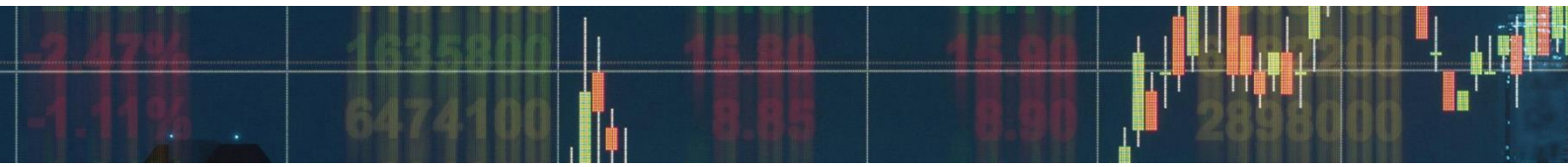


Predictive policing and way forward

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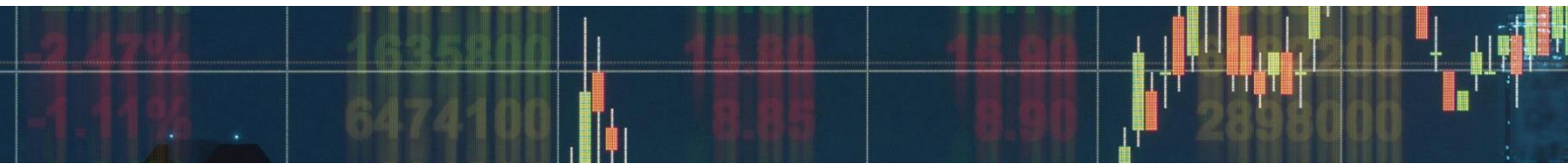
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Foreword

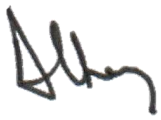


The economic benefit of effective policing, to prevent crime, is obvious. But so are the broader benefits to a nation. The vulnerable are protected, citizens are more productive, and businesses are more likely to invest where they feel secure.

Indian Police forces are constantly under pressure to respond swiftly to critical incidents while working with limited resources. Law enforcement agencies across the globe are turning to technology to help solve this conundrum by finding ways to not just fight crime but prevent it. At the forefront of this adoption is predictive policing—a technique that has acquired newfound importance with the advancement of big data analytics.

Herein lies the opportunity for Industry as well to create an infrastructure with the objective to gather information alongside solutions that efficiently assimilate this data to generate intelligence. For law enforcement agencies, centralized data systems, intelligent use of the information already available, and multi-faceted analytics programs will accelerate the growth of predictive policing.

We are confident that this report will be of considerable value to all stakeholders in understanding the application of analytical and quantitative approaches for various police activities



Dilip Chenoy
Secretary General – FICCI

Foreword



Governments and associated agencies have always faced challenges in ensuring safe and secure environment for its citizens and establishments. At every step, the law enforcement agencies are faced with the onerous task of developing actionable insights from large swathes of structured and unstructured data from internal and external sources.

The rapidly evolving security landscape globally has made it necessary for the law enforcement agencies to be equipped with the latest technological tools that allow them to collect, collate and analyze data from an extremely broad range of sources. In the foreseeable future, the agencies will continuously be tasked with acquiring, identifying, integrating, analyzing and disseminating relevant information to ensure national security.

The recent developments in technology and the development of specialized analytical techniques have made it convenient for police and law enforcement agencies to leverage the capabilities of "Predictive Policing" that focuses on harnessing the power of information processing capabilities, coupled with geospatial technologies and a combination of evidence based police response models to do crime analysis, detection and prevention.

Predictive policing technologies hold the promise to be a new frontier for enhancing the effectiveness and efficiency of homeland security solutions. This paper highlights the key predictive policing techniques like hot spot analysis, data mining, and classification algorithms etc. and also touches upon the core aspects of data collection, data analysis for supporting the critical functions of law enforcement agencies (LEA).

The paper also gives an overview of the prevalence of predictive policing solutions in India, the challenges being faced by Indian agencies and some notable case studies for predictive policing and related projects that have been undertaken by agencies across the country. Predictive policing is indeed the next step of smart policing that enables the agencies to deliver services efficiently and proactively.

We sincerely hope that this knowledge paper proves to be insightful and material in understanding the key drivers, challenges with the usage of Predictive Policing solutions, newer application areas and the way forward for providing the citizens a safe, secure and harmonious way of life.

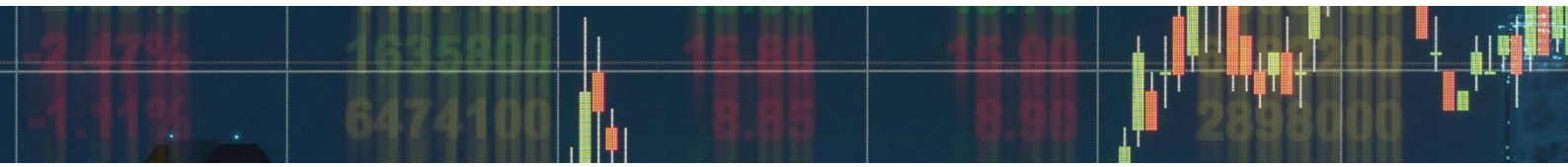
We would like to thank FICCI for giving us an opportunity to present this paper, Predictive Policing and Way forward that shall be instrumental in improving the overall safety and security landscape of the country.



Akshya Singhal
Partner, Advisory Services
EY

Executive summary





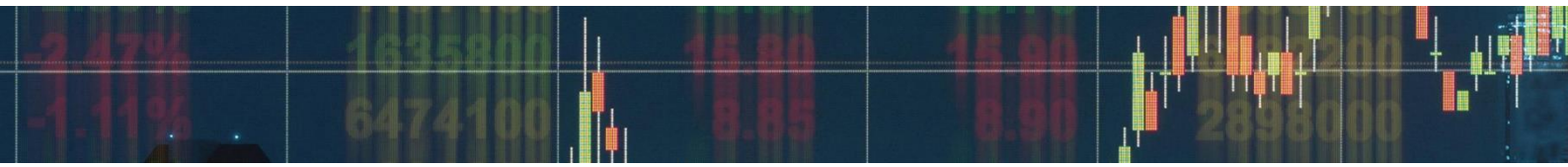
1 Executive summary

Predictive policing supports crime investigation by narrowing down upon potential criminal activities and in turn increases the efficiency of the traditional police investigation techniques. It involves processing of large datasets that are fed into predictive models that gives an output based on the different type of input datasets. In order to make it more useful for the agencies, predictive policing should be accompanied by support systems and continuously evolving automated systems in conjunction with the variance in datasets. Predictive policing also has the capability of utilizing the power of geospatial technologies along with evidence based police response models to enable the law enforcement agencies to undertake crime analysis.

With the help of advanced analytics, decision making capabilities of the law enforcement agencies would improve significantly because of availability of analysis of complex information that was earlier not available in a suitable form. There are four prominent methods that help forecast crimes and in turn, aid the process of policing, namely predicting the time and place of possible perpetration of crime, future offenders, demographics of victim and analysis of profile of past crimes.

Predictive policing offers an opportunity to the law enforcement agencies to pre-emptively act against crimes by focusing on crime-prone areas and individuals that are at risk of becoming offenders or of being targeted. If crimes can be stopped even before they are committed, it shall have great social and economic value not just for those at the risk of being victims of such crimes, but also for the offenders, as they can be stopped from making life-altering mistakes. Prediction-led policing is not just about building assumptions but is a collaborative set of a work process that involves several steps like:

- Collection of a data and then deciding that which method to be used, this mode is generally used in police stations for outlining crimes
- Analysis of the data used to give details of the crime designs specific to a given sector. This includes different types of mining analysis like hotspot analysis which tries to estimate the sectors of growing offences and lets us know about the past miss happenings to alert us about any upcoming crimes. Data mining is used to determine patterns in data and crime locations. Reversion representation is used to search relations amongst free variables and evident variables. This gives information about the past profile of crimes. Classification algorithms basically define the security measures to prevent the future perpetration of crimes. Risk terrain analysis includes analysis of social, physical and bearing factors that make certain areas prone to crime and spatio-temporal analysis is used to predict location and time of a crime
- Support to police operations through predictive policing data analysis that affects the rate of crimes without influencing the police practices. Last is the support for criminal response. Indian law enforcement agencies are now actively switching or including predictive policing as a part of their work culture and investigation procedures. They are increasingly doing crime analytics using big data that involves the storage and analysis of the volume of data in near-real time. Mature big data storage platforms such as Hadoop, NoSQL, etc. are providing them an opportunity to store the structured digital content and unstructured data within the same platform and also provides them with an option for analyzing such large data-sets along with the incoming real-time data to understand crime patterns within their jurisdictions



Predictive policing, with all its advantages, also faces challenges in a democratic society like India where the law enforcement agencies are required to abide by the fundamental rights of individuals. One of the most important areas which needs to be considered is the danger of erosion of privacy and other fundamental rights and democratic principles. Therefore, to counter and to effectively handle the critical law and order situations, a policy needs to be framed which includes safeguards to prevent abuse.

