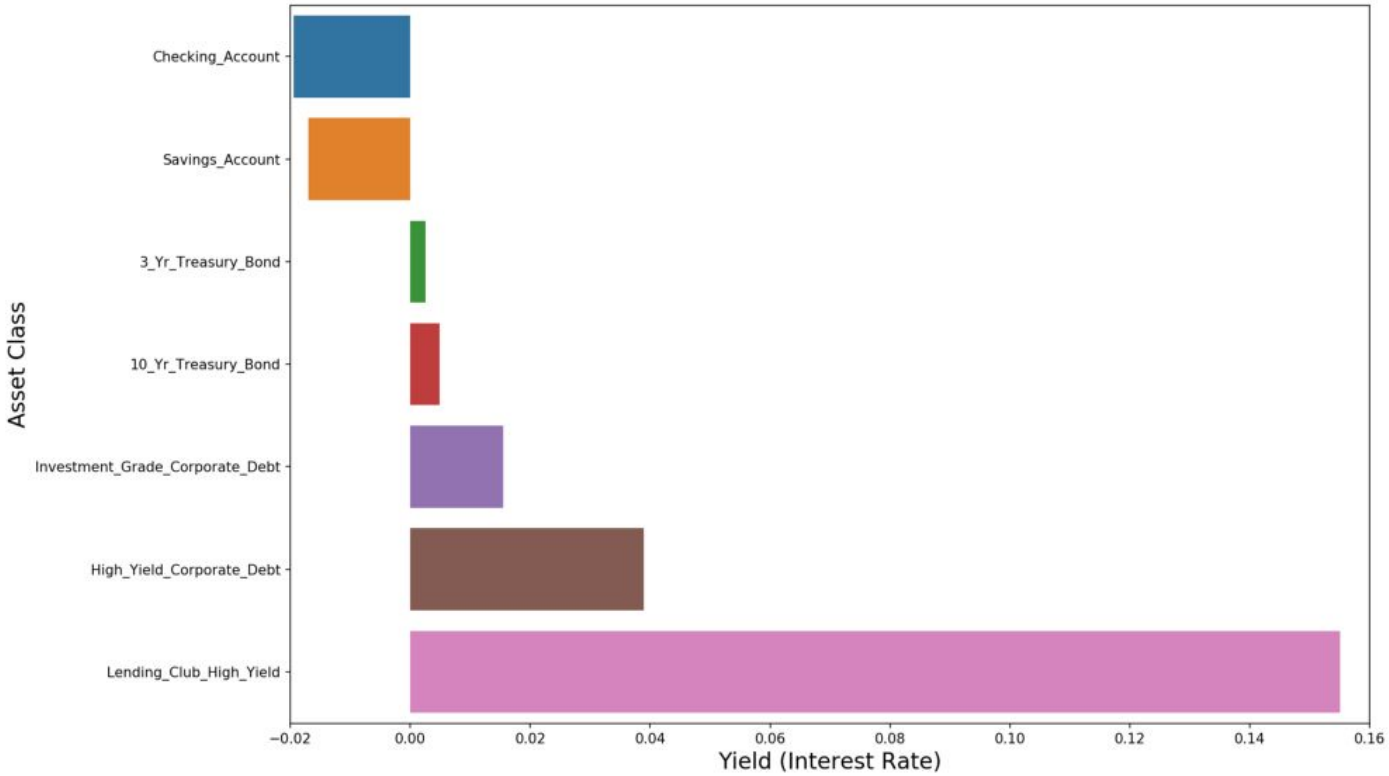
Minimizing Risk in Peer-to-Peer Lending

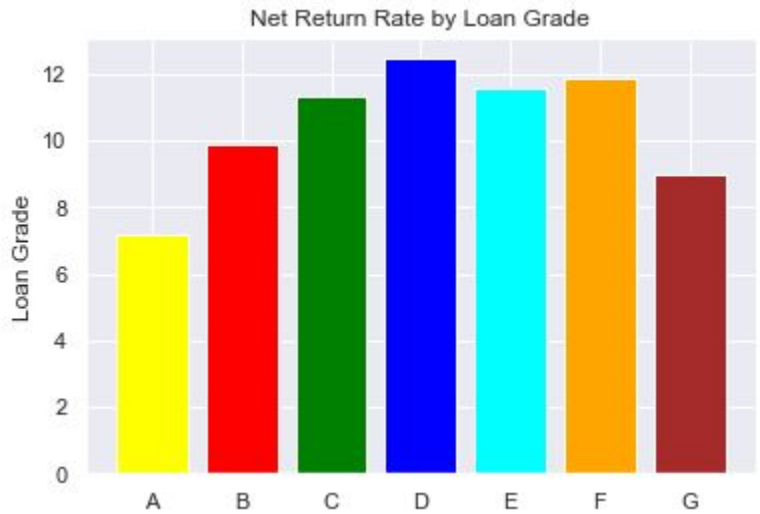
What is Peer-to-Peer Lending?

- The ability for the general public to invest in loans and earn interest, like a bank does
- Loans are underwritten and graded by risk level by the hosting platform (i.e. Lending Club, Prosper, Upstart, etc)
- Just like with any investment the risk (lower graded loan), the higher the reward (interest rate).
- You can invest as little as $1 dollar into a share of a loan.

Interest Rate by Asset Class - Inflation Adjusted



Net Return Rates by Grade - 2014 Dataset



Goal of project

Our aim for this project is to make a model that minimizes risk by selecting fewer defaulting loans than average and to maximize reward by having a greater return on investment than average.

In short we want to minimize risk and maximize reward of our investment.

