

To frame the trading problem as a learning problem, I took these steps.

1. Choose a learner which will give you a trade dataframe containing LONG, SHORT and CASH as actions to take in a market
 - a. I have chosen Random Forest Learner(Bag Learner with Random Tree Learner) which I simply most confident with as I have successfully created Manual Strategy with it and got the good trading result.
2. Choose 3 indicators as data X which gives the learner to randomly choose its value and create a tree model which predict the future of price changes
 - a. I have chosen 3 indicators to use, Bollinger Bands, volatility, momentum, the same as before I used them for Manual Strategy.
3. Standardize the data of indicators
 - a. Without standardization, the data range will be all different and it would be difficult to use as a classifier to discretize any other data.
4. Get data Y from N day returns which are classified into 3 categories, LONG(1), SHORT(-1) and CASH(0)
5. Give the data X and data Y to the learner
 - a. Inside addEvidence method, those 2 data with in sample are given to the learner to train the model.
6. Get prediction
 - a. Inside testPolicy method, get test data X from indicators with new data and use it to query the learner. It will return the list of price changes prediction.
7. Get trades
 - a. According to the prediction, create trades data frame which contains shares information, either 1000 (or -1000)as first trade, or 2000 for long, and -2000 for short.
 - b. Long and Short should be happening alternately.

Experiment 1

Purpose of this experimentation is to compare a strategy based on manually set rules and another strategy based on machine learning, especially with Random Forest Learner.

[Assumption]

My assumption is that, since the Learner trains with 3 indicators in very detail in a way that human eyes can't possibly do with such many data, so that the model it creates will be more accurate prediction than a human can make and the result will be much better than the Manual Strategy.

Also I carefully choose parameters, such as number of days for N_day returns, leaf size and number of bag for the learner, and also values to trigger LONG and SHORT. There is really no good explanation for those values except by trial-and-error to get best result possible not only with in sample but also out sample.

[Outcome]

Unlike I expected, the result I got from this experiment 1 was showing that Learner Strategy beats Benchmark but not Manual Strategy.

I suspect for the reason is below.

Strategy used 3 different indicators. For manual strategy, I was using them in serial.

A later indicator has more weight than earlier ones so the order of the indicators has significant impact on the result. I choose the order carefully to make sure the result will be the best I can get. For Learner strategy, the indicators are chosen randomly in parallel. Because of the randomness and parallel processing, the results vary and not quite as good as Manual Strategy.

I notice that it never beats Manual Strategy and while other 2's results were always the same, the learner gave always different result due to the randomness.

★GRAPH is on page3

Experiment 2

Set impact to 0.08.

[Hypothesis]

