AI IN CRIME PREVENTION & PREDICTION

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Abstract
This study includes multiple investigations regarding the use of artificial intelligence (AI) in predictive crime demonstrating and its broader implications in criminology, illustrating significant advances and challenges. Neural networks used for analyzing historical data achieve an 81% precision, while LSTM networks predict crime occurrences within a 75%-90% range, showing AI's ability to improve public security in urban settings such as Mexico by leveraging spatial and temporal data analysis. Artificial intelligence is being used in the justice sector to improve legal advice, decision-making, and collaborative crime-fighting efforts through applications such as facial recognition and predictive surveillance. Ethical considerations, such as privacy and discrimination prevention, are essential for maintaining appropriate artificial intelligence use. AI is able to detect patterns in large datasets and is increasingly being used for crime prediction and prevention via data mining, machine learning, and deep learning, the field is still in its early stages, resulting in access to larger datasets and more demanding model training. In Abu Dhabi, a study using a multi-linear regression model and data from 316 police department employees emphasizes the importance of predictive policing, specialized training, and collaborative learning in crime prevention. Also, a primer for criminologists explores AI's dual role in crime—as a tool, a target, and potentially a self-driving agent—while emphasizing AI's beneficial impact on law enforcement uses through advanced detection and predictive policing. These studies suggest that criminologists should play a more active role in implementing AI in crime prediction and prevention strategies, proceeding away from traditional statistical models and toward more advanced AI-driven approaches.
Keywords: Crime Prevention, Crime Prediction, Criminology, LSTM.

Introduction

The rise in crime rates in Mexico, caused by ongoing problems that include planned murders, shootings, and illicit drug trade, shows the difficulties in tackling crime through traditional means. In response, advanced neural network algorithms such as Neural Regression, Support Vector Machine, Random Forest, RNN, LSTM, Feed-Forward Network, and CNN are being investigated to improve crime prediction and prevention methods. These technologies have shown great promise in cities such as Atlanta, Baltimore, Chicago, and Portland by successfully utilizing spatiotemporal data to predict multiple kinds of offenses, proving the possibility for greater use through diverse urban and security contexts around the world.

The introduction of these AI technologies into the justice and policing sectors requires careful consideration of ethical implications, particularly those related to honesty, equality, privacy, and rights for individuals, alongside European legal structures providing guidance for responsible deployment. However, the use of AI in crime prevention goes beyond simply implementing technology; it also requires adaptation to the unique environmental and social conditions of different regions in order to maximize success and address potential societal impacts. Predictive policing, which uses AI, big data analysis, and simulations, is gaining popularity around the world, particularly in the UAE, where the Dubai Police's "Oyoon" program employs AI to significantly improve public safety. However, this shift toward technology-driven law enforcement presents challenges, particularly in training law enforcement officers to effectively use these new technologies. Critical issues include precision of data, protest to new working duties and the broader moral consequences of increased monitoring and data usage. The successful implementation of predictive policing technologies is heavily reliant on thorough and creative training courses that address technology integration and proper data handling practices, ensuring that law enforcement

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shifts from a reactive to a proactive stance, ultimately increasing the capacity to prevent crimes before they occur.

Furthermore, the use of AI in criminology is changing the conditions of security, legal decisions, and criminal behavior. AI's ability to perform tasks such as data sorting, anomaly detection, and system optimization, despite limitations such as catastrophic forgetting, exposure to conflicting inputs, and a lack of common sense, opens up possibilities for both preventing and committing crimes. This changing landscape suggests that AI will play a greater part in the legal system, requiring in progress research and adaptation to fully realize its potential responsibly.

The current study investigates the ability of AI in crime forecasting by comparing four AI techniques—ANN, SVR, RF, and GTB—with traditional statistical methods such as linear regression and ARIMA. The study uses a regression approach to provide a more nuanced analysis of crime data, with the goal of improving predictive accuracy and lowering error rates. This approach, which is supported by a uniquely arranged dataset tailored for regression analysis, focuses on the evolving needs and features in predictive policing and resource allocation, with the goal of improving preventive actions and planning in law enforcement.

AI has the potential to transform crime prediction and prevention, its successful implementation across regions will be dependent on addressing technical, ethical, and operational challenges. AI's potential to improve community safety and security will require ongoing research, strategic training, and ethical standards.

