CS-7646 Machine Learning for Trading
Report- manual_strategy

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Date: 03-26-2018

Part 1. Technical Indicators

I have used Simple Moving Average, Bollinger bands and Momentum as indicators.

1. Simple moving average(SMA)

Description:

The Simple Moving Average is calculated by adding the price of a stock over a number of time periods and then dividing the sum by the number of time periods. The SMA is basically the average price of the given time period, with

Formula

SMA = (sum (price, n))/ n (n: time period)

SMA_indicator = price / SMA -1

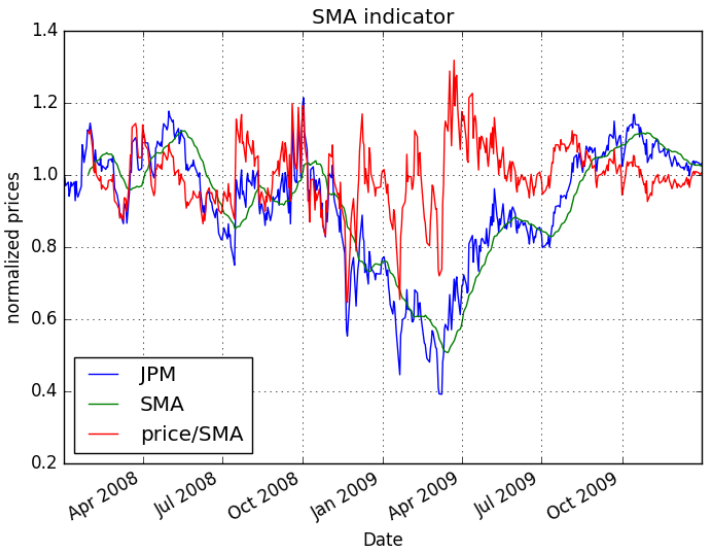
Usage

When using SMA_indicator, choose a threshold.

For instance, with a threshold = 0.1,

If SMA_indicator > 0.1, it's a sell signal

If SMA_indicator < -0.1, it's a buy signal



The chart above is generated with window_size 20. price/SMA instead of direct SMA_indicator was plotted for better visualization.

2. **Bollinger bands**

Description:

The Bollinger Band study created by John Bollinger plots upper and lower envelope bands around the price of the stock. The width of the bands is based on the standard deviation of the closing prices from a moving average of price.

Formula

Middle Band = n-period moving average (sma is used here)

Upper Band = Middle Band + (2 * n-period standard deviation)

Lower Band = Middle Band - (2 * n-period standard deviation)

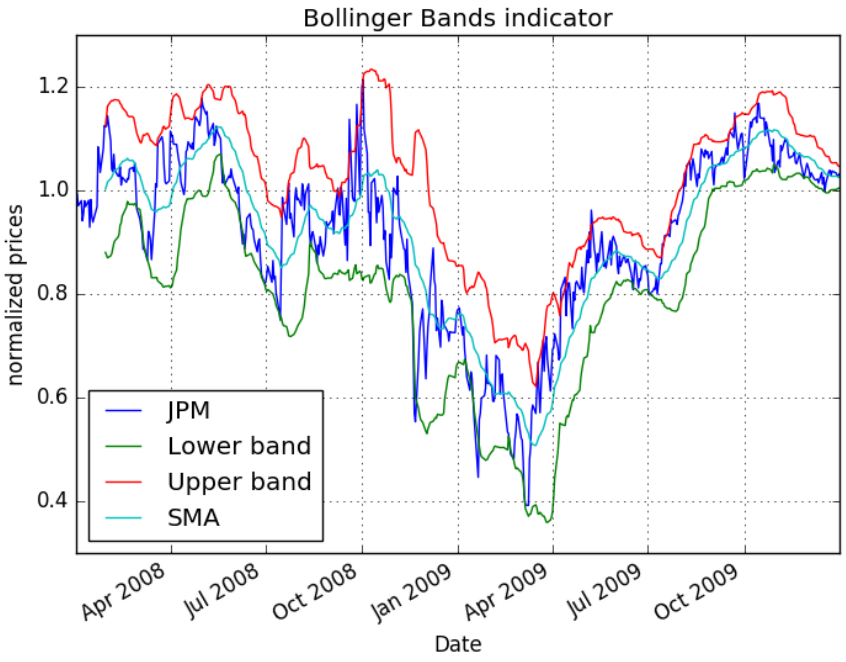
Usage

When using Bollinger_Bands_indicator(BB_indicator),

BB _indicator = (price- sma)/(2 * moving_std)

If BB_indicator > 1, it's a sell signal

If BB_indicator < -1, it's a buy signal



The chart above is created with window size of 20. From the chart we can see that when the price (blue line) goes outside of the Bollinger Bands (Green line: Lower band, Red line: Upper band), it will generally go back soon. The cross points of price line and Bollinger Bands when price is going back are usually Buy/Sell signals.

