

Stock Tracking and Signal Detection

Liangdong Fan, Ph.D.

liangdong.fan.stats@gmail.com

Interview Presentation

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- 1 Stock market tracking on returns and volumes
 - Candle chart of an individual stock
 - Distribution of daily and weekly returns
- 2 Historical stock screening with similar patterns
 - Quantification of a certain stock pattern
 - Similar pattern detection using k-nearest neighbors
 - Graphical and numerical results of similar stocks
- 3 Detection of some typical signals
 - Examples of stocks with certain signals
 - Discussion of signal detection

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Candle chart of stock AAPL OHLC



Figure: Candle chart of Apple Inc. stock from 1/2/2020 to 2/14/2020. The green candles show a higher close price than open price on that specific day, while the orange candles show the opposite pattern.

Distribution of daily and weekly returns

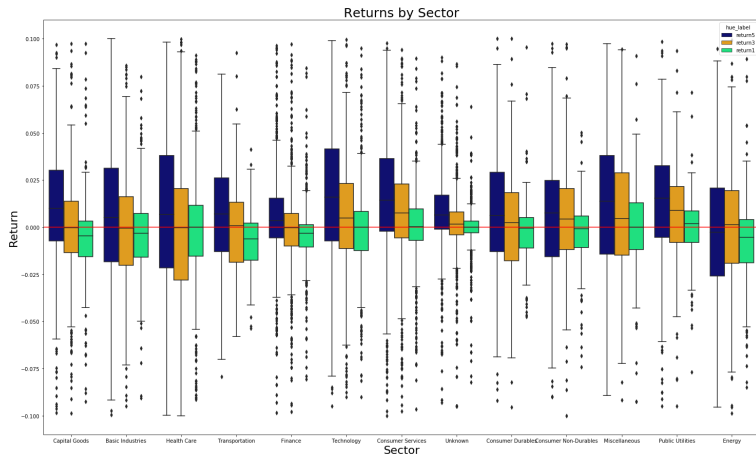


Figure: On 2/14/2020, the distributions of 1-day, 3-day and 5-day returns over each sector are shown in the figure above. Note that only returns between $[-0.1, 0.1]$ are plotted for a better visualization.

Average Trading volume

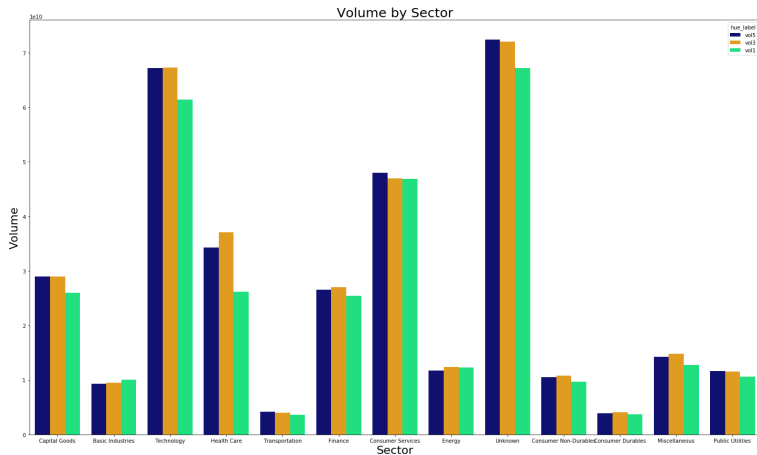
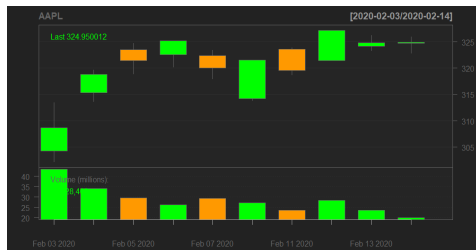


Figure: The bars in green represent the trading volume(close price \times volume) on 2/14/2020. The orange and navy bars represent 3-day and 5-day average trading volume.

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AAPL stock price and trading volume



(a)

Date	Open	High	Low	Close	Volume
2/3/2020	304.30	313.49	302.22	308.66	43,496,400
2/4/2020	315.31	319.64	313.63	318.85	34,154,100
2/5/2020	323.52	324.76	318.95	321.45	29,706,700
2/6/2020	322.57	325.22	320.26	325.21	26,356,400
2/7/2020	322.37	323.40	318.00	320.03	29,421,000
2/10/2020	314.18	321.55	313.85	321.55	27,337,200
2/11/2020	323.60	323.90	318.71	319.61	23,580,800
2/12/2020	321.47	327.22	321.47	327.20	28,432,600
2/13/2020	324.19	326.22	323.35	324.87	23,686,900
2/14/2020	324.74	325.98	322.85	324.95	20,028,400

(b)

Figure: Apple Inc. stock prices from 2/3/2020 to 2/14/2020. As one can see from the candle chart, price went up from 2/12/2020 and showed a very close Open Price and Close Price in the last 2 days.

