

AI For Crime Prediction and Prevention

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ABSTRACT

Crime prevention and ensuring security is one of the most important problems that modern societies are facing today.

Conventional systems of crime investigation and analysis depend mostly on past data analysis, which can prove to be inefficient. This paper presents an Artificial Intelligence (AI) based crime prediction and prevention system that make use of machine learning and data analytics to recognize trends in criminal activity and forecast potential crime hotspots. The proposed system uses historical crime statistics in conjunction with data combined with demographic and temporal factors to train predictive models capable of estimating crime probability in specific locations and time frames. By applying supervised learning algorithms such as Random Forest, Decision Trees, and Neural Networks, the system aims to assist law enforcement agencies in proactive policing and efficient resource allocation.

Experimental results demonstrate that AI-based crime prediction can significantly improve accuracy and support timely preventive actions.

I. INTRODUCTION

Crime remains a constant social challenge, impacting the economy, security, and standard of living. In light of the quick

expansion increase in urban population, crime levels have risen significantly challenge to the functioning of police departments. The current strategies used in crime prevention are largely reactionary and focussed mitigating criminal activities after they happen. Traditional crime analytics rely on manual examination of crime data, crime report files, and statistics. However, conventional crime analysis lacks the ability to detect intricate patterns within big data and make future projections effectively. Moreover, the occurrence of crime is determined by several factors including spatial attributes, temporal variables, socio-economic indicators, and behavioral patterns from previous crime instances. Current developments in Artificial Intelligence and Machine learning have created new opportunities for predicting crimes through analytical algorithms. Artificial intelligence has the capacity to analyze large amounts of data, recognize patterns, and predict events with a higher degree of accuracy. This paper proposes an AI-based crime prediction and prevention system designed to support law enforcement agencies in proactive decision-making and crime strategies.

II. RELATED WORK

Early crime analysis systems made use of statistical methodologies and rule-based models. The earlier crime analysis systems made use of crime frequencies, correlations, and regression models to detect crime trends. Though effective in

basic analyses, the earlier approaches did not provide accurate predictions due to non-scalability issues. In recent times, machine learning has been used to develop crime detection and prediction approaches using models such as K-Nearest Neighbors (KNN), Naive Bayes, and Support Vector Machines (SVM). These models provided better performance than their statistical counterparts; however, the feature selection process was very complex. Recent works in crime analysis are more concerned with deep learning approaches such as ANNs and RNNs to analyze temporal trends in crimes. Additionally, some researchers have considered GIS together with AI in order to detect crime patterns visually. Methods such as transfer learning and collective learning have also been applied to increase prediction accuracy. Open research problems include addressing data imbalance, privacy, and real-time deployment issues.

III. METHODOLOGY

The proposed AI-based crime prediction system follows a structured workflow consisting of gathering of data, preprocessing, training of models, and evaluation.

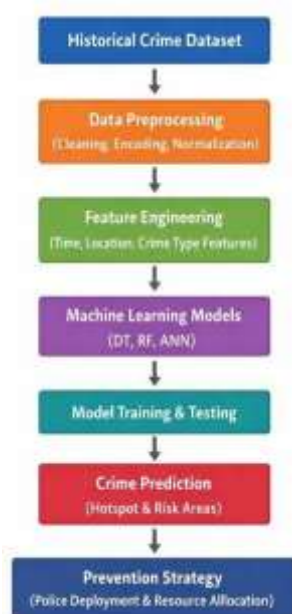


Figure 1: Block Diagram

A. Dataset and Pre-processing Data Acquisition:

The algorithm relies on historical data sets containing crime-related information gathered from police files or open data websites run by governments. **Featured included in the data set:** Type of crime, location, time, date, and demographical data.

Data Cleaning: Dealing with missing values and duplicates.

Feature engineering: Useful features like day of the week, month, crime density, and location coding are created.

Normalization:

Scaling numerical data.

B. AI Model and Algorithms

The system employs multiple machine learning algorithms to predict crime probability:

- **Decision Tree Classifier** – for interpretable rule-based predictions
- **Random Forest Algorithm** – for improved accuracy through ensemble learning
- **Artificial Neural Network (ANN)** – for learning complex nonlinear relationships
- Training and testing sets are separated from the dataset. Supervised learning methods are used to train models, and hyperparameters are tuned to optimize performance.

C. Model Training and Evaluation

The models are accessed using conventional performance metrics:

- **Accuracy** – overall prediction correctness
- **Accuracy and memory** – effectiveness in predicting crime occurrences

- **F1-Score** – harmony between recollection and precision.
- **Confusion Matrix** – visualization of classification performance

IV. RESULTS AND DISCUSSION

A. Quantitative Results

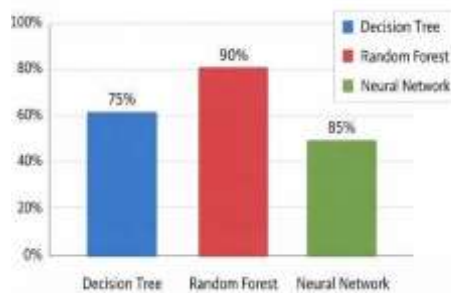


Figure 2: Model Accuracy Comparison



Figure 3: Crime Prediction Output Visualization



Figure 4: Web-based dashboard



Figure 5: Crime-Shield AI interface, with a filled scenario form

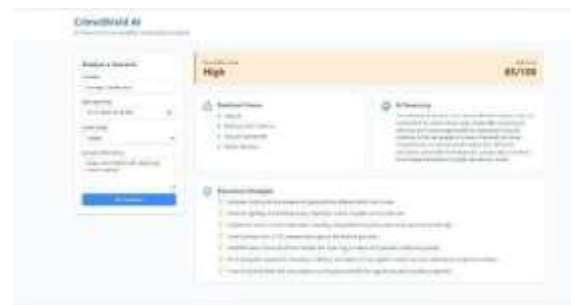


Figure 5: highly risked crime prediction showing threats and recommended strategies to prevent them

According to the experimental findings, ensemble and neural network models outperform traditional classifiers in predicting crime patterns. The Random Forest model achieved the highest accuracy, demonstrating robustness against data noise and imbalance.

Discussion

The results confirm that AI-based crime prediction systems can effectively analyze historical crime data and generate meaningful insights. However, certain limitations exist:

- The system relies heavily on the quality and completeness of historical data
- Real-time prediction requires continuous data updates
- Ethical and privacy concerns must be carefully addressed.

V. CONCLUSION AND UPCOMING WORK

The AI-based crime prediction and prevention system described in this research makes use of machine learning techniques to predict crime trends and support proactive police. When compared to conventional crime analysis techniques, the suggested method shows increased accuracy and provides useful assistance for

law enforcement decision-making. **Future enhancements include:**

- Integration of real-time data streams
- Deployment as a web or mobile application
- Incorporation of deep learning and spatial-temporal models
- Addressing ethical, legal, and privacy challenges

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