

Adopting Artificial Intelligence-Based Predictive Policing in Nigeria: Prospects and Difficulties

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Abstract

Nigeria's criminal landscape is characterised by various crimes, violence, terrorism, political unrest, and alienation of citizens. Nigeria ranked fifth in Africa and twelfth globally in terms of genocide risk as of the end of 2023. With a population of more than 200 million, a high rate of child mortality, continuous deaths from battle, the nation's own history of mass murder, and ethnic fragmentation all contribute to this risk. The conventional policing techniques in Nigeria has not provided adequate crime mitigation due to several factors. This paper canvases the concept and implementation of Artificial Intelligence policing or predictive policing, which is a technique that involves gathering and analysing data from multiple sources, then applying the findings to better predict, mitigate, respond, and react to future crimes while effectively allocating resources. The author determined important police domains where AI has the potential to be highly beneficial because of this research. This paper offers a thorough analysis of the literature and qualitative research methodology with an emphasis on investigating the artificial intelligence strategies used by law enforcement. It provides a roadmap for future creative solutions and advances, understanding of the possible advantages and difficulties of incorporating AI into policing practice. The privacy and legal concerns around the use of AI in law enforcement are the research's main constraints. The paper additionally, provides a summary of the primary features of the predictive policing schemes that are now recognised and its applicability to Nigeria. One of the major constraints to this technological implementation is the epileptic energy supply in Nigeria.

Keywords: Artificial Intelligence, Predictive Policing, Forecasting, Crime Management, Nigerian Law Enforcement.

Introduction

There are several definitions of policing but the context of it changes depending on how individuals interpret it. Policing is the function of the police in safeguarding the nation's citizens' property and welfare. Reactive tactics have dominated crime control measures in the past, whereas the goal of policing was to react swiftly to crimes and situations. The professional approach, which was based on three pillars—preventive round, fast reaction, and continuation inquiry—was standard for police for many years (Johnson, 2013). But the paradigm for policing also shifted from reactionary to proactively as the crime and security landscape evolved. Rather than only responding to crime, proactive action seeks to prevent

it. Research has demonstrated that proactive policing has a stronger correlation with crime prevention than reactive policing. Proactive policing was taken into consideration when developing crime prevention techniques including sagacity-led policing, society-oriented supervising, and challenge-driven police. Predictive watching is a novel proactive data-driven policing approach that has surfaced in recent decades.

Unquestionably, the use of computers in conjunction with conventional techniques is essential to the future of law enforcement. Digitisation, cell phones & tablets, and sensors have generated vast amounts of data, particularly personal information, during the last decade. The "Big Data" age was brought forth by this, when companies try to harness the massive volumes of mixed format data that flow with rapid changes. There are numerous analysis methods that emerged, like: (a) Descriptive deconstruction, such as data aggregation and mining, can provide insights & draw interpretation from the past. (b) Predictive analytics employing statistical and forecasting methods to anticipate future events. (c) Prescriptive analytics, which use simulation and optimization techniques to offer guidance on potential courses of action and results.

There is possibility for descriptive analyses to enhance comprehension of incidents and crime patterns. Extrapolative approaches allow law enforcement departments plan and use their resources more strategically and tactically with greater coherence. The intent is processing multi-origin, diverse, complicated, frequently ill-defined data providing comprehension on crime-associated situations, activity courses, outlines, and tendencies. Hot spot is "an location with an increased than normal rate of criminal or disorderly incidents, or one where individuals are more likely to become victims " (Eck et al., 2005). In order to find crime hotspots instantaneously, strong electronic crime mapping applications are applied. Pattern-matching and algorithmic searches comb through massive police records filled with ever-increasing amounts of data to find individuals who are probably going to be victimised (or commit) crime, locations that are likely to be the scene of it, and factors related to its solving capacity.

These advanced analytics technologies are becoming more and more useful for governments and law enforcement organizations, even though they can be applied in a variety of settings. A particular strategy deployed by police & in the battle against crime is Artificial Intelligence Policing [AIP] or Predictive Policing [PP]. AIP or PP in law enforcement and crime prevention is the application of evaluation methods to pinpoint potential areas for police involvement in an effort to deter crime (Perry, 2013). Utilising technology, such as big data analytics, simulations and, sophisticated algorithms to anticipate possible criminal activity is known as predictive policing.

Forecasts of the crimes that will be committed throughout period and space are centered in part around "place criminology." Criminology of place scrutinises the role that micro-geography plays in comprehending and avoiding crime. It looks at how local geographic areas—often represented as dwellings or street segments—contribute to crime in cities. Identifies and emphasises the significance of geographical microunits as social structures that are pertinent to the issue of crime.

This creative application of vast amounts of historical and current data is a potent instrument for preemptively addressing crimes before they occur. Artificial intelligence and policing offer important perceptions into how the broader pattern of technopoly—in which all facets of society, culture, and economy are subsumed under the umbrella of technology—emerged. Artificial intelligence (AI) is fundamental Industry 4.0, or the Fourth Industrial Revolution, technology. AI, a modern technical discipline, researches, and matures ideas, procedures, practices, as well as implementations to imitate, extend, expand anthropoid intellect (Smith & Eckroth, 2017). Computational simulation with cognitive ability, which enables computers to perform tasks that often require human intellect like: learning, reasoning, solving problems, deciphering spoken language, and reaching independent conclusions. Furthermore, AI platforms use data, algorithms, and computing capacity to evaluate and process information, alter direction when needed and continuously enhance performance.

AI policing's primary goal is to use analytics on data to identify potentially promising crime trends and assist law enforcement in staying one step ahead of criminal activity. AI capacities reduce unnecessary labour, speed up various forms of police work, encourage police forces to further competently allot means, and give police officers the ability to deter crime and shield citizens from a range of potential dangers. Stated differently, generating crime forecasts is the main focus of predictive policing; these predictions are then used to improve crime prevention tactics and help identify new trends and patterns in criminal activity (Bennett Moses & Chan, 2018; McCue, 2014).

