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CS 4646: Machine Learning for Trading
Project 4: Manual Strategy
Due: 3/18/2018

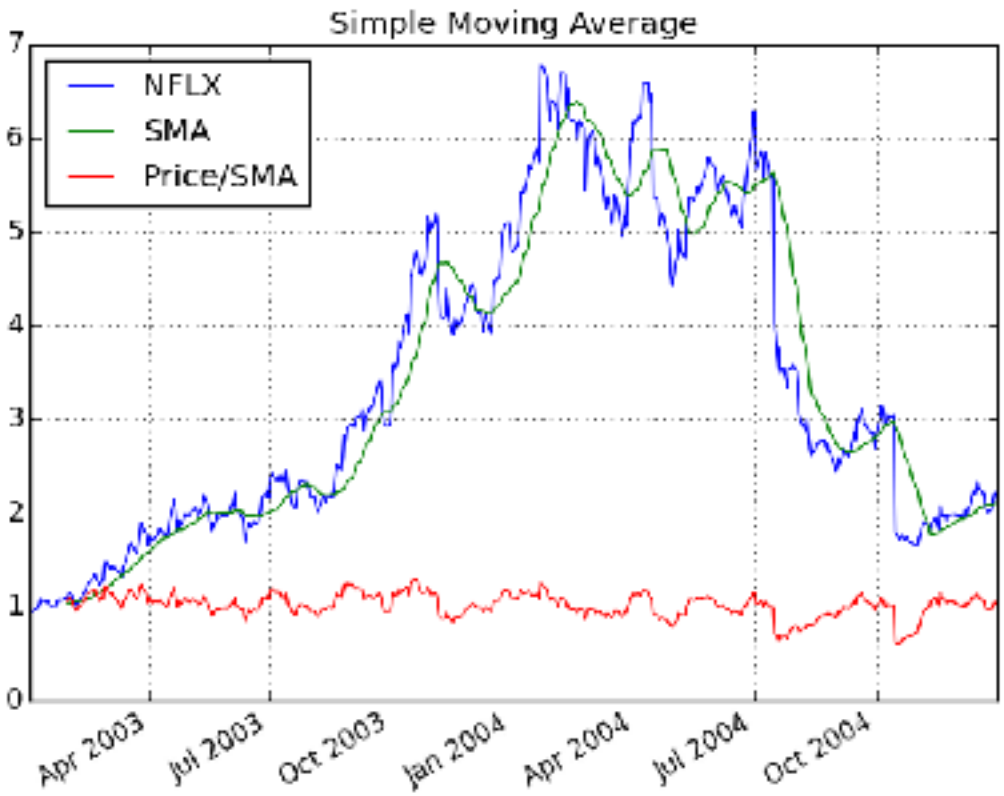
Part 1: Indicators

An indicator is a calculation that is applied to a stock's trends and data that can be used to analyze short-term price movements.
I used the following three indicators:

- Price/SMA
- Bollinger Bands %B
- Volume Rate of Change

Price/SMA

Price/SMA was calculated by deriving the 20-day simple-moving average (SMA) of the stock, in this case "NFLX" and dividing a day's price by that day's SMA. The figure below shows the standardized stock value of NFLX (blue) along with the 20-day SMA (green) and the said stock value divided by the SMA (red). The purpose of the indicator is to "BUY" when the Price/SMA ratio is less than 1 (or when the stock is undervalued) and to "SELL" when the ratio is greater than 1.1 (or when the stock is overvalued).