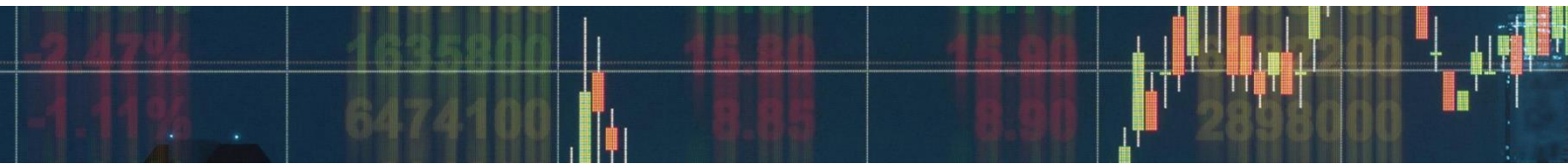
In order to let predictive policing perform to its full potential, changes would also need to be made to the policy landscape. Predictive policing needs a technologically driven approach using data ideology, opacity of predictive models, cyber-security using encryption and cryptography and data capture and storage using other technological initiatives being undertaken in the country.

As illustrated in the paper, the center of predictive policing is data: crime data, FIR data, personal data, gang data, social data, associational data, locational data, environmental data, social media data, behavioral data, consumer transactions data, personal communications, surveillance sources data and a growing web of sensors. The use of big data in world of law enforcement is still largely in its early stages but offers more incriminating bits of data to use and study.

Predictive policing promises to be a game changing concept. It is understood that the application of analytical and quantitative approaches will continue to be an important part of police activities. While it is predictive in nature, the effort involves crunching data of past crimes to forecast and thus in an essence it is largely reactionary police with a proactive approach.



Introduction



2 Introduction

Predictive policing is primarily the usage of analytical techniques, specifically the quantitative techniques to identify the most probable areas for urgent police intervention and to prevent crimes or help solve crimes using the statistical prediction and processing capabilities. Predictive policing focuses on harnessing the power of geospatial technologies with a combination of information processing capabilities and evidence based police response models to do crime analysis, detection and prevention.

As per Andrew Ferguson, an American Journalist and author, patterns of crime are a "function of environmental factors that create vulnerabilities for victims and spaces at certain times"[1]. The basic premise of predictive policing is that crime is not necessarily distributed randomly across places and people but has a set pattern. Thus, instead of simply relying on an investigation officers approximations, this method relies on actionable intelligence derived through the power of analytics.

To be effective, predictive policing must be based on analytical predictions so that interventions can be channelized. Successful interventions typically have top-level support, sufficient resources, automated systems to provide needed information and assigned personnel with both the freedom to resolve crime problems and accountability for doing so. Many agencies may find simple methods sufficient for their predictive policing needs, though larger agencies that collect large amounts of data may get more benefited from a little more complex model.

Predictive policing doesn't intend to change the traditional police investigation and analysis methods but puts a focus on the usage of advanced analytics on huge and diverse sets of data from multiple sources in conjunction with the existing response models to help forecast and prevent crime. By applying advanced analytics on various records and data sets, law enforcement agencies can predict what and where an incident is likely to happen and deploy its resources accordingly.

By using predictive policing, computer models could be empowered for assisting in law enforcement purposes, like anticipating the likely crime events and informing actions to prevent crime. Prediction can focus on fields such as places, people, groups or incidents. Demographic trends, crowd in that region and economic conditions may all affect crime rates in certain areas. Different models are normally used with the historical crime records to inform police about the interventions that can occur which will eventually reduce the number of incidents. [2]

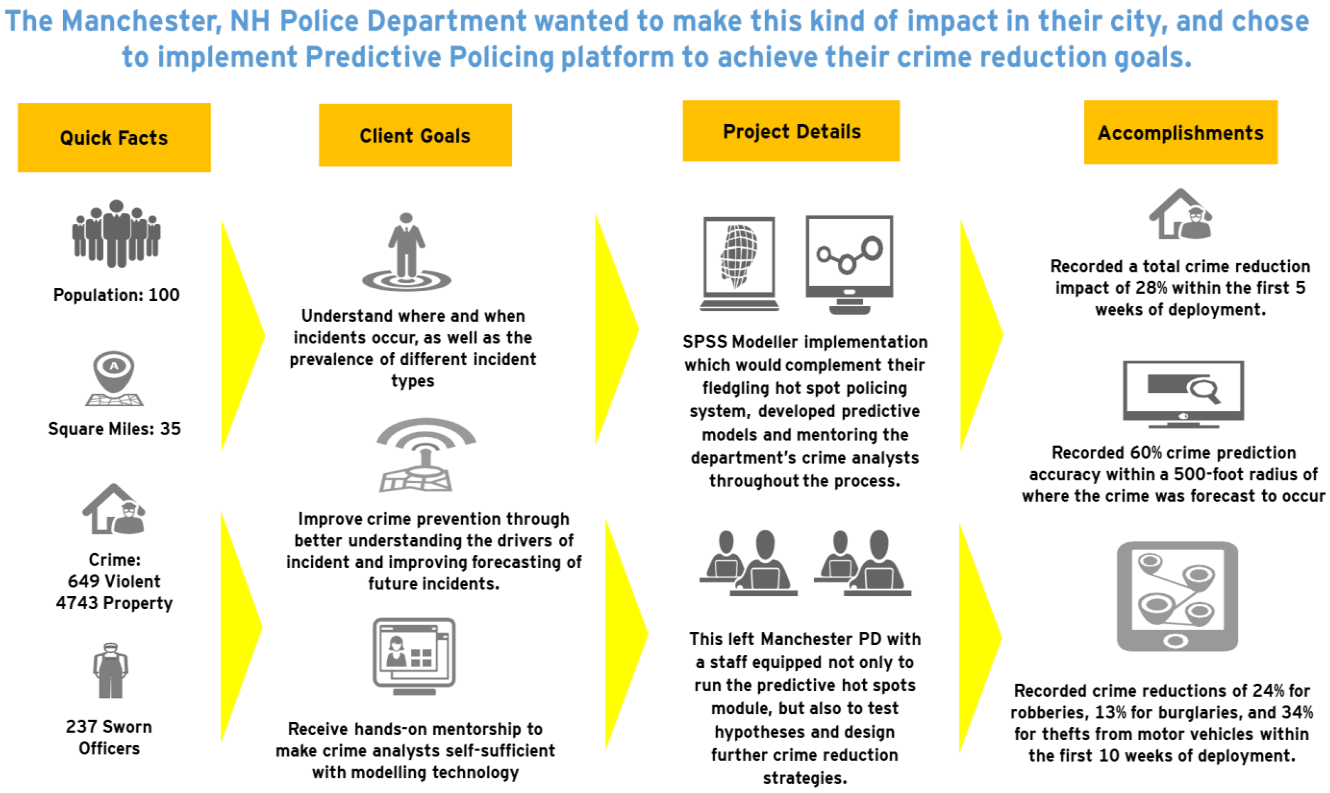
The basic underlying assumption of predictive policing is that crime is not randomly distributed across crowd or locations. Predictive policing seeks to be dependent on algorithmic insights derived using the power of big data rather than relying on a police officer's intuition. Algorithmic technologies also reduce the biases that exist in human decision making. Predictive policing, as a governance measure, reflects the global trend towards data-driven decision-making and its introduction in India sits well with recent efforts to make India a data-rich jurisdiction.[3]

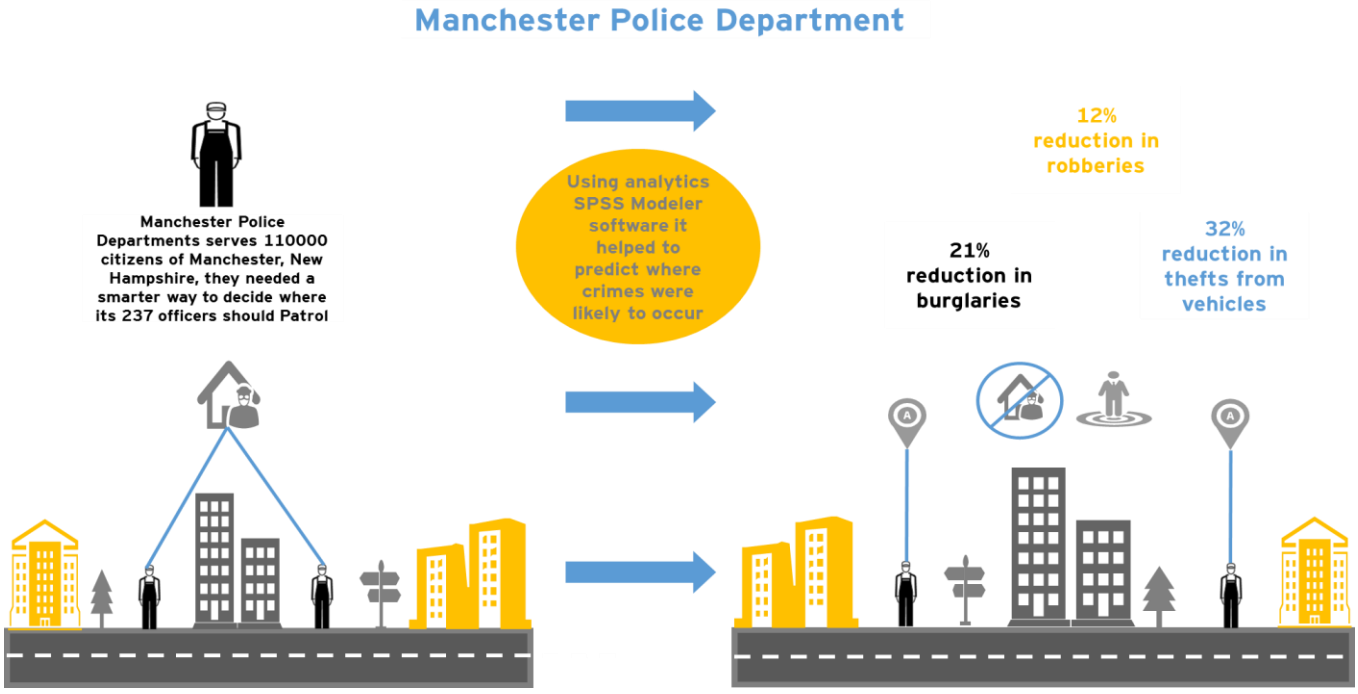
Currently there are four prominent methods that help forecast crimes using predictive policing:

