

## Project

### Strategies

In this project, I will compare two strategies as described below.

1. Neural Network with normal transformation for each month
2. Random Forest with normal transformation for each month

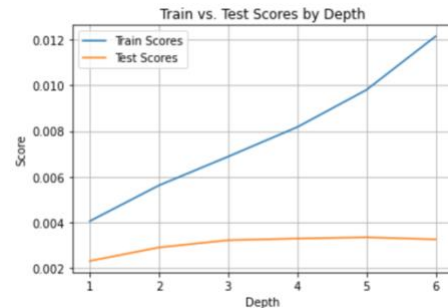
### Back test and evaluation

For both strategies, I used grid search and found the best hyperparameters for these two strategies.

Because I use grid search, it is very time consuming to training in every date. Therefore, I train with 1 month's data and test with 5 years' data. More specifically, training on "2005-01" and predicting up to "2010-01"; training on "2010-01" and predict up to "2015-01", training on "2015-01" and predicting up to "2020-01" training on "2020-01" and predicting up to "3000-01". I average the 4 tests score to generate the overall test score for the model with the hyperparameter.

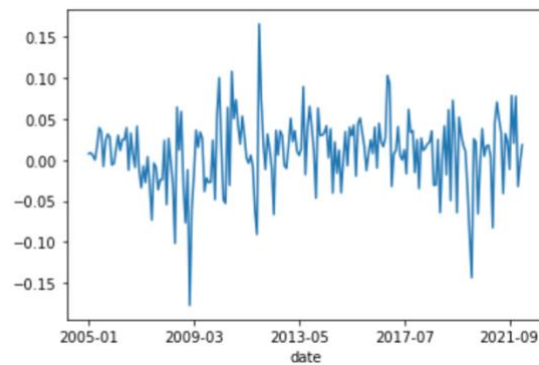
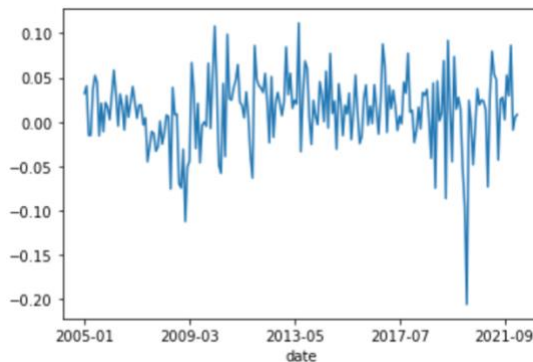
For Random Forest, I did the grid search for hyperparameter max\_depth from 1 to 6. The best test score equals 0.0033452829492095493 and max\_depth equals 5.

For Neural Network, I did the grid search for hyperparameter hidden layer sizes from for two and three. The best test score equals to 0.008896859648172217 and layer sizes is (6, 6, 6). Since the visualization is using Plotly, it is not very meaningful to attach the graph here.



### Evaluation of back test

Now, evaluate the prediction for each model. Compare two models, Neural Networks model is better compared to the Random Forest model because Neural Network's model has larger mean, larger Sharpe ratio, larger alpha, lower drop down, and lower stand deviation.



```
Accumulation: date
2022-03      5.568143
Name: actual, dtype: float64
Drawdowns: -0.5165511359592646
Mean return: 0.00924959584870238
Std dev: 0.04276467810887737
Sharpe ratio: 0.6728662555887124
```

Random Forest evaluation

```
Accumulation: date
2022-03      10.236006
Name: actual, dtype: float64
Drawdowns: -0.45481858063632963
Mean return: 0.012153174589170592
Std dev: 0.041028053500915
Sharpe ratio: 0.9465036072024821
```

Neural Network evaluation

**alpha: 0.008306600679620253**

Random Forest alpha

**alpha: 0.011210179420088466**

Neural Network alpha

### Trading process

All trading were done on Alpaca Markets in the Jupyter Notebook. On Apr. 7<sup>th</sup>. I submitted the first order, and the order went through on Apr. 10<sup>th</sup>. On Apr 14<sup>th</sup> and 21<sup>st</sup>, I submitted my second and third order.

The trading implemented 130/30 strategies with 100 stocks long and 100 stocks short. On each trade, I long the 100 stocks with highest return and short 100 stocks with lowest return in my model prediction.

### Evaluation of returns

For the first week from Apr 7<sup>th</sup> to 14<sup>th</sup>, my stocks increased on Apr. 10<sup>th</sup> and 11<sup>th</sup>, and dropped on other days. My stocks dropped from 100,000 to 96902 on the first week, which lost 3.09%, while SPY increased 1.79%.

For the second week from Apr. 14<sup>th</sup> to 21<sup>st</sup>, my stocks increased on Apr. 18<sup>th</sup> and 19<sup>th</sup> and dropped on other days. My stock dropped from 96902 to 96085 on the second week, which lost 0.84%, while SPY dropped 0.014%.

For the third week from Apr. 21<sup>st</sup> to 28<sup>th</sup>, my stocks increased on Apr. 26<sup>th</sup> and dropped other days. My stocks dropped from 96085 to 94923, which lost 1.21%, while SPY increase 0.89%.

From the monthly contrast with SPY, the worst month of my investment is the first week, and the best month is the second week. The overall return of the project is not desirable compares to SPY. After market close on Apr 28<sup>th</sup>, the equity dropped to \$94923, so I lost 5.07% of the money, while SPY increase 2.6%.



Alpca return



SPY return