Method/Literature Review

This paper examines the use of artificial intelligence (AI) in law enforcement using a qualitative research methodology and an exhaustive literature review. A literature review is a suitable approach for combining the body of knowledge, spotting research gaps, and offering a more thorough comprehension of the ways in which AI technologies are being incorporated into different facets of criminal justice, including policing. This paper attempts to objectively explore the advantages, difficulties, moral ramifications, and societal effects of AI applications in the criminal justice system by evaluating and assessing a broad range of scholarly articles, books, reports, and case studies.

Peer-reviewed journal articles, books, conference proceedings, policy studies, and official documents from governmental and nongovernmental organisations engaged in technology regulation, law enforcement, and criminal justice are among the sources of information used in this literature study. To guarantee the inclusion of a range of viewpoints and thorough coverage of the subject, these sources were accessed via reputable academic resources like JSTOR, Google Scholar, IEEE Xplore, Scopus, and Web of Science in addition to legal and governmental databases. To capture the most recent advancements and trends in the area, the inclusion criteria for choosing papers were based on their applicability to the themes of AI applications in predictive policing, criminal procedure with a special emphasis on studies released during the previous ten to fifteen years.

In order to gather data, a thorough search of the literature was conducted using particular keywords, including "artificial intelligence," "law enforcement," "predictive policing," "machine learning," and "ethical implications." A wide range of publications addressing the theoretical and practical aspects of artificial intelligence (AI) in criminal justice, including its technological, legal, moral, and social components, were intended to be captured by the search method. This exhaustive methodology made sure that a wide range of viewpoints and discoveries pertinent to the application of AI in policing were covered in the review.

Compared to Western countries, policing in Africa is less well defined in practice, and its definition probably has to be broadened to include more than only the activities of official organizations (Reiner, 2010). Crimes and illicit activities appear to be an inevitable component of our modern civilization, based on current happenings worldwide, especially in Nigeria (Ikporukpo, 2007). Oyemwinmina and Aibieyi (2016) outlined the obstacles to Nigerian law enforcement's efficacy and efficiency. An alternate method of Nigerian policing was mentioned in a paper by (Kasali & Odetola, 2016). They said that, in general, community policing has not resulted in significant advancements in crime reduction, not because the strategy is ineffectual but rather because the idea has been misused and poorly executed. In reaction to what seems to be a high frequency of crime in Nigeria, the police have created strategies to minimize crime and criminal behaviour, including stop, search, detention, information collection, surveillance, and undercover operations. However, these strategies proved to be ineffective, which was ascribed to the many challenges the Nigerian security system faces, such as the general lack of public cooperation, insufficient tools for preventing and controlling crime, a shortage of personnel, and insufficient funding, among others (Yunusa & Usman, 2022). Their article looks at the feasibility, acceptance, and application of state police in Nigeria as a way to enhance crime avoidance and management. Routine Activity Theory (RAT) was used in their study to demonstrate how decentralized policing tactics can improve guardianship, lower crime rates, and more successfully meet local security needs (Onuoha et al., 2024). The cross-sectional survey method was employed by Frank and Binpe (2014) as a research technique and tool to gather information from interviewees regarding the topic of interest. Six hundred sample sizes were picked utilizing the multi-stage, simple (probability) random sampling and purposeful technique to choose the respondents. Employed Statistical Pack Social Sciences (SPSS) in probing collected data. Using Pearson's Product Moment Correlation, hypotheses were developed and evaluated. It was discovered that the police perform better and are more effective when they employ ICT and other technologies. Shah et al. (2021) draws attention to the necessity for more potent crime inhibition measures considering growing number cum criminal activity, taking into account how well computer vision together with machine learning operates. Authors suggested using machine learning, computer visualisation algorithms and ways to determine, stop, and resolve criminal issues. They maintained computer visual in addition to ML can assist law execution organizations in developing, becoming extra effective, and that conventional detective work techniques are ineffectual given the present rise in crime. According to Daukere et al. (2023), the states with the

highest percentages of indigenous police personnel were Adamawa, Akwa-Ibom, Benue, Edo, and Kogi; the states with the lowest percentages were Anambra, Bauchi, Federal Capital Territory (FCT), Jigawa, Kano, Lagos, Oyo, and Sokoto. The study discovered that because of their high population density and low number of indigenous police, the states of Delta, Ebonyi, Lagos, and the Federal Capital Territory had high rates of theft. As population density increases, the number of indigenous police personnel decreases, the study found. Additionally, the number of indigenous police personnel was closely linked to the rates of theft and robbery. The table 1 below highlights the crime rates distribution in some cities in Nigeria.