To do this we will focus our analysis on Grade F and G loans. They have the highest interest rates, but also highest default rates.

Dataset

All 2014 issued loans from lendingclub.com

235,659 data points and 150 columns

Loan Grade	# Samples
A	28,622
B	49,235
C	52,193
D	34,832
E	16,470
F	5,139
G	1,443

Class Breakdown - F&G Good Loans vs Bad Loans

- Select only Grade F & G Loans

- Good Loans = Fully Paid
- Bad Loans = Charged Off

- Roughly 2 to 1 class split

	# Samples
Good Loans	4,065
Bad Loans	2,517

Models

We split our data into 80% train and 20% test sets.

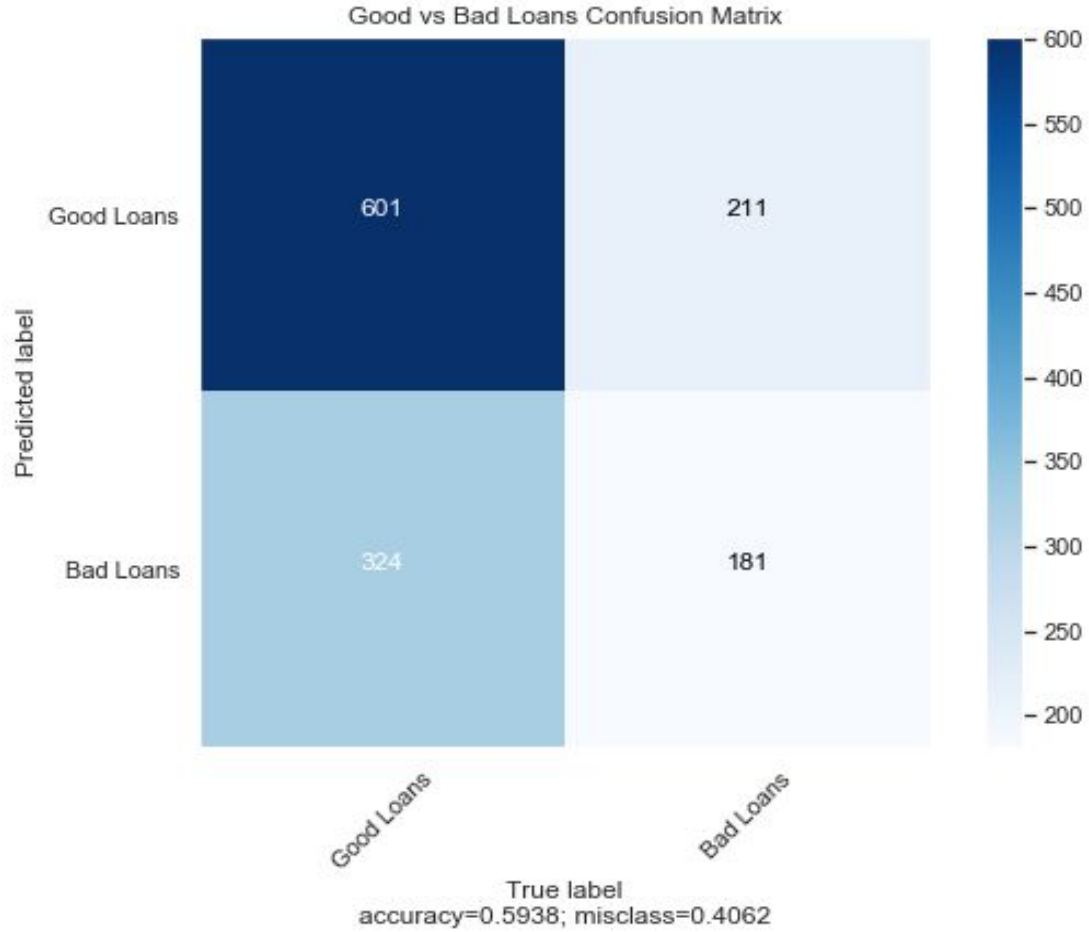
We tried 3 different models with the plan of selecting the model with the highest recall score for the ban loan class and the highest precision for the good loans class. Then we would take that model and tune it to the most optimal hyperparameters.