Simplified patterns of Apple Inc. stock price

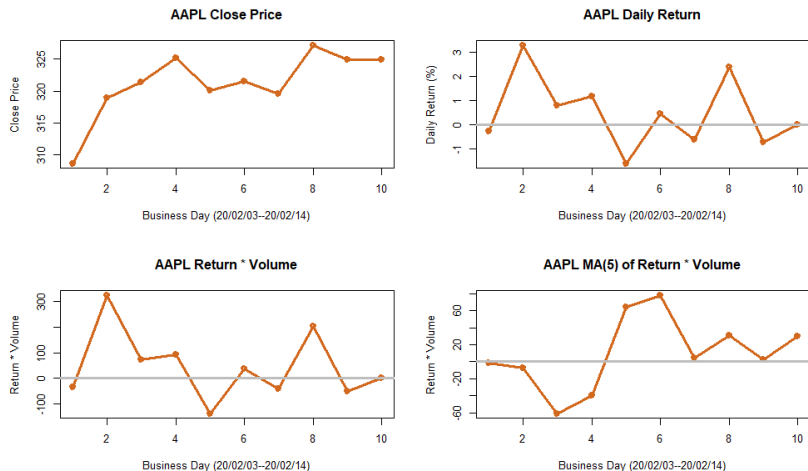
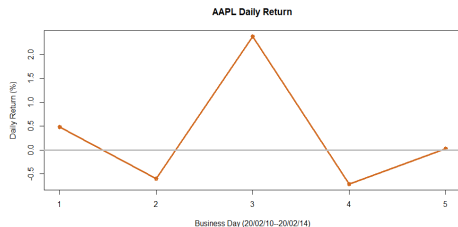


Figure: The close price, daily return, etc. are included in the plots above.

K-nearest neighbors algorithm

The k-NN algorithm finds k nearest neighbors to the input vector in the feature spaces.



(a)

Date	Return
2/7/2020	-1.59281453
2/10/2020	0.47495204
2/11/2020	-0.60332859
2/12/2020	2.37477781
2/13/2020	-0.71210786
2/14/2020	0.02463047

(b)

Figure: Using 5-day data from AAPL, we put the daily return in a vector $\mathbf{x} = [0.4749, -0.6033, 2.3747, -0.7121, 0.0246]$. After searching the historical data, we can find $\mathbf{z}_1, \mathbf{z}_2, \dots, \mathbf{z}_k$, such that $\|\mathbf{x} - \mathbf{z}_1\|, \|\mathbf{x} - \mathbf{z}_2\|, \dots, \|\mathbf{x} - \mathbf{z}_k\|$ have the k smallest values.

Historical stock data with a similar pattern



Figure: All those stocks have a jump in the middle of the date range, after which the open price and close price are very close.

Statistics from similar stocks

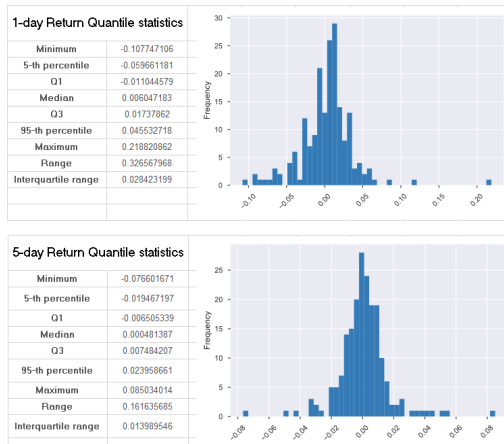


Figure: The statistics and distributions of daily and weekly returns are shown above. The results are derived from ~200 historical stocks with the closest pattern to AAPL on 2/14/2020. Note that the closest pattern are based on how we simplified the data.

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Stocks with some signals

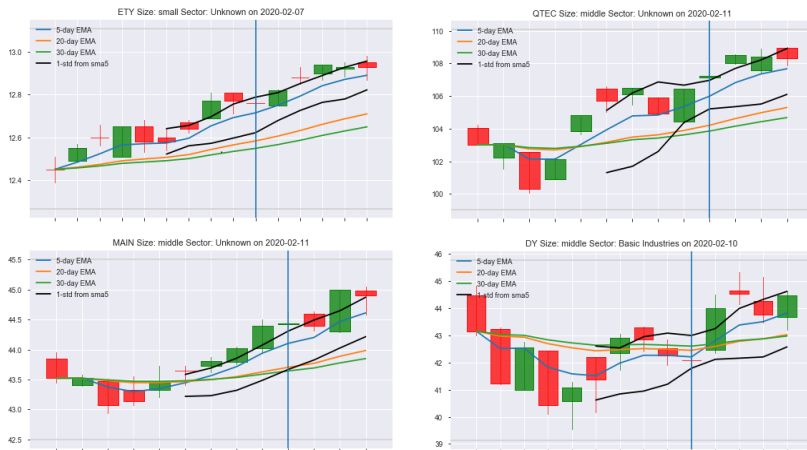


Figure: Those stocks show a cross sign on that date right after a growing momentum. Note that this is ONLY visualization, but NOT to prove that such a pattern guarantees a future growth.

Discussion

- The quick overview of the market is only about returns and trading volume. To better understand the market, more in-depth reviews should be conducted.
- One can also add weight parameters in the k-NN algorithm. For simplicity, it is not included in the presentation.
- There are many ways for the stock-price engineering part. One can also focus on patterns of his/her interest, quantify such patterns and study historical stocks.
- Backtesting can be conducted for either a specific pattern or a trend from certain stock. The difficult part is how to define those similar stocks from historical data.
- If interested in the predictions, one can also engineer a large set of variables and build predictive models.(i.e. weekly returns).

Thank you!