Advancements in Crime Prevention and Detection: From Traditional Approaches to Artificial Intelligence Solutions

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ABSTRACT:
Crime prevention and detection are critical components of public safety in any nation. Traditionally, crime prevention and detection approaches relied on human intuition and limited data, resulting in reactive and resource-intensive methods. However, recent advancements in artificial intelligence (AI) offer a paradigm shift, enabling proactive, data-driven approaches. This study explores the evolution from conventional crime prevention and detection methods to cutting-edge AI solutions. It employs a literature survey, local observation, and global news approach to examine the current state of the art in AI-driven approaches. Traditional crime prevention methods, such as neighbourhood watch programs, random stop-and-search initiatives, and foot patrols, are examined alongside technological approaches, such as surveillance systems, crime mapping, and geographical profiling. These conventional techniques are tedious and time-consuming leading to inefficiency. Findings from the study revealed that AI has the potential to revolutionize crime prevention and detection through its subfields, such as machine learning and computer vision. Machine learning algorithms can process large amounts of data to forecast potential criminal activity, thus transforming law enforcement operations. Also, computer vision models can utilise visual data from surveillance cameras and other sources to analyse, identify, and respond to crimes. The study recommends the integration of AI into law enforcement agencies for crime prevention and detection to transform societal security. In addition, it emphasizes the need for further research in this domain. The study also recommends the development of an efficient framework and model for crime detection based on deep learning to enhance public safety.

Keywords: Public safety, Crime prevention, Crime detection, Artificial intelligence.

INTRODUCTION
Crime is a global issue with far-reaching consequences for individuals and any nation. Law enforcement agencies face an ongoing and formidable challenge in their efforts to prevent and detect crimes. Apart from infrastructural challenges, unemployment, food insecurity and so on, criminal activity is one of the major challenges of urban migration that every government globally is fighting hard to overcome. Security is an essential part of any society – for people to run businesses, attract investors and express cultural rights without fear of getting attacked.
Conversely, crime also hinders economic growth and development by creating uncertainty, discouraging investment and job creation, and undermining the rule of law. Socioeconomic conditions and social inequality play an important role influencing whether or not certain individuals engage in criminal behaviour [1]. For example, individuals who live in poverty and have limited access to education and employment opportunities are more likely to commit crimes and this is the case of most developing countries such as Nigeria. Conversely, developed countries are also victims of crimes such as fights, gun violence, snatching, murder, stabbing, among others and this has heightened the need to an effective crime detection and prevention techniques. Despite government efforts and security agencies deploying personnel to checkpoints and implementing community policing, crime rates continue to rise. This is due to the inherent challenges of predicting the spatial and temporal aspects of crime, making it difficult to determine how, where, and when a crime will occur accurately [2].

The well-established human conventional intervention approaches to crime-fighting using security operatives with their numerous security apparatus and weaponry is presently evolving due to the advances in technology. Similarly, technology has also impacted the way crimes are being executed. Due to the sophistication and prevalence of crime, it has become overly imperative for law enforcement and security agencies to adjust their approaches in combating criminal activities [3].

Traditional crime prevention and detection approaches, limited by human intuition and data, are reactive and often resource intensive. In contrast, Artificial intelligence (AI) driven solutions are revolutionizing the field of crime detection and prevention with proactive, data-driven approaches. This study explores the shift from conventional methods to cutting-edge AI solutions, motivated by the need for more effective crime prevention and detection solutions.

CONCEPTS OF CRIME

Crime is a complex and multifaceted phenomenon, encompassing a broad range of illegal acts that violate established laws and regulations. It involves not only the commission of illegal acts that breach established laws and regulations but also delves into the social, psychological, and economic factors that underlie criminal behaviour.

Violation of law by commission or omission is called a crime, and it results in the imposed punishment that are administered by the state or legal authorities [4]. It could simply be defined as wrongdoing that is prohibited by law and punishable by the government.

