Applied Data Science Project 5

Jason LI Dejian WANG Yuxin ZHU Ke HAN

Introduction

Scope

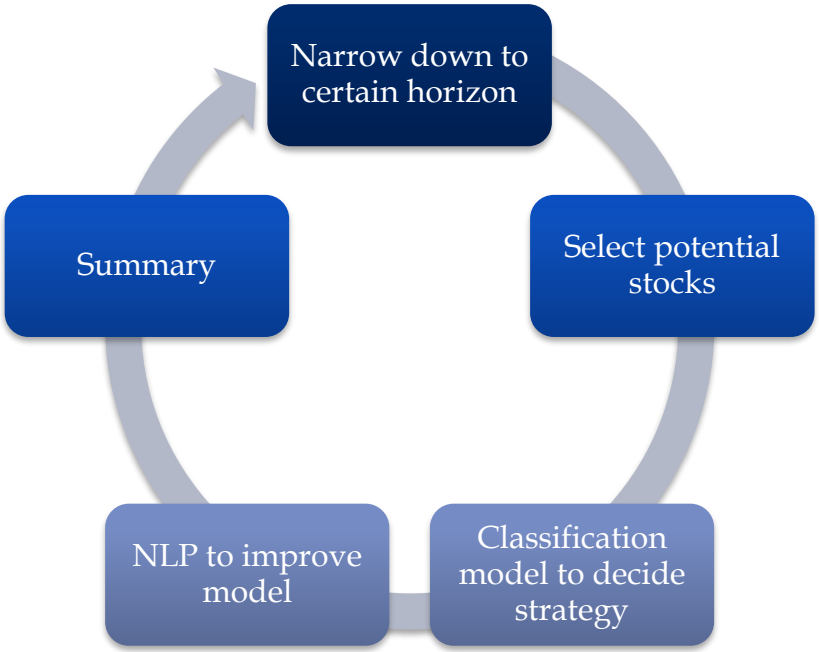
- Using the financial data set
- Focused on Earning release date related days
- Using the US market most liquidity stock
- Across more than 10 years investment horizon

Data Description

- Using more than 1000 stocks
- Using more than 39000+ entries
- Including financial fundamental information

Data Science related

- Predictive modeling
- Classification models
- NLP to generated features
- Data visualization



Step 0: Related Papers and Projects

Adaptive Asset Allocation

- Adaptive asset allocation is a process of constantly rotating into asset with
  - Adaptive momentum
  - Volatility
  - Correlation factors

Momentum

- Defined as the an asset with the greatest relative performance over the past 1 month to 1 year is more likely to exhibit stronger performance over the next few days or weeks
- Some reasons for Momentum:
  - perceptions of risk
  - human cognitive biases
  - the operation of markets

Earning announcement related

- There are two main indicators:
  - SUE (Standardized unexpected earnings
  - EAR (Earning announcement return)

$$SUE_{i,q} = \frac{X_{i,q} - E(X_{i,q})}{\sigma_{i,q}}$$

$$EAR_{i,q} = \prod_{j=t-1}^{t+1}(1+R_{i,j}) - \prod_{j=t-1}^{t+1}(1+FF_j)$$

Here, FF stands for the benchmark size &book t- market FF portfolio

- And the related trading strategy are:
  - Long the stocks with positive announcement
  - Short the portfolio with negative announcement

Step 1: Data collection and Description

Load data

- Data source: Using Bloomberg terminal, Scraping from Yahoo and Wall Street Journal
- Size: including financial data 39034 entries (based on the volatility, choose the most volatility ones), news related txt files

Horizon

- Based on the Earning released projects on the previous page, we focused on the earning released date -6 to 6 horizon
- In our data set, the earning release is covering 2006 to 2016 earning release (can refer to earning calendar)

Data processing

- Calculated and processed the dividend yield ratio, enterprise value to EBITDA ratio, market to book ratio, Momentum, price to sales ratio, days(based on the data to earning release) etc.
- For example here,
  - Momentum is based on the price (CLOSE(J) / CLOSE(J – N) * 100)
  - Fama French Book to market ratio

$$\text{Book to Market} = \frac{\text{Book Value of Firm}}{\text{Market Value of Firm}}$$

*Full code can be found in the R markdown file in github
*http://www.nasdaq.com/earnings/earnings-calendar.aspx

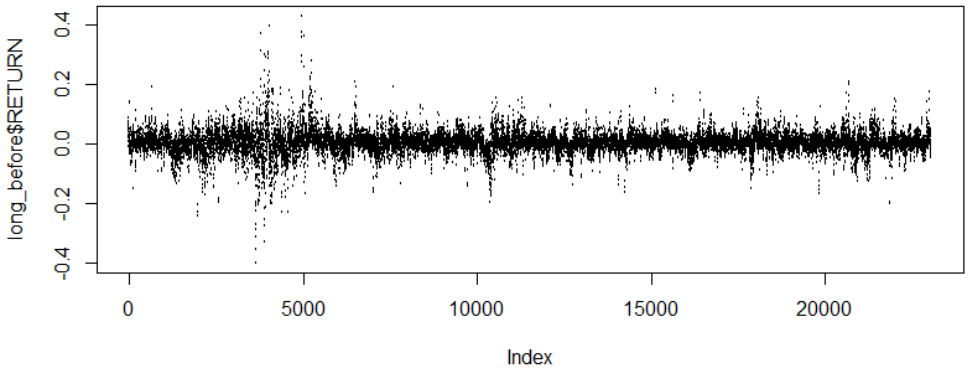
Step 2: Select the stocks based on their Momentum

Select Stocks

- After comparing some subset of the stocks, we decided to pick up a most sensitive, also known as influential stocks to do further analysis
- Here, we choose most momentum stocks!

