Customer Churn Modeling

Connex Communications

Connex is a communications company that provides phone, internet, and streaming services. In addition, they offer supportive services like online security, device protection, etc.

Connex would like to utilize machine learning methodologies to create a model that gives them the ability to get ahead of customer churn.

Key Questions

What model can best predict churn?

Test and optimize a variety of machine learning algorithms

Use product subscription status, account, and demographic information as inputs into the modeling process

Which features (inputs) are more likely to predict churn?

Utilize logistic regression feature coefficients and the feature_importances_ tool in sklearn’s random forest

Getting to Answers

The Data

Kaggle Telco Dataset

7,032 observations

30 Features

Products

- Phone
- Multiple Lines
- Internet
- Online Security
- Online Backup
- Device Protection
- Tech Support
- Streaming TV
- Streaming Movie

Account Info

- Time as Customer
- Contract Type
- Payment Method
- Paperless Billing
- Monthly Charges
- Total Charges

Demographics

- Senior
- Dependents
- Gender
- Partner

Churn

Last month

- Yes
- No

Approach

EDA + Benchmark

- Logistic Regression
- Evaluate key metrics
- Address class imbalance

Test More Models

- Decision Trees, Random Forest, XGBoost
- Tune hyperparameters

Determine Best Performers

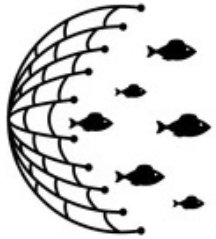
- Best performing models
- Most important features

Identify Further Optimizations

- Identify further tuning opportunities
- Explore other ideas

Tools: Pandas – Sklearn – Imblearn - Numpy

Which metric should we use to optimize the model?



Recall

It’s better for the business to cast the net wider and capture more potential churn customers than to use precision metric and miss potential churn customers.

Recall

VS.

Precision

- Answers what proportion of actual positives was identified correctly.
- Selects best model when there’s a high cost associated with false negative (person that’s predicted not to churn when they did churn)

- Answers what proportion of positive identifications was actually correct.
- Selects best model when there’s a high cost associated with false positive (person that’s predicted to churn when in fact they’re not churning.)

