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

- Logistic Regression
- Evaluate key metrics
- Address class imbalance

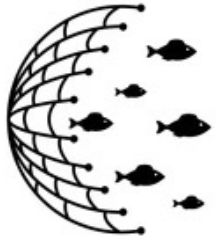
- Decision Trees, Random Forest, XGBoost
- Tune hyperparameters

- Best performing model
- Most important features

- Identify further tuning opportunities
- Explore other ideas

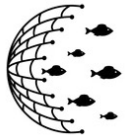
Tools: Pandas – Sklearn – Imblearn - Numpy

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 

correctly classified as churn

# of actual churn in dataset

Precision 

# of actual churn in dataset

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correctly classified as churn

F1 

The harmonic mean of precision and recall. Penalize situations where precision or recall is significantly better than other

Results

Model Performance

Model Settings:
- Default hyperparameters
- Oversampling

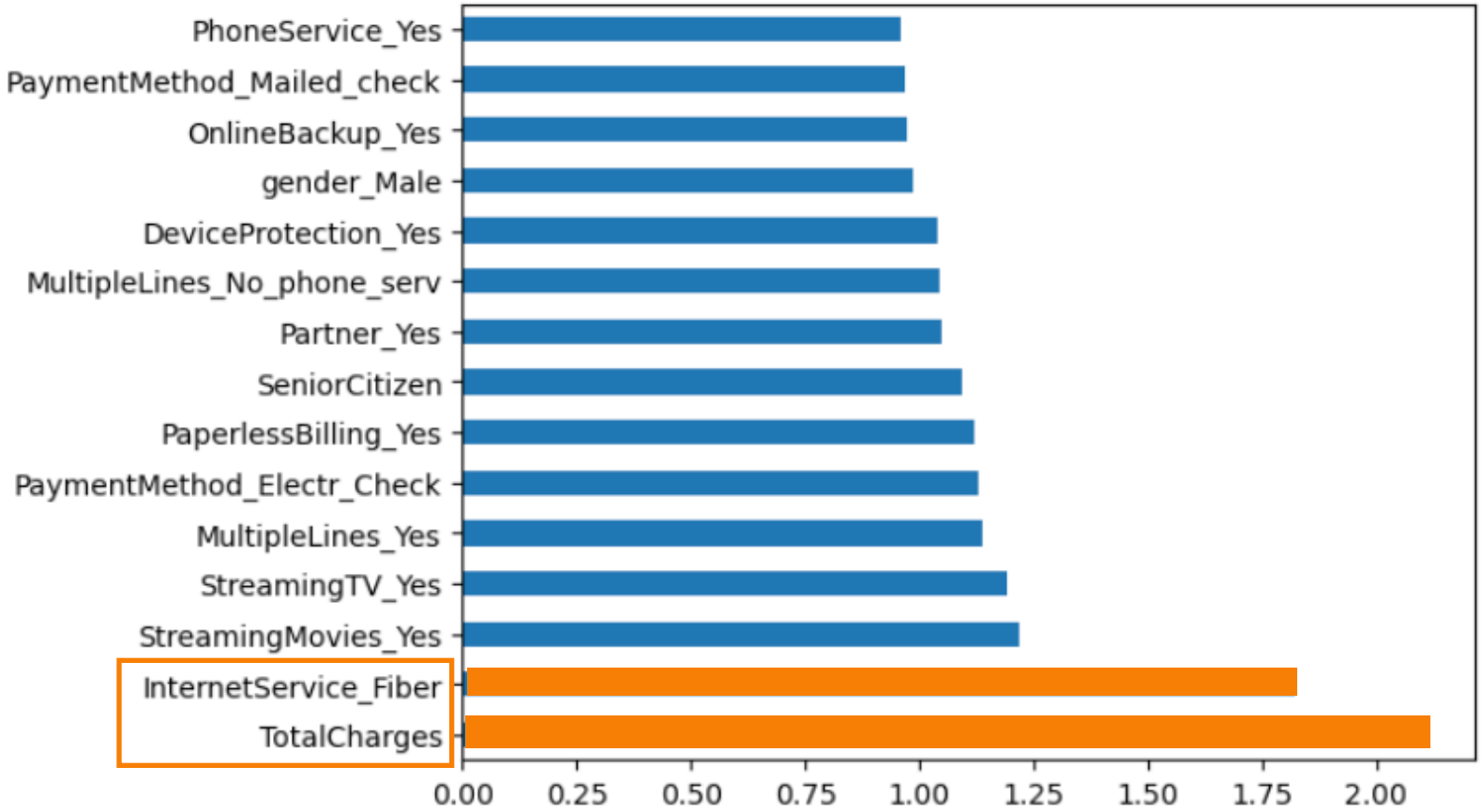
Benchmark

Started with Logistic Regression

Model	Recall	Precision	F1
Logistic Regression	80%	48%	60%

