Investment Campaign Case Study





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Data Science Coding Bootcamp Team

Case Study Definition & Objectives

- Banking campaign for investment product
- First round of campaign already performed, results are available
 - Result for each client: success = client invested, failure = client did not invest
- Objective of the case study is to target additional 3,000 clients for second round of campaign who are most likely to invest and therefore maximize bank's revenue
- Clients will be offered a cash-back bonus of 1,000 CZK if they decide to invest in the product

Workflow



Data Preprocessing

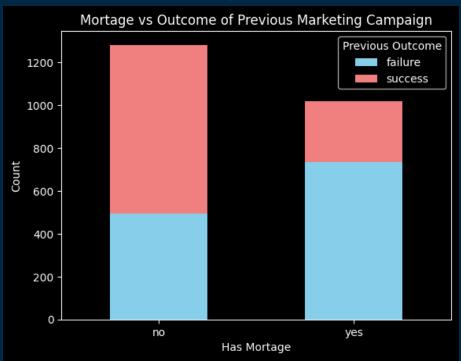
- Dataset of 11,162 clients, for 2,299 results from first round are available
- Database of 4 tables
 - Client's personal info
 - Client's bank product info
 - Client's balances
 - Results from first round of investment campaign
- Data cleaning
 - Replacing missing values
 - Label encoding of categorical variables
 - Client balances recalculated to CZK using daily FX rates for EUR and USD

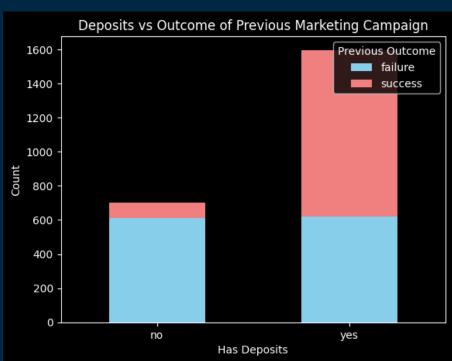
Visualization of variable relationships

Visualization of Variable relationships																	
Heatmap of the dataset																	
poutcome_enc	1	0.099	0.44	-0.15	0.031	-0.33	0.011	0.091	0.017	0.069	0.065	0.065	0.065	0.065	-0.0092		Ĭ
age ·	0.099	1	0.072	-0.039	0.24	-0.16	-0.46	-0.15	0.0088	-0.023	0.099	0.099	0.097	0.1	-0.0038		
has_deposits_enc	0.44	0.072	1	-0.16	0.0075	-0.32	0.03	0.12	-0.01	0.092	0.076	0.076	0.076	0.076	-0.014	- (0.8
loan_enc	-0.15	-0.039	-0.16	1	-0.034	0.16	-0.059	-0.05	0.017	-0.048	-0.088	-0.088	-0.087	-0.088	-0.0079		
has_insurance_enc	0.031	0.24	0.0075	-0.034	1	-0.097	-0.054	-0.11	-0.02	-0.011	0.093	0.092	0.092	0.093	0.011	- (0.6
has_mortgage_enc	0.33	-0.16	-0.32	0.16	-0.097	1	-0.056	-0.11	-0.029	-0.12	-0.081	-0.081	-0.08	-0.081	0.026		
marital_enc	0.011	-0.46	0.03	-0.059	-0.054	-0.056	1	0.15	0.0078	0.065	-0.012	-0.012	-0.011	-0.013	0.0048	- (0.4
education_enc	0.091	-0.15	0.12	-0.05	-0.11	-0.11	0.15	1	0.003	0.078	0.054	0.054	0.054	0.055	0.013		
gender_enc	0.017	0.0088	-0.01	0.017	-0.02	-0.029	0.0078	0.003	1	0.0039	-0.0017	-0.0018	-0.0022	-0.002	0.017	- (0.2
job_enc	0.069	-0.023	0.092	-0.048	-0.011	-0.12	0.065	0.078	0.0039	1	0.043	0.042	0.042	0.042	0.0023		
last_balance	0.065	0.099	0.076	-0.088	0.093	-0.081	-0.012	0.054	-0.0017	0.043	1	1	1	1	0.013	- (0.0
mean_balance	0.065	0.099	0.076	-0.088	0.092	-0.081	-0.012	0.054	-0.0018	0.042	1	1	1	1	0.015		
min_balance	0.065	0.097	0.076	-0.087	0.092	-0.08	-0.011	0.054	-0.0022	0.042	1	1	1	1	0.013		-0.2
max_balance	0.065	0.1	0.076	-0.088	0.093	-0.081	-0.013	0.055	-0.002	0.042	1	1	1	1	0.019		
currency_enc	0.0092	-0.0038	-0.014	-0.0079	0.011	0.026	0.0048	0.013	0.017	0.0023	0.013	0.015	0.013	0.019	1		-0.4
	poutcome_enc -	- ade	ıas_deposits_enc -	loan_enc -	s_insurance_enc -	s_mortgage_enc -	marital_enc -	education_enc -	gender_enc -	job_enc -	last_balance -	mean_balance -	min_balance -	max_balance -	currency_enc -		