Crime comprises a spectrum of offenses, ranging from petty theft and vandalism to more serious and violent acts such as murder, shooting, stabbing and so on. Crime can be classified as all violations which are not limited to felonies such as robbery, murder, and assault which are predominantly on the cover of newspapers but can include other violations such as traffic rule violations [5]. Similarly, [4] added kidnapping, drug abuse, drugs, cultism, smuggling of illegal arms, snatching, hit and run, rape, cybercrime.

TRADITIONAL CRIME PREVENTION AND DETECTION STRATEGIES

Traditional methods of crime prevention and detection have played an essential role in maintaining law and order within communities. These methods are characterized by their reliance on human intervention, community participation, and well-established policing practices. This section discusses these key traditional methods, highlighting their strengths and limitations.

Community Policing

Community policing is an organizational philosophy that emphasizes collaborative efforts between law enforcement and the community to identify and resolve crime and disorder issues. These strategies aim to enhance partnerships, prioritize problem-solving, and improve citizens' overall quality of life [6]. By addressing minor problems collectively, the police and the community can reduce disorder, alleviate fear of crime, and foster trust in law enforcement, factors that influence crime rates. However, evaluating the effectiveness of community policing is challenging due to the lack of conceptual clarity, diverse strategies, and complex initiatives associated with it.
Neighbourhood Watch Programs

Neighbourhood Watch (NW), also known as Block Watch, Community Watch, or Home Watch, is a community-driven crime prevention initiative where residents collaborate to reduce and prevent crime in their neighbourhood. Its objectives include reducing crime and opportunities for anti-social behaviour, offering reassurance to residents, promoting neighbourly bonds, and enhancing the overall quality of life for community members. [7] defined Neighbourhood Watch as a community-based crime prevention scheme that relies on residents to reduce crime and anti-social behaviour. It aims to cut crime, provide reassurance to residents, encourage neighbourliness, and improve the quality of life for local residents. Neighbourhood Watch programs face challenges in crime detection due to limited coverage, resource constraints, difficulty scaling, reliance on human observations, and lack of technological integration.

Vigilante Group Programs

A vigilante group is a community-based organization or informal collective of individuals who take the law into their own hands to address perceived issues of crime or social disorder. These groups operate outside the formal legal and law enforcement systems and may engage in a variety of activities, including patrolling neighbourhoods, enforcing local rules, or responding to criminal incidents. Vigilante groups vary widely in their motivations, methods, and legality, and their actions often raise legal and ethical concerns.

In Nigeria for example, vigilante groups are common, where they are often formed to combat crime and insecurity in the absence of an effective government response. These groups can be found in both urban and rural areas, and they vary in size and organization. In Nigeria, notable vigilante groups include the Bakassi Boys among the Igbo communities in the East, the Hisbah among the Hausa/Fulani in the North, and the Oodua People’s Congress (OPC) among the Yoruba in the West [37]. These groups reflect regional and cultural distinctions, playing roles in community policing and crime prevention. Some vigilante groups are well-organized and have close ties to the police, while others are more loosely formed and may operate outside the law but in agreement with the resident’s permission. Vigilante group may also be state sponsored as cited in [8] where they stated that in Africa, four types of vigilantism have been identified: religious, ethnic, state-sponsored, and community-based. Vigilante Group Programs however, can be a counterproductive and even unsafe approach to crime detection.

Security Officers on Foot Patrols

Before the inception of modern police departments, foot patrols were a fundamental element in law enforcement. Originally, these patrols were reactive, primarily focused on apprehending lawbreakers and responding to ongoing crimes [9]. Today, foot patrols involve law enforcement officers walking through neighbourhoods and public areas. This approach facilitates interaction with residents and businesses, acts as a deterrent to crime, and fosters community engagement, ultimately enhancing trust and cooperation.

Nonetheless, foot patrols come with drawbacks. They demand significant time and resources. Furthermore, concerns exist regarding potential issues such as racial profiling and discrimination associated with this form of policing.

