



# Bank Marketing Prediction

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# Introduction

## ***Data***

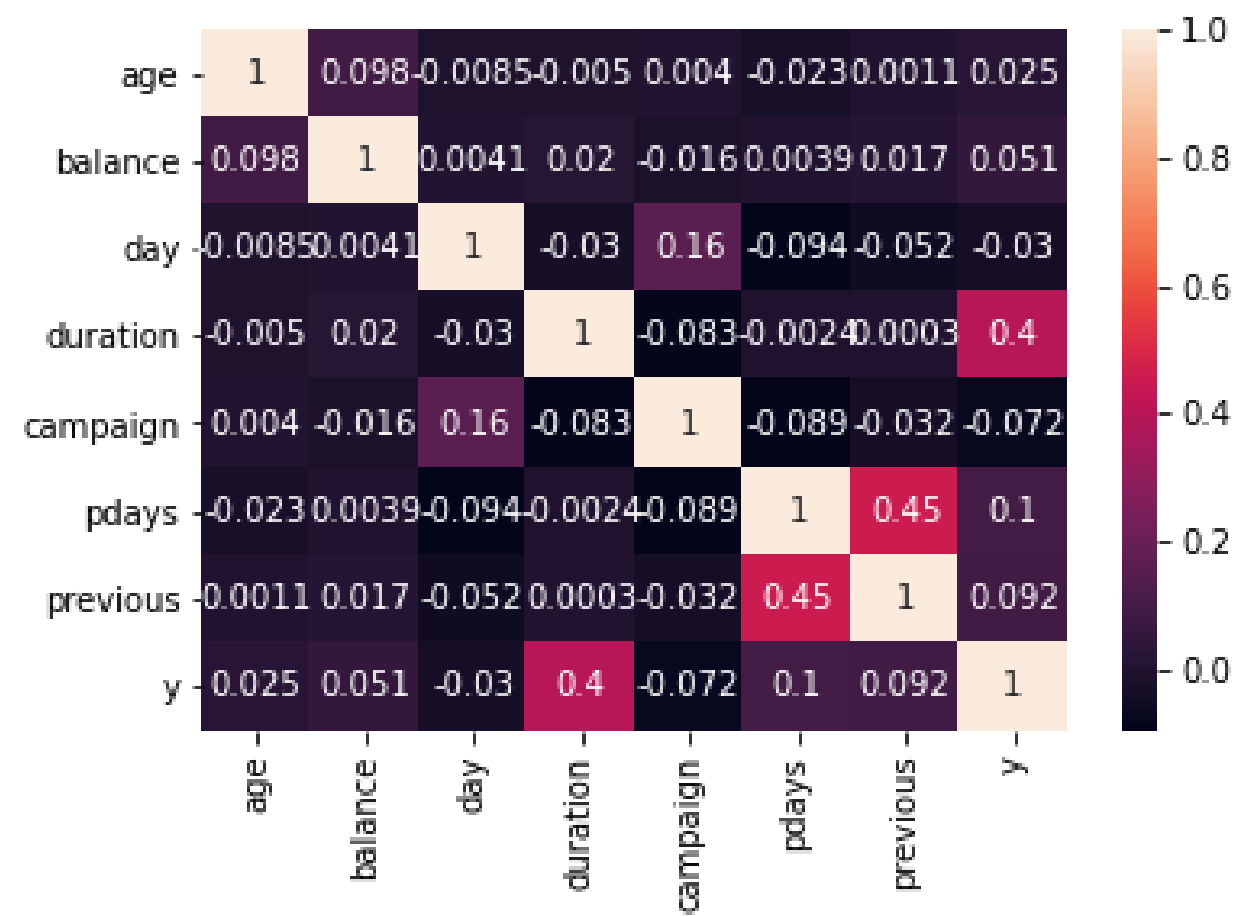
