

A photograph showing a person's hands holding a black smartphone in their left hand and a green and white credit card in their right hand. They appear to be looking at the phone. In the background, a laptop is open on a desk, and some papers and a calculator are visible. The entire image has a teal overlay.

Detecting Credit Card Fraud with Machine Learning

PRESENTATION BY GROUP 3
DSF-PT09



OVERVIEW

- With the rise of **digital payments** and online transactions, detecting **fraudulent activities** in real-time has become a major priority.
- This project aimed to **analyse** credit card transaction data to **detect potential fraud using data analytics and machine learning techniques**.

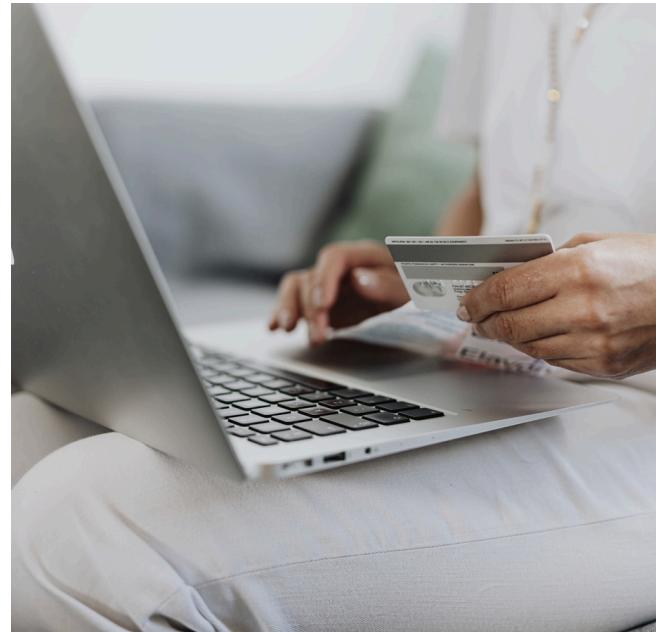


BUSINESS PROBLEM

- Financial institutions face **high risks** from fraudulent transactions, which can lead to substantial **financial losses** and damaged customer trust.
- **Traditional fraud detection methods**, such as rule-based systems, are often not sufficient to catch increasingly sophisticated fraudulent behaviour. Therefore, businesses require **intelligent systems** that can automatically and accurately detect anomalies in transaction data.

OBJECTIVES

- **Analyse** credit card transaction data for fraud detection.
- **Develop** and compare multiple machine learning models for fraud classification.
- **Evaluate** model performance by improving accuracy and reduce false positives.
- **Deploy** the model for real-time use.





METRICS OF SUCCESS

- **Recall** (Fraud Class) $\geq 90\%$: Correctly identify most fraudulent transactions.
- **Precision** (Fraud Class) $\geq 70\%$: Limit false alarms to reduce customer disruption.
- **AUC-ROC Score** $\geq 90\%$: Strong ability to distinguish fraud vs non-fraud.

METHODOLOGY

Data Collection:

- Dataset was gotten from Kaggle.

Data Preprocessing:

- Perfromed data cleaning, feature engineering and selection, scaling and dimensionliaty reduction.

Modeling:

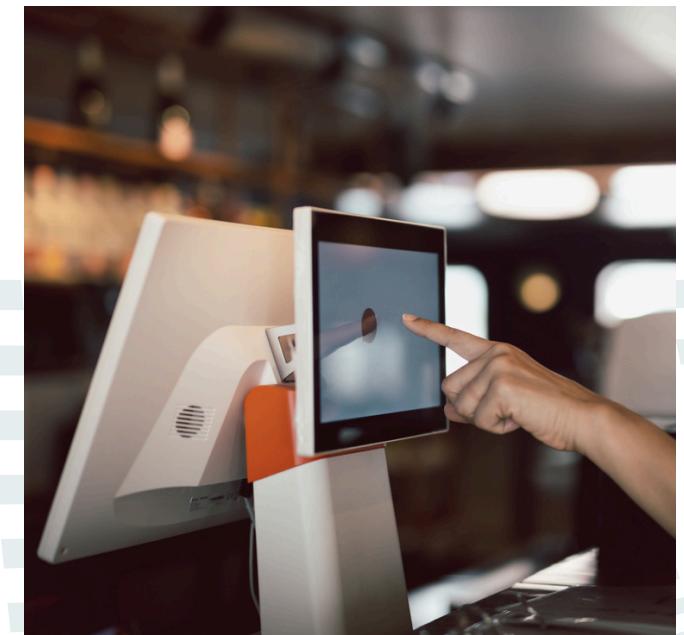
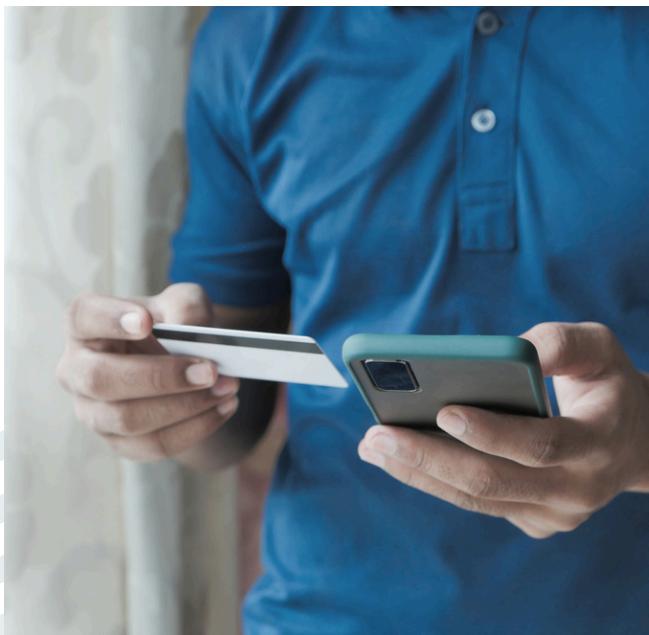
- Trained traditional and advanced models.

Evaluation:

- Recall, Precision and AUC-ROC assessed model performance.

Deployment:

- Developed and documented a plan for deploying the best performing model.





MODELING APPROACH

Models evaluated :

- **Baseline** : Logistic Regression
- **Traditional**: Decision Tree, Random Forest
- **Advanced**: Neural Network, XGBoost Classifier

Class imbalance was addressed using **SMOTE** and **cost-sensitive learning via** class weights.



MODEL PERFORMANCE SUMMARY

Model	Precision (Fraud)	Recall (Fraud)	AUC-ROC
Logistic Regression	0.04	0.75	0.8691
Decision Tree	0.54	0.54	0.7701
Random Forest	0.67	0.48	0.9232
Neural Network	0.48	0.60	0.8844
XGBoost Classifier	0.63	0.68	0.9306



PERFORMANCE ANALYSIS AND BEST MODEL

- The **XGBoost Classifier** slightly outperformed the **Random Forest Classifier** with a marginally higher AUC-ROC score (**0.9306 vs 0.9304**) and a higher recall (**0.68 vs 0.65**).
- Given that minimising missed fraudulent transactions (false negatives) is paramount in fraud detection, the **XGBoost Classifier** is the preferred model for this project.



CONCLUSION

- The project achieved its **core objective** of building and evaluating machine learning models for fraud detection and showcased promising initial results with high AUC-ROC scores.
- **Further work** is required to enhance the models' ability to detect a higher percentage of fraud(recall) while maintaining a low false positive rate (precision) to meet the defined business and technical success criteria.



RECOMMENDATIONS

- **Handling Data Imbalance**

Use advanced resampling such as ADASYN, Borderline-SMOTE, NearMiss

- **Threshold Tuning**

Optimise thresholds using ROC and precision-recall analysis.

- **Deep Learning Exploration**

Test neural network architectures (MLPs, RNNs for sequential data, autoencoders for anomaly detection) to learn complex fraud patterns,

- **Real-time Implementation Considerations**

Consider streaming data frameworks if real-time fraud detection is a business priority.

A close-up photograph of a person's hands. The left hand holds a black smartphone, and the right hand holds a gold-colored credit card. They appear to be performing a mobile payment or transaction. In the background, a laptop is open, showing its keyboard. A spiral-bound notebook and a calculator are also visible on the desk surface.

Thank you!