Random Stop and Search

Stop and search refers to a law enforcement practice where security officers or police officers detain and search individuals, their belongings, or vehicles when they have reasonable suspicion of criminal activity. This practice is typically conducted in public spaces and aims to prevent and detect crime. However, it can be controversial and raise concerns about civil liberties and potential biases in enforcement. This is in line with the study of [10] that concluded that stop and search, while intended as a crime prevention tool, is often found to be ineffective and raises significant social and ethical concerns. In fact, they further stressed that the use of stop and search can have a detrimental effect on police-community relations.

The increasing crime rates have highlighted the inadequacies of conventional crime-fighting approaches. These traditional methods have shown inefficacy and inconsistencies. In response to
increasingly sophisticated criminal tactics, there is a pressing need for advanced technological solutions in crime prevention and detection.

TECHNOLOGICAL CRIME PREVENTION AND DETECTION STRATEGIES

This section explores technology-based approaches for addressing crime, with a focus on solutions that do not involve the use of Artificial Intelligence (AI).

Surveillance Systems

Surveillance systems employ the use of cameras to monitor the environment and analyse various situational elements such as motion patterns, crowd dynamics, individual behaviour, as well as interactions among individuals and between crowds and their surroundings [11]. Surveillance approaches can be either digital or analogue and it could involve audio, visual or hybrid (a combination of both). Surveillance systems are becoming increasingly common in public spaces, both digital and analogue, involving audio, visual, or hybrid data collection. The rise of surveillance systems is largely driven by the prevalence of crime. Closed Circuit Television (CCTV) and unmanned aerial vehicles (UAVs) are two of the most common surveillance systems used today.

Closed Circuit Television (CCTV)

CCTV systems are used for surveillance to protect people, property, and facilities. CCTV systems offer extended and comprehensive monitoring capabilities compared to human security personnel that spend more time to monitor large areas. Often, CCTV systems are integrated with other security measures like intrusion detection and access control, allowing them to capture video evidence when security breaches occur, such as intrusions triggered by alarm systems [12].

CCTV, or closed-circuit television, is a video surveillance system that employs cameras to convey a signal to a specific location and displays it on a restricted number of monitors. CCTV systems operate by capturing, transmitting, displaying, and storing video data through interconnected components. A basic CCTV setup may consist of a camera connected to a video display, while more complex systems managed by security professionals involve various components categorized into cameras, lenses, housings, mounts, monitors, switchers, multiplexers, and video recorders. Each of these categories offers diverse options to fulfil specific operational requirements, even in challenging conditions [12]. The most advanced CCTV setups can comprise extensive networks of hundreds of cameras and sensors for comprehensive security coverage. Figure 1 below describe the typical component of CCTV system setup.

![Figure 1 Component of a CCTV][12]
Unmanned Aerial Vehicles (UAVs)

A UAV, often known as an unmanned aircraft, possesses the ability to fly and remain in the air independently, eliminating the need for a human operator on board. This feature enables cost-effective operations compared to manned aircraft while executing critical missions without endangering human lives. UAVs can be controlled remotely, where commands are transmitted from a ground base station via a remote-control device. Additionally, UAVs have the capacity to autonomously manage control functions using onboard systems like autopilots and various sensors, including global positioning system (GPS) and inertial measurement units (IMU) for navigation and guidance [13].

The advancement of UAVs (Drone) technology is playing a significant role in simplifying our everyday tasks and reducing challenges. It is rapidly evolving into a valuable asset for functions such as surveillance, monitoring, crime detection, and management. Similarly, UAVs find applications across various sectors, including the military, agriculture, public services, aerial photography, and exploration, among others [14].

In the area of crime detection and prevention, UAVs have the capacity to cover a wide area of crime scene by taking aerial images of the scenes which can be used for forensic investigations. Figure 2 below shows the scenario of a UAV capturing a crime scene where a weapon is held.

![Figure 2. A UAV capturing a crime scene [14]](image)

Geographical Profiling

Geographical profiling is a crime analysis method that focuses on examining the locations of a series of connected crime sites to identify the most probable area where the offender resides or operates from. This approach involves creating a probability map, indicating the likely home base of the offender, typically their residence or workplace. Geographical Profiling is used to predict the anchor points of an offender such as its home or work location. The probability map aids in prioritizing suspects based on their addresses, cross-referencing database records, designing targeted patrol areas, and more. The effectiveness of geographic profiling is often measured by the "hit score," representing the percentage of the total region covered by crime sites where the profile successfully identifies the offender's home base [15,16].