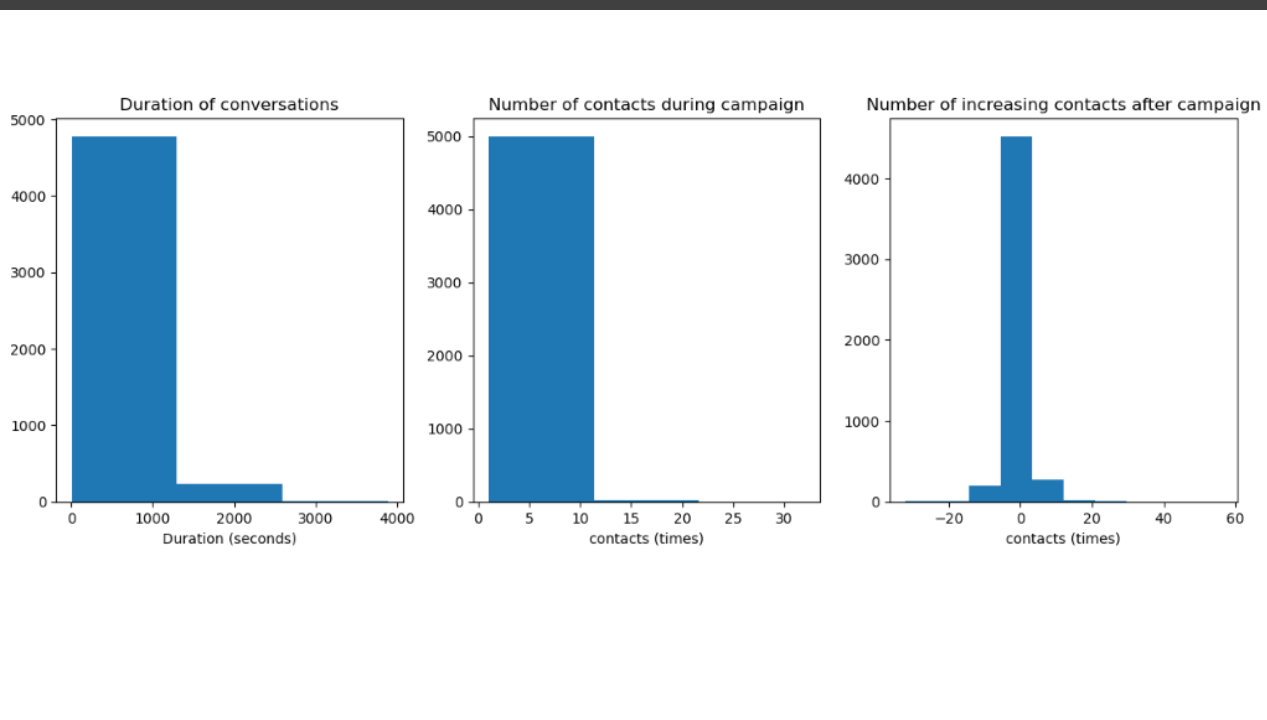
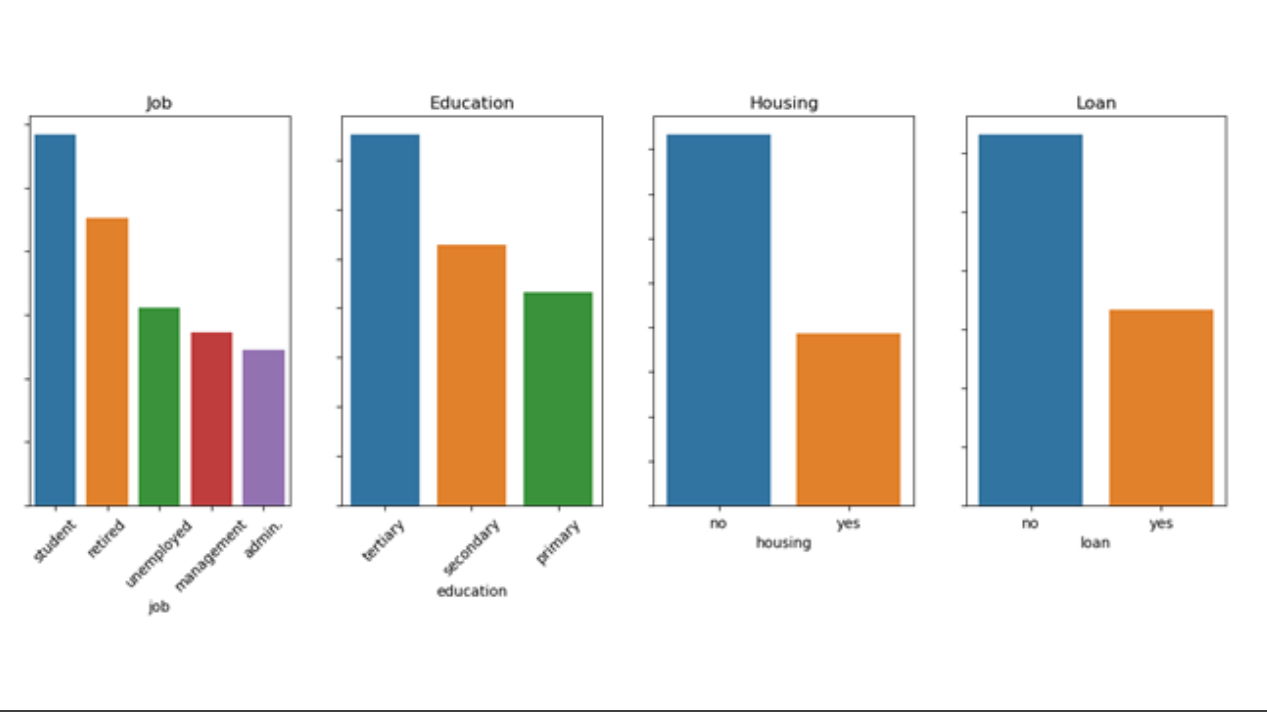
- Portuguese bank (2008 – 2010) throughout 17 past campaigns

