Using MACD histogram to identify trend

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1. **Basic idea**

Here is a simple trending strategy which is based on using MACD histogram to predict trend on stock price. And during this summary I mainly focus on prediction increasing trend and the short sale won’t be involved in my evaluation.

The trading period is around several days, which means that the traders buy the stock, hold for several days, and sell it when the strategy suggests them to do so. The language I use is MATLAB, and the Method and index include MACD histogram; the Savitzky-Golay filtering, which is a smoothing tool; and RSI.

This strategy is motivated by a simple observation: the trend of close price is same as the trend of MACD histogram. That is, when the MACD histogram is increasing, it always suggests that the price of stock is probably in increasing trend. As *figure 1* indicates (the data comes from Appel Inc.)

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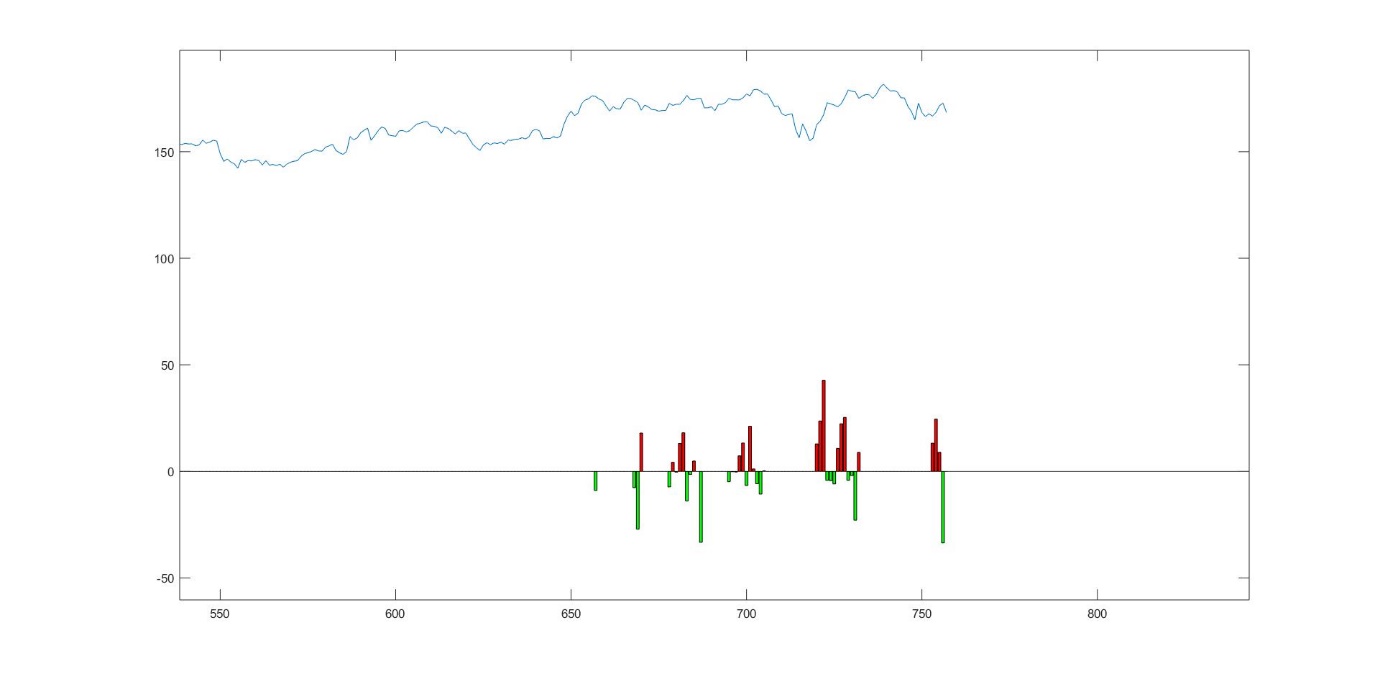
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*Figure 1*

So, here is my strategy: firstly, regard the trend of MACD histogram as the trend of stock price. Buy the stock when MACD histogram of that day is greater than MACD histogram of the day before that day. And sell the stock when MACD histogram of that day is less than MACD histogram of the day before that day.

1. **Evaluation method**

The Evaluation method is simply take logarithm of the ratio between two trading days. For example, the profit of day n is . *Figure 2* shows the result of applying this strategy on Apple Inc. the bar chart below is the profit of each trading day. The number of buy days in recent 100 trading days is 42, and the profit per day (after taking logarithm) is 0.0017.



