

Research on Cup and Handle Price Pattern Based on Svm Method

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Abstract. Analysis of the data of stock is one of the most important methods for investor to knowing if the stock is going to have a uptrend and determine whether call and put the stock. This is one of the methods that can highly decrease the risk of investing. Therefore, to decrease the risk of loss and increase the return, prediction of the stock price become a crucial task and has attracted many investors. To introduce a new method to solve the problem, this paper didn't focus on predicting the price of stock but cup and handle pattern. This pattern always implies that there is an upward trend follows this. The trouble is how to find out the stock has the pattern from many stock data. Based on machine learning (ML) techniques, this paper uses support vector machine (SVM) model to classify the data and to determine whether this set has the pattern or not. The model uses gaussian radial function as kernel function. The experiment result demonstrates that the classify model reach a relatively satisfied result and can give a relative good, classified result.

Keywords: Cup and handle pattern; machine learning; support vector machine; gaussian radial function.

1. Introduction

Analyse of stock price is one of the most important parts in finance market. Therefore, research on prediction of stock price and identify the graphical signal of candle chart is always one of the most famous and hot topics. This strategy can help investor to make more accurate choice and avoid loss. Besides, there are also some mathematical ways to make more precise prediction [1].

Nowadays, there has many tools to make an analyzation of the price of stock, included autoregressive integrated moving average (ARIMA) [2], gray relational analysis [3], and so on [4]. Beside this traditional model, machine learning and data analyze also has potential in prediction problem and has already been used in stock price prediction and reach good performance [5]. But all this method focusses on how to predict the price of stock by using mathematical method and neglect the importance of stock graphic signal. Some paper research on the important point of stock and successfully get information [6]. However, this didn't really a recognition of the stock price signal. There has one of the signals that implies a high probability of upward trend called cup and handle pattern [7].

A cup and handle pattern, which appears on a stock price chart, is a technical graphic that contains a cup with a handle, where the cup shape has a downtrend followed by uptrend just like "u" and the handle shape has a slight downward drift. This pattern contains forward trend, cup pattern and handle pattern. When there an upward trend which follows a pause or downward trend and then again, an uptrend, then the pattern is formed. This second-time upward trend is called a break of the old trend. Based Formatting the title, authors and affiliations. This pattern is first referred by William J.O'Neil at 1988 in his classical book on technical analysis, which named How to Make Money in Stock [8]. This pattern can be seen as a continuation pattern or a reversal pattern. A cup and handle pattern are considered a bullish signal and extends an uptrend. This pattern is used to spot opportunities for a long time period. The stop buy order that technical traders focus on should be placed slightly above the upper trendline of the handle part. However, this pattern appears because the upward trends after this pattern are always implies that this break may reach the peak of lasted trend. True Tamplin said in his website that a breakout through the resistance implies that this upward trend may continue onto

further gains. Cup and handle pattern are an ideal way for long-term investment in stock. Figure 1 shows the details of the cup and handle pattern.

One of previous paper from Texas A&M university [9] commerce introduces an algorithm using analysis method to identify the pattern. Which uses the data of the peak, nadir and gradient to determine whether there has a cup and handle pattern or not. This is an accurate algorithm, it gives 7 criteria, and the algorithm will check each criterion in all the stock data. This is certainly a useful and accurate way to find out cup and handle pattern. But this method needs too many times to identify, since this method needs to traverse all data and calculate the seven criteria, so it's hard to apply on big data. Based on the problem that make the filtrate more efficiency, this paper is trying to find a way without using analysis method and can reach a relatively good result. Another paper about using machine learning to realize recognition of stock price graphic [10], introduces a way using machine learning method to identify the pattern. The paper, using some examples like M shape, W shape, V shape and head shoulder top, implies me that using gaussian radial function to be kernel function is an ideal way and gives some useful machine learning function. In that paper, it gives 9 result that identifies by machine, and 6 of them are correct. This is a relatively good result. and this paper will check whether the machine learning algorithm can also have such a good result.



Source: <https://www.ig.com/sg/trading-strategies/cup-and-handle-chart-pattern-explained-190930>

Fig. 1 Cup and handle patternData

The original dataset is sp500 which contains 504 stocks.

1.1. Pre-processing

The dataset this paper uses is sp500 which contains 504 stock data. This paper set the time window as 60 days, from 2018.11.2 to 2018.12.31. and then plot the graph for every data. Filling the missing data by using the average of value of the previous day and value of the next day. Using MMScalling function to make data normally, which means no bigger than 1 and no less than 0. Then every data time 200 to make sure the data is in a relatively reasonable range, easier to calculate.

