**BACKGROUND**

About Republic Finance

Founded in 1952, Republic Finance is a financial services institution headquartered in Baton Rouge, Louisiana that specializes in providing consumer loans.

- **400K+** Active Customers
- **250+** Branch Locations
- **$4B+** Loaned since 2015

Opportunity

Reduce the total number of live checks sent out in their Direct Mail Acquisition Campaigns by utilizing a Response Model.

**Objectives**

- Decrease Mail Volume by 20%
- Maintain Current Origination Volume
- Increase Response Rate to 1.2%

**DATA**

Began with 833 Features

- Legacy Categorical Features
- Legacy Numeric Features
- Newly Added Features

Features are the variable inputs to the response model.

**IMPACT**

- **23.4%** Mail Volume Decreased
- **$3.7M+** Dollars Saved Annually
- **30.5%** Increase in Response Rate

**MODELING SOLUTION**

Gradient Boosting Machine (GBM) built using the XGBoost Library in Python.

The output of these models is a predicted probability that an individual is a responder, which is used to graph the Receiver Operating Characteristic (ROC).

The Area Under the Curve (AUC Score) of the ROC is the main metric that is used to compare classification models.

**AUC SCORE COMPARISON**

<table>
<thead>
<tr>
<th>Model</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>XGBoost</td>
<td>0.900</td>
</tr>
<tr>
<td>Production Model</td>
<td>0.871</td>
</tr>
<tr>
<td>Last Year’s Team</td>
<td>0.862</td>
</tr>
</tbody>
</table>

**FEATURE IMPORTANCE**

Relative importance of the top features in our model determined using Shapley Additive Explanations (SHAP).

**IMPROVEMENT ALGORITHM**

- Build Baseline Model with All 810 Numeric Features
- Execute Hyperparameter Tuning
- Record AUC Score
- Calculate Mean Absolute SHAP Importance of all Features
- Drop Least Influential Features
- Finalize Model with Categorical Features

**HYPERPARAMETER TUNING**

Hyperparameters are parameters that control the learning process of a machine learning model. Circled points are parameter values that minimize the loss function.

**BACKGROUND**

Client Contact

- Dr. James Haney
  - Faculty Advisor
  - Dr. Christopher Kwaramba

**FEATURES**

- **Train** - 84K Records
  - Build the model
- **Test** - 36K Records
  - Evaluate the model’s progress
- **Validation** - 1.36M Records
  - Determine the overall impact

**Loss Function**

High-level depiction of Bayesian Optimization. Circled points are parameter values that minimize the loss function.

**HYPERPARAMETER SPACE**

- Parameter 1
- Parameter 2
- Parameter 3

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