- Predicting the time and place with increased risk of crime
- Predicting potential future offenders
- Predicting individual or demographics that are most likely to be the victims
- Creation of a profile for past crimes

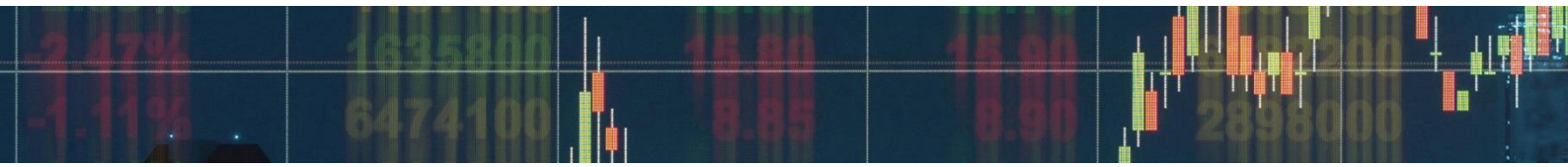
[1] https://www.aals.org/Reducing-Incarceration_final_Spring-2013_law-rev_08.08.2014.SB_.pdf
[2] https://www.rand.org/content/dam/rand/pubs/research_reports/RR200/RR233/RAND_RR233.sum.pdf
[3] https://privacysos.org/predictive/

Case study: Use of predictive policing by Manchester, NH Police Department[4]





[4] http://www.ibmbigdatahub.com/infographic/how-can-predictive-policing-drive-proactive-crime-prevention



2.1 Benefits of predictive policing

Predictive policing method significantly changes the response mechanism from reacting to crime to predicting the likelihood of crime and deploying resources to mitigate crime. The existing traditional approach is leveraged by this new predictive approach by improving their capabilities in intelligence led policing, community led policing and hotspot policing.

This capability has enabled practitioners to perform more sophisticated analysis, gain a better understanding of the factors underlying criminal behavior and provide better forecasts of where and when crimes may occur. It further uses analytical models and computing power to anticipate the crime events and provides with actionable intelligence. Predictive analytics can focus on variables such as places, people, groups or incidents. Furthermore it can also assist in analyzing demographic trends, parole populations and economic conditions that may affect crime rates in particular areas. Different models are used with the prior crime records to inform police about the interventions that can occur which will eventually reduce the number of incidents. [5]

Crime anywhere in the world creates huge costs for society at the national, community and individual levels. It is extremely important to estimate the cost to society of different crimes as it also helps in economic evaluation of many social programs. GIS (Geographic Information System) has great potential in reducing the cost of crime. For instance, in the US, property crimes against citizens are fewer and lower in value than automobile crimes that traditionally include stealing a mobile, wallet or bicycle worth few hundred dollars as compared to typical automobile crime involving vandalism or theft costing a few thousand dollars. These crime costs can be significantly reduced through an effective usage of GIS solutions, e.g., predicting the crime hotspots and increasing police patrols in those areas and swift and accurate response to acts of vandalism and thefts.

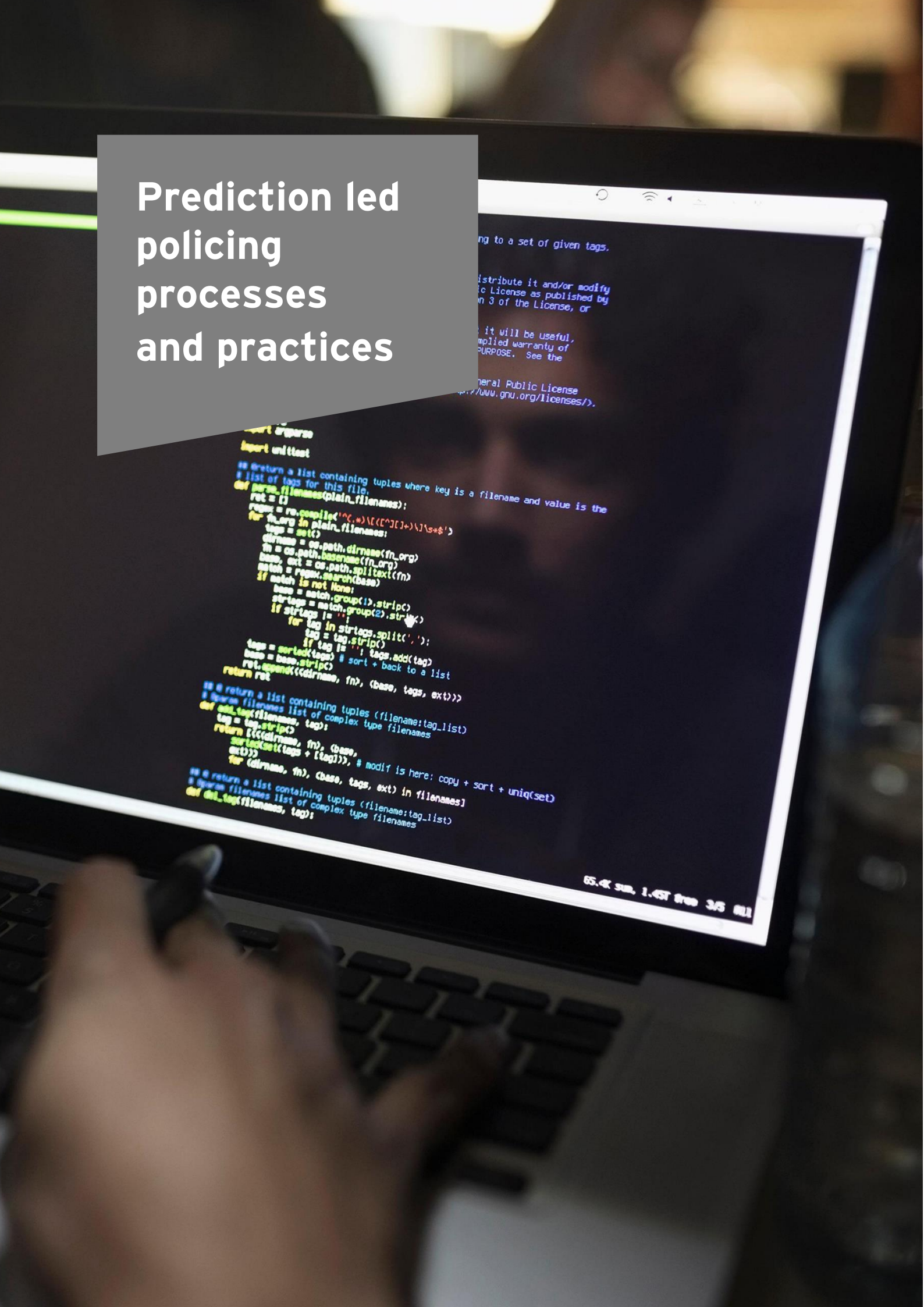
Due to overburdening of work, the police force in India usually faces health and social issues which mandates the need for better allocation of resources. Police officials usually work seven days a week and often have to work very long shifts. So any technology and system of policing which provides a better allocation of resources is extremely desirable. Through hotspots, risk terrain analysis and near-repeat theories, predictive policing promises analysis of data which is easily available that could empower the law enforcement agencies to identify individuals and locations for targeted policing. [6]

Predictive policing offers the opportunity to the law enforcement agencies to pre-emptively act against predicted crimes by focusing on crime-prone areas and individuals at the risk of offending or being targeted. If crimes can be stopped before they are committed, it has great social and economic value not just for those at the risk of being victims of such crimes, but also for the offenders, as they can be stopped from making life altering mistakes.

Predictive policing is a specialized process which aims to bring insights from various fields such as actuarial science, statistics, criminology and constructive understanding of local surroundings. So it is expected that this will lead to a more in-depth and holistic analyses of crime patterns.