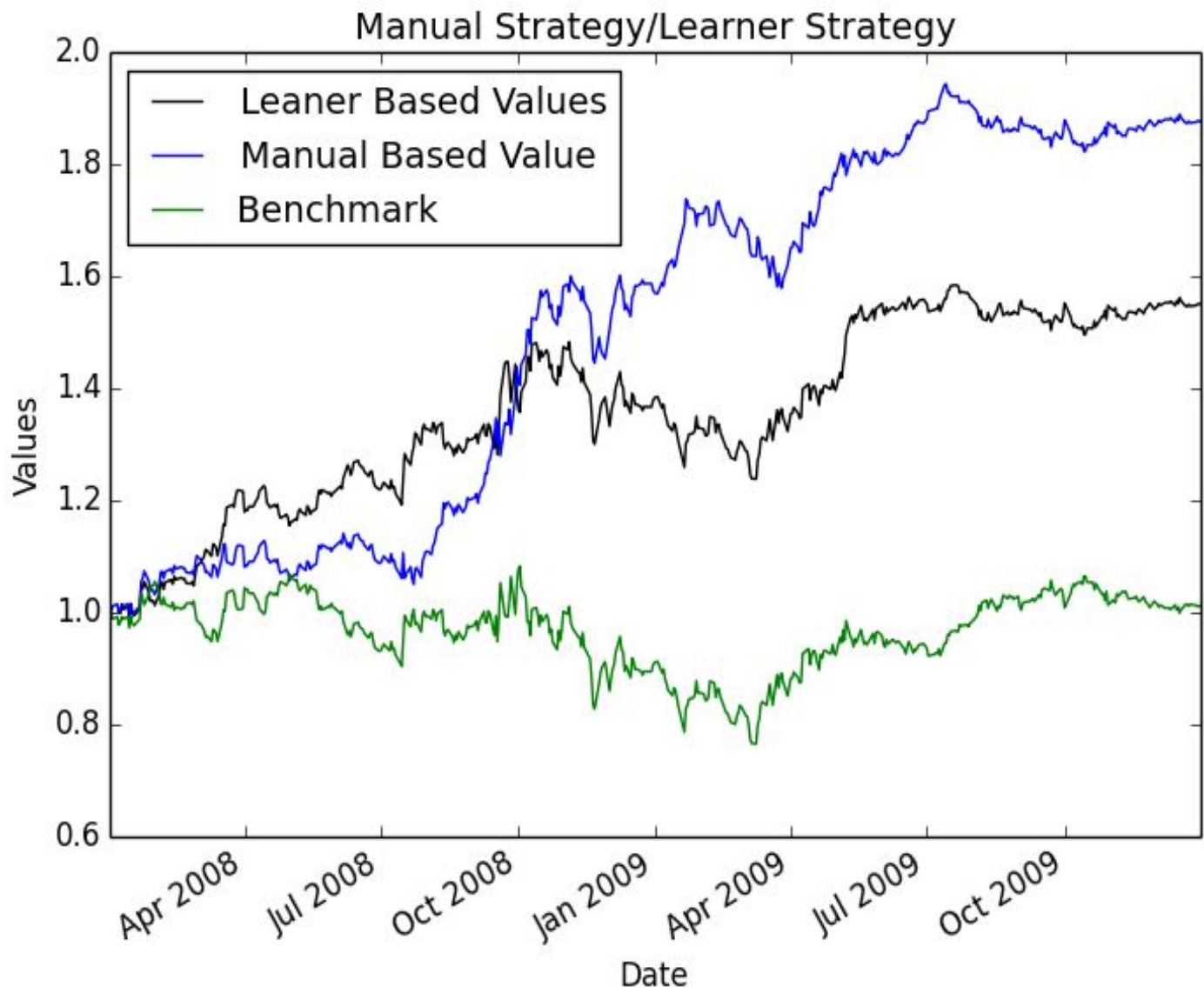
Manual Strategy uses indicators in serial and everyday return will affect how the trading should be. So simply, there would be more buying and selling than Learner Strategy so that it will have more impact on the return values. While Learner Strategy uses indicators in parallel and also has bigger window to classify the values. This let it avoid overfitting to the in sample data. Changes of the impact will have much less affect on the trading results and much more so for benchmark which only trade twice.

