Crime Prevention And Evaluation Using Advanced Techniques

ABSTRACT
The study's objective is to suggest a methodology for crime prevention and provide an opportunity to reduce criminal acts or incidents and improve the chances of arrest and conviction of lawbreakers. To understand the challenges of preventing crime and devise a method of effective prevention. Specifically,

1. To improve the response mechanism of provincial police teams towards crime reports. It will evaluate the formation of crime incidents and their pattern of occurrence concerning geography, season and related crimes.

2. To generate advanced triggers of crime occurrence. This will suggest the implementation of predictive triggers for crime prevention and the sharing of intelligence to manage crime.

3. To improve the conviction rate of criminal cases using richer data and evidence. This will identify the factors and their interactive relationships that influence crime prevention attempts using test data.

Statement of the Problem

Crime prevention approaches to the betterment of crime detection can prevent the occurrence of criminal incidents and manage the image of police forces. For example, understanding the crime pattern within a given jurisdiction limit could be a sequential occurrence, one after another, in a shorter period or may be correlated with a similar or related crime occurring in a nearby jurisdiction. Such patterns can generate triggers, which can alert the law enforcement agency of a likely outcome. These triggers can be shared real time to alert the agents across multiple jurisdictions and to act collaboratively prevent the crime. This study intends to highlight the policy action that crime incidents can be prevented by information based response which can be implemented by the police forces. This proposal seeks to suggest a methodology of crime prevention and provides for opportunity to reduce criminal acts or incidents and improve the chances of arrest and conviction of law breakers.

Table 1 below provides the total crime against women in Jharkhand, West Bengal & Odisha from 2010 to 2012, which has increased from 21,3585(2010) to 22 8650 (2011) and 24, 4270(2012).

Source: NCRB 2019, Tables on Crime against Women, MHA

Table 2 below provides the total IPC crimes reported in three districts (Ranchi, Hooghly & Cuttack) in Jharkhand, West Bengal & Odisha from 2001 to 2016, which has increased manifold.

Seasonality in crime rates is also observed for almost all states in India, which may be related to festivals, disbursal of bonus payments, arrival of tourists, rainy season, rise in gold price, hot summer, etc. There is much discussion now to use technology in governance and to use technology, especially in police services, due to the growing menace of crime against women in India. The reasons for the ever increasing menace of crime against women could be changing

socio-cultural mindset, lack of awareness about a possible “illegal act”, increasing mobility of women to seek social recognition or income enhancement, changes in lifestyle in general, ignorance of women about a potential “response of men”, etc. For example, incidence of a rape, molestation, ‘attempt to life-threatening action’ or acid attack or chain snatching, etc. fatal action could be a result of a robbery for gain or chain snatching or loot for gain, etc.
This proposal will provide the crime impact using NCRB (SCRB) data. The study will also describe the crime prevention literature including its theoretical foundations and the types of data and methods used to generate predictions which are feasibly implemented within the available scope of NCRB data.

Overview of literature

(Summarizing the current status of research in the area, including major findings, the project proposal should clearly demonstrate the relevance or insufficiency of the findings or

Kraemer et al. (1997) argued that only risk factors that can change within individuals can have causal effects between individuals. For example, unemployment is a risk factor for committing an offense (West and Farrington, 1977). However, unemployment is a risk factor for offending since people are more likely to offend during their periods of unemployment than during their periods of active employment (Farrington et al., 1986). The social contexts are also important for individuals to commit an offence. An individual who is part of a gang contributes to offence compared to a non-gang member (Pyrooz & Decker, 2013). Crime follows a trend, and each offense needs special care to be able to be drilled down to the offender. Spatial methods, such as clustering algorithms and density mapping, are used to detect high-risk pockets and subzones. Methods that exploit variation in both time and space can be used to forecast the next crime occurrence in sequence. Time series models that explore the relationship between the size of the crime-prone age population and crime rates generally indicate that both the property and violent crime rates are greatly influenced by whether the number of young men in a society is rising or falling (Fox; Pyle & Deadman; Field; Dhiri et al., Snyder & Sickmund, 1999; Deadman).
Pure heuristic models, such as decision tree models, are also aided by modern random forest or neural network packages that build on a tree model in the dataset. The random forest developed from similar approaches (supervised learning models) are filters to select or deselect bands of space or time or socio-demographic attributes (or zip codes) to create pockets or zones of umpteen interest. Few of these zones created using heuristic logic (if then else) would contain a more significant concentration of crime events than a few others, which should contain almost none (crime). This can help the modeller concentrate only on a few sizable pockets for further investigation, deeper learning, and careful evaluation of the interdependence of the system.Corcoran(2006) uses circular statistics to see the timing patterns of criminal acts daily and weekly. Circular statistics is a distribution model and statistical technique to analyse random variables of the cycle in nature. Circular statistics is used on data with direction-measurement output and is usually expressed in angular size. This technique has developed in some branches of science in which exploration, modelling, and hypothesis trials from directional data and angles have a crucial role.
Video Analysis:
In recent years, face detection has achieved considerable attention from researchers in biometrics, pattern recognition, and computer vision groups. Support vector machine (SVM)SVMs have also been used for face detection (Mingxinget al.2013). SVMs are a new paradigm for training polynomial functions, neural networks, and radial basis function (RBF) classifiers. SVMs work on the induction principle, called structural risk minimisation, which

targets to minimise an upper bound on the expected generalisation error. An SVM classifier is a linear classifier where the separating hyperplane is chosen to minimise the expected classification error of the unseen test patterns. Based on two test sets of 10,000,000 test patterns of 19×19 pixels, their system has slightly lower error rates and runs approximately 30 times faster than the system. SVMs have also been used to detect faces and pedestrians in the wavelet domain. Principal component analysis (PCA)PCA is a technique based on the concept of Eigenfaces (Kirby and Sirovich1990). Turk and Pentland proposed PCA for face recognition and detection. Similarly, PCA on a training set of face images is performed to generate the Eigenfaces in face space (Turk and Pentland1991). Images of faces are projected onto the subspace and clustered. Similarly, non-face training images are projected onto the same subspace and clustered. To detect the presence of a face in a scene, the distance between an image region and the face space is computed for all locations in the image. The result of calculating the distance from face space is a face map.