Methodology

The use of various deep learning models, which employ sophisticated analyses of past criminal activity records, location information, and chronological patterns, has had a significant impact on recent advances in crime prediction. These models, which include Neural Networks, RNN, LSTM, and Random Forest, have proven critical in improving police intelligence as well as targeting high-risk areas. For example, studies carried out in cities such as Atlanta and Baltimore used LSTM to predict various types of theft, with regularity values as high as 0.90. In other cities, such as Chicago and Portland, next-day crimes can be predicted by Recurrent Convolutional Networks that examine spatial-temporal data, indicating a shift toward deeper, data-driven predictive policing approaches. Furthermore, some methodologies have used unsupervised learning techniques like K-Means to segment city areas into clusters, which improves the reliability of crime predictions over traditional grid structures.

These advancements are part of a larger application of AI in criminology, which has been thoroughly examined through extensive literature reviews spanning research from 2000 to 2021. These reviews, which were conducted across multiple databases such as the Criminal justice Collection, Web of Science, and Google Scholar, systematically classified and reviewed the outcomes and ethical issues of previous research. The thorough records and expert consultation during the selection process yielded useful knowledge into AI's applications in crime prediction and prevention, bolstering future research directions and emphasizing the importance of careful implementation while taking potential biases and predictive model accuracy into consideration.

In the UAE, the integration of AI into predictive policing is being studied, with a focus on specialized police officer training and the importance of shared learning. The findings highlight AI's potential to transform public services and improve policing strategies. However, challenges remain, particularly in matching technological capabilities to officers' operational requirements. Specific courses which fill the gap between AI technologies and practical security are critical for increasing the success rate of predictive policing strategies.

The potential societal and ethical implications of AI in criminal justice have also sparked heated debate. For example, the use of AI in predictive policing, such as the COMPAS program, has been criticized for relying on simple algorithms and potentially biased data, resulting in inaccurate predictions and racial discrimination. These systems may also generate self-fulfilling prophecies, in which AI-directed patrols unknowingly check their own predictions by increasing arrests in designated "high-risk" areas, thereby corrupting future data. Such issues highlight the importance of

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transparency, accuracy, and a thoughtful approach to integrating AI tools into law enforcement, to ensure that improvements in technology do not compromise ethical standards or police effectiveness.
Also, an experimental study that forecasted US yearly total crime rates from 1960 to 2015 used AI techniques such as ANN, SVR, RF, and GTB on a Mat Lab platform. The study used multi variate time series analysis, taking into account external factors such as unemployed people and GDP, and evaluated the performance of each technique using the RMSE, MAD, and MAPE metrics. This experimental approach sought to discover the best predictive algorithm by processing and reducing data to determine the utility of each AI technique in correctlypredicting crime rates.
Collectively, these efforts demonstrate a strong engagement with AI technologies in criminology, illustrating the complex interactions between technological advancement, accuracy of prediction, and ethical policing practices. As AI evolves, it may be necessary to reassess and adjust existing societal norms and legal frameworks to reflect its new features.

Discussion

The development of artificial intelligence (AI) in predicting crime and prevention has had a significant impact, as shown by extensive study and application in various urban settings around the world. This technology's applications range from sophisticated neural networks to deep machine learning techniques such as RNN, LSTM, and Random Forest, all of which have demonstrated remarkable efficacy in analyzing large datasets on criminal activity, location specifics, and temporal patterns. For example, studies in Atlanta and Baltimore using LSTM models successfully predicted various types of theft, and similar success has been reported in cities such as Chicago and Portland using Recurrent Convolutional Networks for next-day crime prediction. These models use spatial-temporal data to shift away from traditional reactive policing methods and toward a more proactive, predictive approach.
Also, methodologies that use unsupervised learning techniques such as K-Means for urban area clustering improve the accurate of crime forecasts beyond traditional grid-based systems. This shift toward data-driven strategies demonstrates AI's potential not only in accurate forecasting but also in strategic police planning, providing tools for dynamically allocating resources to regions at risk based on predicted crime patterns.
The incorporation of AI into criminology has prompted extensive literature reviews, which have examined the technology's implications from 2000 to 2021 using databases such as Criminology Collection, Web of Science, and Google Scholar. These reviews critically evaluate AI applications, identifying both its strengths in data handling and predictive capabilities, as well as its weaknesses, such as potential data biases and ethical concerns. The rigorous evaluation process used in these studies emphasizes the need for a careful yet hopeful strategy for AI's role in crime prediction and prevention.
In the UAE, for example, the incorporation of AI into police prediction has been satisfied with enthusiasm, particularly through initiatives such as Dubai Police's "Oyoon" program, which significantly improves public safety. Still, changing to such driven by technology law enforcement systems necessitates not only advanced tools, but also a qualified police department capable of effectively utilizing AI. This includes complete educational courses which fill the gap among technological innovation and achievable security, ensuring officers can correctly interpret and apply AI-generated data in their daily duties.
Ethical considerations are critical in debate about AI in avoiding crime, particularly honesty, privacy, and the possibility of strengthening stereotypes through incorrect information or algorithms. High-profile cases, such as the COMPAS program, have highlighted such problems, identifying how AI may at times keep existing societal inequities in the name of objectivity. This has prompted requests for stricter control of AI in law enforcement, emphasizing the importance of upholding ethical standards and human oversight in order to reduce the risks associated with automated decision-making processes.
Also, AI's role in criminology appears to be expanding, requiring ongoing research and adaptation to fully realize its potential responsibly. Future directions could include improving AI models through

