



# Banking on Fraud

Using Machine Learning to minimize the toll fraud takes on banks

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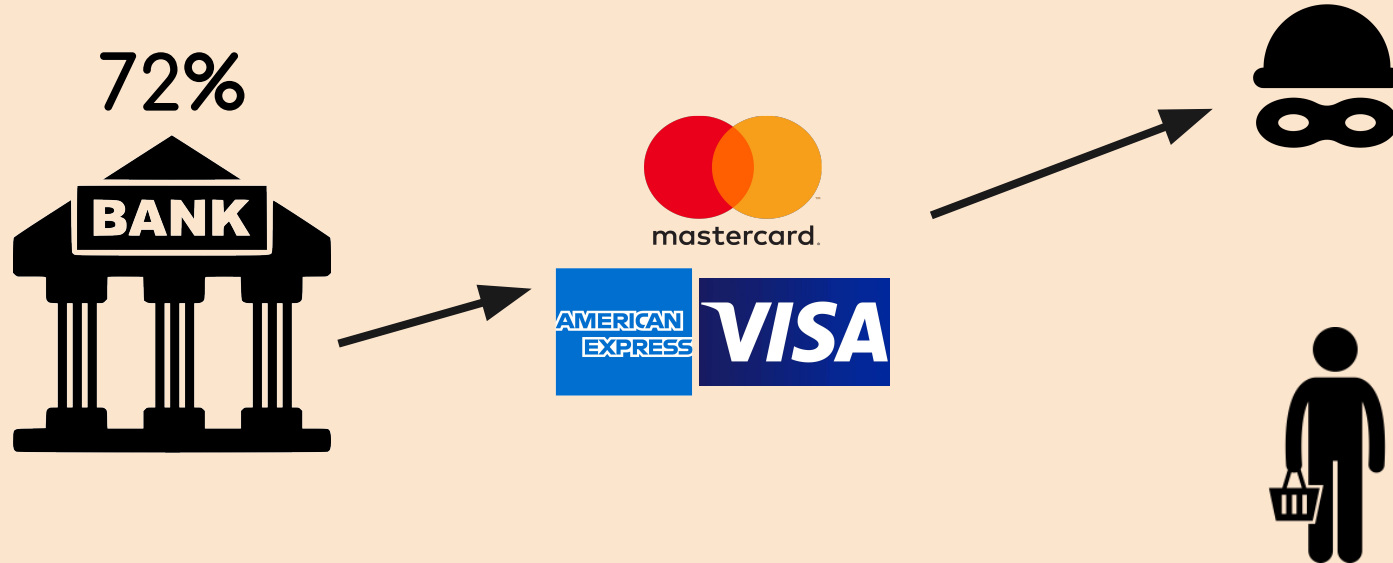
# Fraud is a problem for everyone

In 2018, \$24.26 Billion was lost due to payment card fraud worldwide



<https://shiftprocessing.com/credit-card-fraud-statistics/>

When fraud occurs, banks are often on the hook



# Investigating fraud is expensive!

Forensic projects cost upwards of \$8 per case.

With over 1 billion transactions worldwide every day, we can't afford to audit every transaction.



**Objective:**

**Minimize cost of fraud for banks.**

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# Data

Fraud Detection Dataset<sup>1</sup>:

- 284,807 datapoints
- 30 features (28 composite)
- 492 positive cases

# Tools

Modeling: SciKit-Learn and XGBoost

Data handling: Pandas and NumPy

Visualization: Google Sheets

1. <https://www.kaggle.com/mlg-ulb/creditcardfraud>



# Assumptions

- Customers do not churn because of false positives or negatives.<sup>1</sup>
- A fraudulent transaction costs the bank about €85<sup>2</sup>
- Investigating a potentially fraudulent transaction costs about €6<sup>3\*</sup>

\*The current USD-EUR exchange rate is approximately \$1.17 to €1.00

1. Model has built-in churn costs; all we have to do is re-fit the model when we have data
2. [https://www.ecb.europa.eu/pub/pdf/other/4th\\_card\\_fraud\\_report.en.pdf](https://www.ecb.europa.eu/pub/pdf/other/4th_card_fraud_report.en.pdf)
3. <https://www.valid8financial.com/post/bank-fraud-investigation-cost>

## Metrics

$$C = 6(P) + 85(F_{neg})$$

Naive Models:

Cost/Transaction (Legitimate): €0.146584

Cost/Transaction (Fraudulent): €6.00



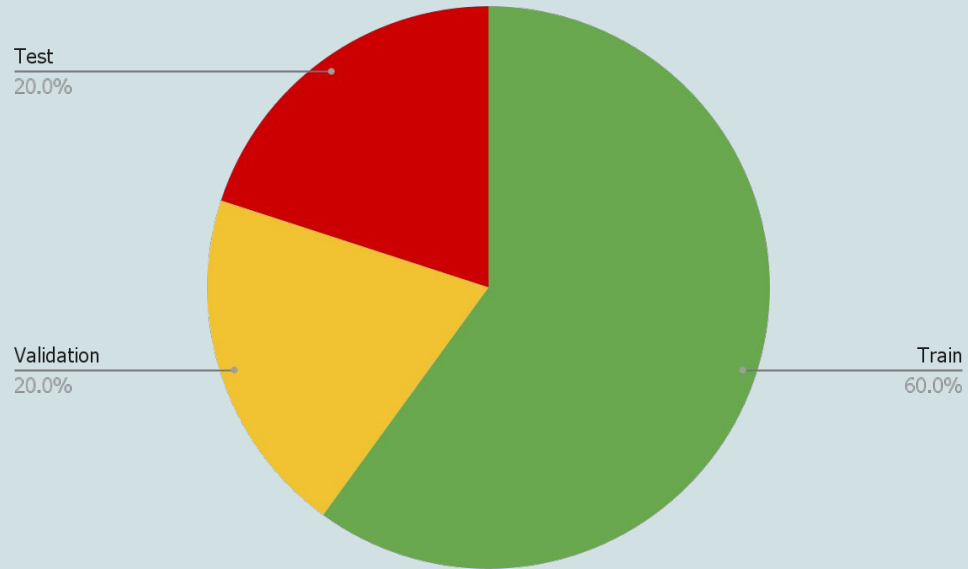




# Modeling

Models evaluated:

- **k-Nearest-Neighbors**
- Logistic Regression
- Random Forest
- Gradient-Boosted Trees



# Techniques utilized

- Adjusting probability threshold
- Undersampling negative cases
- Increasing positive cases' weight

XGBoost-exclusive metrics:

- Learning Rate
- Tree Depth
- Child Weight
- #Features Selected
- Sub-sampling





# Models

- Logistic Regression
- Random Forest
- Gradient-Boosted Trees

Fraud detection models are often “black-box,” so a high recall score (and low cost/transaction) is prioritized over interpretability.

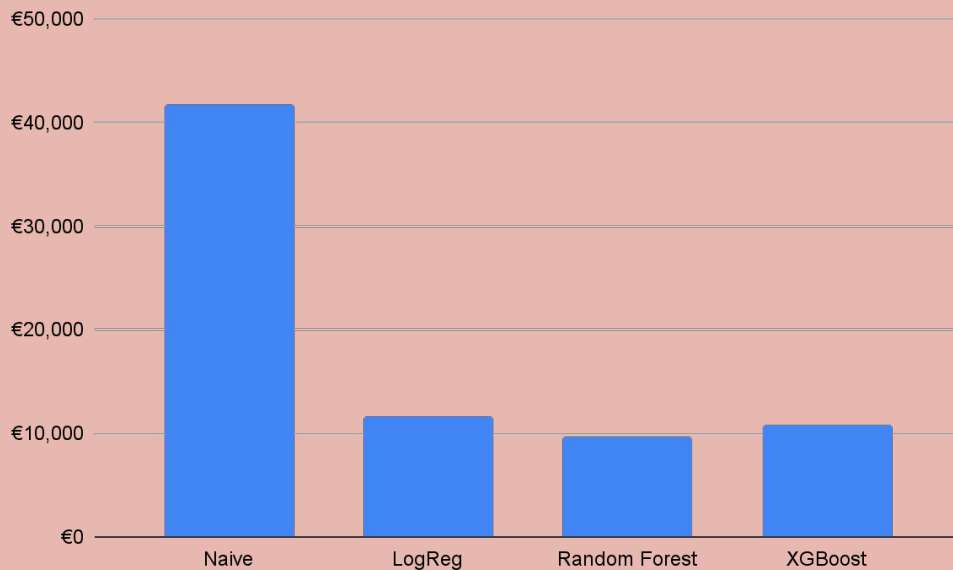
	Logistic Regression	Random Forest	GB Trees
Accuracy	0.998683	0.999719	0.999034
Precision	0.630769	0.918919	0.704545
Recall	0.752294	0.935780	0.853211
F1	0.686192	0.927273	0.771784
Cost/Transaction	€0.0409889	€0.0339465	€0.0377385

# Models

- Logistic Regression
- Random Forest
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The naive baseline loses €40,000 over two days described by the dataset.

By comparison, the Random Forest model saves over €30,000 = \$35000.



# Future Work

Additional factors to take into account:

- Customer churn
- Purchase location
- Customer demographic



# Questions?

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