

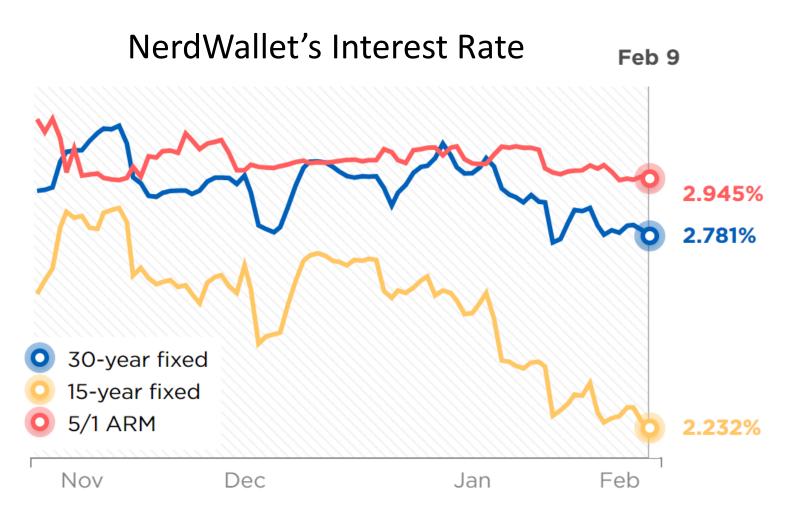


Predicting Lenders' Decision on Home Loan Refinancing Application

A Classification Analysis

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Background



Good time to refinance your home loan

Understand what and how financial features are used to make decisions

Data Collection



Data Summary

State:

MASSACHUSETTS

2019

Action Taken:

1 - Loan Originated

2 - Application approved but not

accepted

3 - Application denied

Loan Purpose:

31 - Refinancing

| Selected Variables Approved | # of Records | \$ Amount |
|---|--------------|----------------|
| 1 - Loan Originated, 31 - Refinancing | 63,212 | 25,012,190,000 |
| 2 - Application approved but not accepted, 31 - Refinancing | 2,003 | 677,885,000 |
| 3 - Application denied, 31 - Refinancing | 13,405 | 3,905,945,000 |

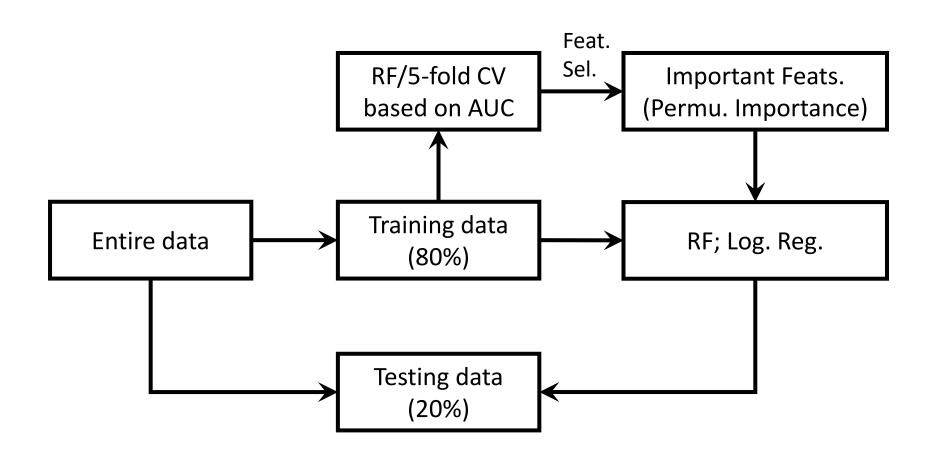
Clean data:

62310 applications:

- 51628 approvals
- 10682 denials

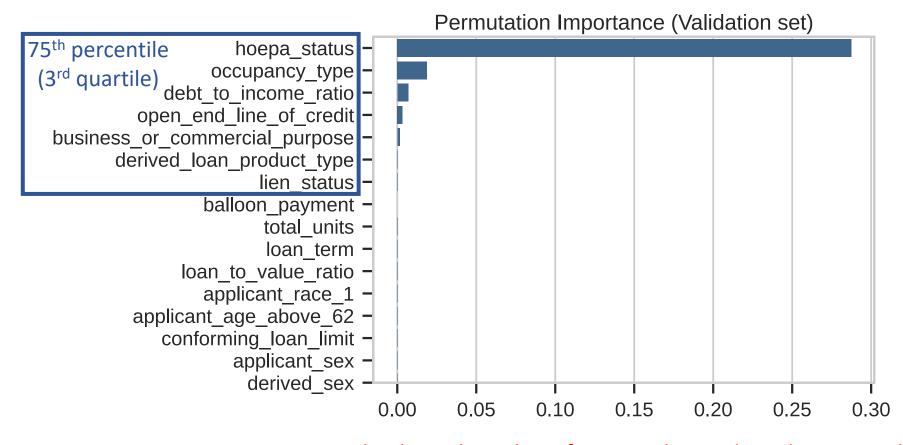
28 features

Modeling Workflow



Random Forest Feature Selection – 5-Fold Randomized Search CV

Tune hyperparams to maximize ROC-AUC (0.99):

