**Credit Card Fraud Detection Model**

#### **Objective:**

Develop a machine learning model to detect fraudulent credit card transactions efficiently using a dataset containing transaction amounts, timestamps, merchant details, and other relevant features. The model addresses class imbalance using advanced resampling techniques and evaluates performance using key metrics.

### **Steps Involved:**

#### **1. Data Preprocessing:**

* Load the dataset and check for missing values.
* Handle missing values using median imputation to maintain data consistency.
* Standardize numerical features to ensure uniformity in data distribution.

#### **2. Addressing Class Imbalance:**

* The dataset contains a significant imbalance between fraudulent and non-fraudulent transactions.
* Synthetic Minority Oversampling Technique (SMOTE) is applied to generate synthetic fraudulent transactions and balance the dataset.

#### **3. Splitting Data & Feature Scaling:**

* The dataset is divided into training (80%) and testing (20%) sets using stratified sampling.
* Features are scaled using StandardScaler to normalize transaction attributes.

#### **4. Model Selection & Training:**

* A **Random Forest Classifier** is chosen due to its robustness in handling imbalanced datasets.
* The model is trained using the resampled dataset to improve fraud detection accuracy.

#### **5. Model Evaluation:**

* Predictions are generated for the test dataset.
* **Confusion Matrix** evaluates true positive and false positive rates.
* **Classification Report** provides precision, recall, and F1-score.
* **ROC-AUC Score** measures overall model performance.

### **Conclusion:**

The fraud detection model efficiently identifies fraudulent transactions by balancing the dataset and leveraging a Random Forest classifier. Performance metrics indicate that the model is well-optimized for accuracy and recall, reducing false negatives while maintaining precision. Future enhancements can incorporate deep learning techniques and real-time anomaly detection for further improvement.