## ***Reason***

- Large number of records from customers

## ***Goal***

- EDA
- Feature Engineering
- Model Selection
- Optimization
- Feature Importance
- Recommendations



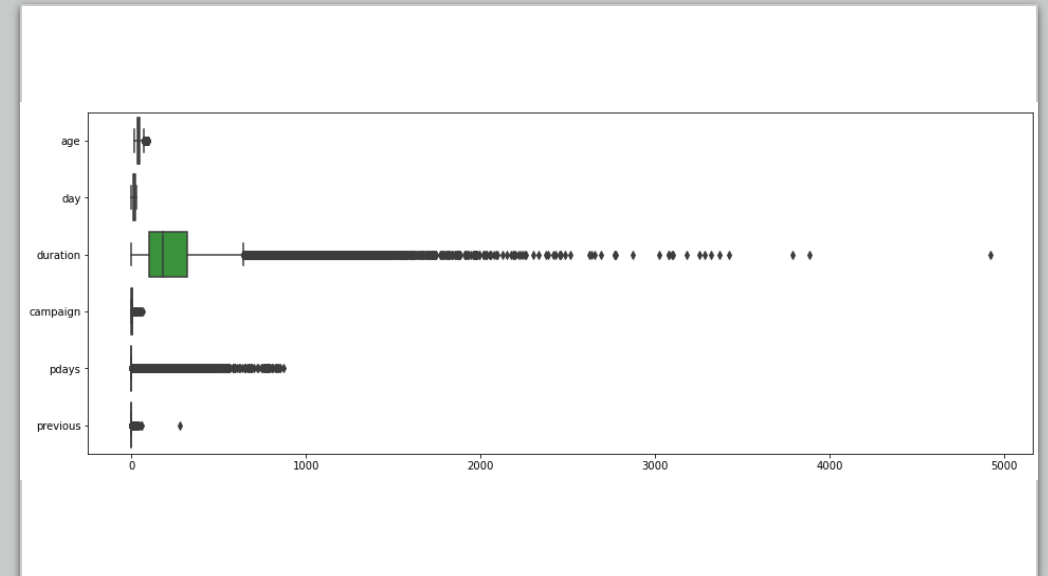
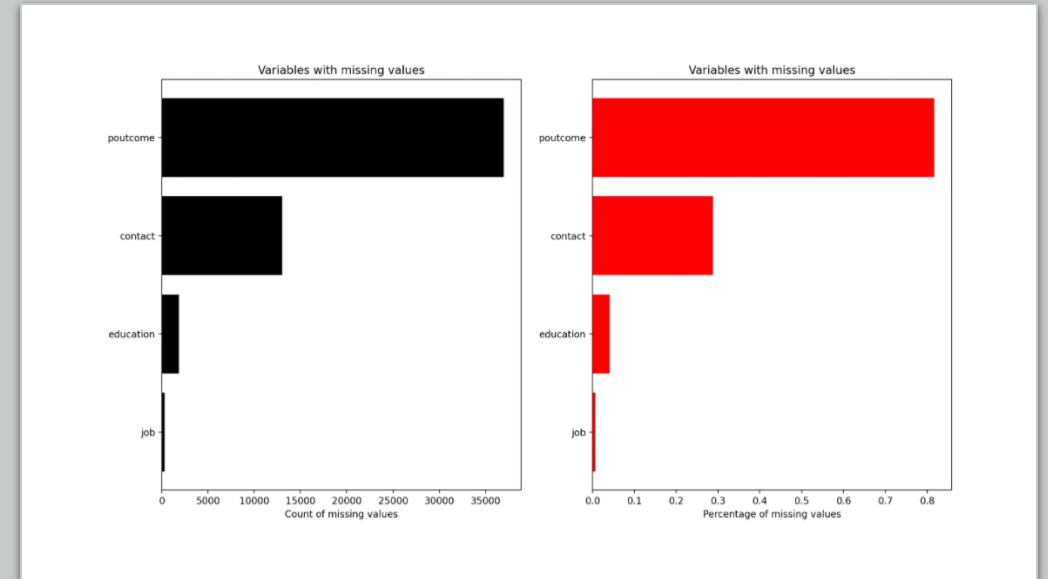
# Data Cleaning

## Continuous variables

- Keep them for analysis of extreme values

## Categorical variables

- Remove variable Outcome
- Remove missing rows from education and job
- Impute Contact