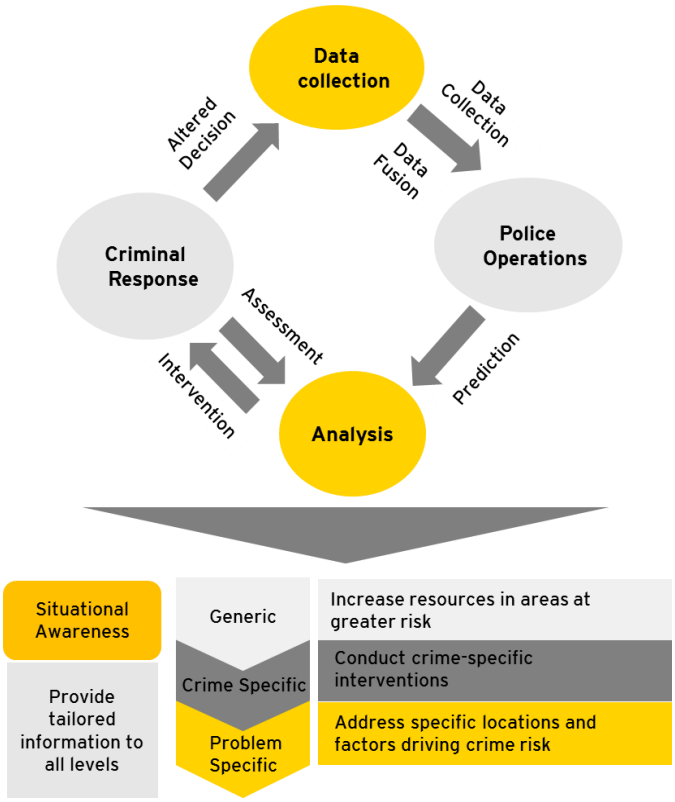
[5] https://ieeexplore.ieee.org/document/7379738/
[6] http://www2.caict.ac.cn/zscp/qqzkgz/qqzkgz_zdzsq/201704/P020170401531116706571.pdf#page=7

Prediction led policing processes and practices



3 Prediction led policing processes and practices

Prediction-led policing is not just about making predictions, rather, it is a comprehensive set of business process, of which predictive policing is a part. Some methods of predictive policing involve application of known standard statistical methods, while other methods involve modifying these standard techniques. The process primarily involves the following steps:



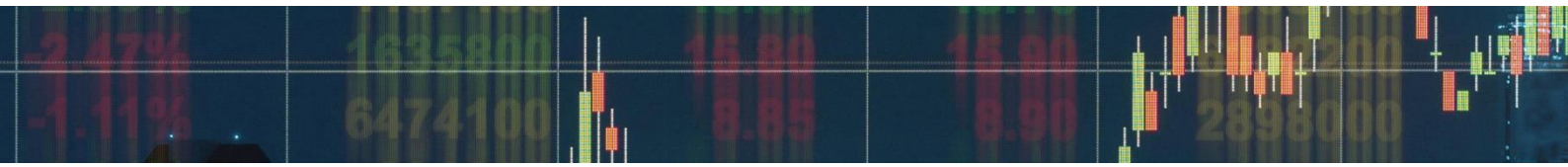
3.1 Data collection:

All predictive policing techniques depend on data. There are a number of methods available for collecting data that is relevant to predictive policing. In many countries around the world, a common integrated police application is being used as an important source of information to support the crime reporting, investigation and prosecution functions.

One of the notable examples is the CCTNS (Crime & Criminal Tracking and Network System) project by Ministry of Home Affairs (MHA), Government of India that pulls the data from various sources such as legacy electronic data, existing registers, reports, case files, images and pictures within the case files, FIR, charge sheet, seizure memo, conviction memo, arrest memo, crime (case/incident) data, criminals' data, the data from the police stations records rooms and citizen complaint information.

New York Police Department (NYPD)'s Domain Awareness System (DAS) exemplifies this kind of big data policing. The system integrates numerous data sources within the department and makes that information available to frontline officers for tactical purposes as well as to commanders developing crime prevention strategies. The system includes data from "audio gunshot detectors, environmental sensors, two billion readings from license plates that are attached with photos, 100 million summons, 54 million 911 calls, 15 million complaints, 12 million detective reports, 11 million arrests, two million warrants and 30 days of video from 9,000 cameras".7

[7] http://www2.caict.ac.cn/zscp/qqzkgz/qqzkgz_zdzsq/201704/P020170401531116706571.pdf#page=7



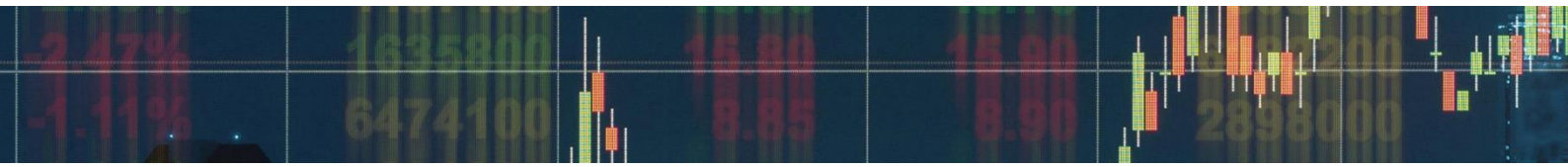
Officers can customize alerts for issues related to their responsibilities, such as 911 calls within their beat, an LPR (License Plate Recognition) reading for a witness they seek or a camera detecting an abandoned package. Through the Domain Awareness System, officers can connect directly with 911 callers rather than route the same through the dispatcher as an intermediary. The officer can also pull up historical information about the address where they are headed so that they can know in advance about restraining orders, mental health issues and warrants.[8]

3.2 Data analysis:

Using regression and data mining techniques to experiment with available data sets can provide insights into crime patterns that are unique to a given region. The trends identified in the analysis can help to design a method to identify hotspots. These technologies can even act as a guide for where to look for crime patterns or whether there are seasonal or weekly trends that should be included in the analysis. GIS data mining can also be informed by regressions and can be used to explore data, geographic profiles derived from clustering techniques can reveal patterns indicating a serial criminal.

- **Hotspot analysis:** Methods involving hotspot analysis attempt to predict areas of increased crime risk based on historical crime data. The premise behind such methods lies in the adage that crime tends to be lumpy. Hotspot analysis seeks to map out these previous incidences of crime in order to inform potential future crime. In February 2011, the Sacramento Police Department began using hotspot analysis along with a research on an optimal patrol time to act as a sufficient deterrent to inform how they patrol high-risk areas. This policy was aimed at preventing serious crimes by patrolling these predicted hot spots. In places where there was such patrolling, serious crimes reduced by a quarter with no significant increase in such crimes in surrounding areas.
- **Data mining:** Data mining attempts to recognize patterns in data and use it to make predictions about the future. One important variant in the various types of data mining methods used in policing are different types of algorithms that are used to mine data in different ways. These are dependent on the nature of the data the predictive model was trained on and will be used to interrogate in the future. In Derbyshire, UK, the Safer Derbyshire Partnership, a group of law enforcement agencies and municipal authorities sought to identify juvenile crime hotspots. They used a specialized software to combine multiple discrete data sets resulting in creation of detailed maps and visualizations of criminal activity, including temporal and spatial hotspots. This resulted in gaining insights for the law enforcement agencies on optimal deployment of their resources.
- **Regression models:** A regression aims to find relationships between independent variables and certain variables that one aims to predict. Hence, this method is able to track more variables than just crime history. For example in Pittsburgh, researchers used reports from Pittsburgh Bureau of Police about violent crimes and leading indicator crimes, for crimes that were relatively minor but which could be a sign of potential future violent offences. The researcher ran analysis of areas with violent crimes, which were used as the dependent variable in analyzing whether violent crimes in certain areas could be predicted by the leading indicator data. From the 93 significant violent crime areas that were studied, 19 areas were successfully predicted by the leading indicator data.[9]
- **Classification algorithms:** It seeks to establish rules assigning a class or label to events. These algorithms use training data sets to learn the patterns that determine the class of an observation. The patterns identified by the algorithm will be applied to future data and where applicable, the algorithm will recognize similar patterns in the data. This can be used to make predictions about future criminal activity.
- **Risk terrain modelling analysis:** Analyzes other factors that are useful in predicting crimes. Examples of such factors include the social, physical and behavioral factors that make certain areas more likely to be affected by crime. Police in Morris County used risk terrain analysis to tackle violent crimes and burglaries. They considered five inputs in their model- past burglaries, the address of individuals recently arrested for property crimes, proximity to major highways, the geographic concentration of young men and the location of apartment complexes and hotels. The Morris County law enforcement officials linked the significant reductions in violent and property crime to their use of risk terrain modelling.

