Project Background: Credit Card Fraud Detection

What is Fraud?

Fraud is an act of deception used to illegally take money, property, or rights from an individual or organisation. In the context of this project, I'm particularly focused on credit card fraud, where stolen credit card details are used to make unauthorised transactions. On average, organisations lose around 5% of their annual revenue to fraud, making it a serious and widespread issue.

Motivations?

Recently I've been thinking about how banks and financial institutions use machine learning to detect and prevent fraud. With big banks like CBA releasing their models that help detect abuse in transactions compromised of thousands of models, I'd like to attempt making my own simplistic model that detects fraud in credit card transactions. Building a model for credit card fraud detection gives me a chance to explore the practical side of machine learning in finance.

Types of Fraud

- **Online fraud** – Manipulation of digital platforms to conduct unauthorised transactions.
- **Credit card fraud** – Involves the use of stolen credit card information.
- **Inventory theft via fraud** – Fraudulent card use to obtain goods.
- **False positives** – Legitimate transactions being incorrectly flagged as fraud, which is a major operational issue.

Key Challenges

Here are some of the challenges we may anticipate when creating our model.

1. **Class Imbalance**

   Fraud cases make up less than 0.5% of all transactions. This makes training models difficult, as most algorithms struggle to detect rare events accurately.

2. **False Positives**

   A major issue in fraud detection is incorrectly flagging legitimate transactions. This can affect customer trust and lead to poor user experiences.

3. **Latency Constraints**

   For fraud detection systems to be effective, they need to make decisions in real-time—typically within 8 seconds or less per transaction.

4. **Handling Imbalanced Data**

   I plan to explore techniques like bootstrapping and other resampling strategies to balance the dataset and improve model performance.

Conclusion

The goal is to build a working fraud detection system that tackles the key challenges above. I'll experiment with different machine learning models, explore feature engineering, and evaluate the system using metrics suited for imbalanced datasets, like precision, recall, and the F1-score.

This project is both a technical challenge and a chance for me to understand how banks apply machine learning at scale to stop fraud effectively. Given that I've recently been using R a lot as part of my university units, I'll be developing this in R.