# Feature Engineering & Selection

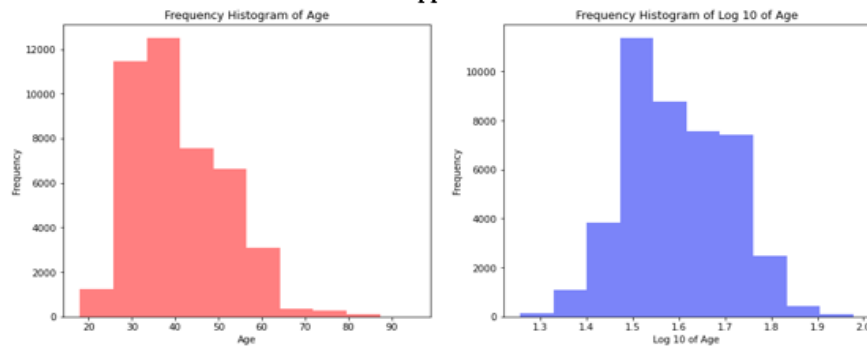


Figure 1. Frequency Histograms of Age

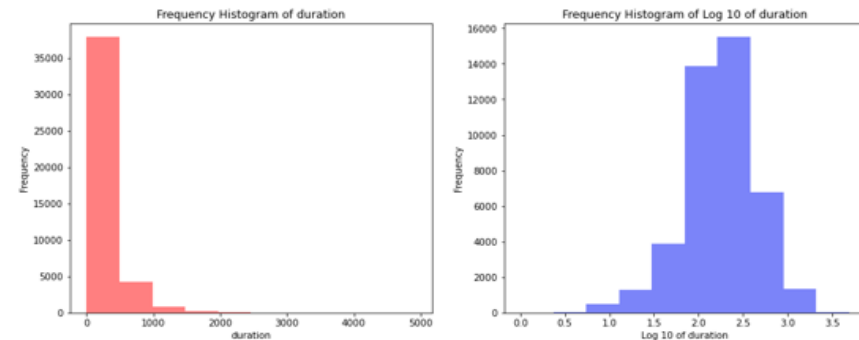
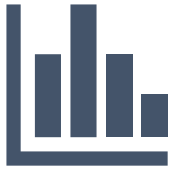


Figure 2. Frequency Histograms of duration

- **Feature Engineering**
  - Dummy variable encoding
  - Log transformation
- **Feature Selection**
  - Feature importance selection
  - Dimension Reduction
  - Split Data Set(80/20)