Geographical profiling is based on two fundamental principles; distance decay and domocentricity [17]. According to the distance decay assumptions, the probability of an offender committing a crime diminishes as the distance from their home increase. This is based on the premise that offenders prefer to operate within areas they are familiar with and can quickly access from their homes. Similarly, domocentricity implies that an offender’s home serve as focal point of their criminal activities with crimes occurring primarily in close proximity to their homes [15,16].
Geographical profiling operates on the assumption that criminals adhere to the principles mentioned, allowing profilers to analyse the locations of known crime scenes and identify the most likely area where the offender resides, integrating these principles as guiding factors.

While Geographical profiling has proven successful in some cases, it is not a one-size fits all solution. One of the limitations of geographical profiling is that some offenders may not follow the distance decay principle, and their criminal activities may extend far from their homes. Similarly, and not all criminals operate close to their homes, thereby challenging the domocentricity assumption. Hence, Geographical Profiling should be used with other investigative techniques for effective crime prevention.

**Crime Mapping**

Crime mapping involves the use of geographic information systems (GIS) to perform spatial analysis of crime-related issues. It entails the practice of utilising location data from crime events to analyse spatial patterns in criminal activity [18]. Crime mapping is a valuable tool for law enforcement in crime prevention and detection, as well as for security and process monitoring.

The fundamental principle of crime mapping is the recognition that crime is not evenly distributed across all areas; instead, there are specific locations where criminal activities tend to concentrate [19]. In the past, crime mapping involved physically marking maps with pins to indicate the locations of crimes and visually analysing crime patterns. However, contemporary crime mapping has evolved, enabling more in-depth analysis. This includes studying crime trends concerning specific days of the week and times of the day, providing valuable insights into variations in criminal activity during weekends and different hours.

While crime mapping is a valuable tool for law enforcement agencies and crime prevention, it has its limitations. One significant limitation is its reliance on spatial data which may not always provide a complete picture of criminal activities. This can make crime mapping strategy ineffective especially when certain crimes go unreported.

From the foregoing, it is seen that conventional technology-based crime prevention and detection methods are limited in their ability to adapt to rapidly evolving and complex criminal activities. AI-powered solutions overcome these limitations by harnessing the power of dynamic data analysis and machine learning to be more adaptive, proactive, and accurate.

**ARTIFICIAL INTELLIGENCE APPROACH TO CRIME DETECTION**

Artificial intelligence plays a significant role in various aspects of crime prevention, detection and law enforcement. In this section, the concept of Artificial Intelligence and its application in crime detection and prevention will be discussed.

**Artificial Intelligence Concepts**

Artificial intelligence (AI) is a field of computer science that studies how machines can mimic the intelligence of humans. Artificial intelligence (AI) at its core can be referred to as the emulation of intelligent behaviour in computer-based-agents with the aim to replicate the human-like intelligence and capabilities. The foundational principles of AI encompass the development of machines capable of wide range of attributes, which encompass knowledge, reasoning, problem-solving, perception, learning, planning, and the capacity for manipulation [20,21]. To provide a more detailed insight into the elements of AI, it includes the following components:

- **Rational Reasoning**: Enabling systems to engage in logical and reasoned thinking, utilizing techniques like automated reasoning, proof planning, constraint resolution, and case-based reasoning.
- **Learning and Prediction**: Equipping programs with the ability to acquire knowledge, explore information, and make informed predictions. This is achieved through techniques such as machine learning, data mining, and the discovery of scientific knowledge.
- **Game-playing Abilities**: Enabling programs to excel in game-playing tasks using techniques like minimax search and alpha-beta pruning.
- **Effective Human Interaction**: Empowering programs to interact seamlessly with humans, facilitated by techniques such as natural language processing (NLP).
- **Lifelike Characteristics**: Developing programs that display lifelike traits, achievable through techniques like genetic algorithms.
- **Physical World Proficiency**: Equipping machines with the capability to intelligently navigate and operate in the real world, involving robotic techniques such as planning and vision [20].