[8] https://www.annualreviews.org/doi/pdf/10.1146/annurev-criminol-062217-114209
[9] https://cis-india.org/internet-governance/blog/predictive-policing-what-is-it-how-it-works-and-it-legal-implications



- **Near-repeat analysis:** Near-repeat methods work off the assumption that future crimes will take place close to timing and location of current crimes. Hence, it could be postulated that areas of high crime will experience more crime in the near future. This involves the use of a "self-exciting" algorithm, very similar to algorithms modelling earthquake aftershocks. The premise underpinning such methods is very similar to that of hotspot analysis. Santa Cruz Police Department, uses a specialized software that applies the Mohler's algorithm to a database with five years' worth of crime data to assess the likelihood of future crime occurring in the geographic areas within the city. Before going on shift, officers receive information identifying 15 such areas with the highest probability of crime. The initiative has been cited as being very successful at reducing burglaries and was used in Los Angeles and Richmond, Virginia. [10]
- **Spatio-temporal analysis:** This technique uses environmental and temporal features of the crime location as the basis for predicting future crime. By combining the spatio-temporal features of the crime area with crime incident data, police could use the resultant information to predict the location and time of future crimes. Examples of factors that may be considered include timing of crimes, weather, distance from highways, time from payday and many more. For example, officers in Chicago Police Department made visits to people whom their software predicted were likely to be involved in violent crimes, guided by an algorithm-generated Heat List.

Some of the inputs used in the predictions include some types of arrest records, gun ownership, social networks and generally type of people you are acquainted with among others, but the full list of the factors are not public. The list sends police officers to peoples' homes to offer social services or deliver warnings about the consequences for offending. Based in part on the information provided by the algorithm, officers may provide people on the Heat List information about vocational training programs or warnings about how Federal Law provides harsher punishments for reoffending.

3.3 Police operations

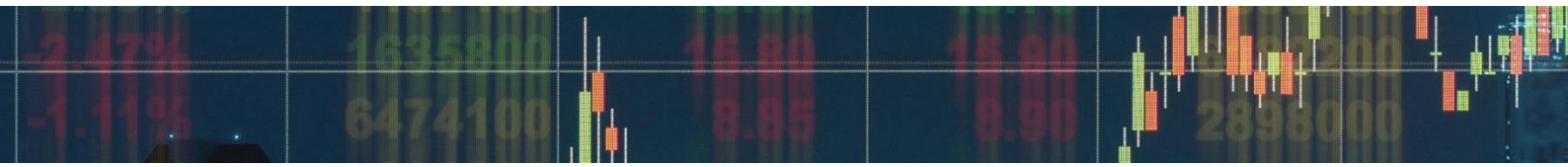
Even the best analysis will do nothing to bring down the crime rates, if it does not influence the existing police practices. Locations identified as hotspots may require additional patrol attention, periodic visits by beat officers, or other responses that are appropriate for the types of crimes occurring there.

Once the police launches an intervention, some criminals may be arrested while some may choose to stop committing crimes, change the locations where the crimes are committed or change the way their ways of perpetrating the crime in response to the police interventions. Thus, a location that had been a hub for crime can suddenly be free from criminal activities, with some of the same moving to another area. These changes will make the original data set obsolete. In this way, the cycle begins again with a new round of data collection, analysis and intervention.

The data collection, analysis and predictions are further assessed to determine what constitutes an appropriate response to the situation. Even after appropriate analysis it will not help to prevent or reduce the crime rate if it does not influence police practices. In certain situations, locations identified as hotspots may require police presence on the crime scene, additional patrol attention, periodic visits by patrolling officers or other responses depending on the types of crimes in hotspots.

Furthermore, it will be required by the officer to take measures to alter the conditions that encourages crime at the hotspots. This makes it necessary for officers who respond to the situations to possess sufficient analytical information and share a common understanding of the problem. The type of intervention for the situation response may vary as per the department or police officer. The interventions can be classified on the basis of level of complexity and the resource requirement to handle interventions. In general, it is hypothesized that more complicated the interventions, the resource requirement will be even higher and will be able to provide a highly customized response.

[10] https://cis-india.org/internet-governance/blog/predictive-policing-what-is-it-how-it-works-and-it-legal-implications



Following are some of the interventions and observations:

1. **Generic interventions:** More resource allocation in response to increased risk. For hotspots, this might mean allocating more resources
2. **Crime specific interventions:** Tailored resource allocation to combat expected types of crime
3. **Problem specific interventions:** Identifying population, location and person specific problem and generating crime risk and deploying resources on the basis of this analysis

The identification of the cause of criminal activity and its resolution is a multi-step process involving various departments and officers working on the situation. Various models have been practiced and followed across police agencies globally. Police operations and crime analysis has its unique set of operational challenges11, few of which are illustrated below:

Challenge 1: Managing a large data set
Data analyzed and collected by police departments might be obtained from various sources like state governments, central government, local sources or some private agencies which may be of different formats. In order to leverage the raw information, police departments must translate the same first into useful data.

Challenge 2: Domain knowledge of analyst
Crime analysis works well when analysts have streamlined process methodology and substance. If the information provided by analysts fails to assist with actual police operations, the crime analysis process breaks down. This makes it necessary for the analyst to possess understanding of crime situation, criminals and police response.

Challenge 3: Adequate analytical capabilities
LEA need to make sure that the analytical team possesses latest software systems, updated knowledge bases, statistical programs and geographical information systems. Also, due to the ever evolving nature of crime analysis, analysts also need to be trained to interpret things in a better way.

Challenge 4: Effective communication between analyst and officers
Analysts should be able to interpret situations and modify the analytical observations on the basis of response from the officers. Presence of an effective communication mechanism may foster better and quicker crime analysis and resolution.

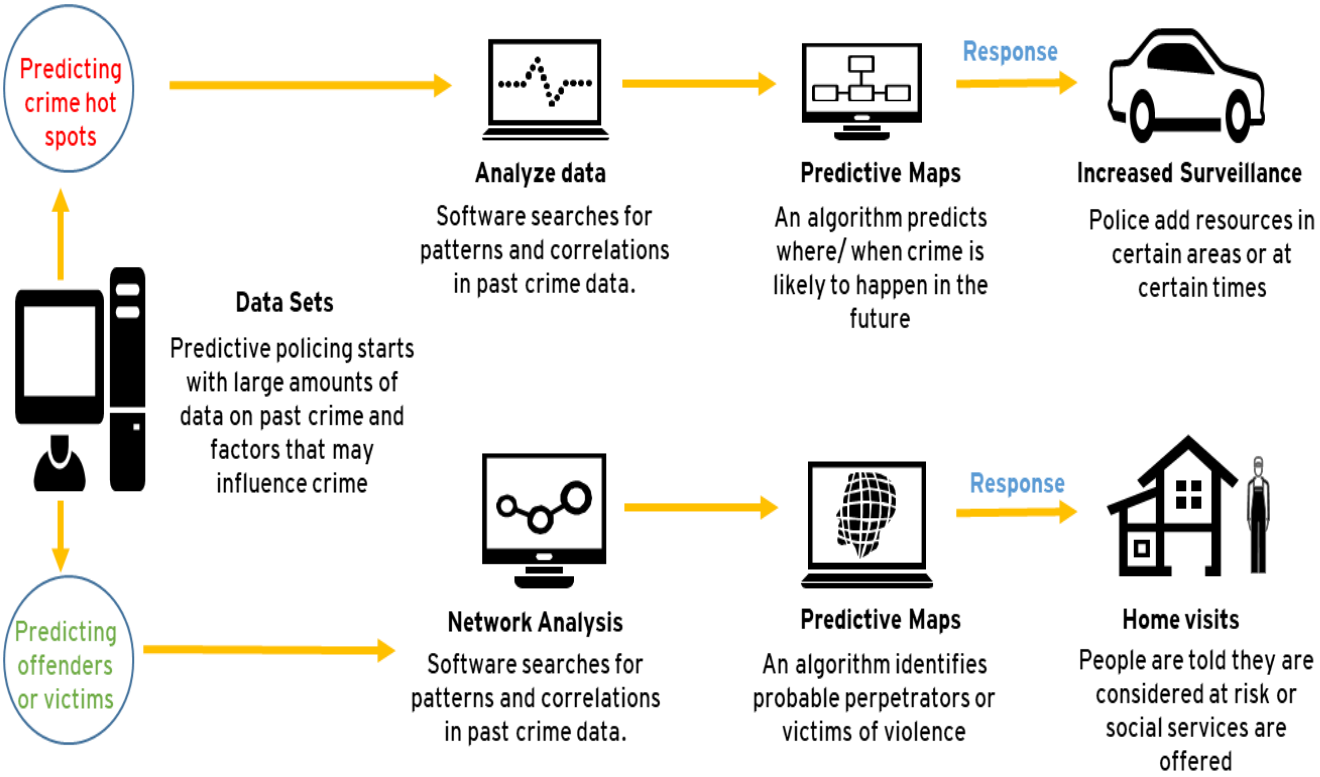
Challenge 5: Guidelines on decision making
Departments should incorporate definitive guidelines for analysts and officers to enable effective decision making. Officers should also be empowered to act on real time information as received and processed by the analyst to derive meaningful insights.