Table 1 – Certain Nigerian cities crime rates distribution

City	Forcible Rape	Burglary	Robbery	Motor Vehicle Theft	Murder & non-negligent manslaughter	Property Crime	Aggravated assault	Larceny-theft	Violent Crime	Total
LAGOS	51.10	1712.90	51.10	2119.00	35.80	7459.10	716.90	3627.20	1382.30	8841.40
BENIN CITY	45.10	1077.30	45.10	1596.90	33.10	5699.20	700.20	3025.00	1323.00	7022.20
WARRI	60.90	1034.40	60.90	1572.50	29.90	5754.80	656.70	3147.90	1277.20	7032.00
PORT HARCOURT	63.00	1190.40	63.00	2072.90	37.20	6790.50	579.40	3527.20	1214.00	8004.50
IFE	3.40	956.10	38.00	450.20	5.40	4179.60	495.50	2773.30	711.30	4890.90
IBADAN	4.50	836.60	35.70	515.60	4.50	4631.20	183.60	3279.00	300.30	4931.50
ONITSHA	51.10	978.70	82.30	718.30	51.10	4794.00	587.90	3097.00	1280.60	6074.60
ILORIN	8.90	546.80	54.60	315.20	8.90	2597.70	315.50	1735.70	487.30	3085.00
MAKURDI	5.30	810.20	44.20	367.70	5.30	4052.00	363.30	2874.10	600.50	4652.50
LAFIA	6.90	540.00	17.00	201.00	6.90	2266.00	96.80	1325.00	205.40	2471.40
ABUJA	7.40	991.20	40.90	969.50	7.40	4206.70	357.60	2246.00	586.00	4792.70
MINNA	5.60	986.00	38.50	316.00	5.60	4025.10	249.10	2729.50	426.60	4451.70
JOS	6.20	884.80	27.40	836.60	6.20	3860.20	276.20	2659.40	447.70	4307.90
KADUNA	12.70	1204.50	35.80	308.40	12.70	5010.30	444.90	2969.20	838.80	5849.10
JIMETA	4.50	731.10	10.40	308.40	4.50	2073.50	73.40	1034.00	154.60	2228.10
ZARIA	8.40	1093.50	32.40	235.80	8.40	4013.10	364.10	2683.80	491.10	4504.20
BAUCHI	5.90	1020.30	27.60	419.40	5.90	4306.50	501.80	2866.80	685.10	4991.60
MAIDUGURI	6.20	703.30	25.70	450.00	6.20	3903.50	343.40	2750.20	490.50	4394.00
KANO	10.60	1157.40	51.40	782.60	10.60	5192.80	179.70	3252.80	466.50	5659.30
SOKOTO	1.40	301.10	6.10	142.80	1.40	1916.60	46.80	1472.70	79.40	1996.00
										100180.60

Source: (Musa & Abubakar) Culled from Nigeria Police Force H/Q, Abuja.

Note:

- (1) Property Crimes are the offences of motor vehicle theft, burglary and larceny-theft
- (2) Violent crimes are the felonies aggravated assault, forcible rape, murder and robbery

Using the above table and according to the results by Musa and Abubakar, high-crime cities like Warri, Kano, Benin City, Port Harcourt, Onitsha, Lagos, and Kaduna, might be classified as hot spots. Shapiro (2023) creates the HunchLab tool, which uses a random machine erudition and artificial acumen methodology thereby forecast crime recurrence timings and hotspot areas. In order to reduce the median reaction interval in Madrid's centralised district, Camacho-Collados and Liberatore (2015) take predictive patrol into consideration. To find a near-optimal solution in a constrained amount of time, they generated GRASP - greedy randomized adaptive searching process algorithm and devise multi-criteria decision-making approach. A kernel density estimate (KDE) technique is developed by Leigh et al. (2016) to determine the hotspot sites based on chronological crime database. In order to emphasis hotspots' reach, they then create searchable tabu strategy which prevents similar solution treatment by maintaining records of previously visited hotspots groupings via tabu list. Similarly, Malik et al. (2014) shaped KDE prototypical with helpful graphic analytical method on account of proactive and predictive decision-making for the best deployment and allocation strategy. They use spatiotemporal association of contemporary incidences at neighbouring regions to create the prediction procedure in this model. Their forecasting method is predicated on the Loess-based seasonal trending deconstruction approach. Okeshola and Usman (2017) noted the Nigeria Police Force deficiencies of necessary digital expertise and technologies to implement digital policing. The majority of prosecutors lack the education and experience necessary to concentrate on prosecuting offenders who use computers and the internet to commit crimes (Danquah & Longe, 2011).

Ikuesan et al. (2020) used Nigeria and South Africa as test case to evaluate dynamic strategy to crime prevention in emerging countries. In order to monitor and respond to crimes, a mechanism integrating unmanned aerial vehicles or UAVs with security administration scheme was proposed by the research. Police officers who participated in a pilot research expressed support for the idea of a proactive tactic for preventing crime, although many had reservations about whether the infrastructure would be sufficient to sustain such a system. Many developing countries struggle with inadequate infrastructure, and the authors of the study emphasized the need for more research on how to improve and make the most of already-existing infrastructure.

Once more, Kuo et al. (2013) created KDE mathematical framework and solve it by creating the best patrol routes with the most hotspot spots conceivable. They do this by using a geospatial data system, reducing the mean reaction stint. To cut down on police dispatch time, they take into account two instances. They focus on creating patrol routes with pre-established hotspots in the first scenario and ones without in the second. They compute the police dispatch time for both scenarios in order to compare and enhance them. The Texas college location police department's case study found that they cut dispatch durations for the most popular 5 and top 10 hotspot paths by Thirteen percent and seventeen percent respectively. Raimi and Mutiu (2018) observes that the scenario necessitates strengthening Nigeria's current policing strategy employing technology of interaction and data for the

purpose to lessen the unsettling, unrelenting spread of contemporary crime. In order to address the insecurity issues that society is currently confronting, this exploratory study aims to fortify the conventional policing strategy. The study's conclusion is that the usage and use of ICT can successfully reduce and manage instances of insurgency, terrorism, and insecurity. The idea of online community monitoring, which looks at the accessibility of mobile gadgets for simple/efficient Nigerian crime reportage and prevention is notably one of the proposals for ICT enhanced police.