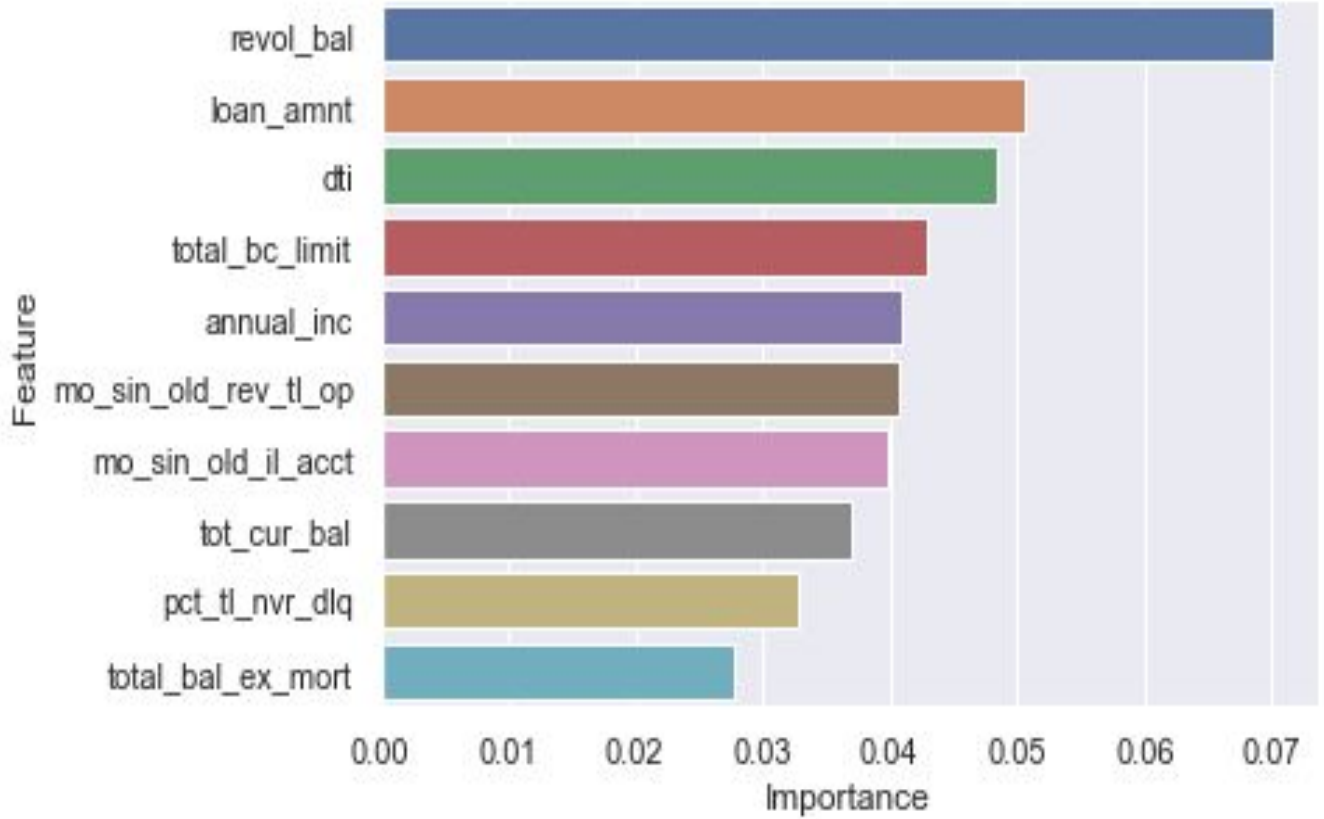
We tried Logistic Regression, Support Vector Classifier, and Ada Boosting with a Decision Tree Classifier.