The mentioned technologies can be summed up to be the functional areas of Artificial Intelligence as identified by [22], specifically it includes, computer vision; extended reality; natural language processing, voice and speech recognition. Similarly, [23] posits that Artificial intelligence (AI) encompasses a wide range of subfields, each of which employs a variety of techniques, such as neural networks, evolutionary computation, vision, robotics, expert systems, speech processing, natural language processing, planning, and machine learning. Figure 3 below is a pictorial illustration of Artificial Intelligence and its subfield. Machine Learning is a subset of AI that focuses on development on machines that can learn from data and gain experience without explicitly programming. Deep Learning is a subset of Machine Learning that uses Artificial Neural Network to learn from data. Computer Vision on the other hand is a subset of Artificial Intelligence that train computers to understand their visual environment. Conversely, Natural Language Processing is a branch of Artificial Intelligence that deals with the interaction between computers and human language. While Expert system is a type of Artificial intelligence that train machines to mimic the decision-making ability of a human expert in a specific domain or field.

![Figure 3. Artificial Intelligence and Its Subfields](image)

**Application of AI in Crime Prevention and Detection**

Artificial Intelligence (AI) has transformed multiple sectors, and the field of law enforcement and crime prevention and detection is no exception. Artificial intelligence (AI)-powered surveillance using AI algorithms has become a crucial tool in modern policing. These algorithms are capable of processing huge amounts of data and forecasting potential criminal activities, in turn transforming the way law enforcement operates. Also, artificial intelligence has the potential to significantly impact the criminal justice system by providing forensic support, assisting in criminal investigations,
enhancing the capabilities of justice professionals, and ultimately contributing to the maintenance of public safety [24].

One of the key advantages of AI-powered surveillance is its ability to process and analyse large amounts of data in real time. This is a considerable improvement over traditional enforcement approaches, which frequently rely on reactive measures, responding to crimes after they have occurred. By identifying prospective crime hotspots and effectively allocating resources, AI systems enable law enforcement organizations to take preventative measures [25].

AI algorithms can also analyse a wide range of data, including crime statistics, social media data, and demographic data, to identify patterns and trends that can be used to predict where and when criminal incidents are likely to take place. This is done using machine learning algorithms to analyse crime trends and predict future crime-prone areas.

Unlike traditional crime prevention methods, such as hotspot analysis, crime mapping, used by police departments, involving mapping past crime data to allocate more resources to certain areas that are reactive in nature, AI techniques analyse crime datasets to extract patterns and forecast future events [26]. For instance, [36] used AI to predict crime hotspots in Vancouver by analysing 15 years of crime data using machine learning algorithms; boosted decision trees and K-nearest neighbours. Similarly, the studies of [27] analysed crime data from six Tamilnadu cities between 2000 and 2014 using clustering techniques. K-Means showed promise for crime clustering and KNN improved crime prediction. The aim is to enhance crime detection and reduce crime rates.

In [28], the authors agreed that AI-based facial recognition technology is a crucial tool for criminal identification, tracking down criminals, and ensuring safety. It has gained global recognition and is now used by various organisations beyond law enforcement to deter crime. Furthermore, Computer vision, a subfield of Artificial intelligence, also plays a critical role in crime detection and prevention by leveraging visual data from surveillance cameras and other sources. It analyses, identifies, and responds to crime activities. To achieve this, it relies on various approaches such as, object detection, video analytics, facial recognition, image recognition etc. Deep learning models based on convolution neural networks are mostly used. Example of such includes Fast-RCNN, YOLO, SSD, etc.

REVIEW OF RELATED LITERATURE

Crime prevention and detection studies have attracted significant research attention, with contributions from many scholars. This section presents an empirical review of some relevant studies.

