Reinforcement Learning vs Manual Trading

In this Project I calculated performance metrics for a RL based trading strategy vs a manual strategy that is based off of the defined technical indicators below. In our RL strategy we defined 3 possible actions(eg buy, sell, and do nothing) for our learner to perform. The normalized portfolio values of each strategy and the effects on performance in response to changes in certain hyperparameters are also shown below.

Price/Simple Moving Average: N=20, BUY: x<1, SELL:x>1.1

The simple moving average of a stock is the average price of a stock over the past N days(lookback window). In our case we optimized the N value to 20 days(both Manual and Strategy Learner for **all** indicators) since values greater or less failed to give performance. Finally, divide by price dataframe.

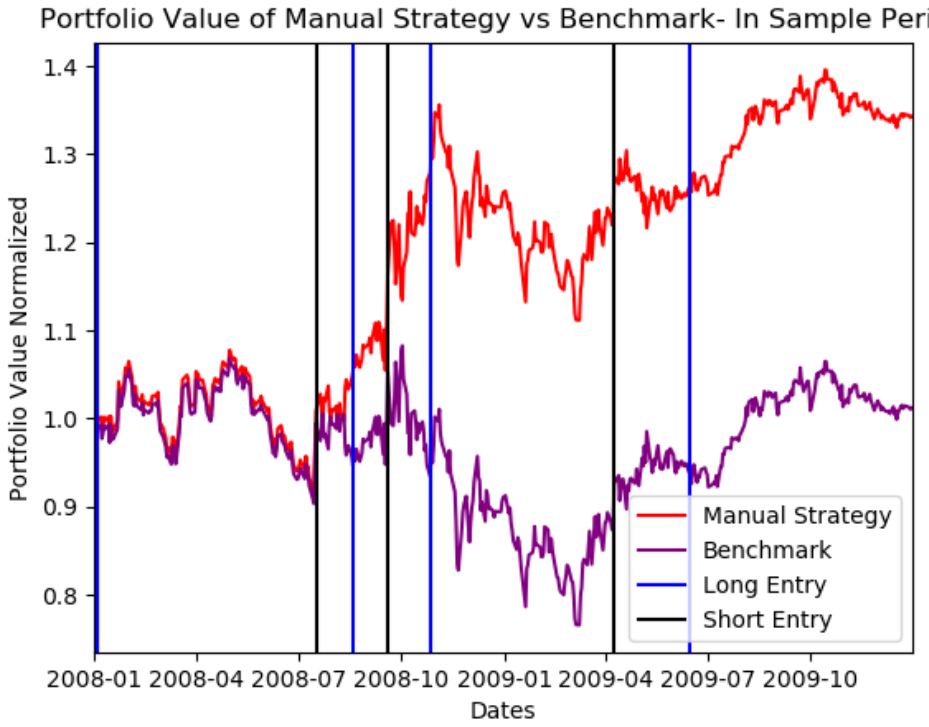
Bollinger Band Percentage:

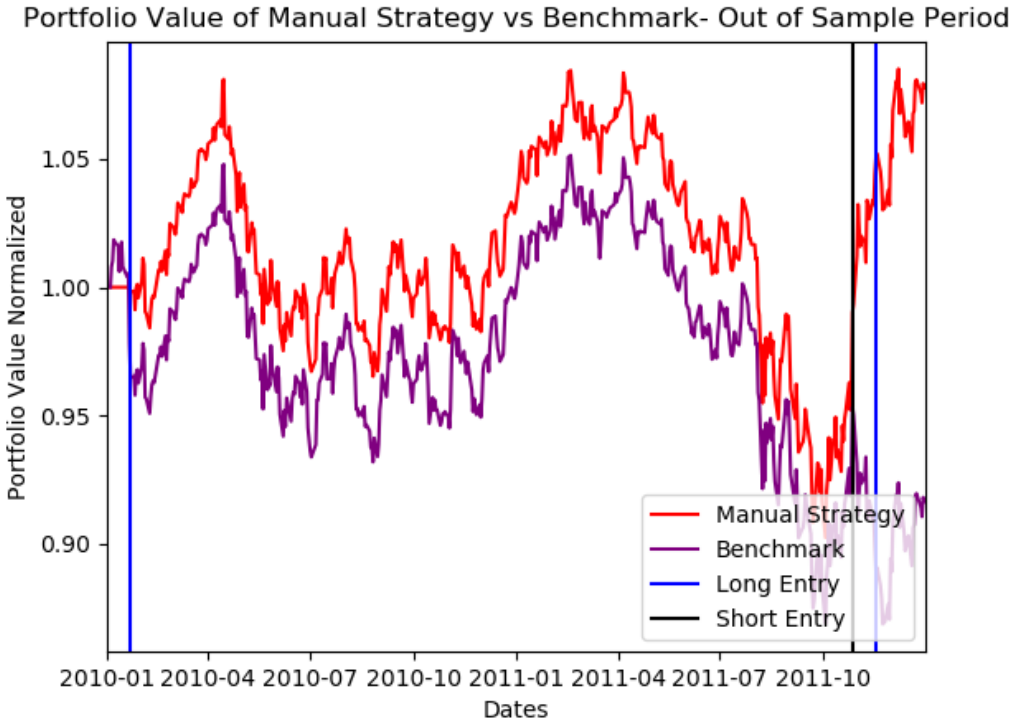
BBP = (Stock Prices - lower band)/(upper band - lower band)
N=20, BUY: x<0.1, SELL: x > 1.1
Rolling Standard Deviation = SquareRoot(Sum(Observation - Mean)/n-1

In order to calculate Bollinger Band Percentage(BBP), we first calculate the Bollinger values which are 2 times the rolling standard deviation(standard deviation of the past 20 days). We optimize for a lookback window of N=20 days here(both Manual and RL). After that take the sum/difference of the SMA and Bollinger Values(2*Rolling Standard Deviation) to calculate upper and lower bands respectively. BBP is simply the prices of the stocks minus the lower band divided by the difference between the upper and lower band(See formula above).

Momentum: (price[t]/price[t-N])-1 N=20, BUY:x<-0.06, SELL:x>0.06

Momentum is the speed and direction of a stock price with respect to a certain look back window(N). In other words, it is just the price of the stock for a given day(t) divided by the price of the same stock t-N days. We take this value and subtract 1 in order to get momentum. We optimized for 20 days in both strategies(manual and RL)


Portfolio Value of Manual Strategy vs Benchmark- In Sample Period
Portfolio Value Normalized
1.4
1.3
1.2
1.1
1.0
0.9
0.8
2008-01 2008-04 2008-07 2008-10 2009-01 2009-04 2009-07 2009-10
Dates
Manual Strategy
Benchmark
Long Entry
Short Entry


Portfolio Value of Manual Strategy vs Benchmark- Out of Sample Period
Portfolio Value Normalized
1.05
1.00
0.95
0.90
2010-01 2010-04 2010-07 2010-10 2011-01 2011-04 2011-07 2011-10
Dates
Manual Strategy
Benchmark
Long Entry
Short Entry