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better feature selection, improving data quality, and broadening the scope of AI applications to include more complex aspects of crime prediction and prevention. As AI evolves, so must its implementation strategies, ensuring that it is used to improve group security and fairness rather than to fuel further societal divisions.

Future direction

By focusing on these future directions, the integration of AI in criminology can be optimized to ensure it contributes positively and equitably to modern law enforcement and public safety efforts: -

❖ **Improved Model Accuracy:**

- Use expanded feature selection to improve AI algorithms' ability to detect and prioritize key crime indicators.Develop and execute developed machine learning models that can change and adapt to changing crime patterns and data sources.
- To improve data quality, invest in acquiring larger datasets and developing methods to remove biases that may affect predictions.Encourage transparency in the gathering and use of data to maintain its confidentiality and accuracy.

❖ **Expanding AI Applications:**

- To achieve a fairer approach to national security, consider expanding AI applications beyond cities to rural and under-documented areas.
- Investigate AI's potential in areas such as criminal activity detection, where traditional approaches are less effective.

❖ **Interdisciplinary Collaboration:**

- Encourage interdisciplinary collaboration among technicians, criminal justice scholars, philosophers, and policymakers to create ethical, legal, and socially responsible artificial intelligence solutions.
- “Create think tanks and groups to regularly assess the impact of AI on law enforcement and public safety.

❖ **Ethical and regulatory frameworks:**

- Create and implement strict ethical and legal regulations to govern the use of AI in criminology.
- Ensure that these frameworks are adaptable to rapid advances in AI and capable of addressing new ethical quandaries as they arise.
- Develop broad educational courses for law enforcement on the technical skills, ethical, and practical use of AI in daily operations.Integrate AI education into criminology and law enforcement training programs to prepare the next generation of officers.

❖ **Public Engagement and Policy Development:**

- Increase transparency and understanding of AI's role in crime prediction and prevention. Use these insights to guide policy development, ensuring that AI tools improve public safety while protecting civil liberties.

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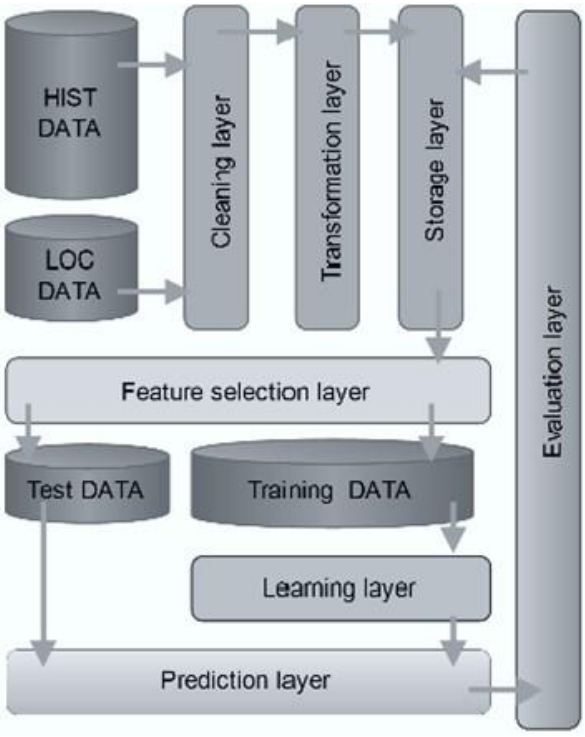