For instance, the study of [23] proposed a novel method for improving crime prediction accuracy using machine learning algorithms; support vector machine, random forest, naive Bayes and K nearest neighbour. The focus was to extract features from crime data of San Francisco and Los Angeles such as time zones, crime probability, and crime hotspots. Naive Bayes algorithm was found to produce an efficient result. The proposed model in the study is a crime predictive model to aid enforcement agencies in resource allocation and crime prevention efforts.

Similarly, the authors in [30] highlights the need for more effective crime prevention strategies in response to the increasing volume and diversity of criminal activities. Considering the effectiveness of Computer Vision and Machine Learning. The authors proposed the use of computer vision and machine learning (ML) algorithms and approaches to detect, prevent, and solve crime problems. They argued that traditional crime-solving methods are ineffective in the current era of rising crime rates and that ML and computer vision can help law enforcement agencies evolve and become more efficient.

[31] assessed a dynamic approach to crime prevention in developing nations using South Africa and Nigeria as case studies. The study proposed a system that integrates unmanned aerial vehicles (UAVs) and a security management system for crime monitoring and response. A pilot study of police personnel found that they supported the concept of a dynamic approach to crime prevention but were concerned about the adequacy of infrastructure to support such a system. Infrastructure
deficiency is a challenge that many developing nations face, and the study authors highlighted the need for further research on how to enhance and maximize existing infrastructure.

Given that urban crimes are increasing, [32] proposed a new artificial intelligence system for predicting per capita violent crimes in urban areas. The system used genetic programming, semantic concepts, and a local search method to combine socio-economic data, law-enforcement data, and other crime-related information. Findings from their study showed that the proposed system outperforms existing systems in terms of prediction accuracy, especially on large datasets. The proposed system is a crime predictive model that holds great promise for optimizing urban security and resource allocation in rapidly developing smart cities.

The potential of natural language processing (NLP) for crime detection in cyberspace is also evident in the study conducted by [33]. The study proposed an innovative system for analysing and detecting criminal content within social media posts and messages. The system utilizes natural language processing algorithms and machine learning models to identify various forms of criminal content, including attacks, drug-related messages, hate speech, and offensive content. The study results indicate a significant level of success in crime detection within texts, with accuracy rates of 86% and 72% for the support vector machine and random forest approaches, respectively. The study concludes that the proposed system has the potential to be a valuable tool for combating cybercrime and enhancing the security of online spaces.

Exploring the potential of deep learning in crime prevention, [34] proposed a hybrid approach using deep learning. The authors stressed the need for crime prevention and presented two approaches to crime prediction: visual analytics and semantic analysis of Twitter posts. The first approach used visual analytics to provide decision-makers with tools for proactive and predictive resource allocation. It relies on historical crime data geospatial, and demographic information. The second approach utilizes semantic analysis and natural language processing of Twitter posts, employing methods like latent Dirichlet allocation, topic detection, and sentiment analysis. Findings from the study revealed that both methods have limitations in accounting for recent crime trends and patterns, and there is a need for a more efficient approach to account for evolving crimes.

A summary of literature review is given in Table 1 of the appendix and it includes details on the types of crimes studied, the authors' method, successful crime detection outcomes, study locations, and potential limitations that could guide new research directions.

CONCLUSION

In conclusion, effective security measures are integral to a nation's economic development, investor attraction, tourism, and immigration. This study examined advancements in crime prevention and detection, encompassing both traditional and artificial intelligence-driven techniques. Traditional methods, such as security officer foot patrols, random stop and search, neighbourhood watch programs, and community policing, rely on human perception and are rigorous. Additionally, techniques such as crime mapping, geographical profiling, and surveillance systems like CCTV and UAVs contribute but are limited in their ability to adapt to rapidly evolving and complex criminal activities.