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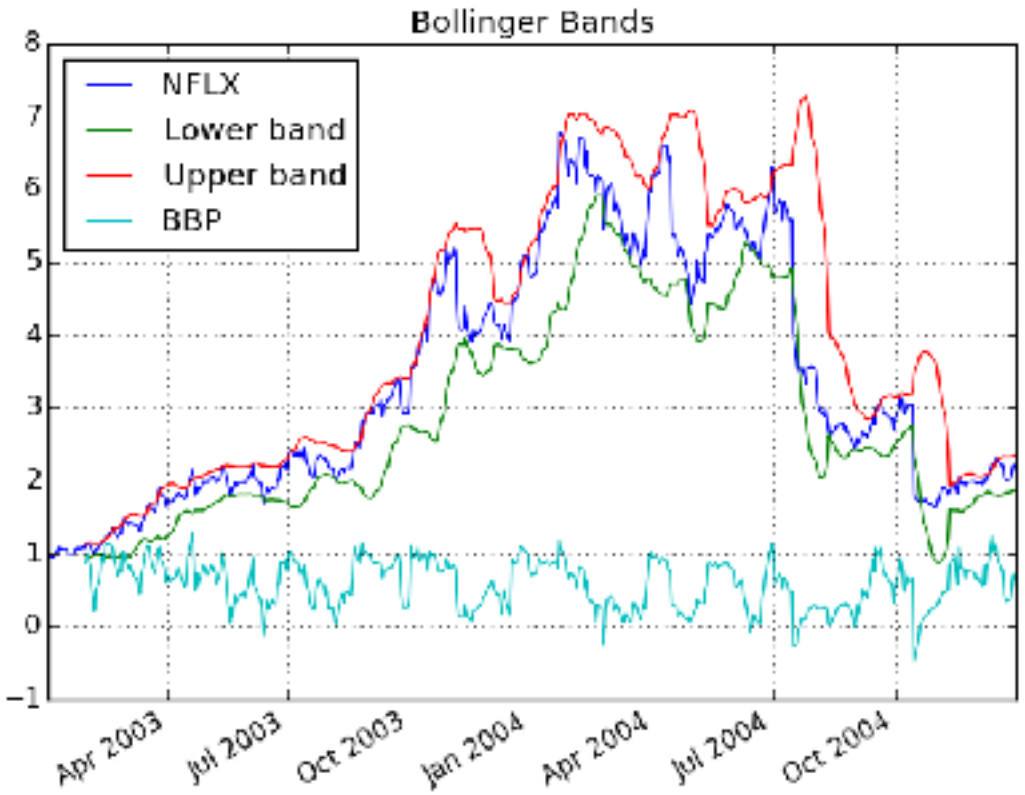
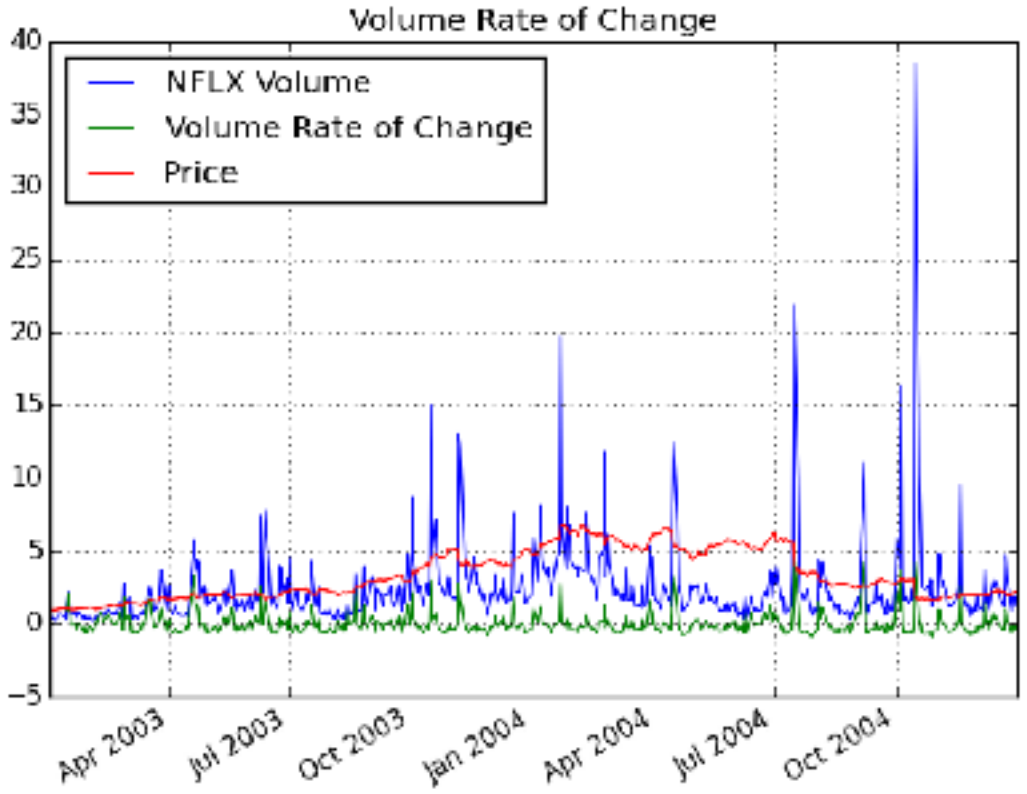
Bollinger Bands %B