Methodology

- analyse the present scenario of crime in India.
- predict crime scenario after five years.
- suggest policing mechanisms to reduce the crime rate in reference to the prediction.
- study the technologies used by police in the digital era.
- Analyse the challenges and limitations faced by using technologies in policing.
- study the technologies used by other countries.
- suggest measures to mitigate the challenges and limitations faced in using technologies in policing.

conceptual framework

The dimensions of the problem exist, namely longitude, latitude, and time, where distance can be calculated from the coordinates or location. The accomplice and the offender are characterised by attributes such as ;

- zip codes (Beat Numbers)
- ordinariliy resident (long, lat)
- crime event (long, lat)
- distance and time from his ordinary residence
- hiding (resting) place (long, lat)
- distance and time from crime event
- disposal place (long, lat)
- distance and time from crime event
- socio-demography of offender and accomplice (age, education, parental history)
- socio-demography of the victim(s) (age, education, parental history)
- other attributes

The spatial Durbin model proposed by Anselin (1988) is suggested for examining space, time, and socio-demographic attributes.

$$y=\rho Wy+\beta 1X1+\beta 2WX1+\beta 3X2+\varepsilon \qquad Eq(2)$$

where y is the dependent variable (crime).

W is the inverse-distance spatial-weighting matrix,

ρ is the spatial autoregression parameter, representing the spatial dependency of neighbors' dependent variable.

β_1 is the regression coefficient of the independent variable X_1, and

β_2 is the regression coefficient of the other independent variable X_1, weighted by the inverse-distance weighting matrix.
β_3 is the regression coefficient of a covariate X_2.
ε is the error term having a mean of 0 and a variance of σ^2.
Further, a predictive form of the variable y where y follows a logistic distribution is as follows;

$$Log\ (p/1\text{-}p)=\rho Wy+\beta 1X1+\beta 2WX1+\beta 3X2+\varepsilon \qquad Eq(3)$$

When p is the probability of occurrence of a crime event,
Log (p/1-p) is the Log Odd's ratio of the occurrence of a crime event. In the predictor model of the likely occurrence of a crime event, the individual values Log (p/1-p) are the scores to distinguish between a false positive and a *false negative.*

Figure 1 below describes the applications of spatial regression models on datasets.



FIGURE 1: CELLS OF CRIME CONCENTRATION

Model Variables

V.iiAdavancedMuti-stage Models;

The best model is never a one-shot model, which may fail in prediction in future implementation datasets. The best model is the one that combines at least two techniques that are implemented on the same dataset, one after the other. The first model could be heuristic (hierarchical) and the second model could be predictive (regression) or vice versa. Using two models one after another will boost the overall predictive accuracy of the model(s), so the joint deployment of two or more models will reduce the total errors in precision (Type I Error + Type II Error). Both Type I Errors & Type II Errors are critical because the Police petrol team must not waste their time on a wrong visit call, or, conversely, missing the right target is a question of life and death for the victim.
For example, a heuristic model (Decision Tree Model) can create splits of zipcode(s) and time (month) in the dataset as beginning triggers or common attributes across zones. This will flag the zones of interest. In the second step, each flagged zone can be analysed with the help of a spatial regression forecast model to select specific variables from the socio-demographic

indicators. This means that for each flagged zone, the particular chosen variables by each model could be different across the different areas. For example, for a large city like New Delhi, the total number of zones could exceed 40 (four) or more.

VI. Research Questions or hypotheses

Research Questions or Hypotheses

1. It is possible to create hotspot segments using KMM models which has distinguishable characteristics.
2. The occurrence of crime is strongly correlated with time-stamped—prior crime events.
3. The occurrence of crime is strongly associated with the contemporaneous occurrence in the vicinity of the reported location.
4. short-term triggers cause temporary spikes in report rates (e.g., lockdowns, loss of jobs, heavy rainfalls, cold winters, hotter summers, elections, open-air concerts, train delays, fall in new LL application rates, etc.)

References

1. Anila S, Devarajan N (2010) Simple and fast face detection system based on edges. Int J UnivComputSci2(1):54–58.

VII. ResearchMethodology

The NCRB includes the following categories of assault; only three or more categories, such as Immoral Traffic, Molestation, and Dowry Prohibition, are the maximum share of cases filed.

i. financial crime
ii. money crimes
iii. money laundering
iv. black money accumulation
v. forensic accounting violations

i. Coverage

The coverage includes three states and three districts, as given below in Table 3;

	Universe of study	1. 30 States		Total
		2 Union Territories		6434
	Samplingframe	State		10
		WEST BENGAL JHARKHAND ODISHA		2407
	Sample Districts	District		2860
		HOOGHLY RANCHI CUTTACK		3663
	Samplingprocedure	Stratified Random		85
		Periods		3663
		Crime Type		3973
				6434
				10
	6434	6434	6434	6434
	10	10	10	10

	2407	2407	2407	2407
	2860	2860	2860	2860
	3663	3663	3663	3663
	85	85	85	85
	3663	3663	3663	3663
	3973	3973	3973	3973
	6434	6434	6434	6434
Source: Authors' calculation				