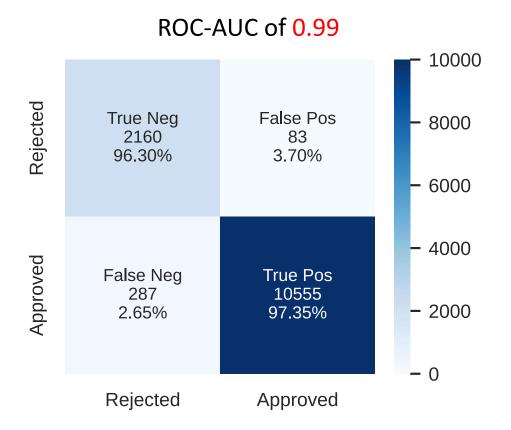


Need to know how these features play a role in decision making

Model Construction with Selected Features

All training data

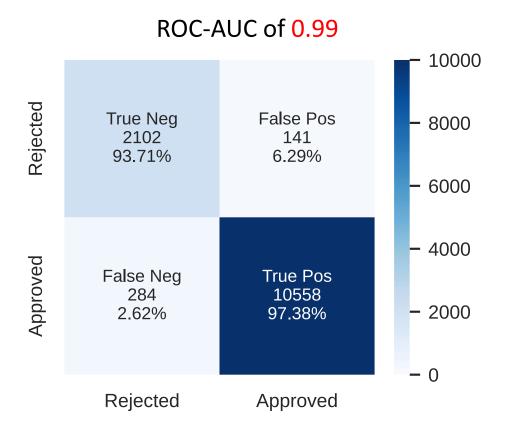
Trained a random forest model



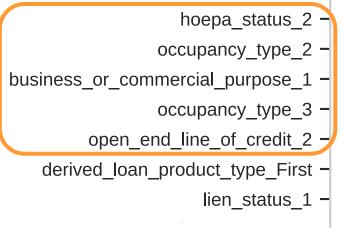
Model Construction with Selected Features

Existing training & validation data

Tuned Log. Reg. model with 5-fold CV (regularization penalty strength, "C")

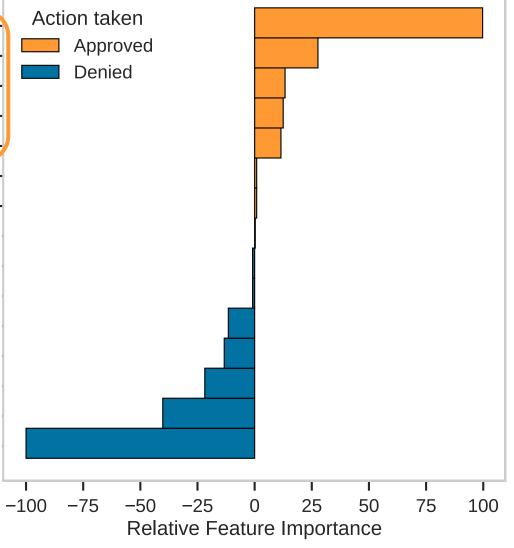


More likely to approve



Approvals:

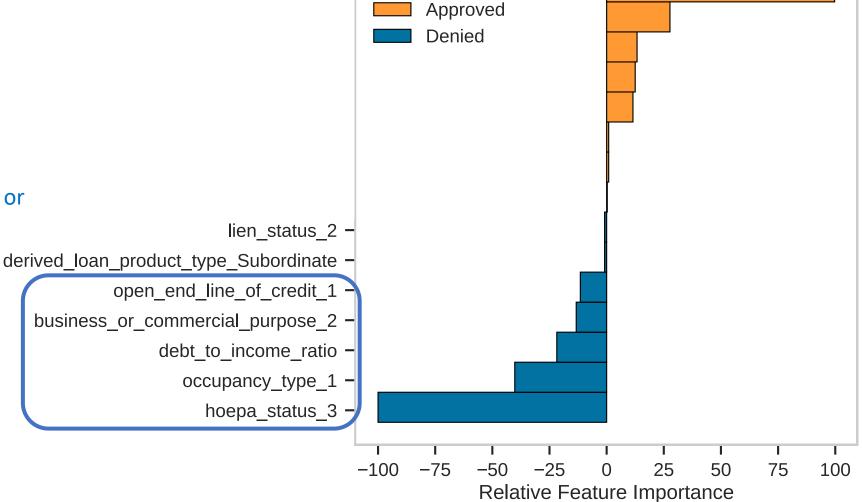
- Subject to HOEPA regulations:
- Second or investment property
- Primarily for a business or commercial purpose
- close-end line of credit



More likely to deny

Denials:

- Not subject to HOEPA regulations
- Principal residence
- High debt-to-income ratio
- Not primarily for a business or commercial purpose
- Open-end line of credit



Action taken

Summary

- Understood how lenders make decisions on home loan refinancing
 - HOEPA Status
 - Occupancy Type
 - Business/commercial purpose
 - Whether if open-end line of credit
 - Debt to income ratio
- Trained RF. and Log. Reg. models

Future work

- Investigate nationwide CFPB data
 - Including multiple loan purchases, e.g., home purchase, home improvement
- More advanced model
 - XGBoost
 - Deep neural network for more complex classification



Thank You

Appendix

HOEPA is highly separable, which explains why the AUC is as high as 0.99.