AI-powered approaches, on the other hand, have the potential to leverage machine learning and computer vision to analyse large datasets of crime data and visual data from surveillance cameras and other sources. This enables them to identify patterns and trends that would be difficult or impossible for humans to detect. This information can then be used to predict future crime, identify criminals, and track down suspects. The study findings showed that AI is currently showing significant progress in crime detection and prevention. AI-based facial recognition technology and computer vision are crucial tools for criminal identification, tracking criminals, and ensuring safety. Natural language processing (NLP) is also being used to detect crime in cyberspace. The study findings suggest that AI has the potential to revolutionize crime prevention and detection. However, more research is needed to develop more efficient and effective AI-powered crime prevention and detection solutions.
FUTURE RESEARCH DIRECTIONS

Based on the study findings, the following future research directions are recommended:

- Development of a real-time crime detection model using a deep learning model: This model should be trained on a large dataset of crime data and visual data to detect criminal activities of various crime classes, such as violence and weapons, vandalism in real time.

- Development of an efficient framework for real-time crime detection: This framework should utilise AI technologies to analyse crime data and visual data from surveillance cameras and other sources in real time to detect and predict criminal activities.

- Exploration of more efficient crime prevention and detection techniques: Researchers should explore new and innovative ways to leverage AI to prevent and detect crime more efficiently and effectively.

These research directions have the potential to develop cutting-edge AI-powered crime prevention and detection solutions that can enhance the safety of citizens and contribute to national development.

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## APPENDIX

### Table 1. Summary of Literature

<table>
<thead>
<tr>
<th>SN</th>
<th>Authors</th>
<th>Type of Crime</th>
<th>Method</th>
<th>Crime Detected</th>
<th>Location</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>[29]</td>
<td>General crime patterns and hotspots</td>
<td>Machine Learning Techniques such as K nearest neighbour, random forest, Support vector machine, and naive Bayes,</td>
<td>Proposed methodology involving feature generation (time zones, crime probability, crime hotspots, and vulnerability analysis) achieved 97.5% accuracy with Naïve Bayes algorithm on San Francisco dataset</td>
<td>Los Angeles and San Francisco cities in California</td>
<td>The study focuses on a specific geographic region (San Francisco dataset), which may limit the generalizability of the findings to other areas with different crime patterns or characteristics. It was limited to only four attributes of the dataset for the prediction.</td>
</tr>
<tr>
<td>2</td>
<td>[31]</td>
<td>Urban Crime</td>
<td>Proposed a dynamic UAV-based surveillance system</td>
<td>Not specified</td>
<td>South Africa and Nigeria</td>
<td>Limitations include pending preliminary evaluation on feasibility and effectiveness, additionally, lack of details on accuracy and performance of video analytics and non-human profiling.</td>
</tr>
<tr>
<td>3</td>
<td>[32]</td>
<td>Violent crimes in urban areas</td>
<td>Proposed an artificial intelligence system based on a variant of genetic programming (GP) that uses semantics during the search process (called GSGP) combined with a local search method (LSGP).</td>
<td>Violent crimes (per capita) in urban areas</td>
<td>Urban areas within the United States</td>
<td>The study focused only on violent crimes and did not consider other types of crimes. The experiments were limited to urban areas in the United States, and the applicability of the proposed method to other regions or countries was not explored.</td>
</tr>
<tr>
<td>4</td>
<td>[33]</td>
<td>Crime done on social media</td>
<td>Utilized NLP algorithms (tokenization, stemming, lemmatization) and ML models (SVM, Random Forest)</td>
<td>Hate speech Offensive/Lite crime Attack-related crimes Drug-related crimes</td>
<td>South Africa</td>
<td>Limitations include: absence of dedicated social media dataset for crime, risk of misclassifying non-spam crime texts, potential incompleteness of self-generated classes, focus mainly on normal English text, and lack of error analysis for algorithm refinement.</td>
</tr>
<tr>
<td>5</td>
<td>[34]</td>
<td>Crime prediction and prevention</td>
<td>Proposes a hybrid approach to crime event prediction using Deep Learning</td>
<td>Not Specified</td>
<td>Not Specified</td>
<td>Overcoming computational complexity while enhancing accuracy with finer details posed a challenge. Acquiring the necessary data and information for effective crime prediction also presented a significant hurdle.</td>
</tr>
</tbody>
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