Social Media Ads Marketing Strategy Optimization with Optimal Regression Tree and XGBoost

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15.095 Machine Learning under a Modern Optimization Lens
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Problem Statement

Optimize Ad marketing campaigns with the minimized cost-per-conversion user group.

- Capture user purchasing behavior: predict the cost per conversion
- Segment users and derive target users for campaigns

Dataset

Kaggle dataset: Sales Conversion Optimization
Facebook advertisement campaign of an anonymous company

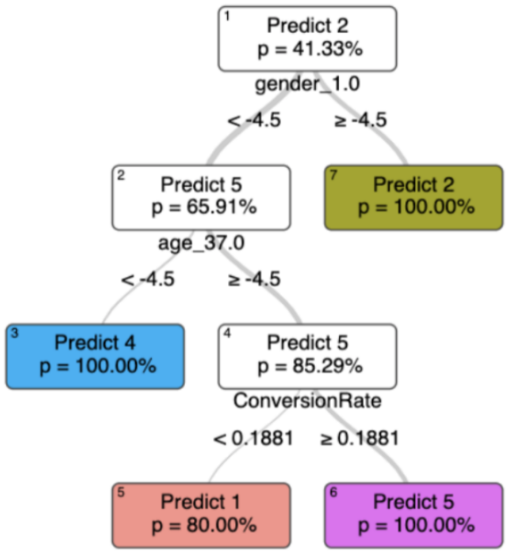
- A total of 11 features
  - User group characteristics: age, gender, interest
  - User response: impression, click, inquire, purchase
  - Ads: Ad ID, ad spent

Impact

- Reduce advertising cost: 25% to 89% of reduced cost
- Better Ads targeting: Optimize Ads placement to only show ads to those who are interested and likely to purchase

Methodology

- Prediction of cost per conversion:
  - Lasso Regression
  - Holistic Regression
  - ORT-L
  - XGBoost
- User Segmentation:
  - Interpretable Clustering



Outcome	Count	Probability
1	4	5.33%
2	13	17.33%
3	1	1.33%
4	26	34.67%
5	31	41.33%

Figure 1. Interpretable KNN with 5 clusters.

Key Insights

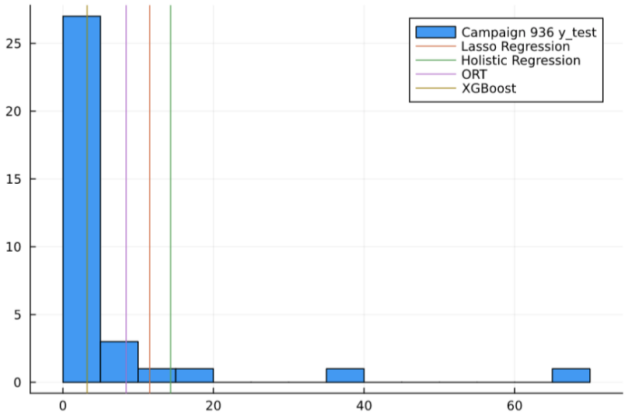


Figure 2. RMSE of Campaign 936 of each model

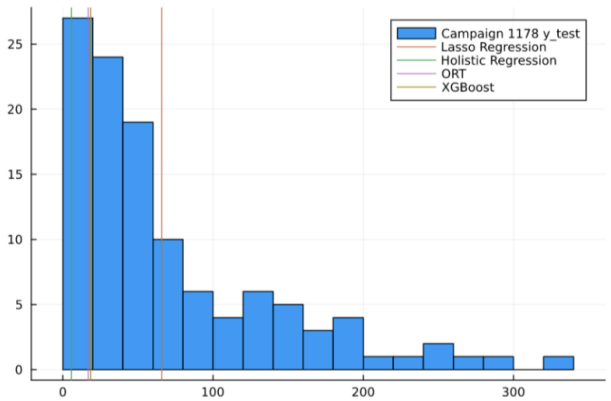


Figure 3. RMSE of Campaign 1178 of each model

- Cost per conversion prediction
  - Campaign 936: XGBoost predicts $3 off from the ground truth
  - Campaign 1178: Holistic Regression predicts $6 off from ground truth
  - Important features: (1) Primary: ConversionRate, ClickRate (2) Secondary: age, gender
- Customer Segmentation
  - Categorize into 5 clusters: Age and gender are most important features
- Cost Reduction: can achieve 25% to 89% cost reduction while obtaining the same number of conversions (product purchases)