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TECH STAR SUMMIT 2025

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Enhancing Crime Rates with Machine Learning: Random Forest and Support Vector Machine

INTRODUCTION

- Crime prediction helps optimize resource use and enhance public safety.
- Traditional statistical models often fall short in capturing the non-linear patterns in crime data.
- Accurate crime prediction supports smarter policing by enabling better planning and faster response to incidents.
- Understanding crime patterns helps allocate resources efficiently and reduces the risk of crime in vulnerable areas.
- This study compares the performance of Random Forest (RF) and Support Vector Machine (SVM) classifiers. The goal is to determine which algorithm provides more accurate predictions.

Fig 1: Crime

MATERIALS AND METHODS

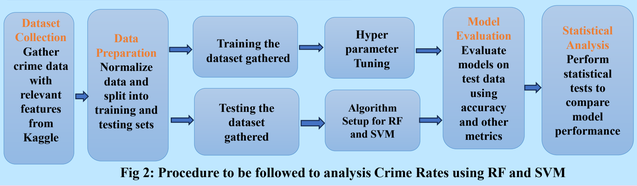

Fig 2: Procedure to be followed to analysis Crime Rates using RF and SVM

RESULTS

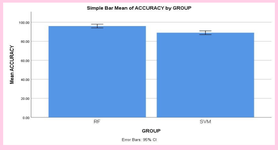

Fig 3: Graphical comparison between RF and SVM

Table 1: Accuracy values of simple RF Vs SVM

	Group	N	Mean	STD Deviation	STD Error
Accuracy	RF	10	96.48	.91864	.29050
	SVM	10	89.40	2.46051	.77808

- The above table shows statistically significant Mean between the Group and Accuracy.

DISCUSSION AND CONCLUSION

- **Random Forest outperformed Support Vector Machine in accuracy and precision, demonstrating superior handling of complex fraud patterns.**
- Support Vector Machine struggled with non-linear relationships, leading to poorer performance on sophisticated fraud tactics.
- Random Forest's ensemble approach captured significance value of 0.04 ($p<0.05$), better fraud detection.
- While requiring more computational power, **Random Forest** delivered significantly better results (96.4% vs. 89.4% accuracy).
- Future research can examine how modern surveillance methods influence crime rates and public safety.

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Improving Crime Rates with Machine Learning: Random Forest and K-Nearest Neighbors

INTRODUCTION

- Crime prediction models benefit from incorporating spatial-temporal data, such as mapping incidents by time and location, which enhances prediction accuracy.
- Hyperparameter tuning is critical for both models, but especially for KNN, where choosing the wrong number of neighbors can drastically reduce prediction performance.
- This study compares the performance of Random Forest (RF) and K-Nearest Neighbors (KNN) classifiers. The goal is to determine which algorithm provides more accurate predictions.

Fig 1: Crime Scene

MATERIALS AND METHODS

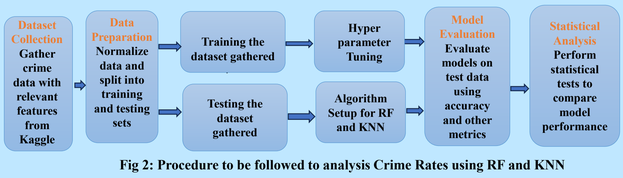

Fig 2: Procedure to be followed to analysis Crime Rates using RF and KNN

RESULTS

Fig 3: Graphical comparison between RF and KNN

Table 1: Accuracy values of simple RF Vs KNN

	Group	N	Mean	STD Deviation	STD Error
Accuracy	RF	10	96.48	.91864	.29050
	KNN	10	83.23	1.80051	.56937

- The above table shows statistically significant Mean between the Group and Accuracy.

DISCUSSION AND CONCLUSION

- **Random Forest surpassed K-Nearest Neighbors in both accuracy and precision, showcasing a stronger capability to identify complex fraud patterns.**
- K-Nearest Neighbors had difficulty managing non-linear relationships, resulting in lower effectiveness against sophisticated fraud schemes.
- Random Forest's ensemble approach captured **significance value of 0.03 ($p<0.05$),** better fraud detection.
- Although Random Forest demands greater computational resources, it delivered substantially superior results, achieving 96.4% accuracy compared to 83.2%.
- Future research can analyze the relationship between unemployment rates and crime levels across different regions.

