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Credit Card Fraud Detection System using Machine Learning

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ABSTRACT Credit card fraud has become a significant challenge in the financial sector. The use of machine learning techniques has shown promising results in detecting fraudulent transactions efficiently. This paper discusses the implementation of a credit card fraud detection system using various machine learning algorithms, including Logistic Regression, Decision Trees, Random Forest, and Neural Networks. We evaluate the performance of these models based on accuracy, precision, recall, and F1-score.

KEYWORDS: Credit Card Fraud, Machine Learning, Classification Algorithms, Fraud Detection

I. INTRODUCTION

The rapid increase in online transactions has led to a rise in credit card fraud, causing financial losses for consumers and businesses. Traditional fraud detection techniques, such as rule-based systems, have limitations in handling large-scale and evolving fraudulent activities. Machine learning (ML) approaches can effectively detect fraud by identifying patterns in transactional data.

II. LITERATURE REVIEW

Several studies have explored ML-based fraud detection. Supervised learning techniques such as Support Vector Machines (SVM) and Random Forest have demonstrated high accuracy in fraud detection. Unsupervised methods like anomaly detection are useful when labeled fraud data is scarce.

III. METHODOLOGY

3.1 **Dataset** We use a publicly available dataset containing credit card transactions labeled as fraudulent or legitimate.
3.2 **Preprocessing** Data is preprocessed through feature selection, normalization, and handling of imbalanced classes using techniques such as Synthetic Minority Over-sampling Technique (SMOTE).

3.3 **Machine Learning Models** We implement and evaluate four ML models:

- **Logistic Regression**: A statistical approach for binary classification.
- **Decision Tree**: A rule-based model that classifies transactions.
- **Random Forest**: An ensemble learning method improving decision trees.
- **Neural Network**: A deep learning model for pattern recognition.

IV. RESULTS AND DISCUSSION

The models are evaluated using performance metrics including Accuracy, Precision, Recall, and F1-score. The results are presented in Table 1.

Model	Accuracy	Precision	Recall	F1-score
Logistic Regression	92.3%	89.1%	85.4%	87.2%
Decision Tree	94.1%	91.5%	88.2%	89.8%
Random Forest	96.7%	94.3%	91.7%	93.0%
Neural Network	97.8%	96.1%	94.5%	95.3%

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V. CONCLUSION

Our study demonstrates that machine learning can effectively detect fraudulent transactions. The Neural Network model outperforms others in terms of accuracy and F1-score. Future work includes optimizing deep learning architectures and integrating real-time fraud detection systems.

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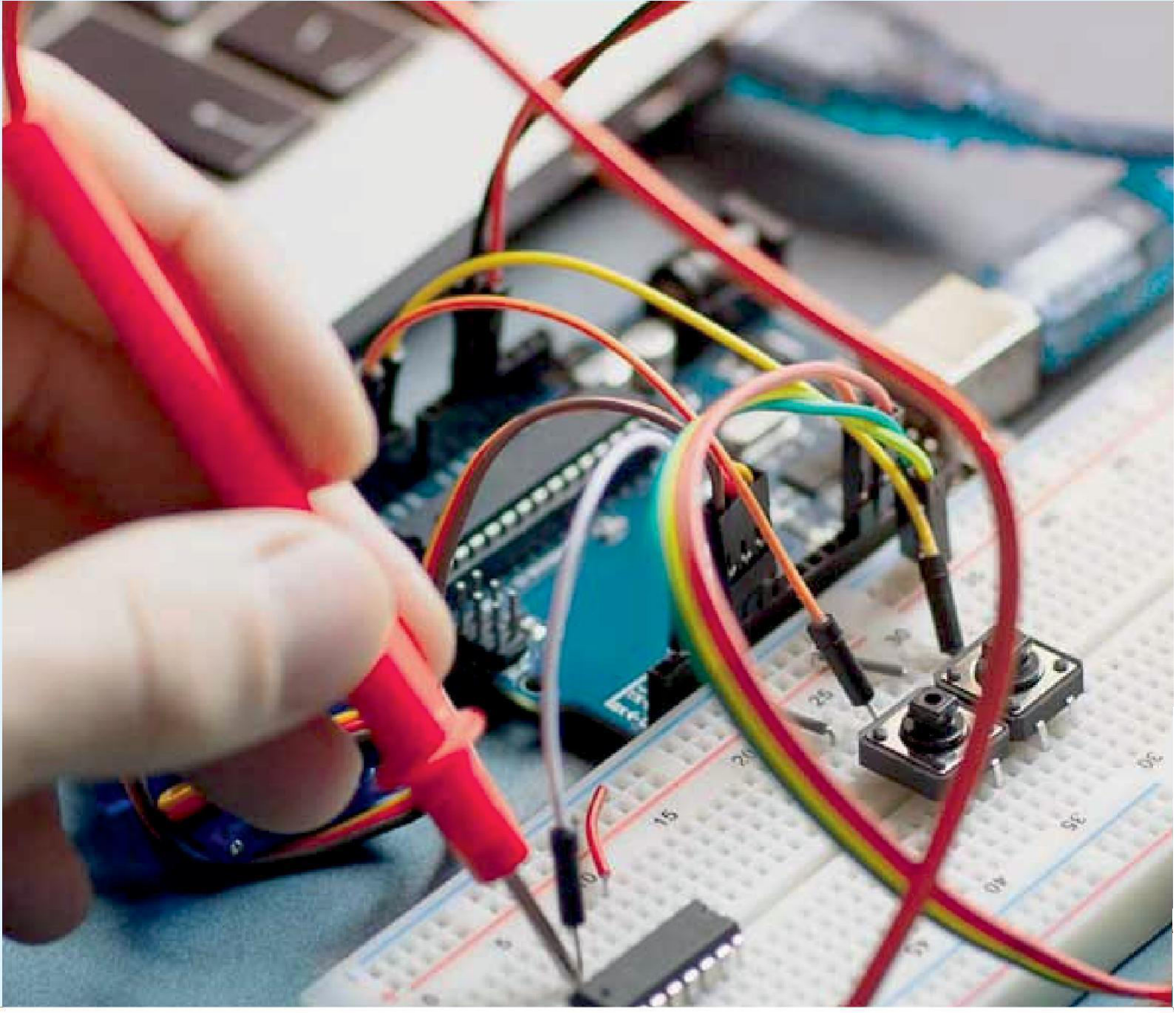

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