Feature Probability

Coefficient Odds Review: Feature Probability of Churn (Logistic Regression)



Highest Probability of Indicating Churn

- TotalCharges
- Fiber Internet Service

Lowest Probability of Indicating Churn

- Tenure
- Two Year Contract

Model Settings:
- Default hyperparameters
- Oversampling

Test More Models

Additional algorithms

Model	Recall	Precision	F1
Logistic Regression	80%	48%	60%
XGBoost	74%	50%	60%
Random Forest	60%	57%	58%
Decision Tree	48%	47%	48%

Tune Hyperparameters

Random Forest + Decision Tree

- Default hyperparameters
- Oversampling

- Tuned hyperparameters
- Oversampling

Model	Recall	Precision	F1
Logistic Regression	80%	48%	60%
Random Forest Hyperparameters Tuned	76%		
XGBoost	74%	50%	60%
Random Forest	60%	57%	58%
Decision Tree	48%	47%	48%
Decision Tree Hyperparameters Tuned	48%		

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

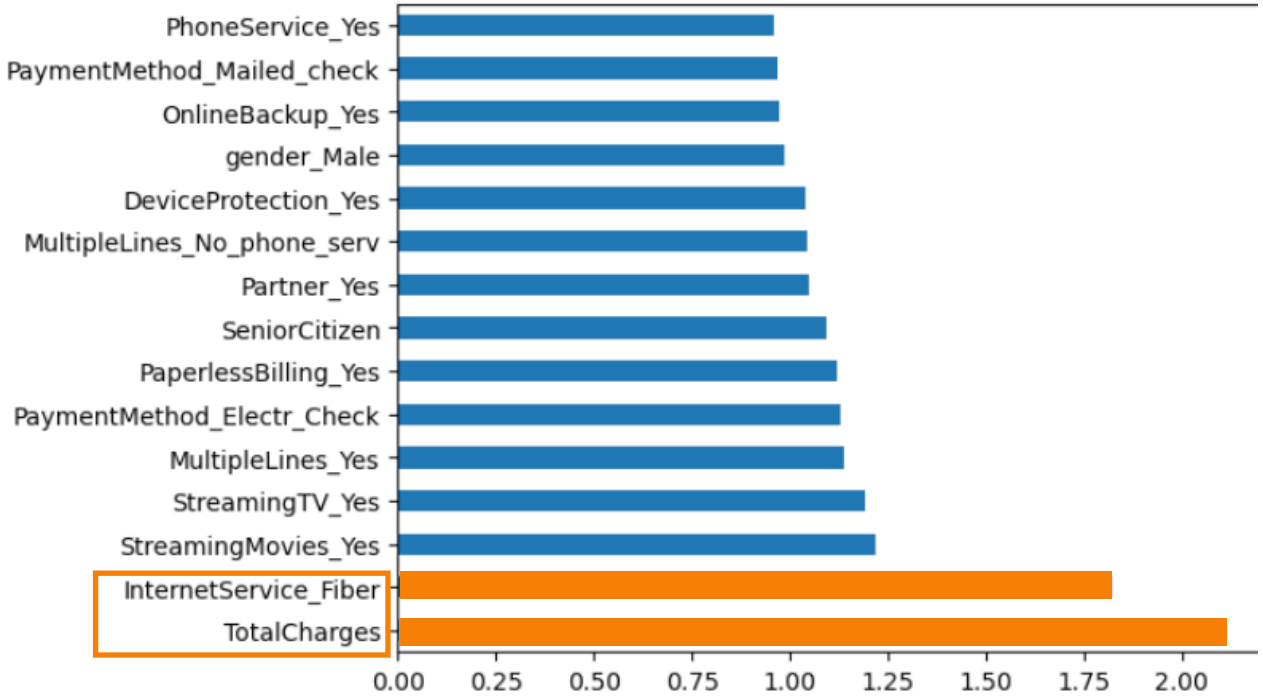
Decision Tree Gridsearch Best Parameters: max_depth: 1, min_samples_leaf: 1

