Exploratory Analysis of Online Payments Fraud Detection using Machine Learning Project Documentation

1. Introduction

Project Title: Online Payments Fraud Detection using Machine Learning

Team Members:
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Team Members (ML & Backend, Data Analysis, Deployment)

2. Project Overview

To detect fraudulent online payment transactions using Machine Learning techniques and reduce financial losses for customers and financial institutions.

Features:

- Real-time fraud detection
- Transaction data preprocessing
- Fraud probability scoring

3. Architecture

Frontend:

HTML, CSS, JavaScript dashboard for monitoring transactions and displaying fraud results.

Backend:

Flask/FastAPI-based Python server handling transaction requests, validation, and prediction logic.

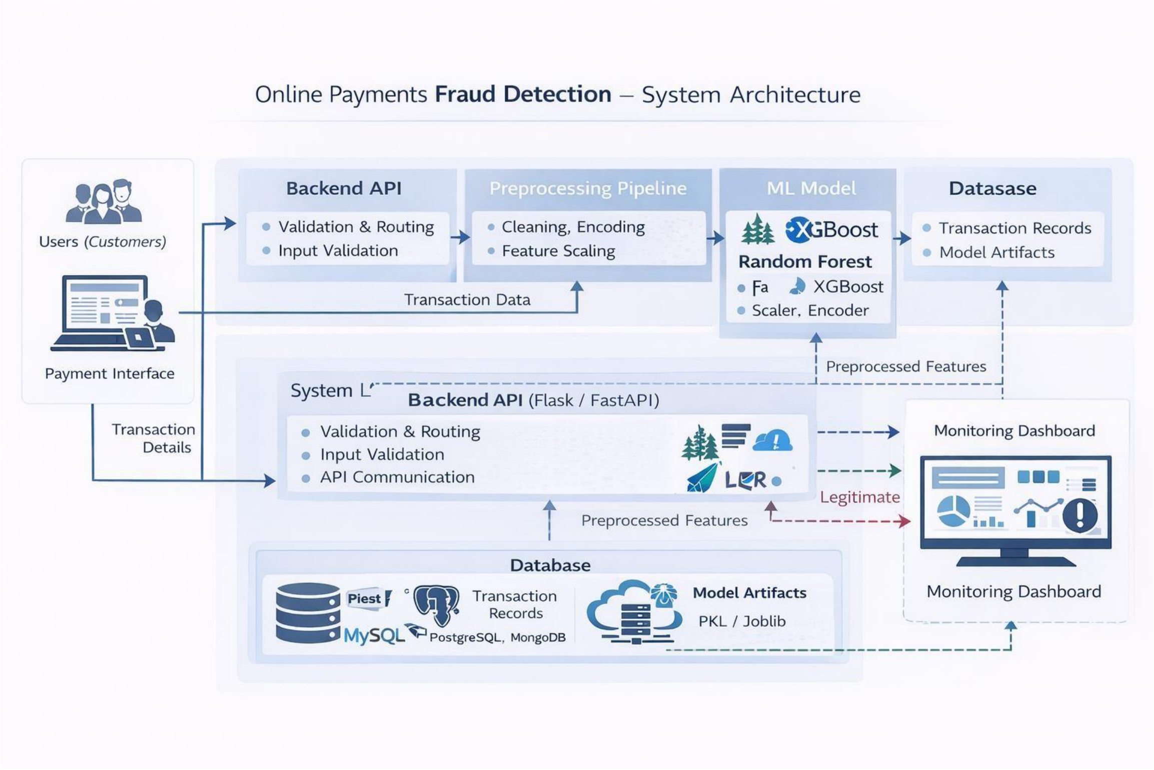
Model Layer:

Trained Machine Learning model (Random Forest / XGBoost) with scaler and encoder artifacts.

Database Layer:

Stores transaction records, fraud logs, and model artifacts.

System Architecture Diagram



4. Setup Instructions

Prerequisites:

- Python 3.x
- Flask or FastAPI
- Pandas
- NumPy
- Scikit-learn

- Joblib
- MySQL/MongoDB (optional)

Installation:

Install dependencies using pip and run the backend application.

5. Folder Structure

templates/ → HTML dashboard files static/

→ CSS, JS, Images main.py → Flask/FastAPI

backend model_training.ipynb → ML model training

notebook fraud_model.pkl → Trained model

scaler.pkl → Saved scaler encoder.pkl →

Saved encoder

6. Running the Application

python app.py

http://127.0.0.1:5000

7. API Documentation

Accepts transaction details and returns fraud prediction.

8. Authentication

Not implemented in current version (Future scope: JWT-based authentication and secure token validation).

8. User Interface

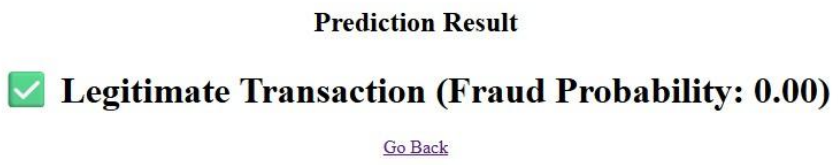
The UI provides:

- Transaction input form (for testing)
- Fraud detection result display
- Fraud monitoring dashboard
- Statistical charts for fraud trends
- Alert notifications

10. Testing

Model evaluated using accuracy, confusion matrix, ROC-AUC. **11.**

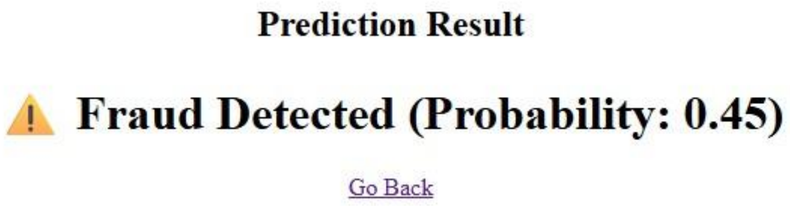
11. Screenshots / Demo



Prediction Result

✅ **Legitimate Transaction (Fraud Probability: 0.00)**

Go Back



Prediction Result

⚠ **Fraud Detected (Probability: 0.45)**

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12. Known Issues

- Performance depends on dataset quality
- Imbalanced data affects recall
- Requires periodic retraining to handle evolving fraud patterns

13. Future Enhancements

- Deep Learning-based fraud detection
- Real-time streaming using Kafka
- Cloud deployment (AWS/Azure/GCP)
- Mobile fraud alert system
- Cross-bank fraud intelligence sharing