	Recall Bad Loans	Precision Good Loans
Logistic Regression	0.09	0.63
SVC	0.0	0.62
Ada Boost	0.37	0.64

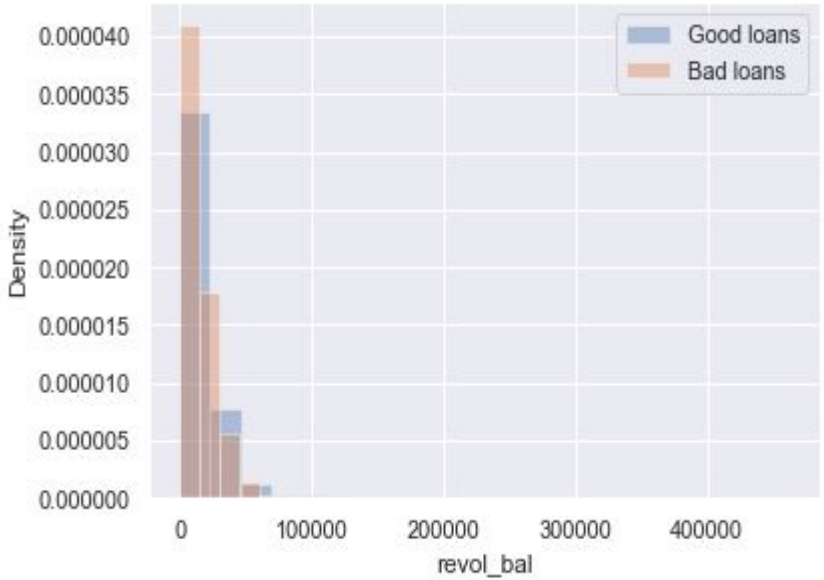
Optimized Model - Classification Report

	precision	recall	f1-score	support
0	0.65	0.74	0.69	812
1	0.46	0.36	0.40	505
accuracy			0.59	1317
macro avg	0.56	0.55	0.55	1317
weighted avg	0.58	0.59	0.58	1317


Good vs Bad Loans Confusion Matrix
Good Loans
Bad Loans
601
211
324
181
Predicted label
Good Loans
Bad Loans
True label
accuracy=0.5938; misclass=0.4062
600
550
500
450
400
350
300
250
200


revol_bal
loan_amnt
dti
total_bc_limit
annual_inc
mo_sin_old_rev_tl_op
mo_sin_old_il_acct
tot_cur_bal
pct_tl_nvr_dlq
total_bal_ex_mort
Feature
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
Importance

