased risk of crime.

With the right kind of data analytics, geologists can predict earthquakes. Turns out those same principles can be applied to predicting crime. That concept has been turned into an analytics tool that is now being used by more than 20 police departments in the U.S, where the practice of crime prediction has been implemented by police departments in several states such as California, Washington, Arizona, Tennessee and Illinois. It is expected to continue increasing, and one in the United Kingdom.

The evidence suggests that crime is predictable, at least statistically, because criminals follow patterns. They tend to go back to work in the same area, the same house or business, because they are familiar with the setup and they got away with it the first time. The nearby risk of one burglary, for instance, tends to be around 200 meters from the first crime over a period of 14 to 28 days. An offender hits a neighbourhood three times and then tends to go to the next neighbourhood over. They travel to avoid detection, but they do not travel too far.

2. Examples of use

There are different softwares for the time prediction such as PREDPOL, CAPS, IBM SPSS Modeler or HunchLab. Apart for that, there are different prototypes, one of the biggest examples is the chinese facial recognition company "Cloud Walk" is making.

PredPol is a software that combines artificial intelligence and big data to help prevent the crimes by predicting when and where crime is most likely to occur. That allows to optimize patrol resources and measure effectiveness.

Crime Analysis & Prediction System (CAPS) was originally developed for Public Safety and National Security team at Microsoft. CAPS is a system to analyze and detect crime hotspots and predict crime. It collects data from various data sources such as OpenData sources or US census data and leverages Azure's Cloud and on premise technologies for back-end processing and desktop based visualization tools. It has some benefits for the local police, for example, the system can alert that a crime is imminent (in the next few hours) based on any new traffic or weather events and the police can run the system once a day and based on the predictions, decide how to deploy policemen in each district or community.

IBM SPSS Modeler. IBM's software can use historical crime data, profiles and maps, as well as other events like weather, holidays, or festivals, as input data. Analysis of data provides insight that lets officers track criminal activities, predict the likelihood of incidents, effectively deploy resources and solve cases faster. It is currently used by the Miami Police Department.

HunchLab, unlike the previous systems, focuses more on social and behavioral analysis to create predictions. It is currently used by the NYPD, Chicago Police Department, and the Philadelphia Police Department.

Chinese prototype, being developed by the chinese facial recognition company "Cloud Walk", uses a big-data rating system to rate highly suspicious groups of people based on where they go and what they do. It relies on several AI techniques, including facial recognition and gait analysis, to identify people from surveillance footage.

However, in this report, we are going to focus on PredPol.

3. PREDPOL

PredPol's unique crime prediction methodology leverages existing crime data that every city already has, advanced mathematics developed over more than six years, computer learning, cloud computing, and the indispensable experience of veteran police. The crime data is analysed through a sophisticated algorithm that applies proven criminal theories about crime, including gun violence. The results are more accurate and more actionable recommendations for when and where crime is most likely to occur.

The software uses an algorithm with ten years of crime data; type and when and where incidents happened, placing an emphasis on recent crimes to calculate a prediction. It uses no personal information about individuals or groups of individuals (such as socioeconomic factors or race), eliminating any personal liberties and profiling concerns. The mathematical models are similar to what is used to predict earthquake aftershocks. Unfortunately, the Department of Justice has estimated that less than half of violent crimes and even fewer household property crimes are reported to the police.

The predictions are good for a 12 hour period in a 150-by-150 meter boxes area. A prediction map will include 10 to 20 red squares highlighting the areas where crime is predicted. They can then patrol that area for anything unusual.

PredPol's core technology has grown from success with property crimes to include prediction of drug crime, burglary, anti-social behaviour, theft of personal property and murder, among others. The tool is about predicting crime and not a profiling tool to identify who is committing crimes.