Figure 1. Predictive Model, Hicham et al (2018)

	Chicago Total	Chicago Type 1	Chicago Type 2	Chicago Type 3	Portland Total
Feed Forward	71.3	64.3	61.0	56.5	62.2
CNN	72.7	65.1	62.7	56.9	62.9
RNN	74.1	65.5	63.6	57.6	63.8
RNN + CNN	**75.6**	**65.9**	**64.7**	**57.9**	**65.3**

Table 1. Accuracy of classification results byStec (2018)

Figure 2: Latest Crime Rate Report of India 2024, State Wise Crime Rate

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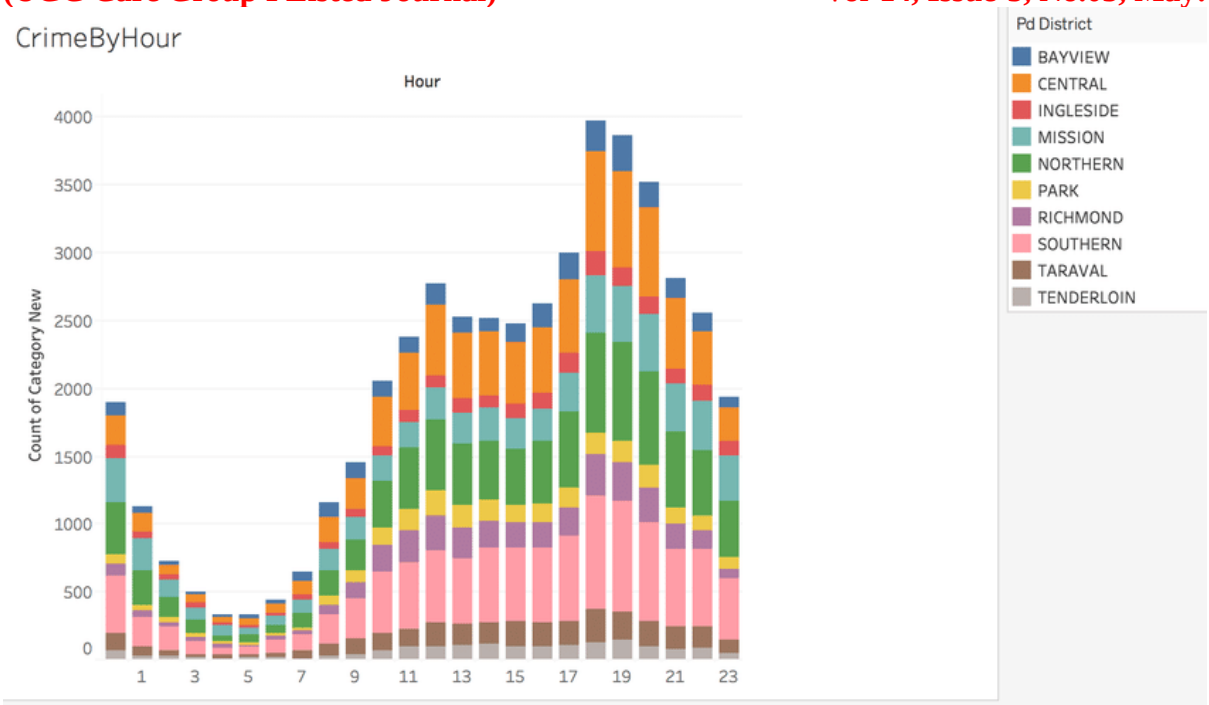

