Maximizing User Acquisition Efficiency for Term Deposits

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Group 4

The Business and its Problem

Banco de Portugal

- Term deposits are a major source of revenue for Banco de Portugal
- Term deposits are when customers deposit money for a set rate and period of time at a bank
- Banks profit from term deposits by lending the money out at higher rates than they give to customers
- Assumption: $200 profit/deposit

Term Deposit Acquisition Cost

- Term deposits are sold through telemarketing conducted by third party call centers
- Currently calls are made through random selection and there is no system to maximize acquisition efficiency
- Under our hypothetical assumptions, the total cost per call is $10

The Opportunity

Enlisting a Classifier Model

- The bank's current situation leads to a baseline expected profit of $12 per call
- Our goal is to build a classifier model that finds which customers are more likely to invest in a term deposit
- This will allow the bank's call centers to be more efficient and increase the profit per call figure

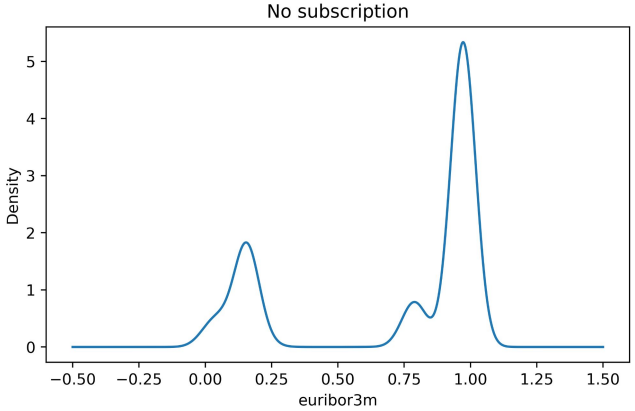
Model Development

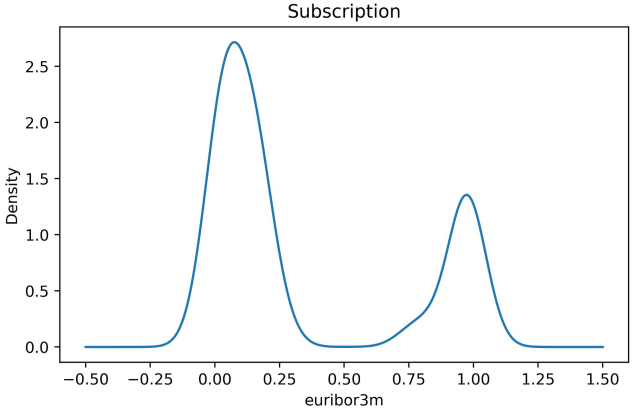
Building Our Model

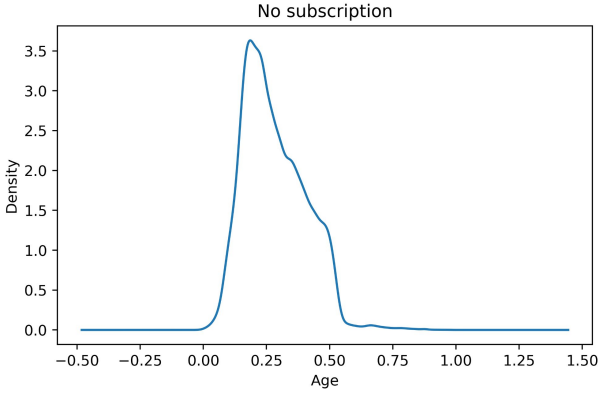
- Data cleaning and feature selection
- We tested 5 different models: ADABoost, RandomForest, XGBoost, GradientBoost, LogisticRegression
- To score each model, we mainly used our cost-function and the ROC AUC scores
- Optimizing our cost function allowed us to find the best cutoff for each model