★GRAPH is after page4

GRAPH

Experiment 1

Impact = 0



Date Range: 2008-01-01 00:00:00 to 2009-12-31 00:00:00

Sharpe Ratio of Learner Portfolio: 1.24807773748

Sharpe Ratio of Manual Portfolio: 1.80848833649

Sharpe Ratio of Benchmark : 0.156918406424

Cumulative Return of Learner Portfolio : 0.5512

Cumulative Return of Manual Portfolio : 0.8755

Cumulative Return of Benchmark : 0.0123

Standard Deviation of Learner Portfolio : 0.0121240981068

Standard Deviation of Manual Portfolio : 0.0115406617966

Standard Deviation of Benchmark : 0.0170043662712

Mean Daily Return of Learner Portfolio : 0.00095321486886

Mean Daily Return of Manual Portfolio : 0.0013147590105

Mean Daily Return of Benchmark : 0.000168086978191

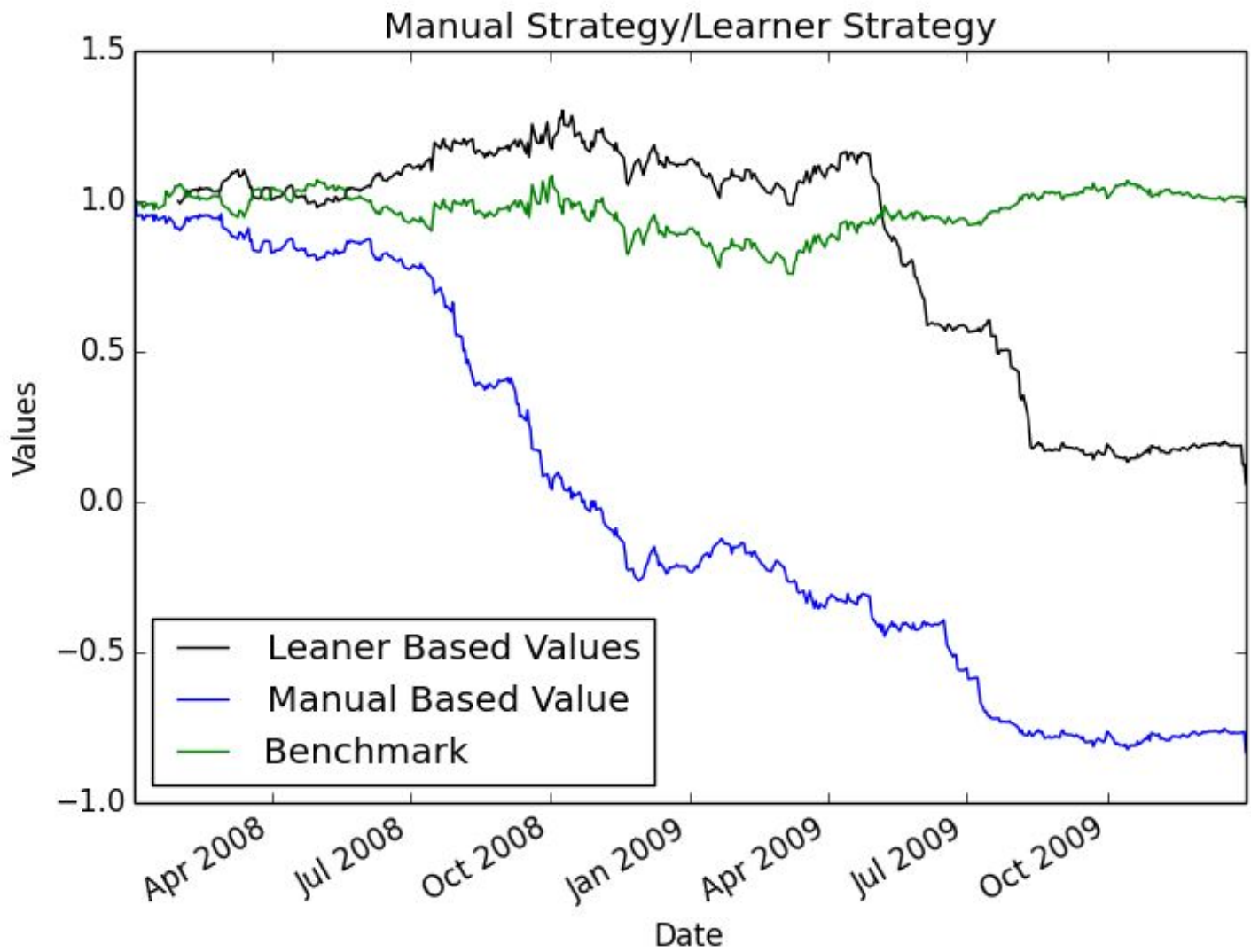
Final Portfolio Value of Learner Portfolio : 155120.0

