15.095 – MACHINE LEARNING UNDER A MODERN OPTIMIZATION LENS

Predicting Marketing Campaign's Conversions for Banking Institutions

Team Members: Ahmad Hussain, Nikos Galanos

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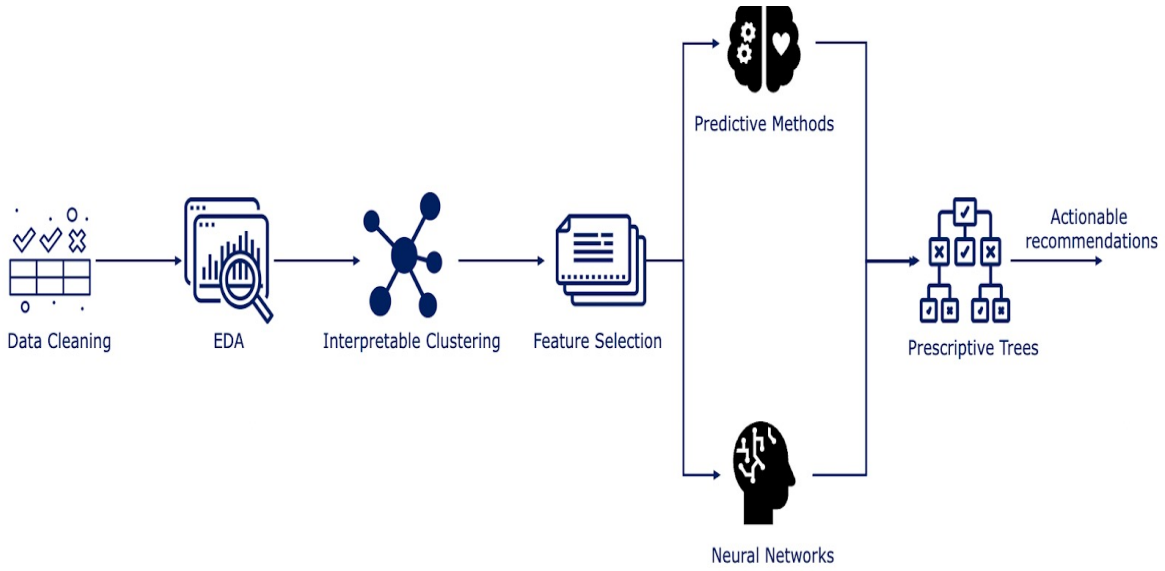
DATA-DRIVEN MARKETING CAMPAIGNS

Problem Statement

- Can machine learning be utilized to predict conversions for bank direct marketing?
- Real-world dataset from **direct marketing campaign for a Portuguese bank (~ 41k instances)**
- Can we predict which users are more likely to make a term deposit?
- Opportunity to unlock **higher return on each dollar** spent on marketing

Methodology



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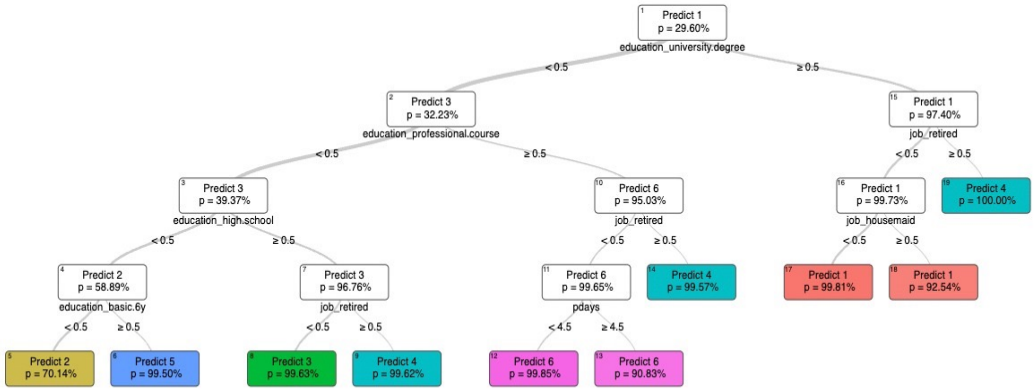
IDENTIFYING MARKET OPPORTUNITIES WITH INTERPRETABLE CLUSTERING