Most Important Feature - Revolving Balance

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Good Loans Avg: 17104.0
Bad Loans Avg: 15486.0
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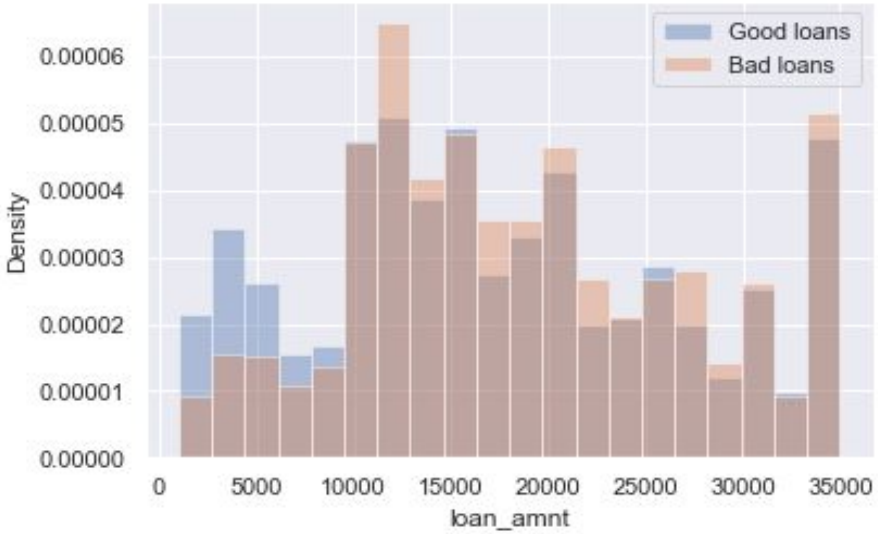
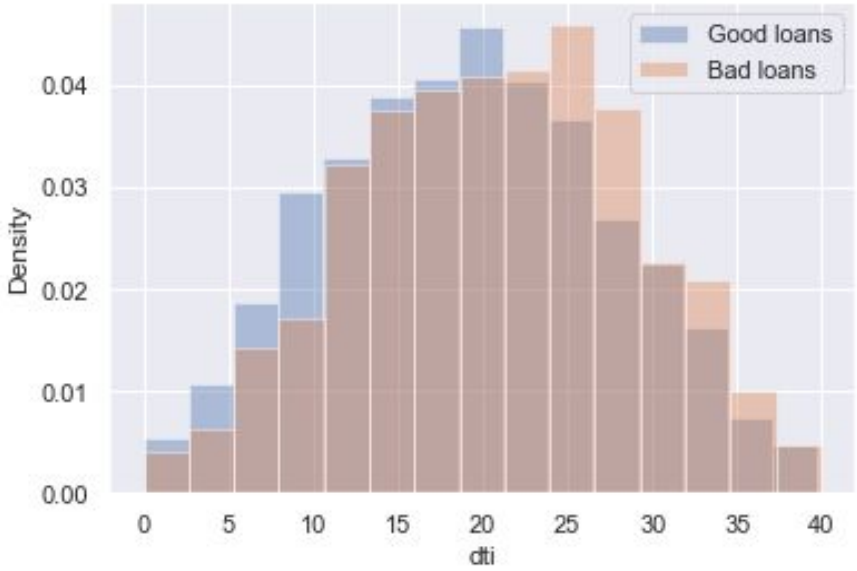
2nd Most Important Feature - Loan Amount




```
Good Loans Avg: 17369.0
Bad Loans Avg: 18703.0
```

3rd Most Important Feature - DTI




```
Good Loans Avg: 19.0
Bad Loans Avg: 21.0
```