[11] https://www.iaca.net/Publications/Whitepapers/iacawp_2013_01_rms_requirements_for_crime_analysis.pdf

3.4 Criminal response:

Post police intervention, the outcome can vary greatly depending on the risks involved and on the resources deployed. It may be possible that some criminals get arrested while some may change the location or the means of committing a crime. This change in modus-operandi significantly alters the pattern and affects the predictive policing process as the data that is used to validate the crime and its occurrence gets changed with the changed criminal activity. These changes can thus make the insights, analytics and data collected so far obsolete. Thus, it gets necessary to start off the entire process with updated data collection, data analytics and police intervention processes.[12]

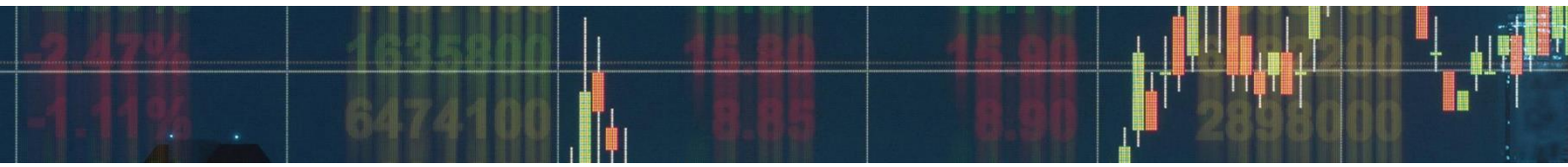
The image below gives an overview of how data sets can be analyzed and used by predictive policing methods in predicting crime hotspots and predicting offenders as well as victims:



[12] Predictive Policing: Preventing Crime with Data and Analytics, by Jennifer Bachner, Center for Advanced Governmental Studies, Johns Hopkins University
Predictive Policing: The Role of Crime Forecasting in Law Enforcement Operations by Walter L. Perry, Brian McInnis, Carter C. Price, Susan C. Smith, John S. Hollywood, RAND cooperation sponsored by the National Institute of Justice and conducted in the Safety and Justice Program within RAND Justice, Infrastructure and Environment.

Predictive policing in India





4 Predictive policing in India

On the whole, predictive policing is a new concept in India. However, Indian police forces have gradually started taking interest in crime analytics using big data that involves the storage and analysis of volume of data in near-real time. This is aimed at predicting and inferencing patterns and trends related to human interactions and behaviors.

A number of law enforcement agencies in the country have already started developing access to mature big data storage platforms such as Hadoop, NoSQL, etc. providing them an opportunity for storing the structured digital content and unstructured data within the same platform and also providing them an option to analyze the incoming real time data to understand crime patterns within their jurisdictions.

4.1 Challenges

Using predictive policing tools and technologies in a democratic society being governed by the rule of law, it is extremely important to respect the fundamental rights of individuals. Thus, while using analytics tools, challenges that are intrinsic to predictive approaches being followed by the law enforcement agencies should be avoided. One of the most important areas under consideration is the danger of an erosion of privacy and other fundamental rights and democratic principles like the presumption of innocence and the prohibition of penalties without a law.

The past decade has witnessed quite a steep rise in the crime rates in India. As per the reports by National Crime Records Bureau, cognizable crimes have witnessed the largest increase of approximately 63%. Departmentalized investigations are not capable of providing a holistic picture to aid the law enforcement agencies. To counter and to effectively handle the critical law and order situations, a holistic analysis of different facets of the information is necessary.

A. Policy

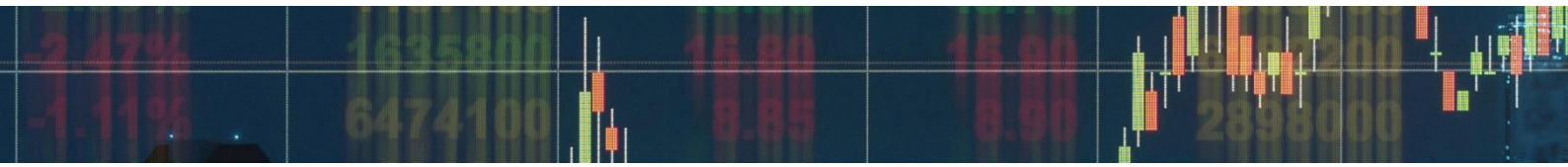
1. **Inadequate safeguards to prevent misuse**
   Predictive policing involves a precautionary response to the threat of crime on a day-to-day basis. This preventive measure also raises concerns about inconveniencing and infringing on the rights of innocent people. The Code of Criminal Procedure in India currently provides a provision to arrest upon suspicion13. Thus, any abuse of predictive policing system could lead to groundless arrests and internment without a suitable cause.

2. **Privacy**
   Use of data to determine hotspots or heat maps may not be a privacy concern, but use of data to identify likely individual offenders poses a privacy issue14. Analysis of any personal information may attract the attention of public and institutions. People are concerned with the use of their personal information and most of them may not want to reveal about their behavior.

3. **Amplification**
   Data driven decision-making systems are prone to amplifying the prevailing inequities in knowledge. Any intervention to rectify the information conjointly feeds into the information in predictive policing that informs decisions. The predictive technologies face a drag of discrimination that is an institutional bias (there are implicit biases in data).15

4. **Inscrutability of algorithms**
   Predictive policing algorithms in many circumstances are inscrutable to the courts. Therefore, current constitutional laws that are meant to prevent discrimination are not effective.15

[13] http://lawcommissionofindia.nic.in/reports/177rptp2.pdf
[14] https://www.researchgate.net/publication/272791309_Privacy_in_the_Information_Age_A_Guide_for_Sharing_Crime_Maps_and_Spatial_Data
[15] http://www2.caict.ac.cn/zscp/qqzkgz/qqzkgz_zdzsq/201704/P020170401531116706571.pdf



B. Technology:

5. **Data ideology**
   Predictive policing involves over-reliance on data and it ignores many other factors. For instance, areas pointed out by heat maps or hotspot analysis are the areas considered for police patrolling by ignoring the other areas. 16

6. **Opacity of predictive models**
   Predictive models are governed by what algorithm is written. It essentially draws attention to the data being used, assumptions being considered and the kind of contextual questions asked by algorithm as being entirely opaque.

7. **Security**
   Security of the data which will be used for performing analysis and storing the reports after analytics on the premise of an institution is a big concern. Need for good infrastructure facility for data safety and security should be considered.17

8. **Data capture and storage**
   Data can be captured from various sources at a high speed and to store the captured data is a challenge in itself. Data sources can be various social media platforms, cell phones, weather forecast reports, websites and other government agencies like Unique Identification Authority of India (UIDAI), Crime and Criminal Tracking Network and Systems (CCTNS) and National Crime Records Bureau (NCRB) after following the due data security and confidentiality procedures.

9. **Over-reliance on technology**
   It is a tendency to believe that new technology will solve old problems. However, technology is just a tool to achieve the means. Predictive policing systems are in a position to analyze the information, but it is the responsibility of people using these systems to interpret the output in a method that's fair and just.18

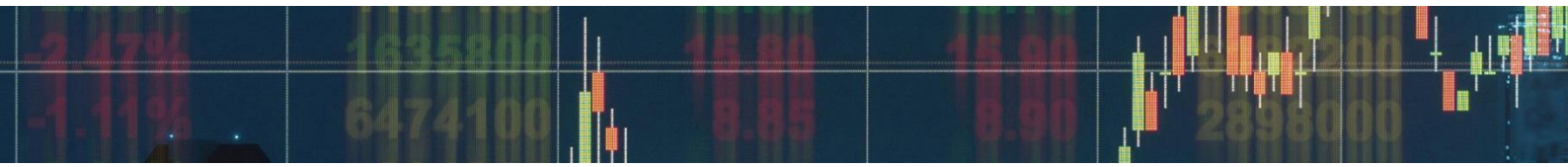
10. **Cybercrime**
    Criminal innovation is another major challenge to be addressed. The data harnessed by law enforcement agencies for predictive policing to prevent and disrupt criminal activity is also valuable to criminals as it enables criminals to commit more sophisticated cyber-enabled crimes. Thus, it is important to protect such data from cyber-attacks.

4.2 Case studies

A. **Delhi Police**
   Delhi Police has been developing an ability to identify the crime hotspots and reduce the possibility of any repetition of crimes in the region through a new software called CMAPS (Crime Mapping Analytics and Predictive System). The web-based software has real-time access to Delhi Police's Dial 100 helpline data and, using ISRO's satellite imageries, the application will spatially locate the calls and visualize them as cluster maps to identify crime hotspots.[19]

B. **Jharkhand Police**
   The Open Group on E-governance (OGE), founded as a collaboration between the Jharkhand Police and National Informatics Centre is a multi-disciplinary group that is responsible for different projects related to information technology in the state. There have been proactive efforts towards developing capabilities in predictive policing, OGE undertook development of data mining software that shall be able to scan online records that are digitized. These are anticipated to act as building blocks for the predictive policing project being thought of by the state police.[19]

C. **Maharashtra Police**
   As a part of cyber security modernization program, the Maharashtra government is working to upgrade its digital technology-based policy to include "predictive policing policy". It is envisaged that the initiative will help law enforcement agencies predict, prevent and detect cybercrimes. In addition to changes in policy, the state government will form an agency called "MH-CERT", similar to Centre's Computer Emergency Response Team (CERT). The agency can cut back the state's dependence on the center to tackle instances wherever social media is employed to fan rumors which will cause a law and order problem. With the predictive policing, police can analyze the social media information in real-time basis to spot people who are attempting to fuel unrest.[20]



D. National Crime Records Bureau (NCRB)

The National Crime Records Bureau (NCRB) in association with Hyderabad-based Advanced Data Research Institute (ADRIN) has been developing a software to utilize crime data for analytics purpose to enable predictive policing. Project uses big data analytics to predict geographical areas where crime is most likely to take place, after taking into account various factors followed by analysis. Based on the analysis, police can plan patrolling, deployment of resources and surveillance so that offences do not take place.