Final Portfolio Value of Manual Portfolio : 187550.0

Final Portfolio Value of Benchmark : 101230.0

Experiment 2

Impact = 0.08



Date Range: 2008-01-01 00:00:00 to 2009-12-31 00:00:00

Sharpe Ratio of Learner Portfolio: -1.64561711152

Sharpe Ratio of Manual Portfolio: -1.24310035743

Sharpe Ratio of Benchmark : 0.103056121822

Cumulative Return of Learner Portfolio : -0.939565447976

Cumulative Return of Manual Portfolio : -1.83233184486

Cumulative Return of Benchmark : -0.0200779180045

Standard Deviation of Learner Portfolio : 0.0442717030353

Standard Deviation of Manual Portfolio : 0.671894702309

Standard Deviation of Benchmark : 0.0176384170765

Mean Daily Return of Learner Portfolio : -0.0045893877583

Mean Daily Return of Manual Portfolio : -0.0526147047599

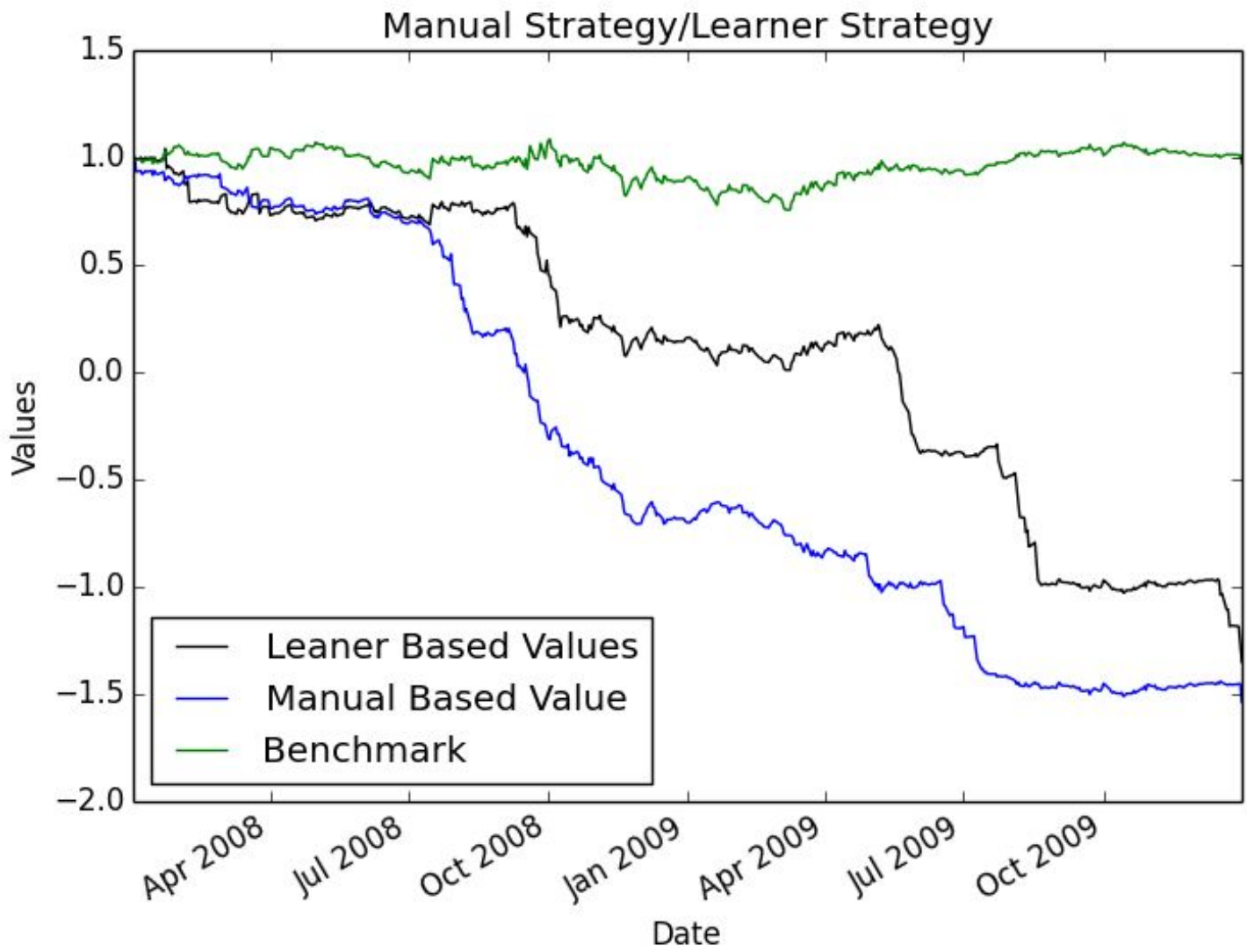
Mean Daily Return of Benchmark : 0.000114507288937

Final Portfolio Value of Learner Portfolio : 5834.4

Final Portfolio Value of Manual Portfolio : -80671.6

Final Portfolio Value of Benchmark : 94976.4

Impact = 0.1



Date Range: 2008-01-01 00:00:00 to 2009-12-31 00:00:00

Sharpe Ratio of Learner Portfolio: 0.766306842214

Sharpe Ratio of Manual Portfolio: -0.698824923163

Sharpe Ratio of Benchmark : 0.0896470998723

Cumulative Return of Learner Portfolio : -2.3507050889

Cumulative Return of Manual Portfolio : -2.53637432009

Cumulative Return of Benchmark : -0.028496250767

Standard Deviation of Learner Portfolio : 0.444474583773

Standard Deviation of Manual Portfolio : 8.13698729976

Standard Deviation of Benchmark : 0.0178222526915

Mean Daily Return of Learner Portfolio : 0.0214560298563

Mean Daily Return of Manual Portfolio : -0.358205090349

Mean Daily Return of Benchmark : 0.000100646475496

Final Portfolio Value of Learner Portfolio : -129977.0

Final Portfolio Value of Manual Portfolio : -147727.0

Final Portfolio Value of Benchmark : 93413.0