I used the general Bollinger Bands model with a 20-day SMA and two 20-day standard deviations above (red) and below (green) the SMA. The graph below also shows the standardized stock value (blue). Bollinger Bands are a volatility indicator. In this particular case, I used the Bollinger Bands %B indicator. %B is calculated as the difference of the Price and the Lower Band divided by the difference of the Upper and Lower bands. When the %B indicator is above 1, the price is above the upper band and when the price is below 0, the price is below the lower band. In other words, when %B is above 1 we will "SELL" and when $B is reasonably below 1 and above 0, we should "BUY".



Volume Rate of Change

I used an indicator not discussed in class called Volume Rate of Change, which is the difference between the current volume and the 20-day rolling mean of volume divided by this same rolling mean. This indicator gives an idea about how the current volume relates to the previous 20-day average of volume. Volume itself is an important indicator because large changes in volume indicate a stock is being rapidly bought or sold, which in turn is a likely indicator of an increase in price.



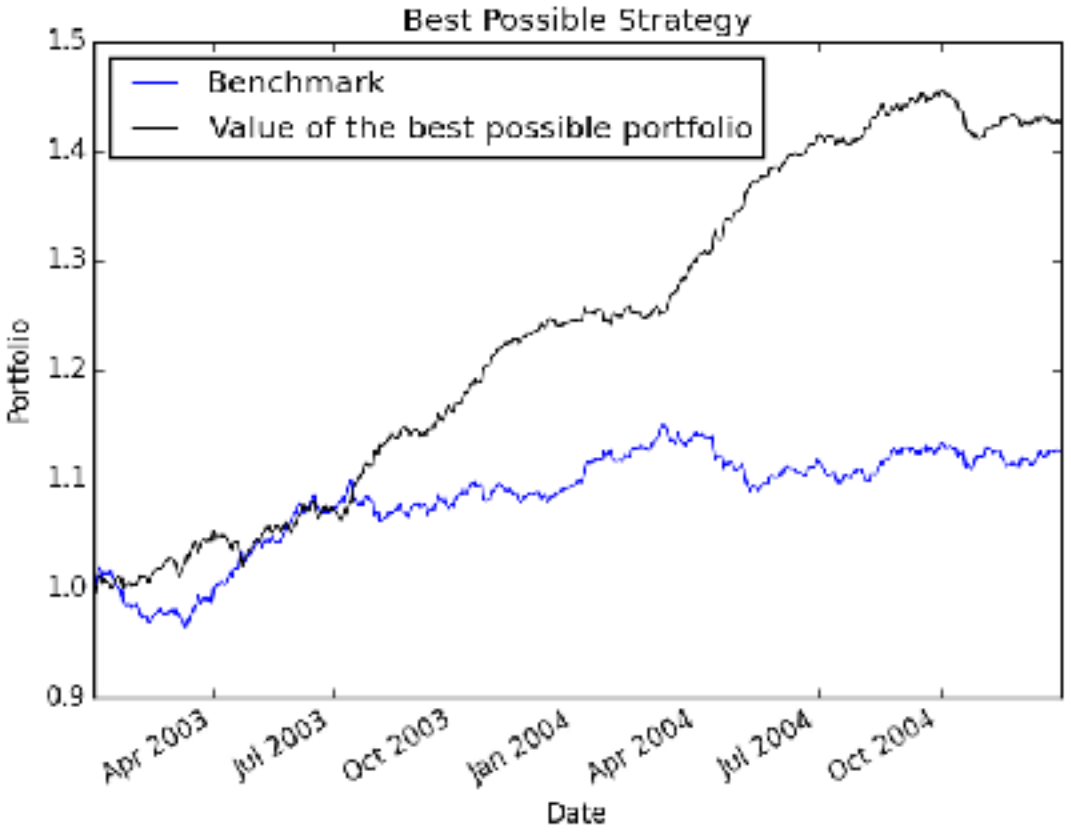
The graph above shows the volume of NFLX (blue) along with the volume rate of change (green) detailed above, and the price, which is not solely important for this indicator but is significant for trend comparison.