# Model Selection

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## Logistic Regression

Simple and easy to interpret



## Random Forest

Decision Trees

Good at predicting noise data set

Reduces overfitting



## Gradient Boosting

Learning rate

Real-time solution

# Model Accuracy & Optimization

Logistic Regression

87%

LOG  
TRANSFORMATION

GRIDSEARCHCV



Logistic Regression

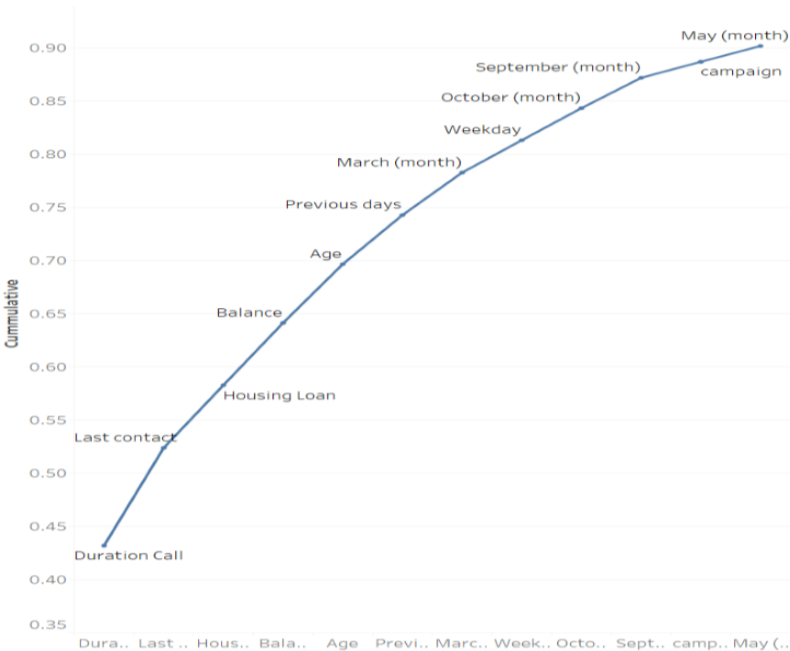
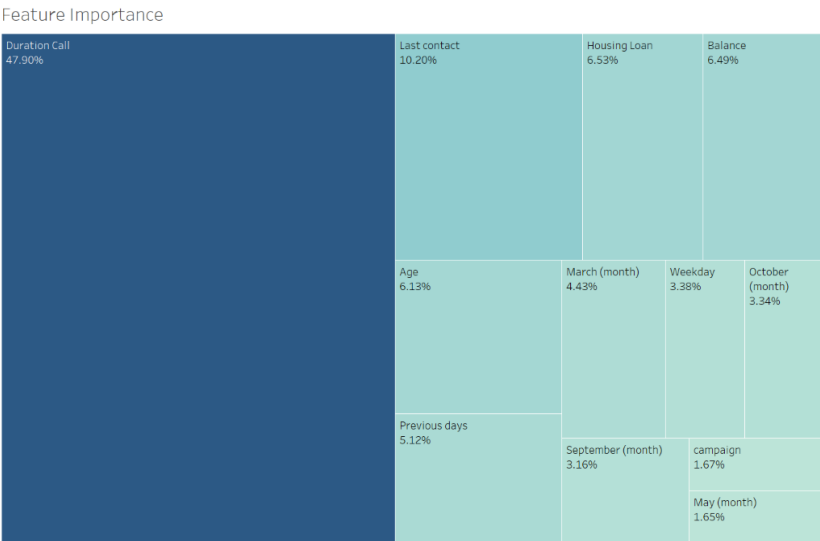
89%

