Chapter 1
AI and Juvenile Justice: Can Machine Learning Predict and Prevent Youth Crimes?

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ABSTRACT

The integration of artificial intelligence (AI) into juvenile justice systems offers new avenues for early intervention and crime prevention. This study explores the potential of machine learning (ML) to predict juvenile offenses in India using socio-demographic and historical data. Drawing from over 1.2 million records (2010–2024) from the National Crime Records Bureau (NCRB), a hybrid ML approach was applied. The Extreme Gradient Boosting (XGBoost) model, effective in handling imbalanced data, was used to identify at-risk youth based on 15 features such as age, education, income, and type of first offense. The model achieved strong results—F1-score of 0.87, precision of 0.91, and recall of 0.83—surpassing traditional models. SHAP

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analysis highlighted key predictors like school dropout, urban-rural divide, and family crime history. Validated on 2024 data from Maharashtra, West Bengal, and Uttar Pradesh, the model reached 89.4% accuracy. The research supports AI-driven risk assessment tools to aid policy and resource planning in juvenile justice.

INTRODUCTION

Juvenile delinquency (Abhishek and Balamurugan, 2024) presents a complex challenge in India, where rapid urbanization, socio-economic disparities, and gaps in education and welfare systems contribute to youth involvement in crime. According to the National Crime Records Bureau (NCRB), juvenile crimes (Rawat et al., 2025) (Rajavat et al., 2024) in India have shown fluctuating but concerning trends, with over 32,000 cases recorded in 2023 alone. Despite numerous reforms in juvenile justice laws and rehabilitation-focused policies, early identification and prevention of youth crimes remain limited by traditional intervention methods that often react after offenses occur.

In recent years, Artificial Intelligence (AI) (Abhishek and Balamurugan, 2024) and Machine Learning (ML) have demonstrated transformative potential across sectors, including healthcare, education, and criminal justice. In the context of juvenile justice, these technologies offer a unique opportunity to shift from reactive to proactive crime prevention (Rawat and Rajavat,2024a). By analyzing patterns in large-scale socio-demographic and behavioral data (Mishra et al., 2024), AI can help detect early risk factors (Rawat and Rajavat,2024b), predict potential delinquency, and assist policymakers in designing targeted intervention strategies.

This paper explores the application of machine learning models, specifically the Extreme Gradient Boosting (XGBoost) algorithm (Upadhyay and Romashkin,2022), to assess and predict juvenile crime risk based on socio-economic indicators, educational background, and prior behavioral data. Using recent datasets from NCRB (2010–2024), the study aims to build a predictive framework that supports early intervention, enhances resource allocation, and complements existing rehabilitation efforts in India's juvenile justice system. The findings aim to bridge the gap between technology and policy, offering a data-driven approach to reducing youth crime while safeguarding ethical and legal standards in predictive policing.

The integration of advanced machine learning tools (Abhishek and Balamurugan, 2024) (Chirgaiya and Rajavat,2023) into juvenile justice systems has opened new pathways for identifying risk factors, predicting criminal behavior, and recommending preventive actions. In this study, we utilized the Extreme Gradient Boosting (XGBoost) algorithm (Mori et al., 2024), a robust and efficient ensemble learning technique known for its high accuracy, scalability, and ability to handle imbalanced