Gupta et al. (2014) examined the flashpoint identification issue within Intelligence Police Platform using clustering-based hotspot detection. Data acquisition and performance assessment methods form foundation for their crime analysis model. The model makes it possible to retrieve crucial data, such as crime detection and investigation. As part of the solution process, they employ classification algorithms, clustering algorithms, and a knowledge gaining system. The expertise acquisition system, which serves as the IPS's brain, is made up of several data mining methods and knowledge accumulation algorithmic. Classification methods such as artificial neural networks and decision trees mine the crime data, while clustering algorithms identify crime hotspots and zones. Otu and Elechi (2018) recognised that technical obstacles prevent the police from forensically accessing and examining digital evidence that is in motion as well as that is at rest. Castelli et al. (2017) suggested a novel artificial intelligence approach to forecast the number of violent crimes committed in cities per capita. The system combined socioeconomically, crime linked data, and byelaw application using hereditary programming, phonological ideas, with home-grown quest strategy. Their study's conclusions demonstrated that, particularly when applied to huge datasets, the suggested method performs better than current protocols concerning the precision of predictions. The suggested classification is for crime prediction having a lot of potential for improving resource allocation and urban security in quickly evolving smart cities. Matthew et al. (2021) studied the scientific possibilities for unpiloted aircraft systems with artificial intelligence vehicles – drones - that are formed using convolution neuronal networks for machine learning within the structure of the growing Internet of Things, modified to transform missions of security surveillance, environmental and remote sensing, salvage, and explore. This study proved Nigerian safeguard services may use artificial intelligence unmanned aerial vehicles (UAVs) to capture terrorists in Mega-Chad, wherein banditry and prevalent uprising of Boko Haram form exist. The study also emphasises how UAVs might play a significant role in security services' search and rescue operations. Most of the work on policing in Nigeria centered more on difficulties encountered in policing, state policing (Onoja et al., 2024; Peter, 2023), community policing (Ivorgba, 2024; Mohammed et al., 2021; Oikhala, 2021; Soyombo, 2016; Ugwu et al., 2021) and communication system usage (Nsude, 2020; Osawe, 2021). There is a lack of literature on embracing the latest technology of Artificial Intelligence in policing for the Nation Nigeria. The issues this article aims to solve are the Nigerian law enforcement agency's lack of the best technical tools for both successful resource management and distribution as well as for fighting crime.

Theoretical Framework of Artificial Intelligence Policing or Predictive Policing

In this section, a few of the key theories that underpins predictive policing also known as forecasting are discussed.

Predictive policing is profoundly influenced by ideas of rational choice and deterrence. According to rational choice theory, people make reasonable decisions by weighing the advantages and disadvantages of their options. Put another way, proponents of rational choice theory contend that people who commit crimes do so because they feel the advantages of doing so exceed the disadvantages (Akers et al., 2020). Thus, this school of thinking holds that if a potential criminal believes the price of crime outweigh the paybacks, then delinquency can be avoided or diminished. Theorists of rational choice and deterrence hold that if society guarantees the certainty, promptness, and severity of the detention and punishment of illegal activity, crime decline (Yang, 2019). Indeed, amount of communal conceptions of lawbreaking, plus labeling notion, routine practices and social regulation are readily compatible with the theoretical foundations of rational choice theory (Loughran et al., 2016). According to rational choice theory, while determining whether or not to shift their focus elsewhere, offenders selectively react to the opportunities, costs, and advantages of specific offenses. In fact, the idea of criminal "energies" that must be channeled into other activities is also called into question, as is the existence of criminal dispositions. The perpetrator is not forced to look for another crime or even a noncriminal remedy if they are dissuaded from committing a specific crime (Cornish & Clarke, 2017). Predictive policing focuses on the certainty and promptness aspects of the solution put out by advocates of rational choice and deterrence theory, while the correctional system is responsible for guaranteeing the harshness of punishment.

Another theory that PP or AIP stems on Routine Activity Theory. RAT asserts that human interactions that ensue from routine activities lead to direct contact predatory crimes (Rosser et al., 2017). According to this idea, crime occurs when there is an appropriate target, a motivated criminal and insufficient monitoring. Caskey et al. (2018) constructed a multi-agent hypothesis-learning model based on game theory to create a routine activity theory (RAT) of outlaws. A motivating criminal must attain an envisioned victim in time and space without the assistance of law enforcement, as stated by RAT, for an offense to be committed. Agents in this concept pick up knowledge via the activities of other agents. Whereas rational choice theory makes no explicit assumptions about human nature, routine activities theory has a very negative view of human nature and assumes that anyone can be a motivated offender in the absence of appropriate intervention. For routine activities theorists, therefore, diminishing prospective offender motivation is not the goal. Habitual activities are the main elements influencing people's behaviour at different times of the day. It therefore determines what they will do as well as where they will be. A motivated criminal will commit a crime, as per the RAT, if they come into contact with a victim or target that they could take advantage of. A necessary condition for crime to occur is the absence of a person who could stop it. In actuality, police patrols and presence in high-risk neighbourhoods serve as a preventative measure against criminal activity (Miro, 2014).

Target hardening and more competent guardianship are the two ways the theory recommends preventing and reducing crime. Both of these situations can benefit from predictive policing. Law enforcement organisations can “harden” potential targets by predicting high-risk crime victims and using this information to educate potential targets on possible crime dangers. Furthermore, by stepping up police presence in high-risk locations and near those with a higher propensity for perpetrating crimes, predictive policing also aims to provide capable guardianship. While routine activities theory assumes criminal desire as a baseline, predictive policing can indirectly diminish offender motivation by making criminal activity more costly and challenging for offenders through victim hardening and more capable supervision (Yang, 2019).

Pareto Model or 80-20 precept as universal tenet that is not specific to crime. Pareto's discovery of a notable disparity in resource allocation left a lasting effect on experts and sparked a great deal of interest in examining similar patterns in systems of many kinds. Numerous examples in various fields of knowledge confirm that the coefficient of relative concentration, $K \approx 20/80$, where the denominator is the share of the resource belonging to them and the numerator is the share of the first elements in rank, consistently manipulates itself (Koch, 2011). According to the Pareto model, 80% of the outcomes are typically caused by 20% of the factors. Even while in reality it is rarely precisely 20%, a small portion of something or some group is always responsible for a significant portion of the results (Eck et al., 2005). In terms of crime, this thumb rule indicates that eighty per cent of crimes are committed in twenty per cent of crime locations, or that 80% of crimes are committed by 20% of criminals, and so forth.

Repeated Victimization Theory asserts that there is a greater chance that people and locations who have experienced crime in the past will experience it again. Previous studies have shown that the likelihood of being a victim again peaks 48 hours after the initial crime is committed and persists for almost per month (Braga et al., 2012; Hoppe & Gerell, 2019). According to the near repeat idea, certain crimes appear to result in recurrent criminal activity in the same place (Bowers & Johnson, 2004). This hypothesis states that there is a statistically higher likelihood that a place or the surrounding area will experience crime in the immediate aftermath of a first crime (Caplan et al., 2013).