Major 4 category

- Long VS Short
- Before earning release VS after

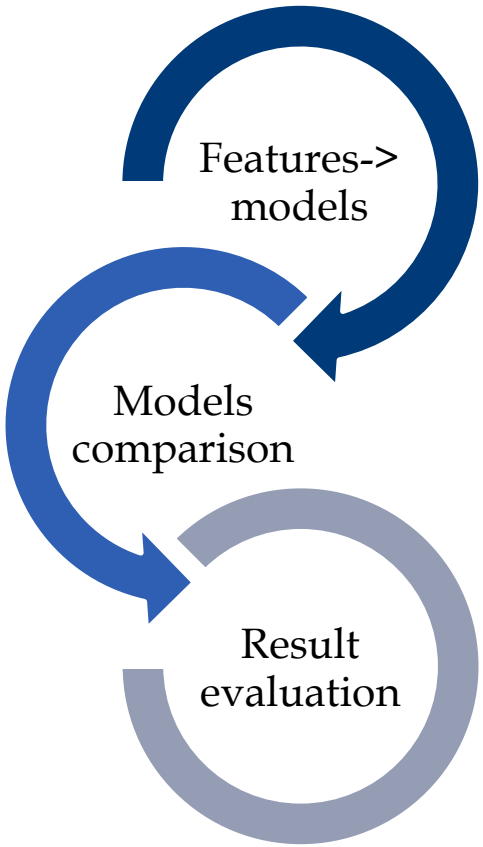


Statistical Description of the data

Name	Mean	Median
Dividend yield	3.07	2.069
EBITG	40.35	0.24
EV/EBITDA	11.77	9.19
M/B	5.64	2.80
Momentum	-0.032	-0.104
P/E ratio	22.59	13.96
P/S ratio	2.11	1.64
Return	0.0033	0.0020
Days	3.5	4.0
Surprise	10.73	3.70
P/F ratio	28.19	14.35

Step 3: Classification model

Final model



- After feature selection and running Gradient Boosting Machine, BP Neural network, Random Forest, Logistic regression, Supported Vector Machine,
- Model comparison:
  - SVM: $J_\lambda(\alpha) = \frac{1}{m}\sum_{i=1}^{m} \mathrm{L}(K^{(i)T}\alpha, y^{(i)}) + \frac{\lambda}{2}\alpha^T K\alpha$

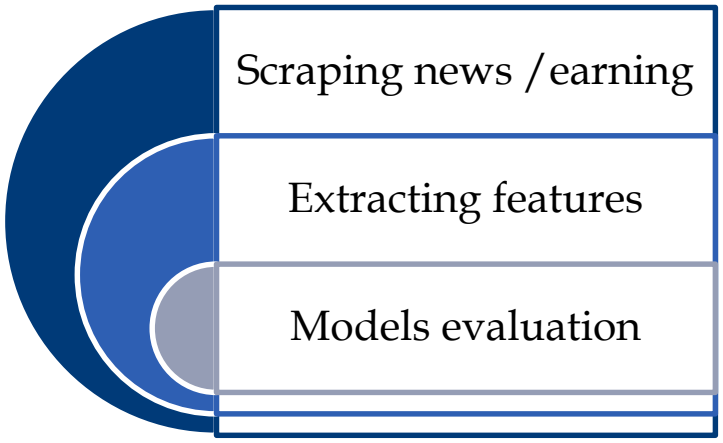
    tuning on bandwidth and using kernel RBF
  - Random Forest: tuning on mtry
  - Logistic regression: $\beta = (X'WX)^{-1}X'WY$

    tuning on bandwidth
- We summarized the prediction accuracy on test data set and runtime analysis

Models	Prediction accuracy	Run time analysis
SVM	72%	Tens of minutes +
GBM	66%	Tens of minutes
Neural Network	76%	Tens of minutes
Random Forest	82%	Tens of minutes

*Full code can be found in the R file attached

Step 4: Including news features from NLP



- **News and analytic articles**
- We would like to analyze if these articles from mainstream media could influence stock market and investor's trading strategies
- **EPS vs Forecast**
- How much the actual EPS bits consensus expectation is also a key factor to be considered for investment strategy
- Those features would expand our info

- Building up the advanced model from the features, we would have more accrete prediction
- Compared the mixed portfolio and specific stock, we see that specific is better, improved by **5-8%??**
- How to utilized this, the investment horizon changed on this model, we can more flexibility change our portfolio and thus gain better result

Step 5: Strategy and Back test

- After building up the portfolio based on our analysis, we have the following lines!

*Full code can be found in the R file attached

Summary and Improvement

Summary

- Stock market is known as a chaotic system. We get more information on news by limiting our scope to earning release day, and are able to build the prediction model of more than 80% accuracy
- Models and features: SVM seems to give us a better prediction than NB and other generalized LR algorithms. Also, random forest gives us the best among all of them
- Further, it is observed that data visualization from different companies shows that data set from a certain company is much more distinguishable than mixing data (portfolio and index)

Discussion

- NLP

Future work

- NLP analysis: The sentiment result from toolkit is too general to apply for financial news and our word vector list is quite limited
- Model Improvement: high dimension can be handled better

Thank You !

Contact Information: Jason LI
Dejian WANG
Yuxin ZHU
Ke HAN