Santander Customer Transaction Prediction Project: find the target customers for marketing campaign

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Key Takeaways

- Predicting which customers will make a transaction helps to better campaign
- Feature engineering techniques can improve prediction accuracy
- Based on Area under ROC Curve (AUC), LightGBM algorithm has the highest performance(AUC = 0.92282)
- The best model, LightGB algorithm, produces **15.4%** higher average customer profit than baseline model, and **200%** higher than without using any algorithm

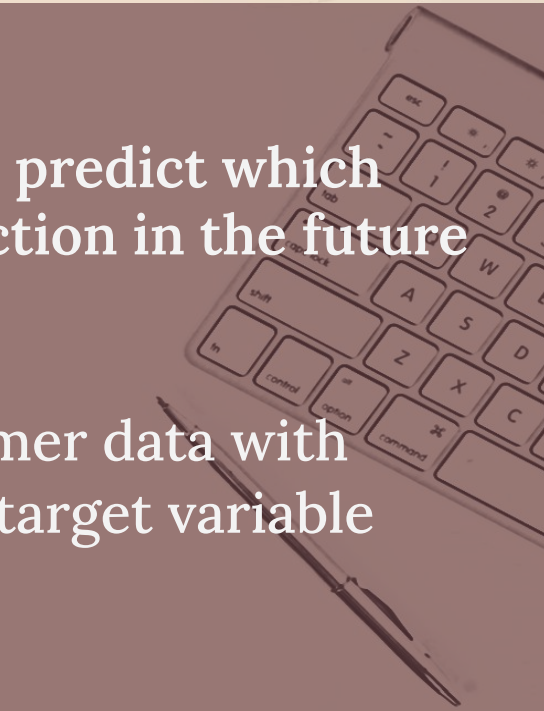
Project Overview

Goal

Discover the best approach to predict which customers will make a transaction in the future

Data

De-identified historical customer data with 200 predictor variables and 1 target variable



Analysis Process

Transforming the raw data into features that better represent the underlying problem to the predictive models

Feature Engineering

Designing a predictive model that has the best performance

Model Selection

Converting a predicted probability into a class label

Threshold Selection

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Feature Engineering helps prediction to perform better

Fake Test Data

- Synthetic data from real testing data
- Intentionally disturbs final prediction performance.
- Found 100,000 fake records

Magic Features

- Unique value that only appears once among a feature
- Provides more useful information to the prediction model.
- Added 200 magic features

Data Augmentation

- Resampling data
- Helps the training algorithm to learn about the data better.
- Added new information to the data set

LightGBM:

- Raw data: AUC = 0.8979
- After feature engineering : AUC = 0.9228

Compared to raw data, model built with data after feature engineering has better performance, with AUC increased by 2.5%

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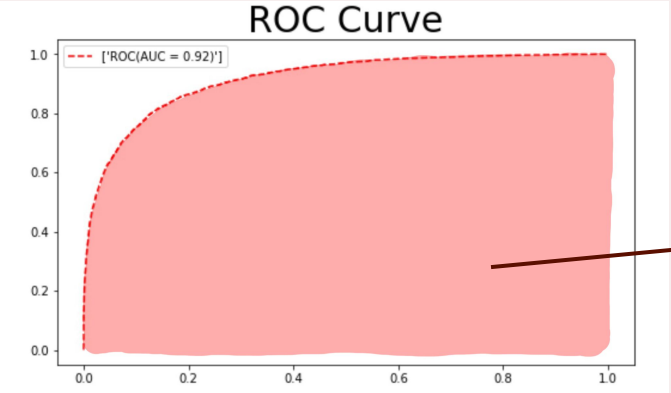
Threshold Selection

Model Selection: Introducing AUC

AUC - Area Under Curve



AUC

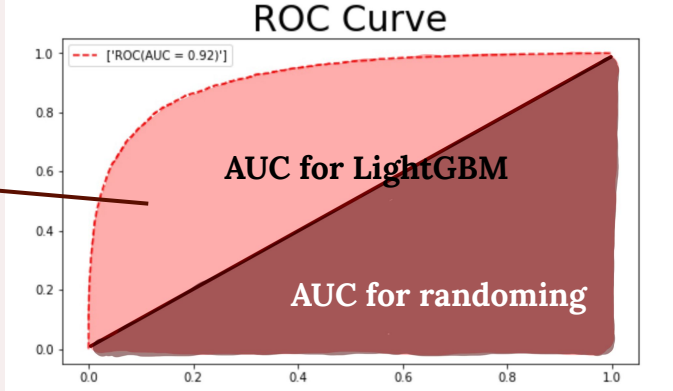
AUC represents the probability that a model can distinguish between a positive and negative outcome when given a random record from the dataset. The higher the AUC, the better.

Model Selection: LightGBM has the best performance

Best Performance

Model	AUC
LightGBM	0.92282
XGBoost	0.91745
Neural Network	0.88149
Naive Bayes	0.888