Market Segments

Customer Base

- **Cluster 1**: Individuals with university degrees who are currently active in their jobs
- **Cluster 2**: Individuals without any education across all the 4 categories defined for education
- **Cluster 3**: Individuals with only a high school education who are still active in their jobs
- **Cluster 4**:
  Retired individuals with only a high school education
  Retired individuals with a university degree
  Retired individuals without a university degree but with a professional course
- **Cluster 5**: Individuals with only a basic 6 year education
- **Cluster 6**: Individuals who are currently working without a university degree but with a professional course

- Banks can unlock strategic advantage by designing tailored products per market segment
- For example, cluster 6 identifies freelancers as a category to specifically target



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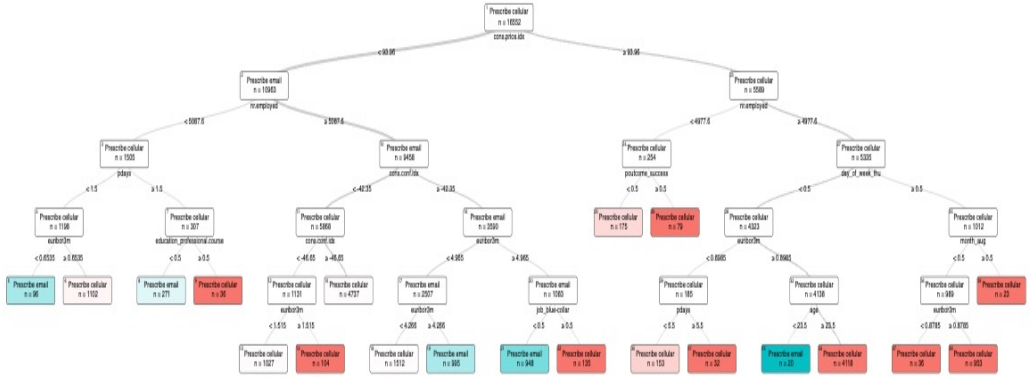
PREDICTING CONVERSION USING ML AND NEURAL NETWORKS

- Utilized 12 Machine Learning Classification Models
- XGBoost and OCT performing the best
- Trained Neural Network to compare with ML Models
- Achieved an 85.2% NN AUC → slightly worse than our best ML model

Model	AUC	F1 Score	Accuracy
Logistic Regression	83.56%	94.51%	92.88%
Decision Trees	82.31%	94.36%	92.85%
Random Forest	83.39%	94.48%	92.92%
Optimal Classification Trees	86.71%	96.06%	92.59%
Optimal Classification Trees with Hyperplanes	86.85%	96.14%	92.62%
SVM	81.575	94.25%	92.85%
K Nearest Neighbors	79.24%	93.95%	92.59%
Naive Bayes	69.69%	89.54%	90.09%
Bagging	74.58%	92.57%	92.07%
ADA Boost	82.10%	94.33%	92.85%
XG Boost	87.03%	96.05%	92.60%
Gradient Boosting	81.28%	89.54%	90.09%

PRESCRIBING THE BEST MEDIUM TO CONTACT THE CUSTOMER

Optimal Prescription Tree



- Customer Acquisition Medium: Agent Call vs Email
- Age, Occupation and days since last contact are important factors
- 88% AUC for Calling and 82% for Email
- 50% increase in average reward compared to actual treatments
- Method can be generalized across business to decide optimum customer acquisition channel

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KEY FINDINGS

- The right machine learning tools **add value at each step** of the marketing process
- Clustering gives us greater insight into user segments- **companies can divide and conquer and adapt their offering per market segment**
  - Important **diagnostic tool** to understand which **specific user segments lag in adoption**
- ML Models can lead to increased conversion by optimal targeting and cost reduction by avoiding to call
- Prescription methods could help the bank personalize customer's experience with the right offering, at the right time, in the right way

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THANK YOU!

Questions?

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