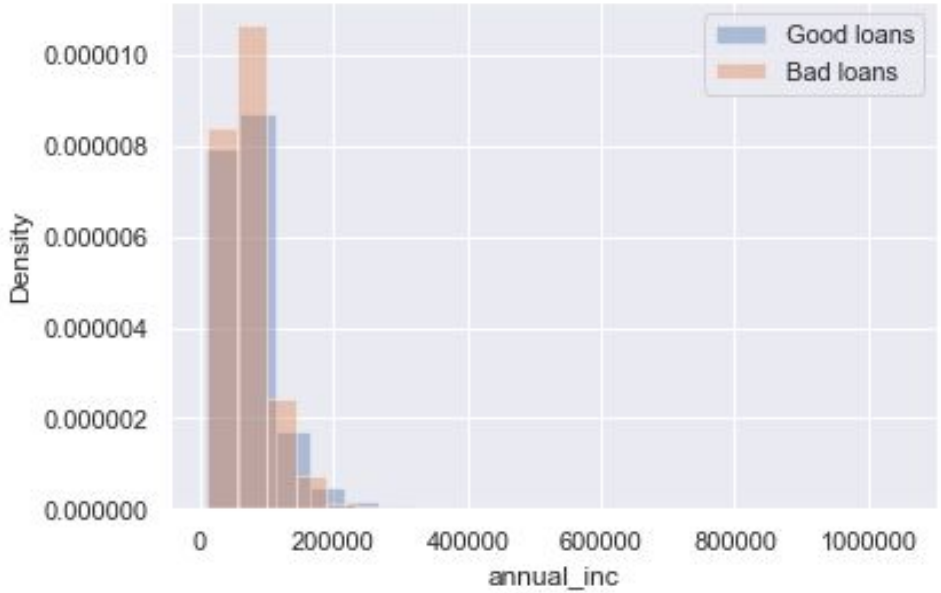
Revolving Balance vs Debt to Income Ratio

- Our model prioritizes borrower’s with higher credit balances, but also prefers those with lower debt to income ratios.

- This seems contradictory on its face.

- Possible Explanation - borrower’s with higher credit balances have higher incomes.

5th Most Important Feature - Annual Income

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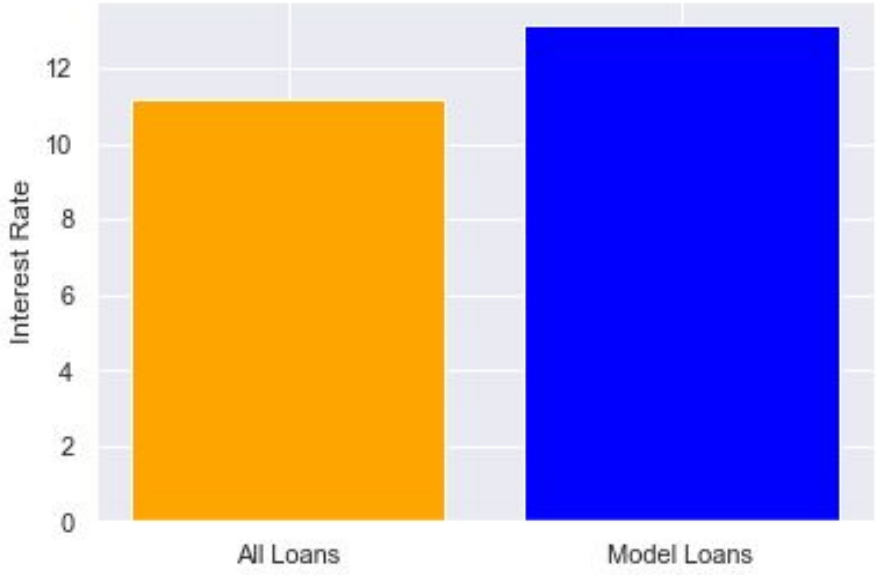
Good Loans Avg: 75701.0
Bad Loans Avg: 70604.0
```

ROI with no model and with model



Takeaways

- Our optimized model reduced defaults by 3.2%
- Our optimized model increased raw returns by 1.95%
- Our optimized model increased percentage returns by 17.4%

- Higher returns than most other investment classes
- Perfect for new investors who want to see some of the highest returns possible from peer-to-peer lending.
- Perfect for investors with limited capital, but who also want to maximize returns.

Limitations

- All grade F & G loans are very profitable (11.18% interest rate) without any optimization. If you have the capital it could be argued to invest in all of these loans
- All the data comes from 2014 which was a great year economically. Including down years for the economy like (2009 and 2020) would make for a more reasonable picture for investor returns.
- Lending Club could have improved their loan grading process since 2014. Things like higher credit card balances (revolving balance), lower loan amounts, and lower debt to income ratios might put the loan in a less risky grade.

Questions?