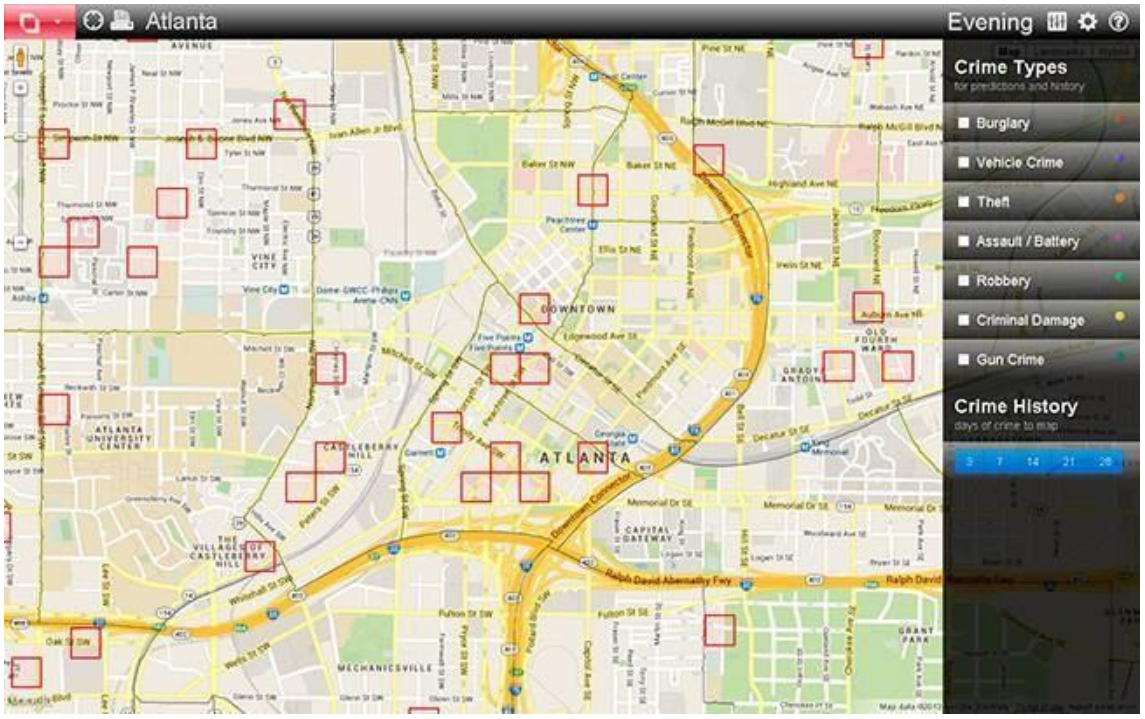

Figure 1: PredPol's output

This is not a substitute for police experience and knowledge. PredPol is a tool to enhance the work that officers do.

As for aftershocks, he points to the law enforcement concept of repeat victimization. If a house is broken into, chances of a next-day burglary go up. Not only that, but neighbours are more at risk. The offender can map what was successful for them in your house to your neighbour's house with very little added cost. A lot of human behaviour can be explained with very simple mathematical models.

So far, PredPol has been considered a success. The effectiveness was recently tested by the Los Angeles Police Department (LAPD), which found its accuracy to be twice that of its current practices. In addition to this, for the Santa Cruz, California, Police Department, statistics show an overall decline in crime in targeted areas. From 2011, when PredPol was implemented to 2012, burglaries declined 11 percent, robberies declined 27 percent and assaults were down 9 percent. Meanwhile, arrests were up 56 percent and auto theft recovery improved by 22 percent (look at figure 2).

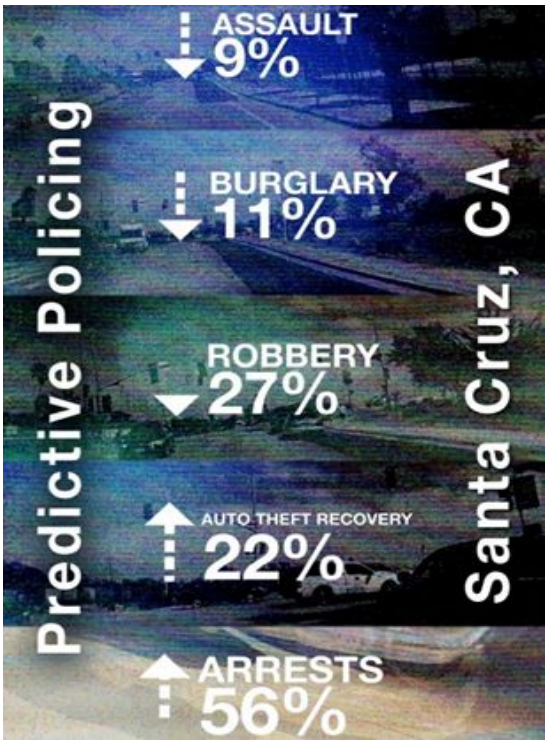

Figure 2: Statistics after a year of PredPol use in Santa Clara, Cal.

After these successful initial deployments PredPol has deployed its innovative technology in dozens of cities around the United States as well as the United Kingdom.