3. **Momentum**

Description:

The Momentum indicator compares the current price with the previous price from a selected number of periods ago.

Formula

Momentum = Price - Price of n periods ago

Usage

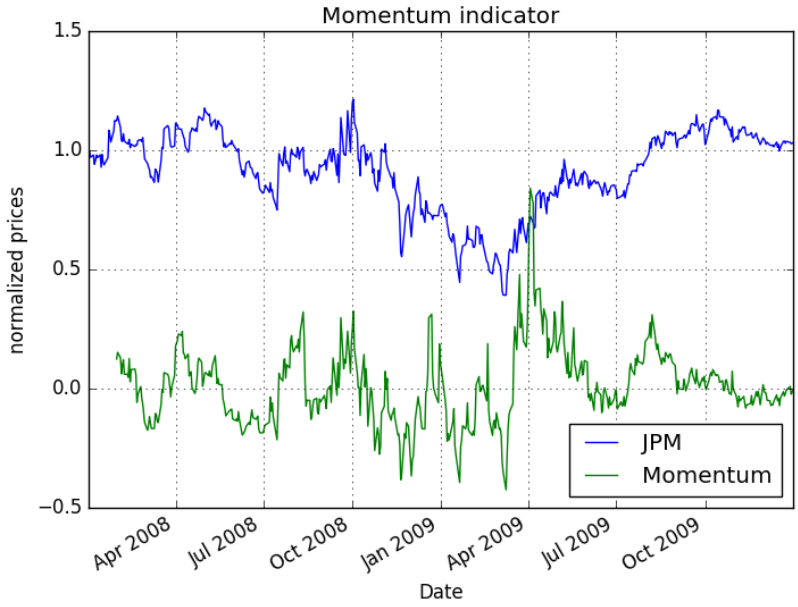
When using Momentum_indicator(MM_indicator),

MM_indicator = (price/price(-n))-1 n is the timeperiod

Here MM_indicator is calculated by price.diff(window_size)/price.shift(window_size)

If MM_indicator > 0, it's a buy signal

If MM_indicator < 0, it's a sell signal



The chart above is created with window_size of 20. If the Momentum_indicator(green line) crosses above the 0 line, it indicates the price is starting to move higher since the price has moved above the price "n" periods ago. A drop below the 0 line shows the price is dropping since it has moved below the price "n" periods ago.

Part 2. Best Possible Strategy

Rules:

1. Trade only on 'JPM'.
2. Time period is January 1, 2008 to December 31 2009.
3. Starting cash is $100000.
4. No transaction costs.
5. Allowable positions are: 1000 shares long, 1000 shares short, 0 shares.
6. There is no limit on leverage.
7. Benchmark: The performance of a portfolio starting with $100000 cash, investing in 1000 shares of JPM and holding that position.

Strategy:

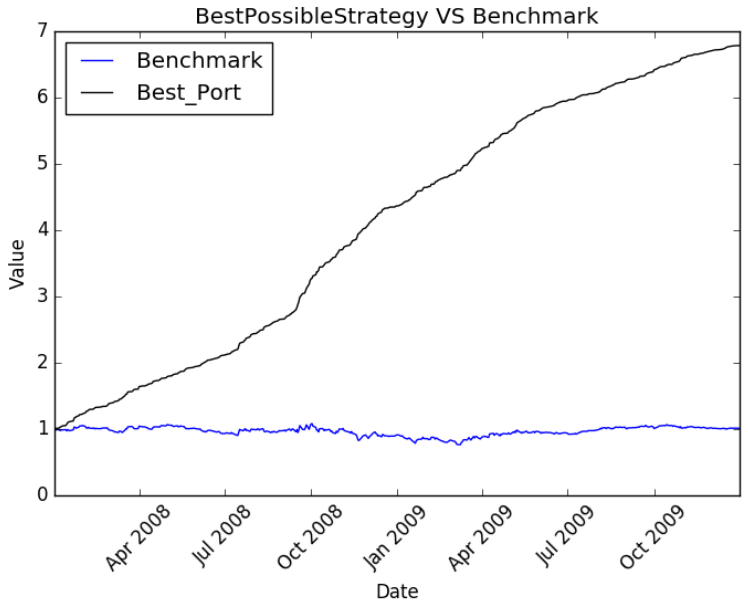
Since we can look at the future data, we may just buy at a lower point and sell at a higher point. Also without the transaction costs, we can have transactions as many as we want. All of these conditions give us this Best Strategy:

If JPM_price[t+1] > JPM_price[t], position[t] = long 1000

If JPM_price[t+1] < JPM_price[t], position[t] = short 1000

Otherwise, position[t] = 0

Here 't' is the date for today.



Performance	Cumulative return	Stdev of daily returns	Mean of daily returns
Best Possible Strategy	5.7861	0.00454782319791	0.00381678615086
Benchmark	0.0123	0.0170043662712	0.000168086978191

Part 3. Manual Rule-Based Trader

My Strategy

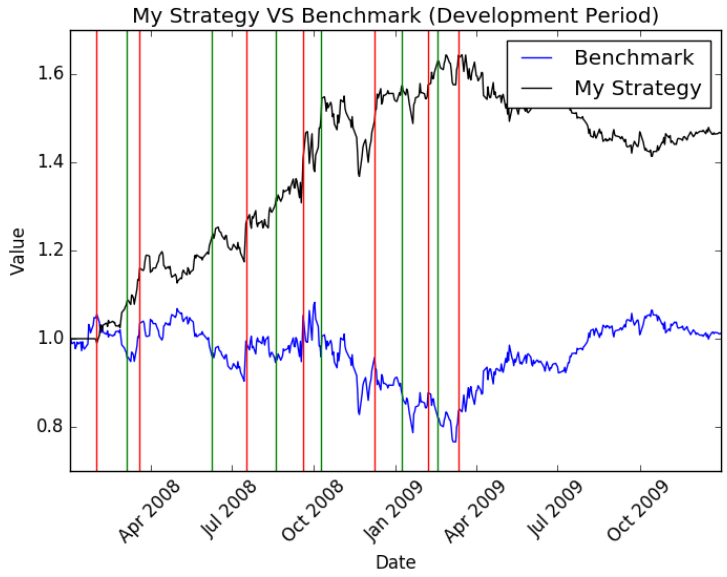
I simply picked simply moving average(SMA) indicator in this part. Since SMA is one of the most popular and often-used technical indictors. It's easy to calculate and is a powerful visual trend-spotting tools once plotted on a chart. And also according to the definition of SMA indicator, I think it's very reasonable to indicate the entry and exit points for stock trading.

SMA Indicator

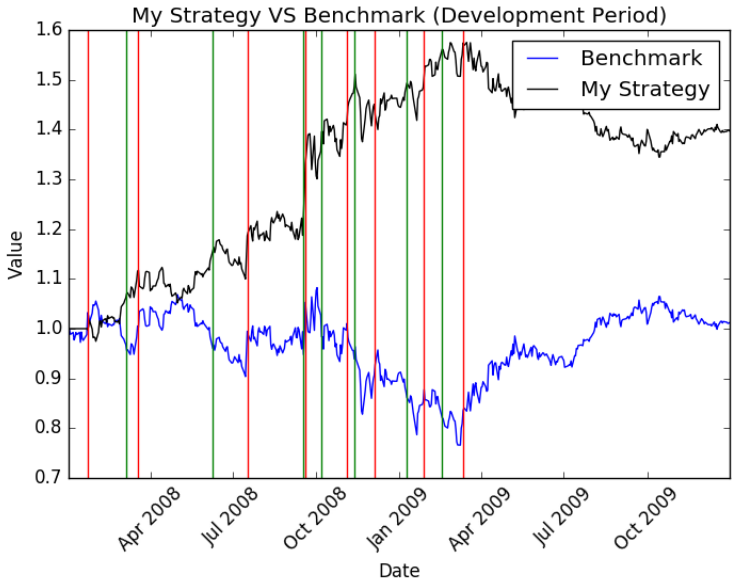
with a threshold = 0.1,
When SMA_indicator > 0.1, it's a sell signal(exit)
When SMA_indicator < -0.1, it's a buy signal(entry)