Figure 3: Rate of Crime

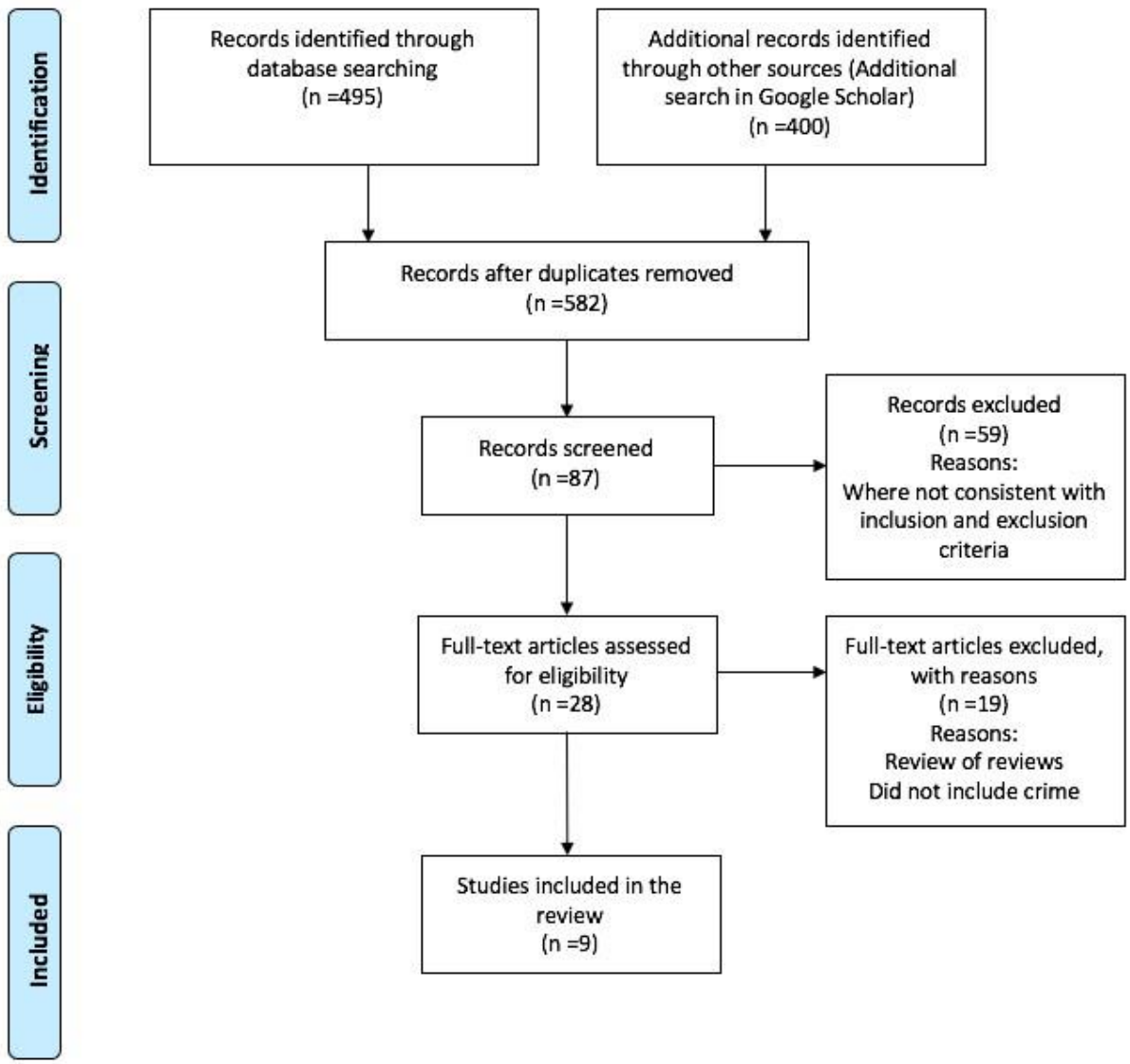

Figure 4: Flowchart of the literature search.