Part 2: Best Possible Strategy

The best possible strategy as indicated in the assignment is a strategy that allows us to peak ahead into the future and make the optimal decision every trading day. My strategy for this involves looking one day into the future to determine the optimal trade. The result for this is indicated in the graph on the next page which shows the standardized portfolio value (black) and the standardized benchmark value (blue). The benchmark as defined for this strategy and future strategies is purchasing $1000 shares of NFLX with $100,000 at the very beginning of the time period and holding that position for the entire time period.

Data:

	Portfolio	Benchmark
Cumulative Return	0.427	0.1248
Standard Deviation, Daily Returns	0.00323	0.00357
Mean, Daily Returns	0.000712	0.000240

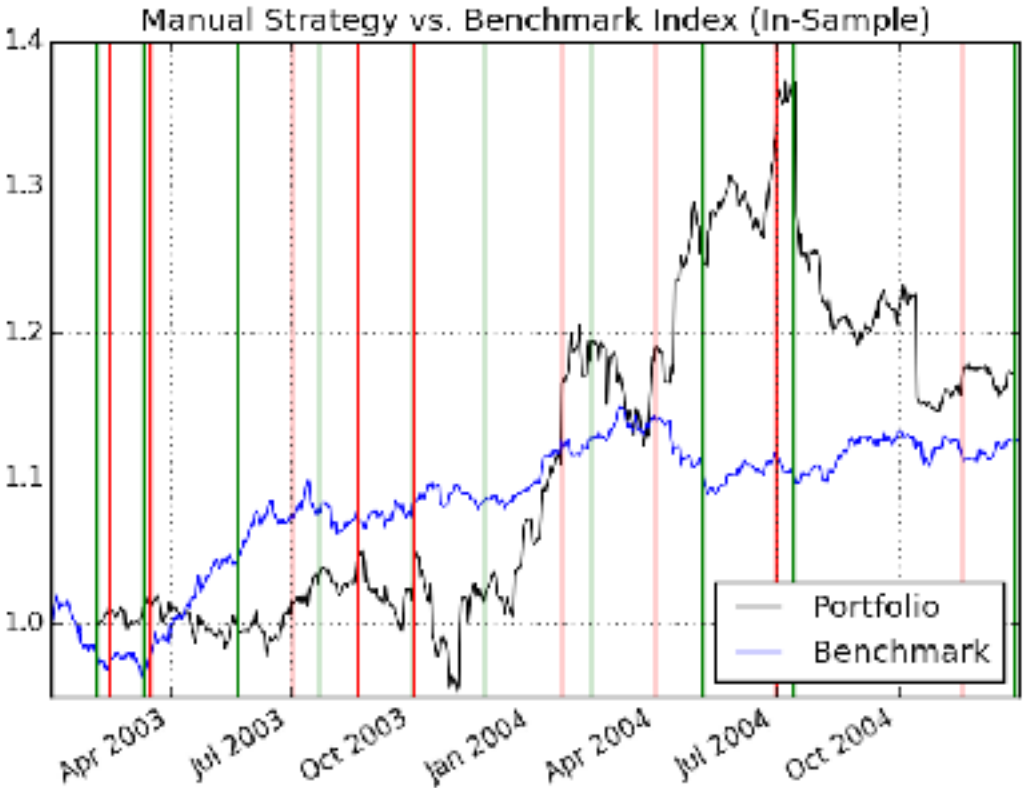


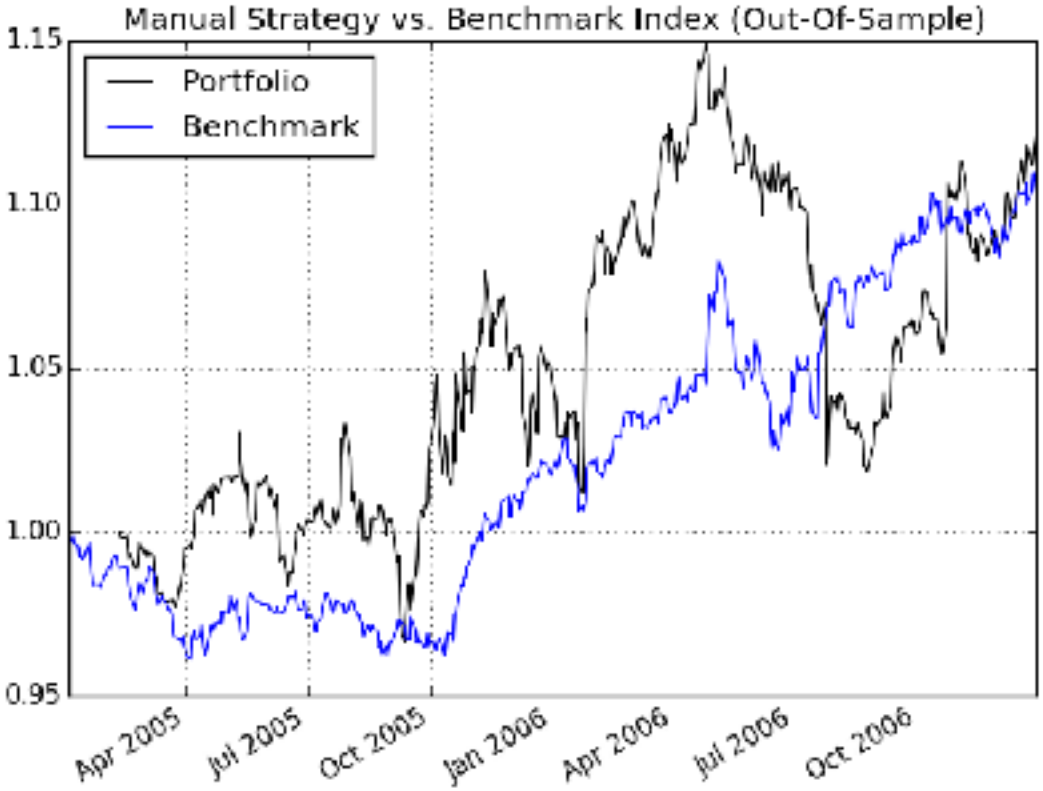
Part 3: Manual Strategy & Part 4: Comparative Analysis

For the manual strategy, I used the indicators in the following way:
When the %B is greater than 0.3 or less than 0.8 and when the volume rate of change is less than 0 and when the price/SMA ratio is less than one, buy the stock if possible. Otherwise, if the %B value is greater than 1 and the volume rate of change is greater than 0.5, and the SMA is greater than 1.1, sell the stock if possible. The cutoffs