*Figure 2*

1. **Improvement**
   1. **smoothing**

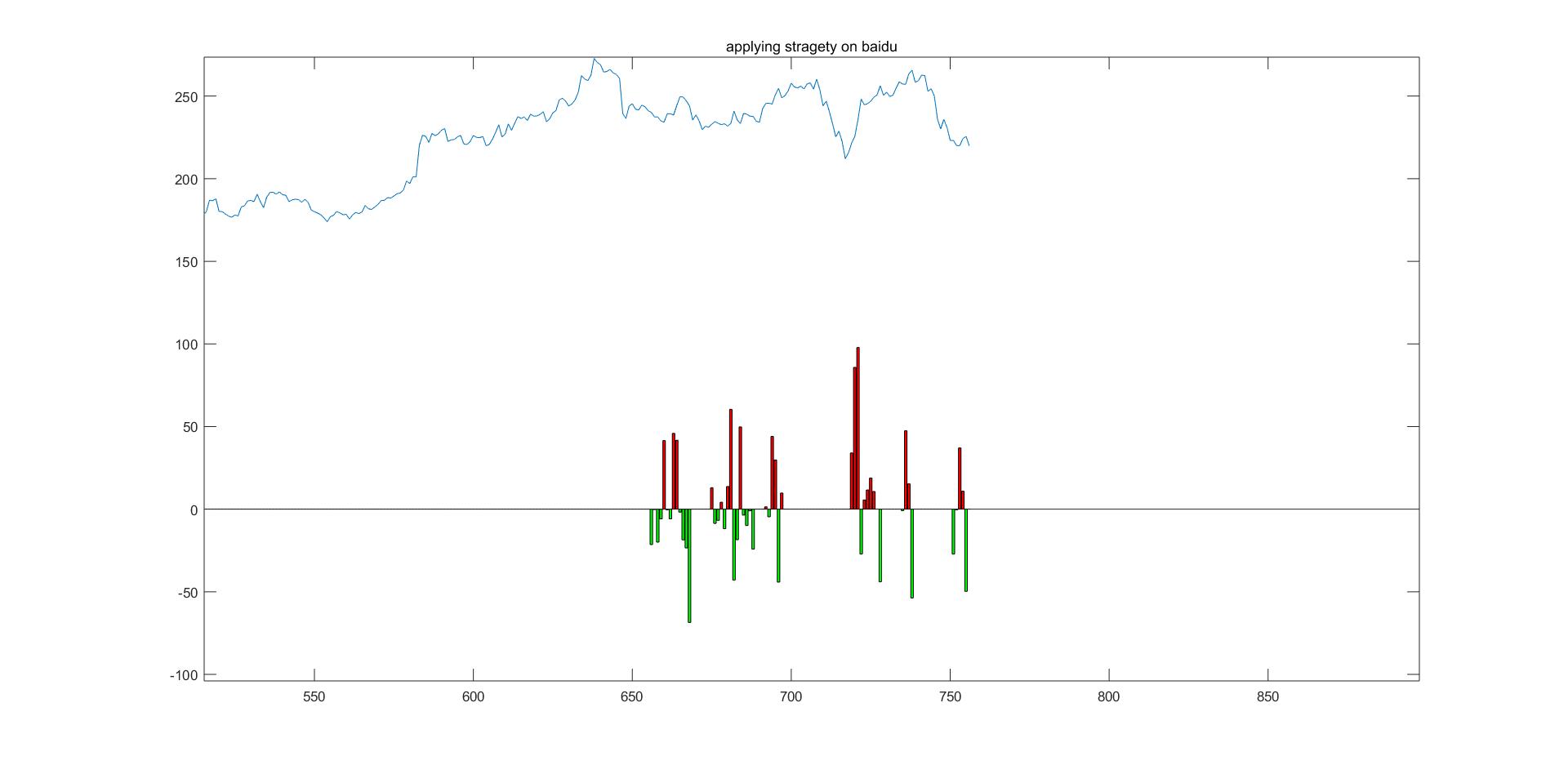
The histogram may have small oscillation within small period, and here I use Savitzky-Golay method to smooth the data. Although there are many smoothing tool, Savitzky-Golay filtering is suitable for this strategy. Firstly, it can smooth the graph without greatly distorting the signal, in other words, it won’t cause any phase. That is the reason why moving average is not suitable here, besides, when applying EMD or wavelet decomposition, we should be very careful about which level of wave we are going to take in to consideration, thus the wave decomposition method is not suitable too. Secondly Savitzky-Goaly filtering has very good estimation at “end point”, just as *figure 3* suggests.

![图片包含 地图, 文字

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*Figure 3*

After smoothing MACD histogram, we evaluate the result by applying this strategy on Baidu, a search engine in American stock market, which is shown by *figure 4*. The number of buy days in recent 100 trading days is 51, the profit per day is 0.0019 (after taking logarithm). Here I used polynomial of order 2 and the frame size of 7 to smooth it.

