

Paper 1:

Paper Title: Machine Learning in Crime Prediction

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Year: 2023

URL: <https://doi.org/10.1007/s12652-023-04530-y>

Abstract/Objectives: This paper aims to evaluate state-of-the-art crime prediction techniques from the last decade and discuss challenges and future directions. It reviews 68 machine learning papers on crime prediction, focusing on methodologies and datasets used to assist law enforcement authorities and scientists in mitigating and preventing future crime occurrences.

Importance: Predicting crimes can save lives and reduce property loss. The advancement of data mining and machine learning techniques offers significant potential for predicting criminal activities.

Challenge: The rise in crime rates alongside population growth impacts accurate prediction. Additionally, there are challenges related to data availability, data preprocessing, and the computational efficiency of models.

Approach: The paper follows the systematic literature review (SLR) methodology by Kitchenham et al. It involves planning, conducting, and reporting phases, including identifying the need, developing the review protocol, selecting primary studies, conducting quality assessments, extracting data, and synthesizing findings.

Literature Review: The review covers crime analysis, spatial-temporal crime hotspot prediction, suspect prediction, feature selection, and social media crime prediction. It discusses the use of various datasets and machine learning techniques.

Dataset: The study examines datasets collected from government and law enforcement agencies, including crime records from cities such as Chicago, San Francisco, and New York.

Research Questions/Problem Addresses:

What are the objectives of the papers reviewed?

What data source types are used to collect data?

What independent variables (features) are used?

Which machine learning algorithms perform best?

What are the top machine learning categories?

What challenges and limitations are identified?

Future Directions:

Develop Explainable AI (XAI) models to enhance transparency and trust.

Use new deep learning models such as transformers to improve performance.

Create unsupervised learning-based crime prediction models.

Develop new public datasets for research.

Implement cross-country crime prediction models.

Conclusion: Machine learning models can predict crime with high accuracy. The development of novel prediction models and improved data collection methods is encouraged. The paper suggests focusing on explainable AI, new deep learning models, unsupervised learning, and open-source tools for future research.

Limitations:

Data Quality: The study points out issues with noisy and imbalanced data, impacting model performance.

Model Performance: Some models face computational challenges and efficiency issues.

Labeled Data: There is a lack of labeled data in real-world scenarios, limiting the applicability of supervised learning models.

Interpretability: Complex models often lack transparency, making them less practical for use by law enforcement.

Paper 2

Paper Title: Crime Prediction Using Machine Learning and Deep Learning: A Systematic Review and Future Directions

Authors: Varun Mandalapu, Lavanya Elluri, Piyush Vyas, Nirmalya Roy

Year: 2023

URL: 10.1109/ACCESS.2023.3286344

Abstract/Objectives: The paper aims to predict crime using machine learning and deep learning techniques. It examines over 150 articles to provide insights into datasets and methodologies used in crime prediction. The goal is to enhance prediction accuracy and assist law enforcement strategies.

Importance: Effective crime prediction is crucial for community safety and reducing crime rates. The study of machine learning and deep learning techniques offers new opportunities for analyzing large crime datasets and predicting future criminal activities.

Challenge: The complexity of crime prediction arises from the diverse types of crimes and the various prevention techniques required. Additionally, issues with data availability and the interpretability of models present significant challenges.

Approach: The paper follows a systematic review method by Kitchenham & Charters, involving three phases: planning, conducting, and reporting. The methodology includes defining objectives, developing a search strategy, study selection, quality evaluation, data extraction, and synthesis.

Literature Review: The review covers crime analysis, spatial analysis, human behavior analysis, and social media analysis, identifying 34 crime categories and 23 crime analysis methodologies.

Dataset: The study discusses 40 different datasets, with Chicago, India, and US datasets being the most common. These datasets include crime records, social media data, and other relevant sources.

Research Questions/Problem Addresses:

What are the most effective machine learning and deep learning techniques for crime prediction?

How can crime data be used to develop accurate prediction models?

What are the challenges and limitations of current crime prediction models?

How can future research address these challenges and improve prediction accuracy?

Future Directions:

Incorporate more location information and utilize social media data to enhance prediction models.

Develop and test hybrid models that combine multiple machine learning and deep learning techniques.

Address biases in crime prediction models to ensure fairness.

Improve data quality and explore new datasets for crime prediction.

Conclusion: AI techniques, including machine learning and deep learning, perform well in crime prediction with high accuracy. The use of hybrid models is promising for future research. The paper encourages further development and testing of hybrid models and emphasizes the need to address current limitations and explore new technical aspects of crime prediction.

Limitations:

Data Quality: The review highlights issues with data quality and availability.

Overfitting: Some machine learning models suffer from overfitting, which reduces their generalizability.

Interpretability: There is limited discussion on the interpretability of complex models such as deep lea

Paper 3:

Paper Title: Artificial Intelligence & Crime Prediction: A Systematic Literature Review

Authors: Fatima Dakalbaba, Manar Abu Talib, Omnia Abu Waraga, Ali Bou Nassif, Sohail Abbas, Qassim Nasir

Year: 2022

URL: 10.1016/j.ssaho.2022.100342

Abstract/Objectives: Objective: Investigate AI strategies in crime prediction. The paper reviews 120 research papers published between 2008 and 2021, identifying 34 crime categories and 23 distinct methodologies. It discusses 64 different machine learning techniques used in crime prediction, with supervised learning being the most applied. The goal is to provide advice and guidance for researchers working in AI crime prediction.

Importance: Community safety is a top priority for governments to ensure economic growth and quality of life. AI in crime prediction can significantly aid in reducing crime rates by efficiently analyzing large datasets to identify patterns and predict future criminal activities.

Challenge: The complexity of crime prediction is due to the variety of crime types, motives, repercussions, handling methods, and prevention techniques. Additionally, there are challenges related to the availability and quality of crime data.

Approach: The study follows the systematic literature review (SLR) method by Kitchenham & Charters (2007), divided into three phases: planning, conducting, and reporting. The review involves six stages: defining research objectives, developing the search strategy, identifying study selection processes, establishing quality evaluation guidelines, outlining data extraction techniques, and synthesizing acquired data.

Literature Review: The review categorizes crime analysis types into five main aspects: crime analysis, spatial analysis, human behavior analysis, social media analysis, and other analyses. It identifies that crime density and spatial analysis are the most common research focuses.

Dataset: The paper discusses 40 different datasets, with Chicago, India, and US datasets being the most common. These datasets include crime records, social media data, and other relevant sources.

Research Questions/Problem Addresses:

What is the primary focus of crime prediction research?

What machine learning algorithms are used in crime prediction, and how accurate are they?

What performance metrics are applied, and how are they evaluated?

What tools are utilized in the approach, and what are the strengths and limitations of the proposed methods?

Future Directions:

Incorporate more location information and utilize social media data for enhanced crime prediction models.

Develop and test hybrid models combining multiple machine learning and deep learning techniques.

Address biases in crime prediction models to ensure fairness and accuracy.

Improve data quality and explore new datasets.

Conclusion: AI techniques, including machine learning and deep learning, perform well in crime prediction with high accuracy. The use of hybrid models is promising for future research. The paper

encourages the development and testing of hybrid models, addressing current limitations and exploring new technical aspects of crime prediction.

Limitations:

Time Constraints: Papers often mention time constraints that limit extensive exploration and application.

Bias and Fairness: The review indicates that existing models may suffer from biases, emphasizing the need for fair and unbiased predictions.

