Tarun Pasumarthi
903085537

HW8 Strategy Learner Report

Description:

In this project, we are given a time series data of stocks, and my task is to determine whether to buy, sell, or hold a particular stock on a given day. We tackled this task two ways, the first was through a manual, self-determined strategy, based on certain indicators, and the second way was to train a learning model on the given indicators to come up with another strategy. In this report, I will compare how the two performed

How I framed this as a learning problem: For this assignment, I chose to train my indicators using an ensemble learner, BagLearner. I used a leaf size of 5 and bag size of 15, thereby using 15 RTLearners, or random trees to perform the learning task. To create the training data, I use the recommended in-sample data to calculate my indicators. Then I concatenate these indicators into my training data, each indicator now being a feature. To create the labels, I use N-day return to determine weather our action, labeling 1 for buy, -1 for sell, and 0 for hold. With this, I train it using the BagLearner, and then use that model to test the out-sample data.

What are my indicators: For my indicators, I am using Simple moving average, Bollinger bands, and momentum.

The simple moving average is the average stock price of a given stock from a certain fixed number of time units to the present. In this project, I used a window of 30 days to calculate the moving average. This means that the rolling average at any given time would be the average of the stock of the last thirty days. The formula for this calculation is given below:

SMA[t]= price[t-window ,t].mean()

The simple moving average is useful as an indicator, since it gives a good approximation of a stocks value. Therefore, if the actual price of the stock on a given day deviates significantly from the SMA, it would lead to buying and selling opportunities, as the stock price will eventually return to the mean. Moreover, if the price of the stock crosses the SMA line, this would be a useful signal to trade the stock. If price is tending upwards as it crosses the SMA, it indicates a buy opportunity, and if the price is tending downwards as it crosses the SMA, it indicates a sell opportunity

Bollinger Bands: This indicators has the given formula below:

BB[t]=(price[t]-SMA[t]) / 2*std[t]

This indicator essentially plots two lines, one +2 standard deviations and one -2 standard deviations from the stock price. This approaches not only considers the simply moving average but also the volatility of stocks when making a trading decision. This approach works as an indicator as highlights buy and sell opportunities when the deviation from the SMA is high.

Momentum: Momentum measure the speed at which a stock is rising, and is represented by the following formula:

Momentum[t]= (price[t]/price[t-N])-1

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This is basically the slope between two data points (of distance N) in the stock price. If the momentum is high and positive, it may be a buy opportunity as the stock is rising fast, and conversely, if the momentum is negative it indicates a sell opportunity.

Discretization/ data adjustment: Since I've chose to use a BagLearner for my strategy Learner, as opposed to a Q-leaner, I did not have to adjust, or discretize the data. I am however using an N-day return to help me determine my models.

Experiment 1:

Description: In this experiment, I am using portfolio performance metrics (Cumulative return, Average Daily Return, Standard Deviation, and Sharp Ratio to determine which stock did better. I am assuming that the strategy learner will do better since its algorithmic. The parameters I'll be using for this experiment are:

JPM, 1/1/08 – 12/31/09, $1000000 stating cash, 0 impact, +- 1000 shares

Outcome: As expected, the Strategy Learner did better than the Manual Strategy, which did better than the benchmark. Here is the tabular and graphical proof:

	Benchmark	**Manual Strategy**	**Strategy Learner**
Cumulative Return	0.012299	0.2753	1.4205
Avg Daily Return	0.000168	0.000584	0.001813
Std Daily Return	0.016987	0.013598	0.010798
Sharp Ratio	0.157074	0.682742	2.665995

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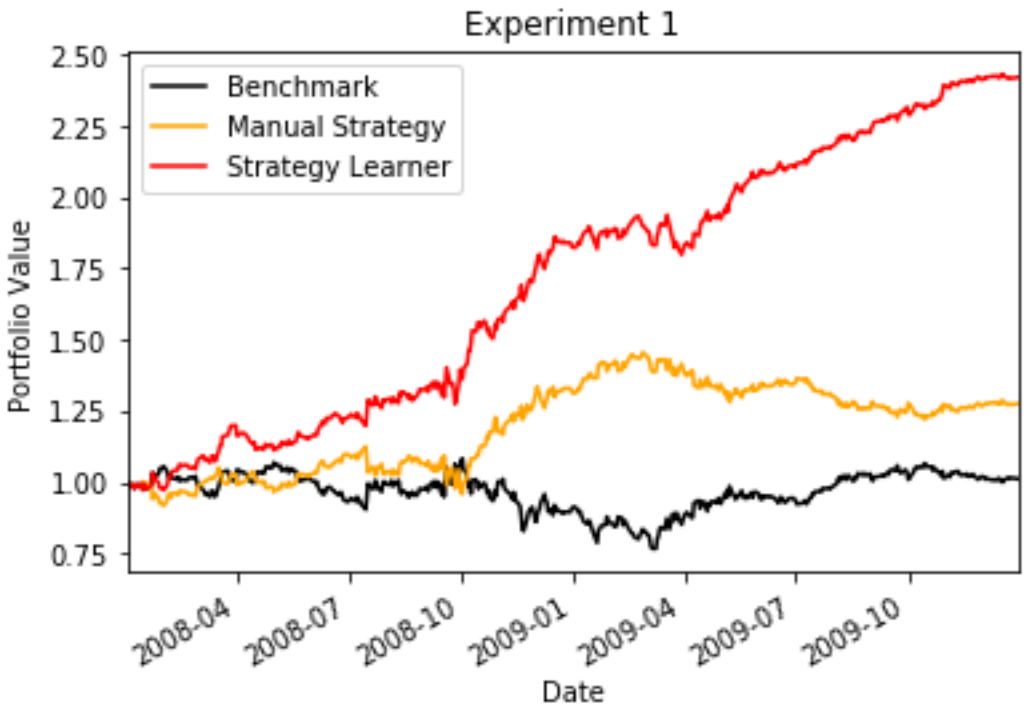

Would I expect consistent results: Since the learner I am using uses randomness, I expect the values to be different every trail, but overall, relatively speaking, the strategy learner should perform better than the manual strategy most of the time.

Experiment 2:

In this experiment, I am going to determine how changing the impact affect the trading behavior. I am using all the same parameter as mentioned above, but varying the impact to 0.05, 0.005, and .0.0005, to make three different learning model.

Hypothesis: Since impact Is how much buying or selling a stock affect the buyer or seller, I believe the lower impact will have a better overall yield.

Outcome:

As per my perdition, the lower impact did lead to better portfolio metrics. The results are listed below:

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	Learner_impact: 0.05	Learner_impact: 0.005	Learner_impact: 0.0005
Cumulative Return	-1.638618	0.627759	0.579957
Avg Daily Return	-0.004172	0.001053	0.001938
Std Daily Return	0.261775	0.013171	0.010679
Sharp Ratio	-0.253011	1.269976	2.882227