for these values were determined by analyzing the Part 1 indicator graphs and seeking out particular trends. The graph below demonstrates our portfolio against the benchmark. Our portfolio has a final value of 117133.8 against the initial 100000. The red and green lines are our selling and entering points for buying the stock. Note: Black lines are not shown because the strategy always goes maximally long or short.

The graph for the out-of-sample strategy is shown below although without the red and green lines for selling and entry points. Our in-sample portfolio performed unsurprisingly better than our benchmark as well as against our out-of-sample portfolio, although the difference was not extreme. The in-sample performance was used to "tweak" the strategy while the strategy was simply performed on the out-of-sample data, which obviously performed worse.

	In-Sample	Out-of-Sample
Cumulative Return	0.177	0.1215
Standard Deviation, Daily Returns	0.009	0.0065
Mean, Daily Returns	0.000381	0.000262
Final Value	117730.55	112150.5


Manual Strategy vs. Benchmark Index (In-Sample)
1.4
1.3
1.2
1.1
1.0
Portfolio
Benchmark
Apr 2003
Jul 2003
Oct 2003
Jan 2004
Apr 2004
Jul 2004
Oct 2004


Manual Strategy vs. Benchmark Index (Out-Of-Sample)
1.15
1.10
1.05
1.00
0.95
Portfolio
Benchmark
Apr 2005
Jul 2005
Oct 2005
Jan 2006
Apr 2006
Jul 2006
Oct 2006