Performance

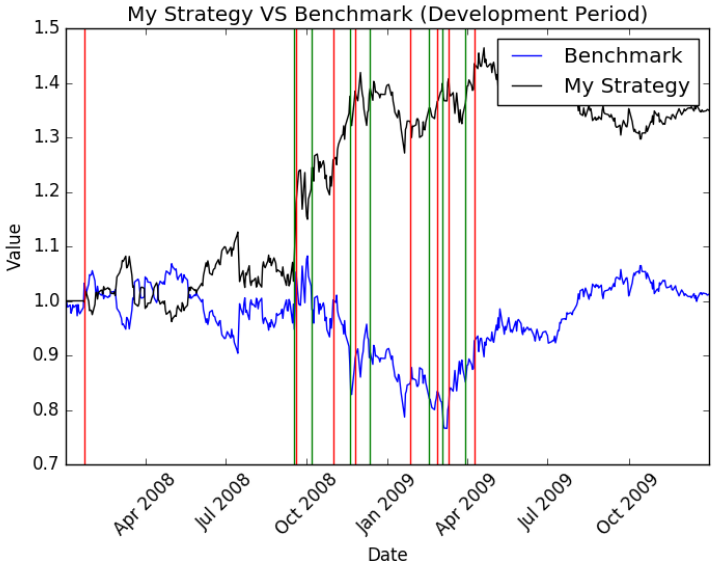
I tuned a little bit on window_size, tested 5,10,20 on SMA. Using window_size of 20, I got the best performance on in-sample backtests.



Window_size = 20



Window_size = 10



Window_size = 5

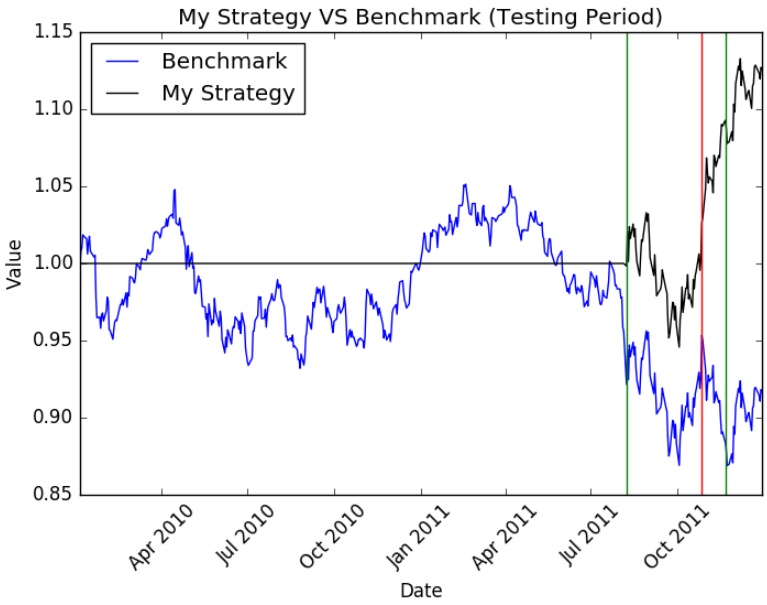
In-Sample period (n : window_time)

Performance	Cumulative return	Stdev of daily returns	Mean of daily returns
My Strategy(n =20)	0.4659025	0.0111512711693	0.000821044918194
My Strategy(n =10)	0.3970445	0.0118073859759	0.000732972770893
My Strategy(n =5)	0.3493095	0.0128963999418	0.000677369852402
Benchmark	0.0123	0.0170043662712	0.000168086978191

Part 4. Comparative Analysis

Based on performances of My strategy on in-sample period, I used window_size 20 here for out-sample period.

Although the performance is not as good as for in-sample condition, we still got a much better return compared to benchmark.



Out-Sample period (n: windown_size)

Performance	Cumulative return	Stdev of daily returns	Mean of daily returns
My Strategy(n = 20)	0.125503	0.00487873364945	0.000246911015762
Benchmark	-0.0834	0.0084810074988	-0.000137203160195