Random Forest & Gradient Boosting

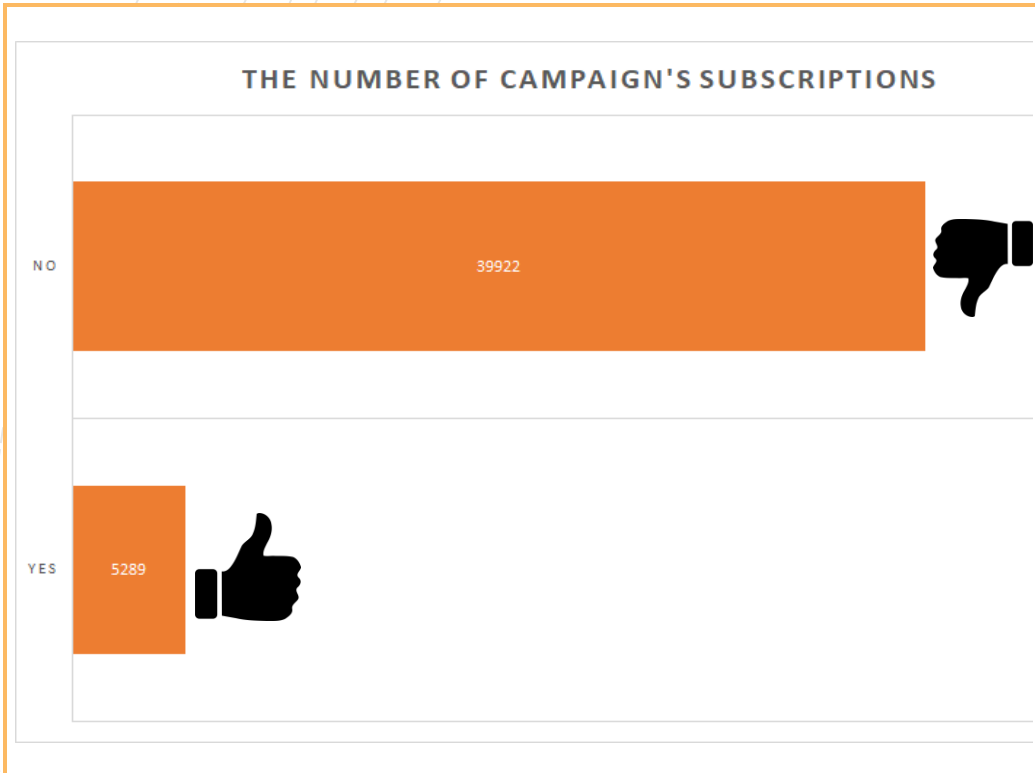
90%



Random Forest



# Recommendation



## Duration of Call

- Create products that allows customers to be more interested.
- Improve customer service.

## Housing Loan

- Separate customer with housing loan and without housing loan.
- Create a new product with lower balance for customer with housing loan.



# Conclusion

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BUILD A MODEL TO SAVE TIME AND INCREASE  
PROFIT FOR BANK.



RECOMMENDED AREAS FOR THE BANK TO  
IMPROVE TO MAKE THE NEXT CAMPAIGN  
MORE SUCCESSFUL.

# References

- Moro, Cortez, & Rita. A Data-Driven Approach to Predict the Success of Bank Telemarketing. Decision Support Systems, Elsevier, 62:22-31, June 2014