One of the most popular criminal ideas in law enforcement, particularly in problem-oriented policing is probably the broken windows theory. According to this argument, neglected minor offences or disorderly conduct could foster an atmosphere that suggests “no one cares,” which then encourages major crimes by undermining community norms. According to this view, crime can be avoided if law enforcement concentrates on minor offences to make the neighbourhood less inviting to crime in the future. The broken windows theory developed into broken windows policing. It is not unexpected that this theory became well-liked in the law enforcement community because it incorporates concepts of crime prediction and prevention, which have been among the most crucial objectives of policing since Vollmer era. By concentrating on property crimes as auto theft, burglary, and theft from vehicles, contemporary predictive policing also makes use of the shattered windows

concept, either directly or indirectly (Mohler et al., 2015). In addition to pragmatic considerations like the viability of gathering data, the broken windows hypothesis is essential to the advancement of these predictive police tools.

Artificial Intelligence

Artificial intelligence (AI) can be understood as a contemporary form of technological education that investigates and advances concepts, methodologies, procedures, and applications to mimic, extend, and ultimately enhance human intelligence (Smith & Eckroth, 2017). To create a new kind of automated agent that behaves like a person, this field of technology aims to comprehend the principles of cognition. Study areas in this field include robotics, computer vision, computational linguistics, and intelligent systems. AI is able to mimic the growth of information that supports both logic and hominoid instinct. Even if artificial intelligence (AI) cannot yet match general cognition, it can nonetheless perform better.

In this field, the ultimate goal is to build fully autonomous beings that can interact with their environment and gradually learn the optimal behaviours through trial and error. The creation of AI apps with exceptional learning capabilities and responsiveness has taken some time. This covers the field of robotics wherein robots are able to sense and react to their surroundings. The primary applications of this are in language processing and the capacity to engage with interactive media.

Jon Krohn's proposed categories of Artificial Intelligence (Krohn et al., 2019):

- Specific jobs like interpreting languages, identifying faces, medical evaluation, self-driving automobile navigation, and playing games like chess or go are all carried out by artificial limited intelligence. At the moment, this type of artificial intelligence is accessible.
- Artificial general intelligence implements a single set of code able to perform effectively across a range of tasks formerly undertaken separately under artificial narrow intelligence. Such a code does not already exist, and experts estimate that it will take decades to implement, assuming it can be done at all.
- At best, fifty years from now, artificial superintelligence—, which is essentially a stand-in for machine intelligence—will outsmart humans.

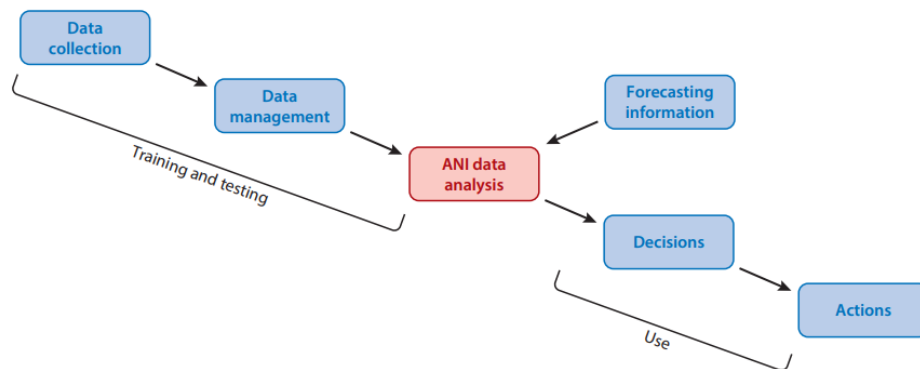


Fig. 1 – Data analysis using ANI incorporated into other procedures (Berk, 2021)

Predictive Policing Model

The fact that artificial narrow intelligence relies on algorithms rather than models is one of its key characteristics. Algorithms are ways to do calculations. An algorithm is used when you perform a singular value decomposition or calculate a regression coefficient. A model, on the other hand, is a clear hypothesis about how the world functions. Models and algorithms are not the same thing because a variety of errors might occur.

In theory, there are three stages to the application of predictive policing and therefore the building of a predictive model: (1) gathering and preparing data; (2) modelling; and (3) mapping. The gathering and cleaning of the data is the first stage. Next, using geocoding, data is connected to a region's grid chart in which it's utilised. As a result, the grid units are the minutest component of prediction, and each grid cell will eventually have a risk percentage determined for it. A statistical model analyses the data in the second stage. Training segment, also prediction leg are two stages that make up this method. The statistical model connects rates of pertinent clues to likelihood regarding a fresh criminal incident during training by discovering pertinent patterns in the historical data that is currently accessible. In the prediction step, a proportion of risk is output in every grid cell determined by present measures of the metrics, and real forecasts are designed for a specific period (e.g., the succeeding day, subsequent week, etc.). Ultimately, the second phase's predicted outcomes are mapped in the third phase. A critical threshold value is typically used to designate the greatest risk areas, considering the operating strength of the police. After that, these zones are drawn out and typically coloured according to the sort of crime or risk value. These same maps can also show other information, like calls to emergency services.