Feature Comparison by Model

Both models agree that Total Charges is the most important, differ on others

Logistic Regression, Defaults

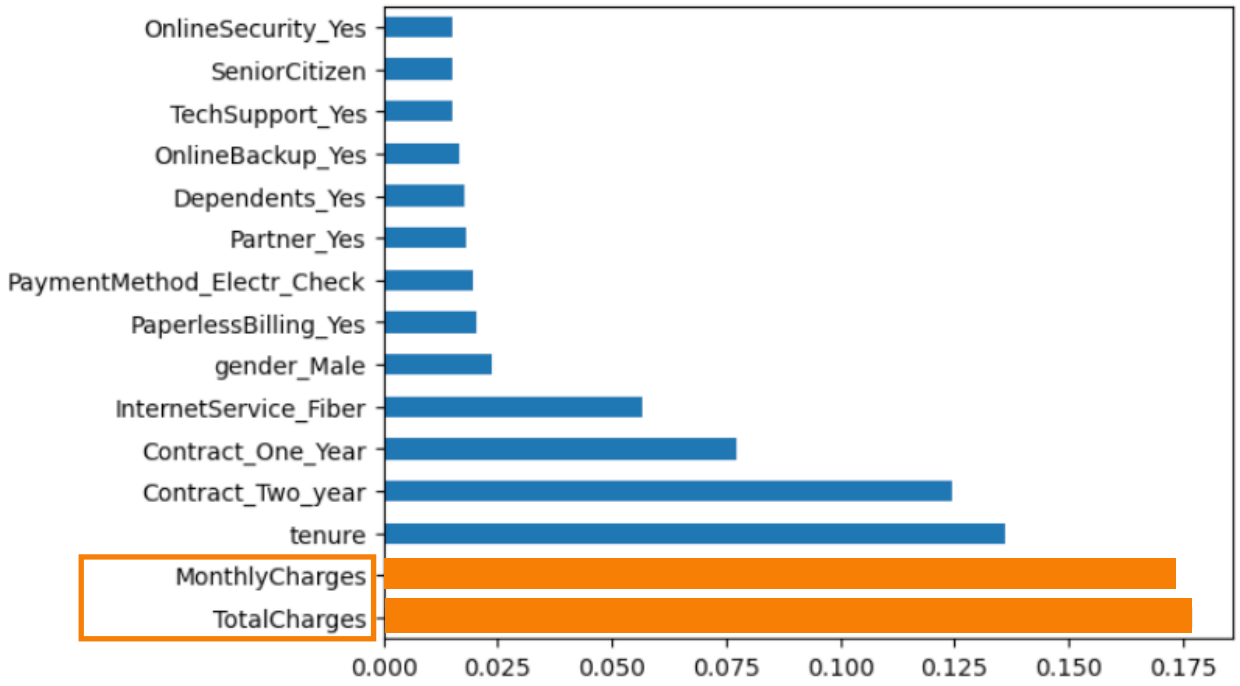
Top 15 Important Features



Recall: 80%

Random Forest, Tuned Hyperparameters

Top 15 Important Features



Recall: 76%

Future Work

Modeling

Further hyperparameter tuning

- XGBoost could be a winning model (Currently set to default parameters)
- Threshold tuning on Logistic Regression

Explore ‘Total Charges’ feature

- Feature engineer: bin by range to determine the specific total charges that indicate churn
- Determine if research exists within the company that have insight on price sensitivity. This could contribute to the feature engineering.

Add Naive Bayes model

- Binary data is its jam

Coding

Update pipeline to work with Gridsearch

Consider utilizing some of the flows discovered while doing this project

Discussion