4. Comparisons with other works with similar characteristics

Comparison between PREDPOL and IBM SPSS Modeler

IBM's system get even more detailed in their algorithms. It wisely incorporate other data points like weather, nightclubs, locations of bus stops and even proximity of liquor stores of bus stops when predicting where crime is going to happen.

Predpol, unlike IBM SPSS Modeler, only records crimes, dates, and locations, not victim or suspect information. That, therefore, makes it impossible to use the data for profiling.

Comparison between PREDPOL and chinese prototype

Predpol is about predicting where and when crime is more likely to happen and not a profiling tool to identify who is committing crimes.

On the contrary, the chinese prototype is already integrated into police databases in more than 50 cities. Those databases are filled with personal information on millions of Chinese citizens gathered for years. The facial recognition software combined with surveillance footage and predictive analytics is reportedly able to recognize people, track their activities and to identify suspicious behavior to warn police of potential criminals. It can also track people for past suspicious behavior so when they appear in high-risk areas, the police are immediately alerted.

5. Discussion or reflections regarding the work presented

Like every innovation, the method has advocates and critics.

Controversy / Racial problems

PredPol has generated controversy after research showed it appeared to be repeating systematic discrimination against black and ethnic minority offenders. Critics said that by relying on past data to create the software, the program had itself “learned” racism and bias, and would continue reinforcing it even if police forces and wider society progresses.

PredPol designates "hot spots" - small areas to which police units are sent to patrol. The act of sending police to a designated small area to watch for suspicious activity will inevitably lead to those police sent there being more suspicious than usual of everyone they encounter . This will lead to more "reasonable suspicion" stops which are in fact not reasonable, leading to civil rights violations, all the more problematic because hotspots are so likely to be in minority neighbourhoods."

While drug use (look at figure 3) estimated from public health data is roughly equivalent across racial classifications (top), police using a predictive policing algorithm in Oakland, California, would target black people at roughly twice the rate of whites (bottom).

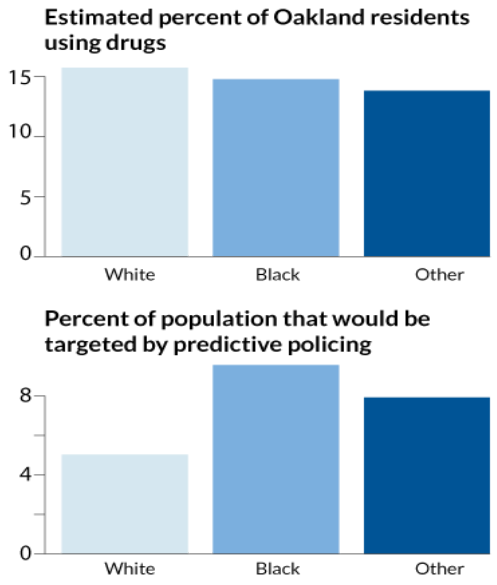

Figure 3: Estimation on drug use in Oakland, Cal.

Properties devaluation

According to a new research, one in 10 adults have witnessed or been a victim of crime but did not report it for fear of the impact on their home's valuation or or making it more difficult to rent. A large amount of buyers would refuse to live in a high-crime area so plenty of householders fail to report crime. They are the most affected ones since they are victims of that delinquency, constant police presence monitoring their activities, properties devaluation and stigma. Not only does it affect to householders, but also to that area’s business owners.

Freedom or security

If the chinese prototype put into practise, what will happen with the privacy? The police will be able to make cities safe, but there is always a cost. Freedom or security, that is the

question. China has no specific data protection law. Consequently, the government can use personal data in any way they like, which could pose a huge threat to its citizens' privacy. Nevertheless, the use of this sophisticated systems by police and other public security officials can be particularly troubling in a democratic society. A vast number of people would consider that their privacy is being violated by this new technology.

6. Conclusions

After considering all the facts we have been reading in different articles and web pages related to the topic, we can say that the crime prediction or predictive policing is a adequate method to make sure the crime is eased off in conflicted areas. However, we should check that the privacy of the people is not violated.

In some way, there would have to be some law that would control the information that intelligent systems can process, that is, that people's personal information cannot be accessed.

Furthermore, the systems should be provided with enough information to mitigate the racial problems that nowadays they have, as we have seen in *figure 3*, there is a huge difference between what intelligent agents predict and what is predicted by what the real prediction should be.

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