Results

Model Performance

Model Settings:
- Default hyperparameters
- Oversampling

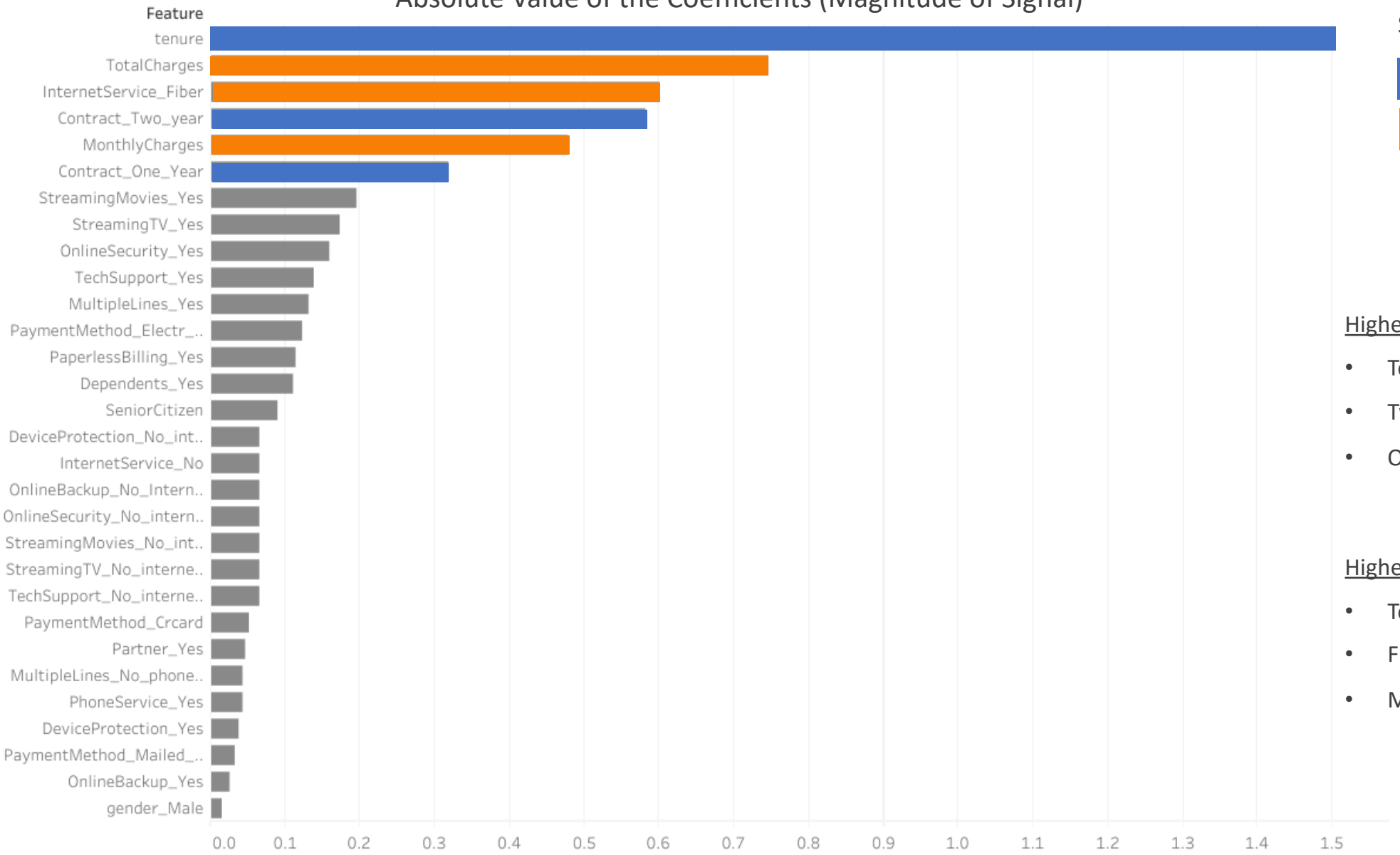
Benchmark

Started with Logistic Regression

Model	Recall	AUC
Logistic Regression	80%	.75

Important Features

Absolute Value of the Coefficients (Magnitude of Signal)



Stronger Signal:

- No Churn
- Churn

Logistic Regression

<u>Highest Magnitude No Churn</u>

- Tenure
- Two Year Contract
- One Year Contract

<u>Highest Magnitude Churn</u>

- TotalCharges
- Fiber Internet Service
- Monthly Charges

Model Settings:
- Default hyperparameters
- Oversampling

Test More Models

Additional algorithms

Model	Recall	AUC
Logistic Regression	80%	.75
XGBoost	74%	.73
Random Forest	60%	.71
Decision Tree	48%	.64

Tune Hyperparameters

- Default hyperparameters
- Oversampling

- Tuned hyperparameters
- Oversampling

Random Forest + Decision Tree

Model	Recall	AUC
Logistic Regression	80%	.75
Random Forest Hyperparameters Tuned	76%	.71
XGBoost	74%	.73
Random Forest	60%	.71
Decision Tree	48%	.64
Decision Tree Hyperparameters Tuned	48%	.64

Random Forest Gridsearch Best Parameters: max_features: 23, n_estimators: 119

Decision Tree Gridsearch Best Parameters: max_depth: 1, min_samples_leaf: 1

Best Performers

(thus far in the process)

Model	Recall	AUC
Logistic Regression	80%	.75
Random Forest Hyperparameters Tuned	76%	.71

XGBoost is likely to be best performing, with hyperparameter tuning, given its performance history in the industry

Future Work

Modeling

Further Hyperparameter Tuning

- XGBoost is likely to be the best performing algorithm with hyperparameter tuning
- Logistic Regression:
    - Grid search with lasso regression to reduce feature space and determine impact on model score
    - Experiment with probability threshold

Create Additional Features

- Review churn research that other departments have implemented to get ideas for new features to enhance model performance

Try Voting + Stacking Ensemble Techniques

- To learn the different aspects of the data with each model

Business Strategy

Identify customers with highest churn probability

- Create communication strategies toward this audience considering both strongest features that indicate churn and strongest features that don't indicate churn. Features that strongly indicate not churning can also potentially inform retention strategy

Coding

Update pipeline to work with Gridsearch

- Utilize workflows discovered while doing this project

Discussion