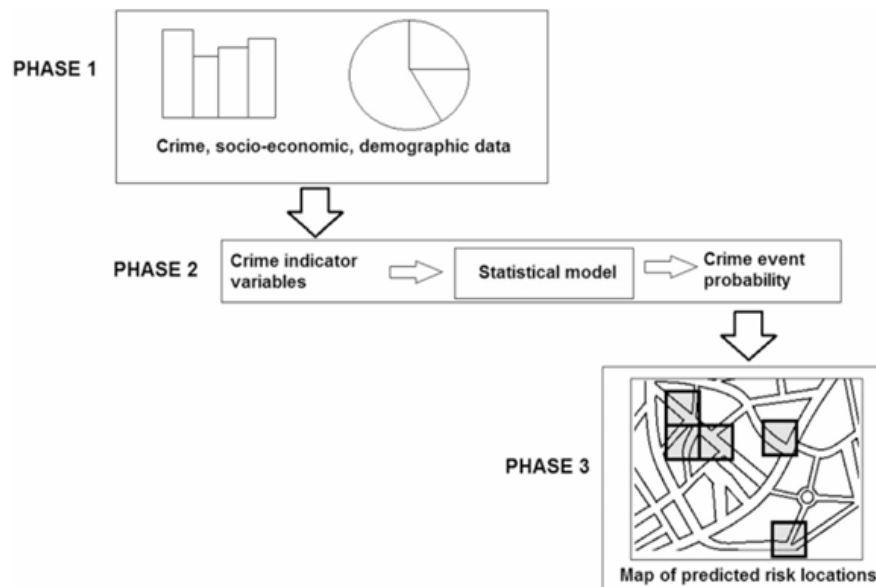


Fig 2 Analytical Prediction Flow Chart (Hardyns & Rummens, 2018)

It is crucial to think carefully about the factors to include when gathering data. Time, location, and kind of crime are the three elements that are always required. These three common factors are frequently supplemented by a variety of other pertinent indicators. Depending on the literature, applications that have previously been developed, explorative data scrutiny, or variable selection during the creation of statistical models, most appropriate and pertinent indicators can be identified. Generally speaking, the following sets of variables can be identified: The first set of variables relates to crime history and includes time elapsed since the last crime, number of crimes committed in preceding month, six months past, last year, nearby grid clusters crimes count, emergency assistance calls quantity, etc. The second set of variables is dependent on time and includes holidays, meteorological conditions, time of year, week/weekend, happenings, etc. The third characteristics related to opportunity (populace density, escape pathways like highway immediacy or major routes crossroads, accessibility of communal spaces, pubs, (night-time) shops, etc.); and fourthly antecedent crimes (crimes that take place prior to actual offences, e.g., an increase in savagery). Police records are utilised to collect crime parameters, while countrywide or local census agencies are used to collect socioeconomic, population, and opportunity pointers.

A classic four-step thorough business cycle can be used to characterise the AIP or PP process, as stated by (Perry et al., 2014) and shown in figure 3. The first two procedures, which deal with obtaining and assessing crime, incident, and offender data, require data fusion. The cycle of obtaining information, projecting results, and implementing those predictions is divided into four parts. The initial action is comprehensive quantitative records assemblage, which is required for accurate forecasts; the second is the data analysis itself; the third is the crime prediction; and the fourth is the implementation of specific police measures meant to deter or arrest offenders in order to prevent crime.

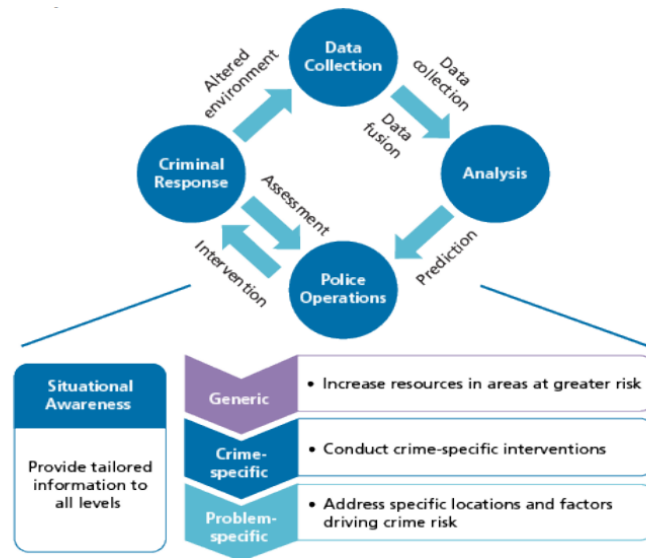


Fig 3 - Functioning predictive Policing Archetypal (Perry et al., 2014)

A visual review of popular forecasting techniques, grouped into three major sets, is provided in Figure 4. It demonstrates techniques that depend on illuminating data summaries that, at the very least, imply forecasting (Rey et al., 2012). The first type of approach is model-based, where predictions are based on a statistically stochastic model or a subject-matter framework for crime origination. The subsequent type of strategy involves creating forecasts using factual summaries of criminal activity in many places and times, presented on variety of maps. The third category includes techniques based on algorithms that can be classified as artificially limited intelligence. According to Figure 4, predictive policing may be described as figuring out how likely it is X will result in Y regardless of particular police scenario then acting appropriately in response to X or Y.

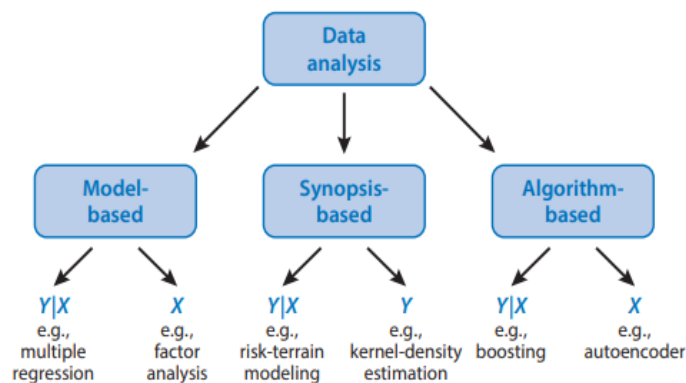


Fig. 4 – Predictive policing data analysis techniques employed by scholars and investigators (Berk, 2021).

Applied Methods

Profiling - strategy that, through the examination of conduct at the crime scene, aids in identifying the primary demographic, behavioural, and personality traits of an offender. By utilizing the connections between certain crime sort and traits of criminals having previously carried out these crimes, profiling can be utilized to reduce the pool of potential subjects.