One of the key features of this path-breaking project is hotspot analysis, where law enforcement agencies can analyze and predict geographical areas of increased crime on the premise of crime information. Hotspot analysis can process all patterns with reference to time of incidence, actual locations, even shops, hotels, bars or different establishments. [21]

E. Hyderabad Police

Hyderabad Police has entered into a MoU with Synchrony Financial for installation of community closed circuit television (CCTV) surveillance system in the city. The cctv-based video surveillance system involves setting up of IP-based outdoor security surveillance cameras, automatic number plate recognition system (ANPR), video analytics, mobile surveillance system, command and control center and data center, etc.

Proposed system would include multi-agency operation center and every department would have a place for its technology teams where the CCTV footage could be analyzed and feedback obtained to empower their respective field operation teams. [22]

F. Kolkata Police

Kolkata police have proposed a system using analytics to effectively manage city traffic and optimize the number of vehicles passing through the intersections based on the data derived from Google maps. The aim of proposed system is to predict the exact signal cycle based on the input from real-time traffic data from Google maps and then calculating the traffic lines at intersections throughout the city. All the signals in city are connected though Wi-Fi thus paving a way to manage signals centrally.[23]

[16] https://www.floridatechonline.com/blog/criminal-justice/4-problems-with-predictive-policing/
[17]https://www.ifc.org/wps/wcm/connect/IFC+Data+Analytics+and+Digital+Financial+Services+Handbook.pdf?MOD=AJPERES
[18] https://www.floridatechonline.com/blog/criminal-justice/4-problems-with-predictive-policing/
[19]https://cis-india.org/internet-governance/blog/predictive-policing-what-is-it-how-it-works-and-it-legal-implications
[20] https://indianexpress.com/article/india/maharashtra-government-to-come-up-with-predictive-policing-policy-5097896
[21]http://www.newindianexpress.com/nation/2017/sep/23/indian-police-to-be-armed-with-big-data-software-to-predict-crime-1661708.html
[22] https://timesofindia.indiatimes.com/city/hyderabad/Synchrony-Financial-to-install-CCTV-surveillance-system-in-Hyd/articleshow/54673626.cms
[23] https://www.analyticsvidhya.com/blog/2018/01/kolkata-analytics-google-maps-traffic/

Way forward

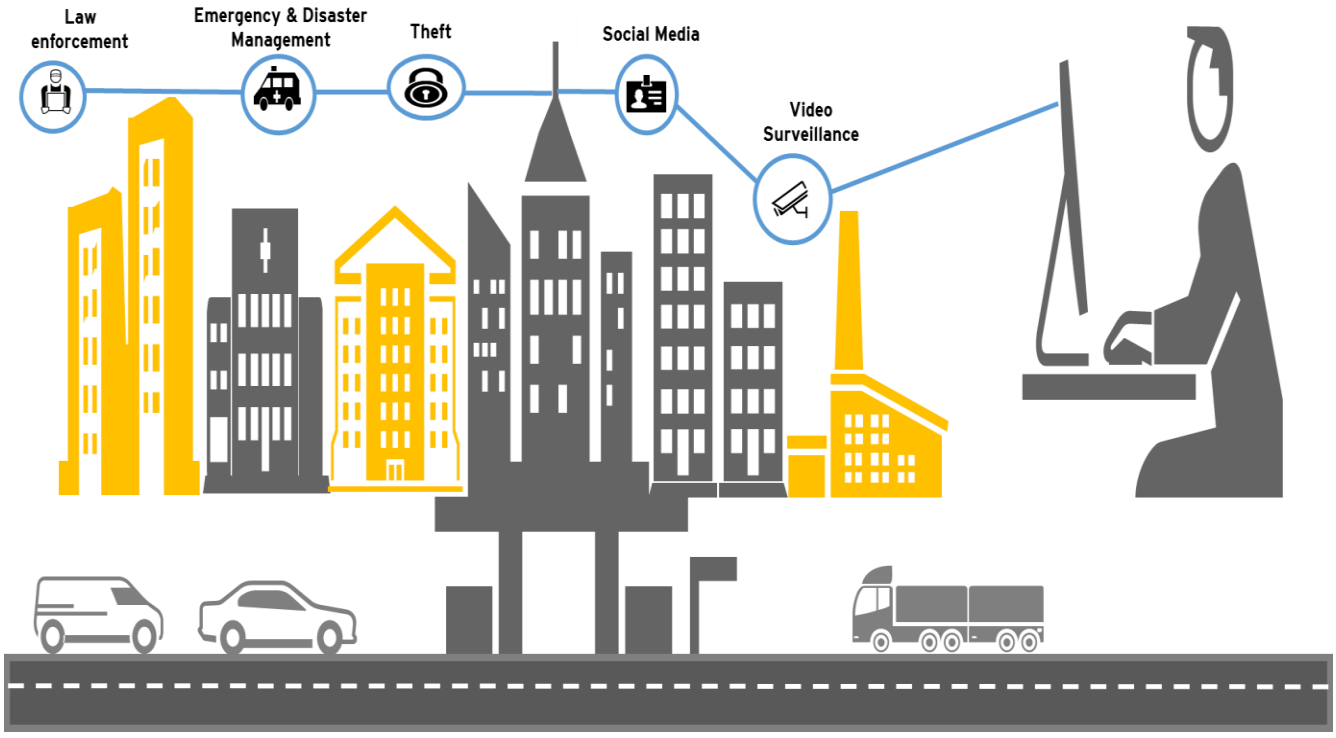

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By Date
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167.00
156.50
146.00
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24 May
03 Jun
24.02M
974.6K
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Way forward

As we have seen in this discussion paper, predictive policing promises to be a game changing concept. It is understood that the application of analytical and quantitative approaches will continue to be an important part of police activities. While it is predictive in nature, the effort involves crunching data of past crimes to forecast and thus, in essence it is largely reactionary policing with a proactive approach. Predictive policing begins with data analysis, so it is important that the law enforcement agencies understand the data and goal of the analysis.

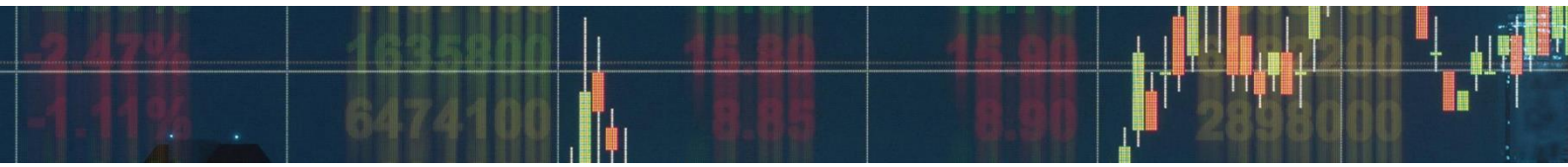
It is extremely important to obtain the concurrence of user agencies and to understand the context in which the tools are supposed to be used. In addition, the agencies are required to work closely with analysts to ensure that their findings are tactically useful and able to reduce the rates of crimes prevalent in the society. Going forward, police administrators must deal with the proper scope of data collection, retention and use and be able to explain to the public how data is being used to enhance public safety.

As evident, at the center of predictive policing is data: crime data, FIR data, personal data, gang data, social data, associational data, locational data, environmental data, social media data, behavioral data, consumer transactions data, personal communications, surveillance sources data and a growing web of sensors. The use of big data in world of law enforcement is still largely in its early stages but offers more incriminating bits of data to use and study. With the advent of technologies, law enforcement agencies can resort to finding suspicious activity from the digital trail that is left behind by the criminal.



One of the illustrations of the usage of predictive policing in future can be the reading machines that may get into the main stream by mid-2040s. While this tech will have profound ramifications on how courts operate and how innocence and guilt are proven, it will have an equally insightful impact on how we forecast crime.[24]

[24] https://www.independent.co.uk/news/uk/home-news/police-big-data-technology-predict-crime-hotspot-mapping-rusi-report-research-minority-report-a7963706.html



Consider a scenario where by the late 2040s, laws are passed by governments around the world stipulating the need of handing over the contents of their online profiles, have their psychological profiles assessed by psychologists and their thought profiles documented by the thought reading machines.[25]

Once all existing and new prisoners have been assessed, their digital, psychological, thought, demographic and criminal records will be shared with the national criminal investigations supercomputer. The thought profiles of millions of prisoners will be analyzed and statistically modeled against their public metadata with the goal of isolating a collection of detailed criminal profile types. In other words, the computer will create a series of archetypes that possess a certain set of attributes that predict a certain level of criminal inclination. These criminal profiles will then be compared against the profiles of every citizen in the state.