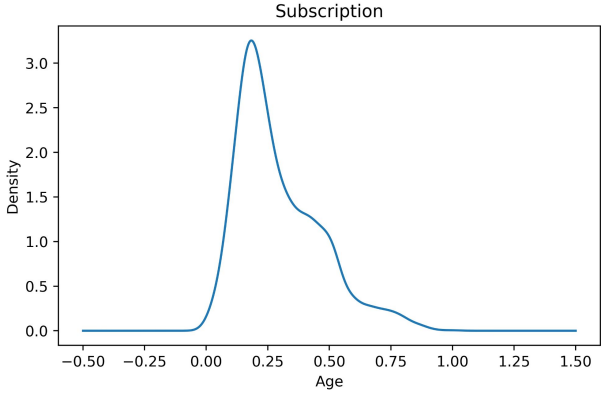
Optimizing our cost function was the most important factor in training our model, since it allowed us to find the most profitable business decisions for the bank

Distributions of Variables

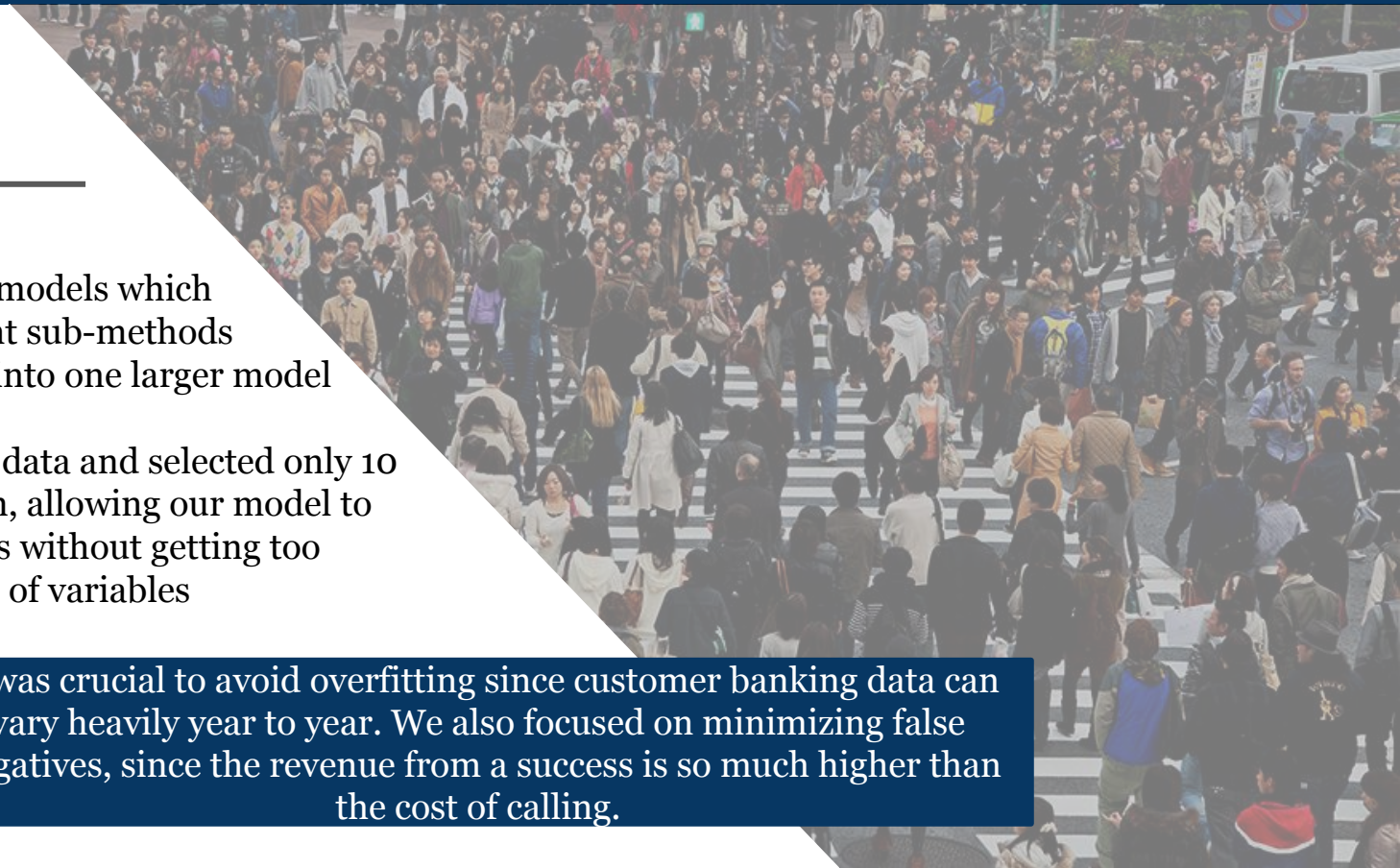








Obstacles in Model Development

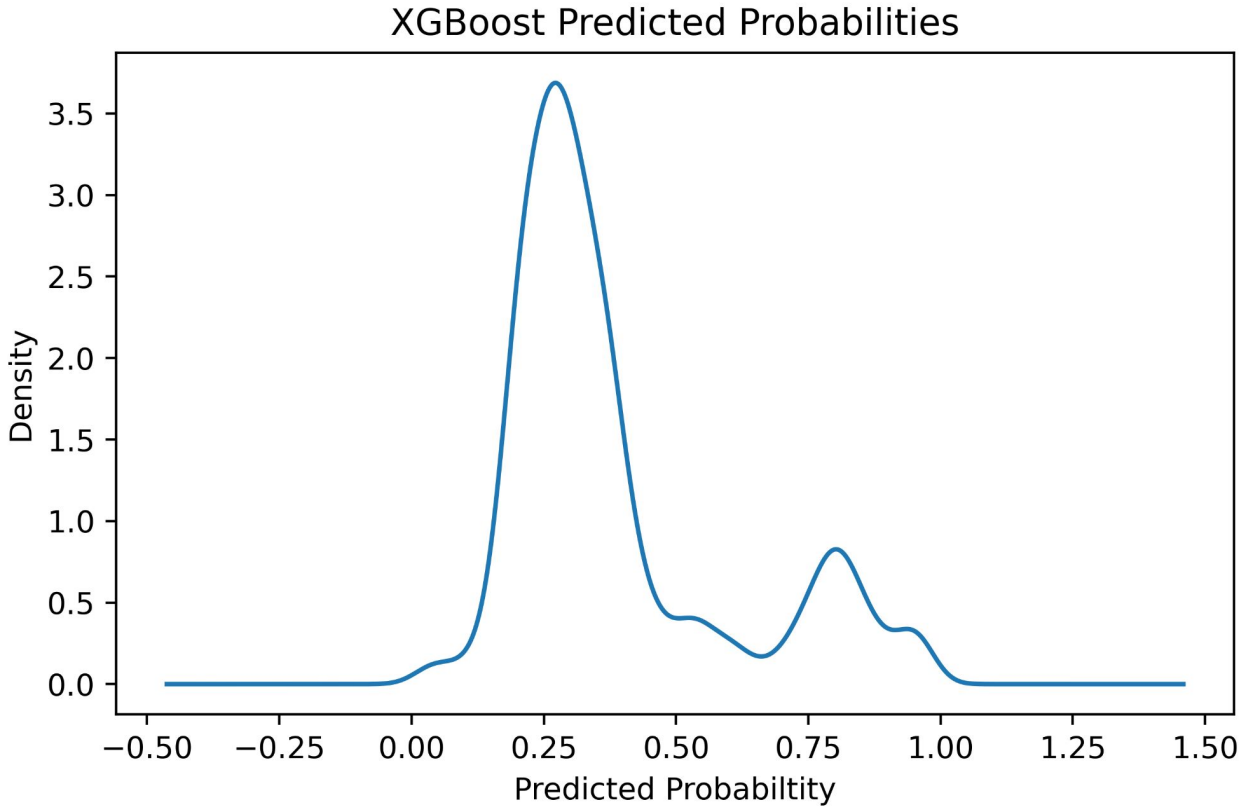


Avoiding Overfitting

- We chose ensemble models which use multiple different sub-methods then combine them into one larger model
- We also cleaned our data and selected only 10 features to train with, allowing our model to generalize the results without getting too specific among a ton of variables

It was crucial to avoid overfitting since customer banking data can vary heavily year to year. We also focused on minimizing false negatives, since the revenue from a success is so much higher than the cost of calling.