Risk terrain modelling, or RTM - aims to pinpoint specific criminal risk variables and integrates them into a computer mapping system. This approach bases its results on the dynamic interactions that take place at a given location between physical, social, and behavioural elements (Kennedy et al., 2011).

Deep Neural Network (DNN) – mathematical function that maps a collection of i/p values to o/p values by assembling multiple smaller functions at each layer.

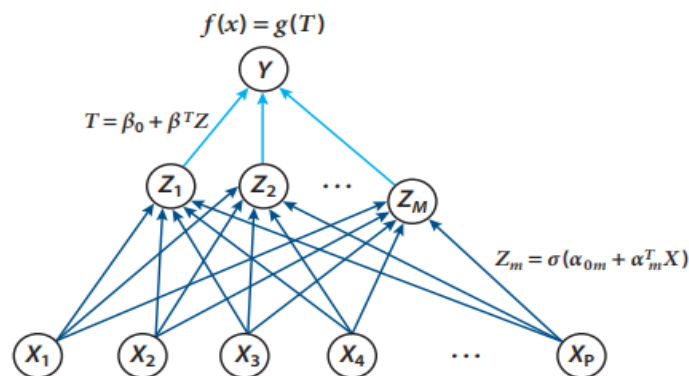


Fig. 5 – Simple DNN with one buried layer, M nodes make up. (Berk & Berk, 2020; Hastie et al., 2009)

- $x_1 - x_p$ inputs—in statistics, predictors.
- Nodes z_1 thru' z_m named latent variables are linked to each inflow.
- An activation parameter is used to transform the linearly coupled inputs. σ (use a non-linear transformation to learn the data's complicated underlying patterns). The nonlinearities introduced by activation functions are amplified over hidden layers in deep neural networks.
- Every node in the concealed layer is populated with transformed linear combos.
- These altered consecutive blends are joined linearly & able to be changed by g thereby deliver suited values regarding output Y .
- Y possibly categorized/numerical and typically crime statistics or (binary) criminal occurrences used for predictive policing.
- Multiple Y may exist and are added as results for similar network. They may be crime & victim quantities.

- Certain applications require the estimation of thousands of values due to the presence of numerous entries and many hidden layers. They perform roles akin to α s and β s. Seen Figure 5.
- The loss function is non-convex, which contributes to the intimidating nature of computational issues. However, once the loss is as small as possible, one has an algorithmic structure that can be applied to predicting in situations where the result is unknown and fresh inputs are added.

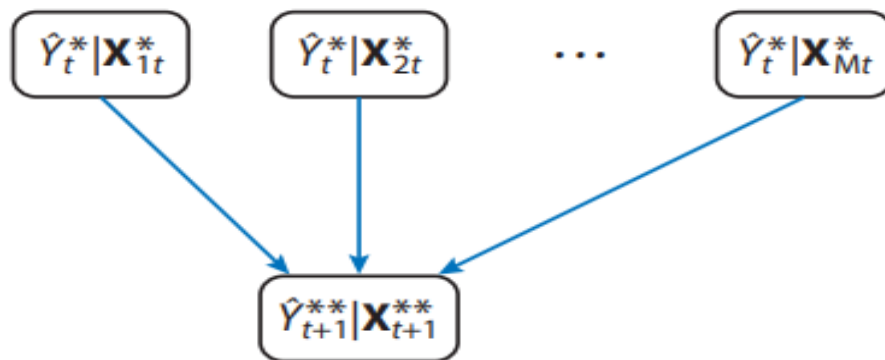


Fig. 6 - Machine learning using stylised ensemble approaches (Berk & Berk, 2020).

- Upper row indicates M transverses the data, every time handling the conditional distribution of Y at moment t given a set of predictors X also at time t .
- The setting could be a sentence decision post-conviction. Y might be an arrest for a violent crime and X might be predictors such as age, the current convicted crime, as well as prior record.
- The purpose of asterisks is to indicate that the original data was not used in its original form. Instead, use reweighted observations or a random sample containing replacement, also known as a bootstrap sample.
- M samples being analyzed can differ in other ways as well.

Approaches to Predictive Policing

Predictive policing uses a wide range of methodologies, from sophisticated deep learning techniques to conventional machine learning algorithms. Among the often utilised algorithms are:

- Random Forest: Robberies in São Luís, Brazil, have been successfully predicted using Random Forest, a crime prediction tool renowned for its excellent accuracy (Monteiro, 2024).
- Convolutional Neural Networks (CNNs): These algorithms have been utilised in predictive police models to pinpoint crime hotspots and are especially good at examining spatial crime patterns (Mehdipour et al., 2023).

- Recurrent Neural Networks (RNNs): In order to predict crime trends over time, predictive police systems have incorporated RNNs, which are helpful for examining temporal crime patterns (Dwivedi et al., 2024).
- Deep Learning: Deep learning strategies, such as those employed in the Neural Integrated Learning algorithm, were deployed to crime datasets in Chicago to identify crime patterns and categories with excellent precision (Saini & Kaur, 2023).

Table 2 - Crime Forecast and Mining Technique

Approach	Description
Clustering	• Sorting procedure of alike objects/data into categories of associated items. • Can treat a collection found using data objects as a single group.
Classification	• Representative inputs and results are used as examples to categorise, forecast unstructured information. • Model is extracted in ascertaining an object's class subject to its characteristics.
Association Rule Mining	• Connection among data objects plus variables are verified. • A well-liked research technique for identifying intriguing correlations between variables in huge databases.
Frequent rule mining	• Applied identifying recurring outlines in a dataset. • It serves as the basis for identifying innate patterns in data.
Hybrid approach	• Mixing techniques from one or more supervised learning models for crimes.
Outlier analysis	• Determine whether things, occasions, or particular observations do not fit the predicted pattern. • It is sometimes referred to as the data anomaly detection procedure.
Regression analysis	• Most often, utilized to forecast continuous values, or a spectrum of values in a particular dataset's numerical data.