Another illustrative application of predictive policing can be its usage with the UAV technology. With the advancements in UAV technology, many sensors that are essential to monitor and help the law enforcement agencies can be built-in various applications. Data from these various sources can then be transferred on a real-time basis to computers capable of performing complex calculations.

As the processing of data becomes efficient and with even more refined predictive algorithms, machines can autonomously drive the UAVs remotely to monitor the crime sensitive areas[26]. This step forward in the future would enable the law enforcement agencies to reach places quickly and thus assist them in becoming omnipresent towards protecting the cities. If the cameras on UAVs are enabled with facial recognition and retina scanner, then real-time identification of individuals captured on any camera can simply help map and track the missing persons, fugitive and suspects. If the drone hovering above is able to record any incident, artificial intelligence/ deep learning shall be able to calculate the distance from nearest police station or patrolling vehicle and provide a firsthand information about the incident. Alerting the police department is just a small step, but artificial intelligence/ deep learning is capable of guiding the police patrols to the crime sites with interactive conversations.

The potential of predictive policing in law enforcement is indisputably real and so is the fear of invading into the privacy of community. The ever increasing law and order rhetoric can also lead to surveillance overreach. Police supervisors, advocates, communities and the corresponding governments are required to address these concerns before venturing into any large scale implementation of such technologies.

It is critically important to analyze the applications of predictive policing across the multi-faceted procedures being followed within the criminal justice system. In fact, it has been assessed that in the different stages of a criminal procedure, from starting an investigation to gathering evidence, followed by arrest, trial, conviction and sentencing, as the individual gets subjected to serious sanctions and punitive actions by the law enforcement agencies, the system is able to obtain a higher standard of certainty about the crimes committed by the individual through predictive policing that also helps in legitimizing the particular action by agencies.

Given that the nature of predictive evidence is probability based, it can be inferred that arrest warrants or trials, on their own can have a tangible impact. Predictive policing under the current scenario has been designed to calculate the risk of future crime occurring based on statistical analysis of past crime data. It is also important to deploy need-based and customized applications as per the unique requirements of the agencies.

Smaller agencies may not need expensive software and agencies of any size should compare open-source alternatives to commercial products. Larger agencies will want to consider more sophisticated systems. However, the key for agencies of all sizes is to think of the tools as providing situational awareness rather than crystal balls. The systems should help agencies understand the where, when and who of crime and identify the specific problems driving that criminal activity; this information will help support interventions to address these problems and reduce crime.

[25] https://www.quantumrun.com/prediction/predicting-crimes-they-happen-future-policing-p4
[26]https://www.digitaltrends.com/features/dt10-crime-from-drones-to-body-cams-tech-is-changing-the-fight-against-crime/

FICCI Homeland Security Department

FICCI has many specialised committees where key concerns of the industry are debated and discussed with the specific aim of presenting the recommendations to the Government for favourable decisions.

Considering internal security is the backbone of growth and overall development of the nation, FICCI has constituted a Committee on Homeland Security (HLS), which is working towards bridging the gap between policing and technology.

Some of the focus areas:

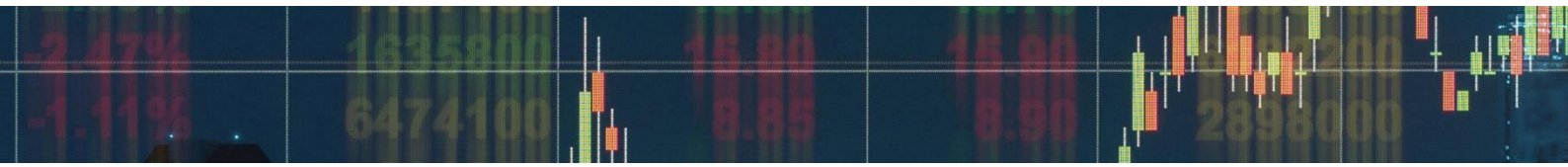
SMART Policing: FICCI has instituted the first ever SMART Policing Awards in India for best practices in SMART Policing, with the objective to promote initiatives taken by the Police for safety and security of Indian citizens. This can change public perception and build positive and progressive image of the police among people. FICCI SMART Policing Awards provide a platform to police officials across India to learn from the experiences of other states and also for possible adoption of the best practices to further enhance policing in their respective states.

Police Modernisation: FICCI is working towards bridging the gap between policing and technology. We engage with various enforcement agencies and provide them a platform to interact with industry, to articulate their requirements and to understand new technologies for security. This initiative is under our umbrella theme of "Modernisation of India's Internal Security Mechanism".

Smart Border Management: FICCI is working towards addressing the emerging challenges faced by India in smart border management, by bringing stakeholders together to discuss how India can create smart borders that, on the one hand, allow enhanced trans-border movement of peoples, goods and ideas, and on the other, minimise potential for cross-border security challenges.

Indian Unmanned Aerial Vehicle (UAV) Policy & Regulations: FICCI has set-up Working Groups in areas of: (a) enabling regulations for developmental use of UAVs, and prevention of rouge UAVs; (b) framework for permission and licencing for manufacturing of UAVs; and (c) technological structure for detection and neutralisation of unidentified UAVs. FICCI has recently submitted its preliminary suggestions and recommendation for Indian UAV Policy & Regulations to the NITI Aayog, Ministry of Home Affairs and Directorate General of Civil Aviation.

Policy for Public Procurement in Internal Security: FICCI is working towards advocacy for bringing well-defined procedures for fair and transparent procurement of security products and solutions, so as to provide level playing field to the industry. Although the Central Armed Police Forces (CAPFs) and State Police Forces are guided by the same policies and guidelines for public procurement as other government organizations, the nature and requirements of public procurement process for police forces is different from that of the general government departments. FICCI has provided policy inputs to the Government of India for numerous challenges in regard to procurement by Internal Security forces, in the areas of policies and regulations, processes, technological advancements and capacity-building.



Cyber Crime Management: FICCI has initiated working towards promoting development and implementation, of systems and concepts to combat cyber-crime as well as improve cyber security.

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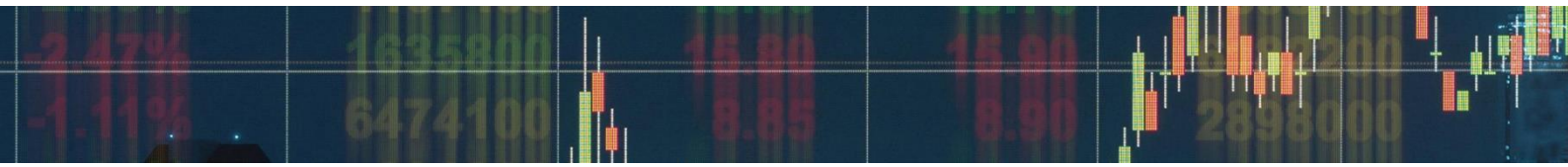
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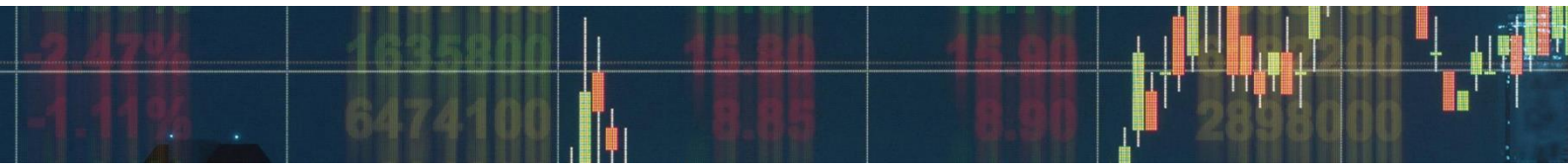
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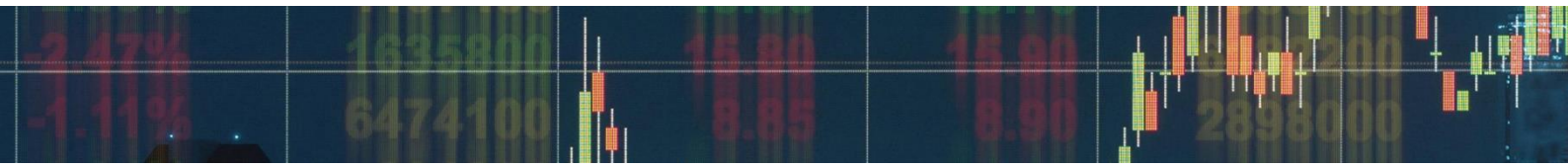
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A non-government, not-for-profit organisation, FICCI is the voice of India's business and industry. From influencing policy to encouraging debate, engaging with policy makers and civil society, FICCI articulates the views and concerns of industry. It serves its members from the Indian private and public corporate sectors and multinational companies, drawing its strength from diverse regional chambers of commerce and industry across states, reaching out to over 2,50,000 companies.

FICCI provides a platform for networking and consensus building within and across sectors and is the first port of call for Indian industry, policy makers and the international business community.

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