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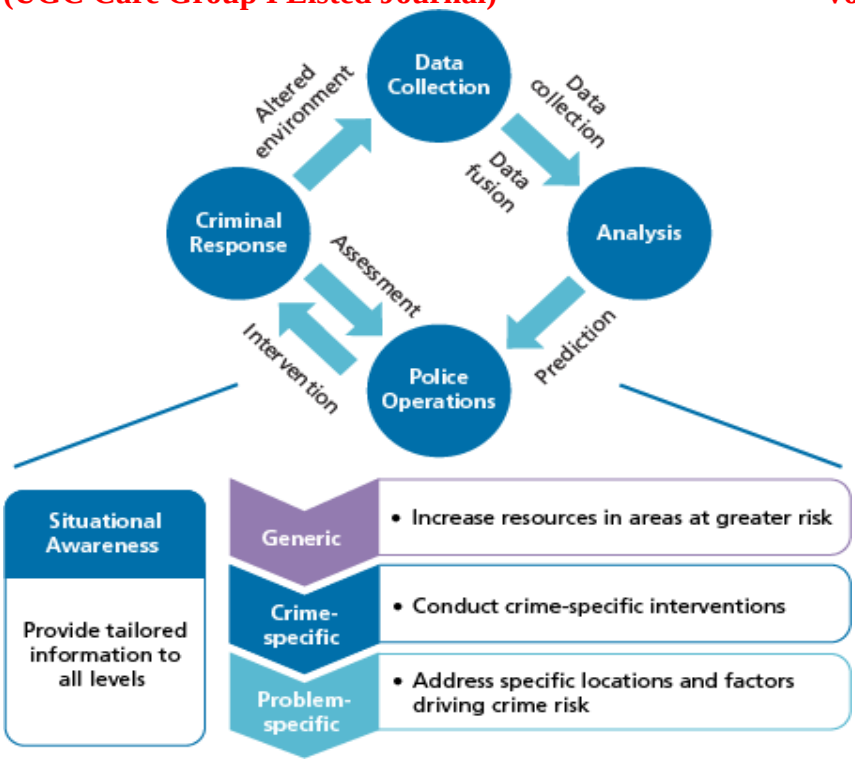

Figure 5: - Operational predictive Policing Model Source: Perry et al. (2014)

Conclusion

This comprehensive review shows the accuracy of artificial intelligence (AI) algorithms as well as neural networks in predicting crime in a variety of urban contexts, with a focus on their potential in regions such as Mexico and Latin America, where crime is prevalent and judicial systems are often inconsistent. The use of models such as ANN, SVR, RF, and GTB has resulted with considerable accuracy in urban crime prediction, highlighting the need for additional research and development focused on these regions. The review proposes integrating real-time surveillance with historical crime data to improve predictive accuracy and reduce inherent biases, as well as leveraging upcoming advancements such as the GSMA network infrastructures expected by 2025 to facilitate the widespread implementation of AI-driven crime prediction applications.

The context of regional applications, AI's capabilities are being tested in a more controlled environment, such as the Abu Dhabi Crime Scene Department. A multi-linear regression model developed with data from 316 department employees was effective in predicting Crime Mitigation Performance (CMP). This model, which includes variables such as Forecasting Security Implementation, Specialized Police Training, Innovative Officer Performance, and The collaborative Learning, not only aids in making smart choices but also improves law enforcement operations by enabling proactive planning.

Regardless of AI's promising capabilities, the review points out several limitations, including its reliance on the accuracy and breadth of data provided, which necessitates significant human input and curation. Obstacles such as recognizing between regular and abnormal but ineffective behaviors can result in false alarms, emphasizing the importance of ongoing human oversight and AI model training. This is essential for adapting AI technologies to the evolving circumstances of crime prevention and ensuring their effectiveness.

The article discusses the broader implications of AI in criminology and maintains towards viewing AI as a magical solution to crime. It emphasizes that, like any data-driven program, AI's effectiveness is limited by the 'Garbage In, Garbage Out' principle and necessitates fine-grained human expertise for creating hypotheses and system governance. It encourages criminologists to broaden their research to involve the tech-crime nexus, actively influencing discussions about technology's effect on criminology and making sure that technological uses in justice and law enforcement are ethical and non-discriminatory.

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Furthermore, a study on predicting US annual total crime rates found that Gradient Tree Boosting (GTB) outperformed other AI techniques such as ANN, SVR, and RF. GTB not only performed well in terms of lower RMSE, MAD, and MAPE values, but it also demonstrated versatility in dealing with various data structures, including imbalanced datasets. This demonstrates GTB's utility in crime analysis, presenting it as a viable model for crime rate prediction tasks. Future research is planned to improve the predictive accuracy of these artificial intelligence (AI) methods through feature selection, with the goal of identifying the most significant indicators that could influence the forecasting capacity of AI technologies.

AI is an effective tool for crime prediction and prevention; however, its successful implementation necessitates a thorough analysis of moral norms, data quality, and present human involvement. As AI evolves, criminologists and law enforcement must stay engaged to ensure responsible and effective use in combating crime.

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