Benefits & Disadvantages

- Offer an indication of the likelihood of a particular crime.
- Provide data that facilitates the start or modification of police operations, tactics, and strategies.
- Aid in the understanding of the situations and elements that either precipitate or encourage crime in general.
- Contribute to specific case investigation and evidence provision (Lie detection).
- Encourage the more efficient design and implementation of crime prevention strategies.
- It can be used to detect goods being transported illegally.

- Give resources for developing and evaluating hypotheses, such as the ability to compare a theory across time to events or facts.
- Providing tools for using analytics to uncover underlying patterns, meanings, and trends in datasets both inside and between them.
- Offer instruments for determining which facts, from the standpoint of the analyst, are essential and which are not.
- AIP enables detecting crime related to money laundering and other similar frauds.

Meanwhile the disadvantages or challenges are as follows:

- The threat to privacy and other fundamental rights and democratic principles, such as the presumption of innocence (*in dubio pro reo*) and the prohibition of penalties without a law (*nulla poena sine lege*), is most prominent in this context. For example, by assuming that someone is more likely to commit a crime, police may target them (Susila, 2024). Numerous sources, such as social media, criminal records, and security cameras, can yield a wealth of personal data that predictive models frequently rely on. The right to privacy may be violated by this massive data collection, which may also result in widespread surveillance (Apene et al., 2024; Kahla, 2024).
- Predictive models are *mostly driven by data rather than theory*, which can have significant effects on how these models are applied. An overemphasis on correlations rather than causation may result from the use of big data and data-based methodologies (Andrejevic, 2017).
- With a lack of transparency and understanding of predictive models, *accountability problems* might occur. Finding and fixing biases or mistakes in the system becomes difficult if prediction models lack transparency. There is a chance that law enforcement will not be able to completely comprehend and interpret the software's results and consider them to be adequate information for making decisions. This might result in a situation where police personnel lack the understanding necessary to determine the models' biases, which would create an accountability gap (Zakaria, 2023).
- Because of the absence of transparency, using a predictive police model for profiling could stigmatise people and groups, leading to algorithm-based prejudice.
- The implementation of AI is hampered by a lack of proper technological infrastructure, including fast internet and data storage facilities.
- The price of purchasing, creating, and maintaining AI systems can be unaffordable, particularly in a nation with potentially constrained security budgets. However, I dare claim that theft of available funds, rather than a lack of funds, is Nigeria's problem.

Applications

Algorithmic tools might be employed to track all online activity and social media posts from a hotspot to predict criminality. Hot spot mapping is one type of predictive crime mapping that makes use of both time and area to forecast when crimes will occur.

The location of people within a hotspot, together with the type of social interactions and exchanges they engage in, might be discovered by monitoring communication data from smartphone apps. This and below technologies are best suited for their adoption in Nigeria.

- Various technologies (like CCTV and Wi-Fi sensors) have the ability to identify ringleaders through network analysis, watch the movement of huge groups, gauge their mood based on messages posted online and traded, and detect the creation of such groupings.
- Miniature self-governing surveillance drones assigned to keep an eye on gatherings as they travel (Matthew et al., 2021).
- 'Smart' recognition systems including technologies that identify vehicle registration plates, knives and the sound of gunshots can be deployed.
- AI arrangements equipped with computer vision proficiencies & rules recognize relevant patterns, identifying people based on their faces (shape, colour, & distance b/w eyes); their gait (walking or running movements). Their speech (identifying forms in accent, intonation, syntax, & enunciation); their writing style (by patterns in sentence structure, phrasing, & spelling, for instance); & even by "reading" their lips when conversations are not audible (Joh, 2019; Quijano-Sánchez et al., 2018).

Future Directions and Recommendations

- Addressing the difficulties and moral dilemmas posed by AI is crucial to achieving the full promise of predictive policing. The creation of more accountable and transparent AI models that are impartial and guarantee forecast fairness is a crucial future path. This can be accomplished by putting in place strong moral standards and legal frameworks that control the application of AI in law enforcement (Singh et al., 2024).
- Investing in projects for collaborative learning and officer training is another crucial step. Agencies can guarantee that predictive policing models are applied legally and ethically by equipping law enforcement personnel with the abilities and information needed to use AI tools efficiently (Al Shamsi & Safei, 2023).
- Furthermore, encouraging cooperation between law enforcement and AI developers can result in the development of predictive models that are more accurate and trustworthy (Al-Shamsi & Ahmad, 2024).

Conclusion

By analysing movement and patterns, analytical video can be used to find suspects, spot crimes in process, and stop crimes from happening, through integrated facial recognition, identification of people at various places via closed-circuit television or using abundant cameras, in addition to object and activity detection. Massive amounts of data are being

generated by cameras, video, and social media hinged technologies together with artificial intelligence (AI) could help guarantee increased public safety by looking into possible criminal activity and detect crimes that would otherwise go undetectable. This would increase community confidence in security agencies and the criminal justice system. AI may also help the country's crime laboratory with tasks like intricate DNA mixture analysis. The necessity and benefits of implementing AIP or PP in Nigeria have been emphasised in this article. These advantages include but are not restricted to the capability to identify trends in criminal activity, lowering crime rates, better resource allocation, data-driven decision making, and the possibility of more intense collaboration, therefore, ardent support for using these methods to create a safer and better society is encouraged. There are drawbacks, like the possibility of racial profiling, privacy issues, a lack of openness, infrastructural deficiency, etc.

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Conflict of Interest Statement:

The author attests that no organisation or entity with a financial or non-financial interest in the topic or materials included in this article is associated with or involved with the author.

Ethics Statement:

I confirm that: I have been directly and actively involved in the substantial work that went into the manuscript, and I will be held accountable for its content; this material has not been published in whole or in part elsewhere; and the manuscript is not presently being considered for publication in another journal.

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