Distributions of Predicted Probabilities



Key Results

Maximizing Profit

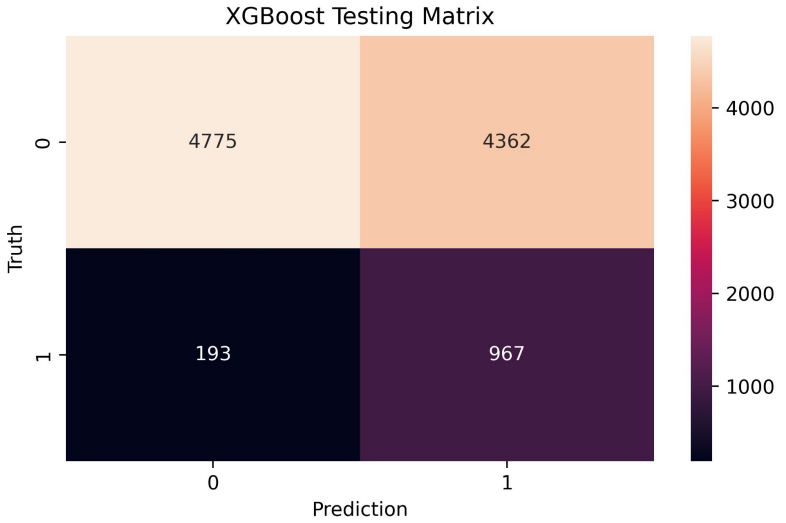
- After training our models, we chose the XGBoost model which maximized profit
- After using our model, the profit per call was $13.60, a $1.60 increase from the current figure ($12.00)
- We had an optimistic model with a cutoff of 0.31; we wanted to minimize false negatives at the expense of more false positives

Our model proved successful at increasing the profitability and efficiency of term deposit acquisitions. By maximizing profit we were able to minimize the opportunity cost of false negatives

Classification Report and Confusion Matrix (Test Set)

XGB...

	precision	recall	f1-score	support
0	0.96	0.52	0.68	9137
1	0.18	0.83	0.30	1160
accuracy			0.56	10297
macro avg	0.57	0.68	0.49	10297
weighted avg	0.87	0.56	0.63	10297



Conclusions

The Bigger Picture

- While a $1.60 increase may seem small, given that the current method and the model based method both call 10,000 people, the model gives an expected profit of **$136,000**, **$16,000 larger** than the baseline expected profit of $120,000.

- With a more efficient calling process, the bank may even be able to downsize its call center contracts and save even more

Overall, our model successfully maximized the efficiency of our term deposit acquisition process and maximized profit per call

Future Recommendations

Maximizing Profit

- We recommend that Banco de Portugal implement our model immediately, calling customers whose predicted probability is greater than 0.31 to maximize and increase profit
    - We also recommend that the bank collects more social and economic data as opposed to customer demographic data so that the model has access to variables holding more predictive power

Q&A

Sources

Dua, D., & Graff, C. (2012, February 14). *Bank Marketing Data Set*. UCI Machine Learning Repository. Retrieved March 18, 2022, from https://archive.ics.uci.edu/ml/datasets/bank+marketing.

Moro, Sérgio, et al. “A Data-Driven Approach to Predict the Success of Bank Telemarketing.” *Decision Support Systems*, vol. 62, June 2014, pp. 22–31. *DOI.org (Crossref)*, https://doi.org/10.1016/j.dss.2014.03.001.