**Department of Computer Engineering**



**Cairo University**

**Faculty of Engineering**

**Machine Learning Project Report**

**Submitted to**

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# **1- Credit Card Transactions Fraud Detection**

**Problem Definition:**

The realm of credit card transactions is rife with challenges ranging from fraud detection to customer behavior analysis, necessitating sophisticated strategies to ensure security and efficiency. Our objective is to leverage transactional data spanning from January 2019 to December 2020, generated through simulation, to tackle pertinent issues within this domain.

1. **Fraud Detection and Prevention:**

Credit card fraud poses a significant threat to both financial institutions and consumers. Our aim is to develop robust algorithms capable of accurately identifying fraudulent transactions while minimizing false positives. By analyzing transaction patterns, anomalies, and customer behaviors, we seek to enhance fraud detection capabilities and prevent illicit activities.

1. **Customer Behavior Analysis:**

Understanding customer transaction patterns is crucial for tailoring services and optimizing engagement strategies. By segmenting customers based on demographics, spending habits, and transaction preferences, we aim to predict churn, identify high-value customers, and personalize offerings. This analysis will provide insights into customer behavior, enabling us to improve customer satisfaction and loyalty.

1. **Merchant Analysis and Relationship Management:**

Merchants play a pivotal role in the credit card ecosystem, with transaction volumes and characteristics providing valuable insights. Our objective is to analyze merchant behavior, identify high-performing merchants, and detect potential risks such as fraudulent activities or disputes. By building risk profiles and optimizing transaction processing strategies, we aim to foster trust and transparency in merchant-customer relationships.

**Motivation:**

The motivation behind addressing the challenges within credit card transactions through advanced analytics stems from the imperative to safeguard financial interests, foster trust, optimize operations, ensure regulatory compliance, promote innovation, and contribute to economic stability. By leveraging data-driven insights and proactive measures, we aim to create a credit card ecosystem that is not only secure and efficient but also customer-centric, compliant with regulatory standards, and conducive to sustained growth and prosperity. Ultimately, by addressing these challenges, we can enhance the reliability, transparency, and integrity of credit card transactions, thereby benefiting financial institutions, merchants, and consumers alike.

**Evaluation metrics:**

1. Accuracy: Measures the proportion of correctly classified instances (both fraudulent and legitimate transactions) out of the total number of instances. It provides a general overview of the model's performance across all classes.
2. Precision: The proportion of correctly identified fraudulent transactions out of all transactions flagged as fraudulent. A higher precision indicates fewer false positives.
3. Recall (Sensitivity): The proportion of truly fraudulent transactions that are correctly identified by the system. Higher recall indicates fewer false negatives.
4. F1 Score: The harmonic mean of precision and recall, providing a balanced measure of model performance.

**Dataset:**

[Fraud Detection (kaggle.com)](https://www.kaggle.com/datasets/kartik2112/fraud-detection)