****

*Figure 4*

**3.2 Using RSI**

If we study *figure 4* carefully, we may find that this method has bad “end-point behavior”, which means that MACD histogram can not find out the right position to exit market, and when it suggests existing market, it is always a little bit late and the price begins decreasing.

To get over this shortcoming, I use RSI to improve the safety of this strategy (it is suggested by professor Chan). Based on MACD histogram, I use RSI to exit earlier to avoid losing. For example, if I think when RSI is greater than 60, the stock is oversold, then I will exit market when RSI is greater than 60 even though MACD histogram indicates that the price is increasing.

And here I use a period of 14 to calculate RSI.

**4 Final evaluation**

The data of each company I have discussed is the close price in recent 3 years (from 2015/4/9 to 2018/4/9).

I take recent 100 trading days to be the testing period, and 300th to 100th recent trading days to be the training period. The aim of training period is to find what number of RSI is suitable for exiting market and which order of polynomial we take to apply Saviztky-Golay method (here I make the frame size 7).

For Apple Inc. the number of buy days in recent 100 trading days is 29 (it is 42 without using RSI), and the profit is 0.0038 per day (it is 0.0017 without using RSI).

For Baidu, the number of buy days in recent 100 trading days is 28 (it is 51 without using RSI), and the profit is 0.0036 per day (it is 0.0019 without using RSI).

For AMD, which has a decreasing trend in recent 100 trading days, the number of buy days is 26 (it is 51 without using RSI), and the profit is 0.0022 (it is 0.0016 without using RSI).

**5 Code**

**1 Plot the price vs MACD histogram**

**Input: the close price in recent years**

function plot\_his\_graph(data)

for n=1:length(data)

if isnan(data(n))

data(n)=(data(n-1)+data(n+1))/2;

end

end

[MACD,MACD1]=macd(data);

histogram=(MACD-MACD1)\*mean(data)/5; %to make the histogram easy to identify

histogram\_positive=zeros(length(data),1);

histogram\_negtive=zeros(length(data),1);

for n=1:length(data)

if histogram(n)>0

histogram\_positive(n)=histogram(n);

elseif histogram(n)<0

histogram\_negtive(n)=histogram(n);

else

end

end

plot(data)

hold on

bar(histogram\_positive,'r')

bar(histogram\_negtive,'g')

hold off

end

**2 Mainn function**

**Input: the close price in recent years**

**Output:**

**Nb: the number of buy days in recent 100 years**

**ub: the profit per day (after taking logarithm)**

**n: the order of polynomial I should take to smooth data**

**r: the value of RSI which acts as upper bound**

function [Nb,ub,n,r]=project\_final(data)

for n=1:length(data)

if isnan(data(n))

data(n)=(data(n-1)+data(n+1))/2;

end

end

n=0;

k=0;

r=60;

%training period

for m=[1:3,6]

for R=45:5:75

buy\_day=[];

i=0;

profit=zeros(length(data),1);

for day=(length(data)-300):(length(data)-101)

data\_new=data(1:day);

[MACD\_new,MACD1\_new]=macd(data\_new);

histogram\_new=(MACD\_new-MACD1\_new);

wave=sgolayfilt(histogram\_new,m,7);

% using RSI

RSI=rsindex(data\_new);

RSI\_end=RSI(end);

%

if wave(day)>=wave(day-1) && RSI\_end<R

i=i+1;

buy\_day(i)=day;

end

end

for day=buy\_day

profit(day)=log(data(day+1)/data(day));

end

Nb=length(buy\_day);

ub=sum(profit)/Nb;

if k<ub

k=ub;

n=m;

r=R;

end

end

end

if n==0

error('this stragety fails')

end

%testing period

buy\_day=[];

i=0;

profit=zeros(length(data),1);

for day=(length(data)-100):(length(data)-1)

data\_new=data(1:day);

[MACD\_new,MACD1\_new]=macd(data\_new);

histogram\_new=(MACD\_new-MACD1\_new);

wave=sgolayfilt(histogram\_new,n,7);

%usin RSI

RSI=rsindex(data\_new);

RSI\_end=RSI(end);

%

if wave(day)>=wave(day-1) && RSI\_end<r

i=i+1;

buy\_day(i)=day;

end

end

for day=buy\_day

profit(day)=log(data(day+1)/data(day));

end

Nb=length(buy\_day);

ub=sum(profit)/Nb;

plot(data)

hold on

profit\_positive=zeros(length(data),1);

profit\_negtive=zeros(length(data),1);

for day=(length(data)-100):(length(data)-1)

if profit(day)>0

profit\_positive(day)=profit(day);

elseif profit(day)<0

profit\_negtive(day)=profit(day);

end

end

bar(profit\_positive\*mean(data)\*10,'r')

bar(profit\_negtive\*mean(data)\*10,'g')

hold off