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Elaborating Crime Rates with Machine Learning: Random Forest and Decision Tree

INTRODUCTION

- Accurate crime rate prediction is essential for proactive policing, enabling authorities to anticipate incidents and allocate resources more effectively.
- With the increasing availability of crime data, machine learning techniques offer powerful tools to uncover hidden patterns and support evidence-based decision-making.
- Comparative analysis of predictive models helps identify the most effective approaches, ensuring that crime prediction systems are both accurate and reliable.
- This study compares the performance of Random Forest (RF) and Decision Tree (DT) classifiers. The goal is to determine which algorithm provides more accurate predictions.

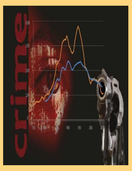

Fig 1: Crime Analysis

MATERIALS AND METHODS

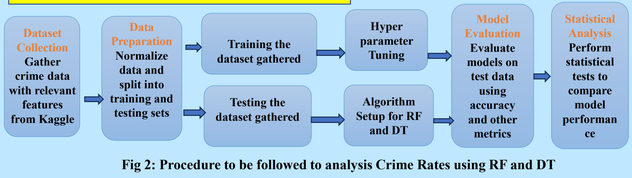

Fig 2: Procedure to be followed to analysis Crime Rates using RF and DT

RESULTS

Fig 3: Graphical comparison between RF and DT

Table 1: Accuracy values of simple RF Vs DT

	Group	N	Mean	STD Deviation	STD Error
Accuracy	RF	10	96.48	.91864	.29050
	DT	10	81.45	2.14022	.67680

- The above table shows statistically significant Mean between the Group and Accuracy.

DISCUSSION AND CONCLUSION

- **Random Forest surpassed the Decision Tree algorithm in both accuracy and precision, showcasing its enhanced ability to identify complex fraud patterns.**
- The Decision Tree algorithm faced challenges in capturing non-linear relationships, resulting in lower effectiveness against sophisticated fraud schemes.
- By utilizing an ensemble strategy, Random Forest effectively modeled significance value of 0.02 ($p<0.05$),, improving fraud detection capabilities.
- Although Random Forest demands greater computational resources, it delivered substantially superior results, achieving 96.4% accuracy compared to Decision Tree of 81.4%.
- Future research can explore the impact of urban planning and infrastructure on crime distribution.

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Optimizing Crime Rates with Machine Learning: Random Forest and Logistics Regression

INTRODUCTION

- Linear models may struggle to capture complex relationships in crime data, especially when patterns involve interactions between multiple factors like location, time, and socioeconomic indicators.
- Feature interactions and non-linear trends are common in crime patterns, which makes it important to evaluate models that can automatically capture these complexities.
- Machine Learning algorithms techniques helps better in Crime Rates prediction.
- This study compares the performance of Random Forest (RF) and Logistics Regression (LR) classifiers. The goal is to determine which algorithm provides more accurate predictions.

Fig 1: Crime Scene

MATERIALS AND METHODS

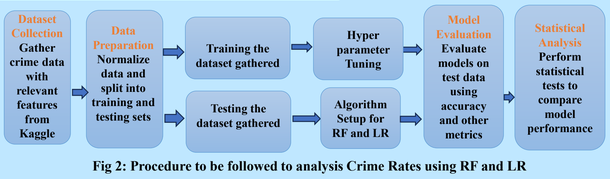

Fig 2: Procedure to be followed to analysis Crime Rates using RF and LR

RESULTS

Fig 3: Graphical comparison between RF and LR

Table 1: Accuracy values of simple RF Vs LR

	Group	N	Mean	STD Deviation	STD Error
Accuracy	RF	10	96.48	.91864	.29050
	LR	10	78.20	3.04777	.96379

- The above table shows statistically significant Mean between the Group and Accuracy.

DISCUSSION AND CONCLUSION

- **Random Forest outperformed Logistics Regression in accuracy and precision, demonstrating superior handling of complex fraud patterns.**
- Logistic Regression is a statistical method used to model the probability of a binary outcome, making it useful for predicting whether a crime will occur in a specific area or not based on historical and contextual data.
- Random Forest's ensemble approach captured significance value of 0.04 ($p<0.05$), better fraud detection.
- While requiring more computational power, **Random Forest** delivered significantly better results (96.4% vs. 78.4% accuracy).
- Future research can investigate the influence of social media on the organization and reporting of crimes.

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