Value that LightGBM brings in compared to randoming



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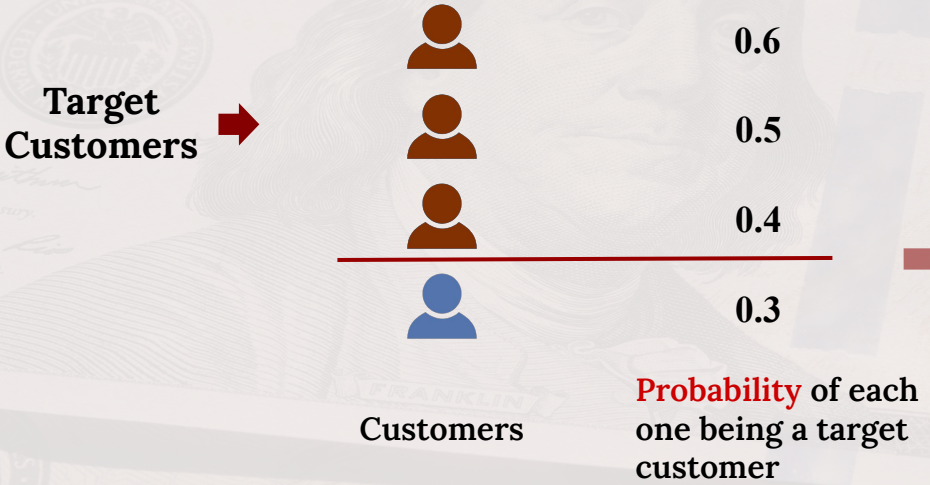
Threshold Selection

Output of Prediction Model and Threshold Selection

Example of output of our model:



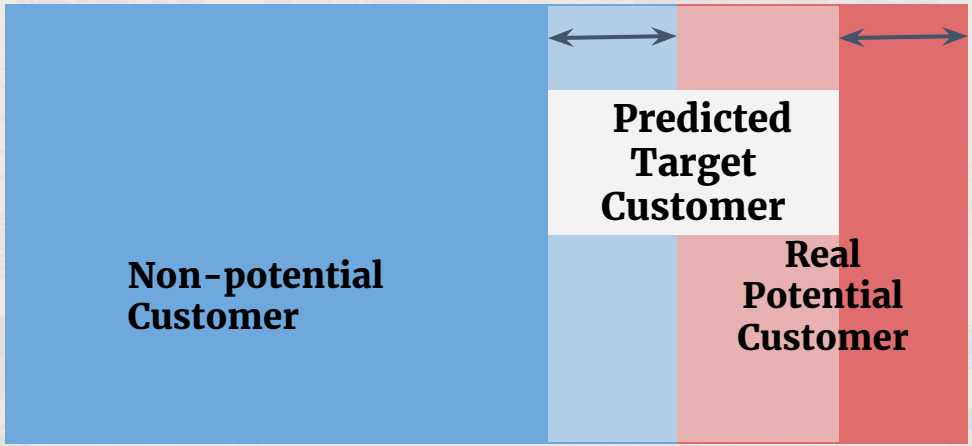
Threshold: lowest probability of a customer to define as a target customer

Threshold Selection - Minimize misclassification cost

How to choose the optimal threshold?

Threshold Selection - Minimize misclassification cost

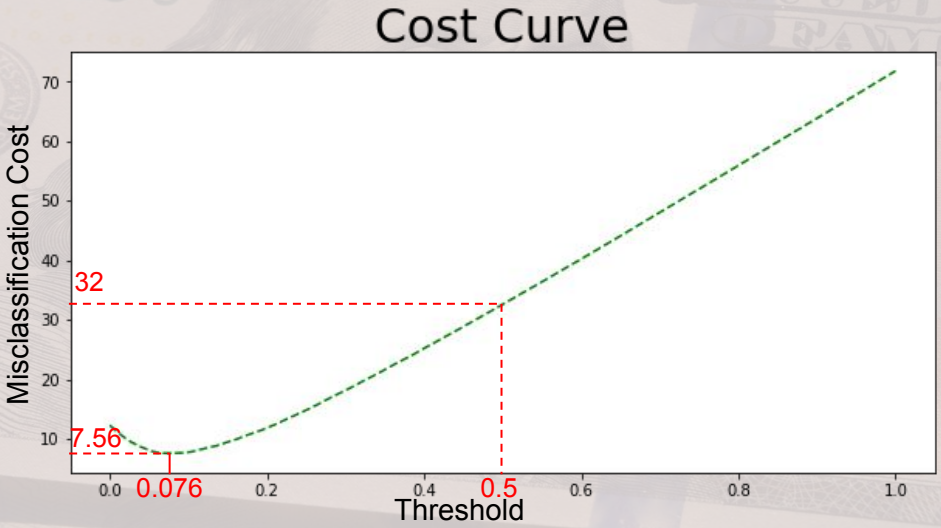
Sunk Cost of wrongly targeting a non-potential customer + Opportunity Cost of missing a potential customer = **Misclassification Cost**



Goal:
Cover more total potential customers and avoid covering non-potential customers to **minimize the misclassification cost**

Threshold Selection - Minimize misclassification cost

Select optimal threshold



Optimal threshold is 7.6%, the corresponding average misclassification cost is 7.56, compared with 32 using the naive threshold of 50%.

Business Value

Business Value: our model leads to better marketing campaign strategy

$$\text{Revenue} = \#\text{ of Real Potential Customers} \times \text{Revenue Per Person}^{[1]}$$

$$\text{Cost} = \#\text{ of Target Customers} \times \text{Cost Per Person}^{[1]}$$

$$\text{Avg Profit Per Customer} = \frac{\text{Revenue - Cost}}{\#\text{ of Target Customer}}$$

[1] What is the average customer acquisition cost that a bank pays to acquire a credit card customer?, Parvathy P. and 2 others
https://askwonder.com/research/average-customer-acquisition-cost-bank-pays-acquire-credit-card-customer-i-m-fy512dtei

Business Value: our model leads to better marketing campaign strategy

Average profit per target customer

Method	Average profit per target customer ($)
Randomly Select Target Customer	-59.51
Using Baseline Model	53.90
Our Optimized Model	62.19

Conclusion

Feature Engineering , Model Selection, Threshold Selection

- Choose LightGBM as the algorithm to help Santander to predict which customers will make a transaction in the future
- Achieve AUC of 0.92282
- 7.6% threshold

Business Value

- Achieve an average profit of $62.19 per customer