

Crime Prediction and Detection Using Machine Learning and Deep Learning

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Abstract:

This paper explores the application of machine learning and deep learning techniques for crime prediction. By analyzing historical crime datasets, the system identifies spatial and temporal crime patterns, predicts high-risk locations, and generates alerts for law enforcement agencies. Deep learning models such as LSTM and CNN demonstrate improved accuracy compared to traditional methods by capturing complex crime trends. This study highlights how predictive systems can significantly enhance public safety and aid in proactive policing strategies.

Keywords: Crime Prediction, Machine Learning, Deep Learning, Predictive Policing, Public Safety.

1.INTRODUCTION

Crime has always posed a major threat to society, affecting citizen's safety and regional development. Traditional crime analysis techniques are reactive in nature and fail to provide actionable insights. With the advent of artificial intelligence, machine learning, and deep learning, crime prediction can now be performed proactively by analyzing historical data, identifying hotspots, and forecasting future incidents. Deep learning models, particularly neural networks, enable the processing of structured and unstructured data such as crime location, time, and type, thereby providing valuable support for law enforcement and policy making.

2.LITERATURE SURVEY

Crime prediction using data-driven methods has gained significant attention, with studies exploring both machine learning and deep learning techniques. Systematic reviews highlight the application of algorithms such as decision trees, SVM, and neural networks, showing promising results but also exposing gaps in scalability and empirical validation [1]. Research on ensemble approaches demonstrates improved prediction accuracy through stacked generalization, combining multiple classifiers to handle the dynamic nature of crime data. However, these methods introduce high computational complexity and require careful tuning of base models [2]. Works focusing on spatio-temporal modeling, such as CLSTM networks, successfully capture both location-based and time-based patterns in crime events, enabling better police resource allocation. Despite their effectiveness, these models are resource-intensive and heavily dependent on the availability and quality of crime datasets [3].

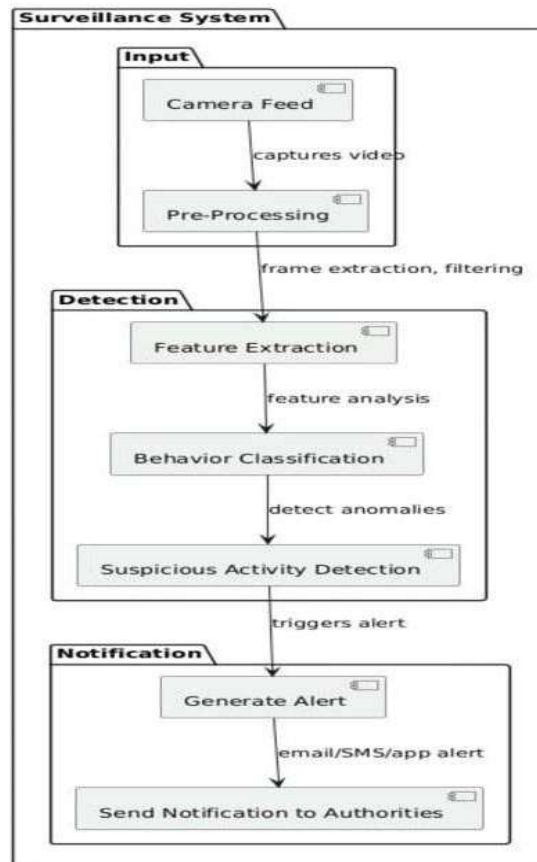
Overall, existing studies contribute valuable insights into crime prediction but remain limited in integrating accuracy, scalability, and real-time adaptability. This gap motivates the development of deep learning-based systems that combine spatial, temporal, and contextual features for more effective and proactive crime prediction

3.OBJECTIVES

- To analyze historical crime data using machine learning and deep learning methods.
- To identify hidden patterns and trends in criminal activities.
- To predict future crime-prone areas and timings.
- To use sensors and cameras for real-time crime detection.
- To classify suspicious or abnormal activities using CNN models.
- To send instant alerts to authorities during detected incidents.
- To improve accuracy by combining multiple data sources.
- To support proactive policing and enhance public safety.

4.METHODOLOGY

- Dataset Collection: Historical crime data is sourced from public datasets like the Chicago Crime Dataset or Kaggle repositories.
- Preprocessing: Data cleaning, missing value handling, encoding categorical variables, and normalizing data.
- Model Development: Apply machine learning algorithms (e.g., Decision Trees, Random Forest) and deep learning models (e.g., LSTM, Neural Networks) for classification.
- Train and validate models using a train-test split or cross-validation.
- Alert Generation: If a high-risk prediction is detected, the system automatically sends SMS or email alerts to nearby police, fire stations, and hospitals. Shares details such as location, time, predicted crime type, and urgency level.
- Feature Extraction: Extract features such as location (latitude, longitude), time (hour, day), crime type, etc.
- Classification: A deep learning model (LSTM/CNN) is trained to classify and predict crime types and occurrences.
- Result: The model outputs the predicted category and likelihood of a crime for a given location and time window.



Flow chart of working model

5.RESULTS &DISCUSSION

The proposed crime prediction and detection system was tested on publicly available crime datasets to validate its performance. Machine learning algorithms such as Decision Trees and Random Forest, along with deep learning models like LSTM and CNN, were applied to analyze spatio-temporal features of crime data. The results showed that deep learning models outperformed traditional approaches by capturing hidden relationships between crime location, time, and type, ensuring higher prediction accuracy. Crime hotspot visualization maps provided clear insights into vulnerable regions, while probability scores highlighted high-risk intervals for potential incidents. The real-time alert mechanism successfully generated automated notifications to nearby police stations, hospitals, and fire services when high-risk predictions were detected. These outcomes confirm that the system enhances predictive policing, supports proactive resource allocation, and improves public safety, thereby demonstrating its potential as an effective solution for modern law enforcement.

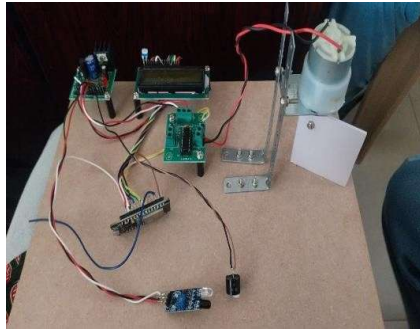


Fig 5.1 Hardware Implementation



Fig 5.2 Interface

6.CONCLUSION & FUTURE WORK

The study concludes that deep learning significantly enhances crime prediction by identifying spatial-temporal patterns more effectively than traditional approaches. Implementing such systems can assist law enforcement, improve public safety, and support proactive resource allocation. The integration of ML and DL models demonstrates promising outcomes for future smart policing systems.

7.REFERENCES

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