Exploratory Analysis of First Round

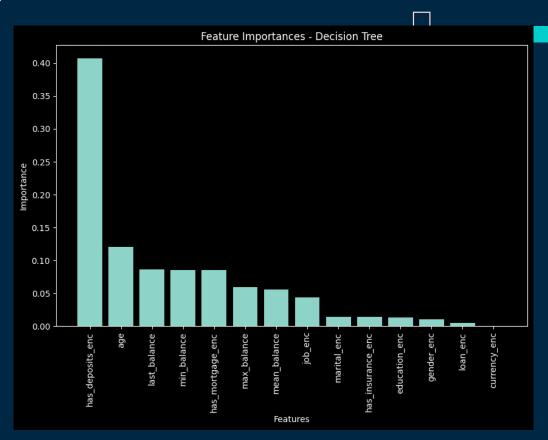
 Clients who do not have mortgage and have deposits were more likely to invest in first round of campaign





Feature Engineering

- Developing new variables
 - Mean, Last, Min, Max balances
 - Currency
- Selecting most important features based on a Decision
 Tree algorithm



Model Selection

- Random Forest
- Logistic Regression
- K-Nearest Neighbors (KNN)
- Adaptive Boosting (AdaBoost)
- Neural Network

Hyperparameter tuning

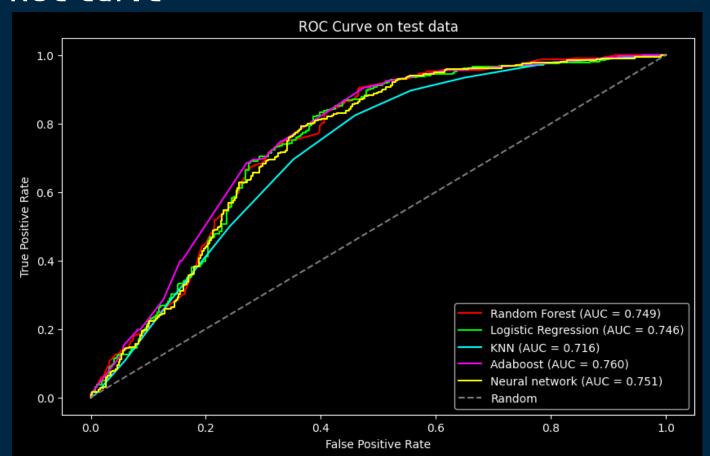
- Finding the best combination of parameters to achieve the maximum performance of the models
- E.g. What should be the number of trees in a random forest or number of layers in neural network?
- GridSearch build model for each combination of parameters, evaluating each model and selecting the architecture which produces the best results

Metrics Used for Model Evaluation

	Random Forest	Logistic Regression	KNN	Adaboost	Neural network
F1 Score	0.672	0.679	0.660	0.681	0.693
AUC-ROC	0.749	0.746	0.716	0.760	0.751
AUC-PR	0.655	0.646	0.610	0.681	0.642
Accuracy	0.699	0.700	0.670	0.699	0.696



ROC Curve



Selection of The Best Model

- Random Forest
 - Metric scores are lower compared to others, computationally inefficient
- KNN
 - Overall lowest performance
- AdaBoost
 - Highest AUC scores but does not provide default probabilistic output
- Neural Network
 - Highest F1 Score but no interpretability
- Logistical Regression
 - Highest Accuracy, Highest Robustness between train and test data, Model Simplicity



Evaluating the Results

- Run the logistic regression model with best hyperparameters
- Output is probability of success (investment) for each client
- Based on the outputs 3,000 clients were chosen.
- Our data-driven solution predicted 71.4% of the investments
- Comparison of data-driven solution and random choice
- If each client invests on average 5,000 CZK
 - Based on our model: total amount invested by clients would be 6,890,000 CZK
 - Based on random choice: total amount invested by clients would be 3,595,000 CZK

-3,295,000 CZK

Potential increase in the clients investments with data-driven solution



THANK YOU FOR YOUR ATTENTION Do you have any questions?