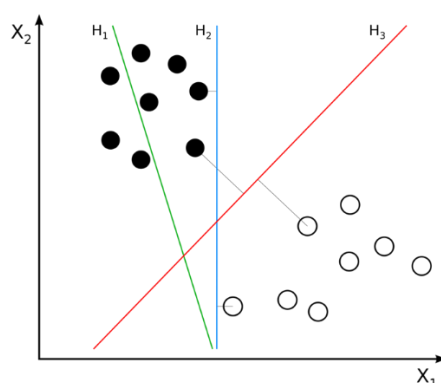
1.2. Label the data

firstly, label the original data by humanly identify that if there has cup and handle pattern. This paper set the time window to 60 which means each data contains 60 days price. The cup and handle pattern can only be obtained in graph, and if one stock's open price has cup and handle pattern, its close, high and low price has this patter similarly. If the graph has cup and handle pattern, this paper give it label 1, if not, 0.

2. Model

2.1. SVM

This paper uses one of the supervised machine learning methods supporting vector machine, which also named. SVM. This method is used to divided data and can make a classification. Given a training set, each marked as belonging to one of the two categories, then a SVM generating algorithm will find a function that can identify these two different classes of data. However, this can also be seen as finding a hyperplane to separate two different set of points. SVM is a non-probabilities binary linear classifier. The hyperplane that SVM trained will maximize the length of the gap between the two classes. After receiving a new example which has no label, it can classify it by using the function it calculated before. The new data can also be seen as a new point, and this problem become finding which side of the hyperplane the new point fall. In Figure 2, it shows how to use hyperplane to separate different set of points. It is easy to find that the red line H3 is a better way to separate black and white points than green and blue ones. How to find the line like H3 is what SVM doing.

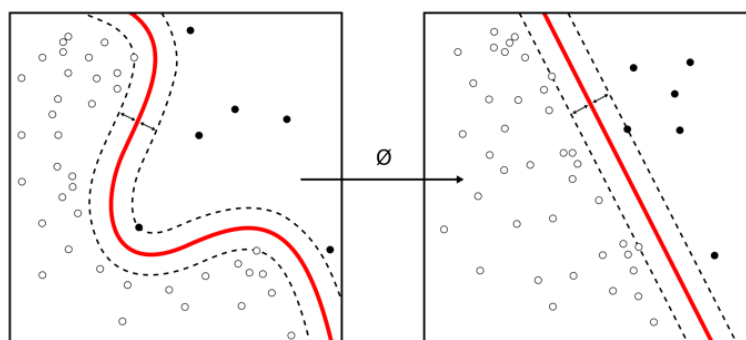


Source: <https://tangshusen.me/2018/10/27/SVM/>

Fig. 2 SVM

2.2. Kernel function

The method that generating algorithm use to find the hyperplane can be kernel function. The first SVM used linear function for the hyperplane, but linear function has too many restrictions and perform relatively bad dealing with erratic data, so the kernel trick appears to help to build a better hyperplane. The resulting algorithm is similar but replace the linear dot product by kernel trick function. This allows the algorithm can fit in transformed feature space. The transformed feature space can be higher dimension place, though in transformed space, the hyperplane is still a linear space, it is a non-linear function in original space. In Figure 3, left one is low dimension space that we need to find a curve to separate the black and white points. While in the right one, a higher dimension space, black and white points can be mapped and separated by a linear function. That make the separation far easier.



Source: https://en.wikipedia.org/wiki/Data_mining#/media/File:Kernel_Machine.svg

Fig. 3 Kernel functiongaussian radial function

Gaussian radial basis function is defined as

$$k(x_i, x_j) = \exp(-\gamma \|x_i - x_j\|^2) \text{ for } \gamma > 0 \quad (1)$$

Sometimes parametrized using $\gamma = 1/(2\sigma^2)$

The distance is usually Euclidean distance, although other metrics are sometimes used.

Gaussian radial basis function is one of the most useful functions in SVM, and another field of machine learning like neural network.

2.3. SVM based classification model.

While the identify problem can generally be described as following mathematical form: giving a set $A=\{x_k \in R^m | k = 1, 2, 3 \dots, N\}$ which has N different numbers and a homologous set $B=\{d_k \in R^1 | k = 1, 2\}$. In this time, N equals to 2016 and m equals to 60. It's important to find a function F to make a map that $F: R^m \rightarrow R^1$ which satisfy this equation:

$$f(x_k) = d_k, k = 1, 2, 3 \dots N \quad (2)$$

And this equals to a classify a set of 60-dimension point, each number in A represent a point and each number in B represent a label. therefore, it's ideal to use SVM to train this classification model and the Gaussian function has lots of advantages like avoiding local optimal problems and enhance the convergence speed. Thus, this model use gaussian radial function as kernel function.

3. Results

As referred in 2.1, this paper uses the sp500 and author extract the historical stock price data from 2018.11.2 to 2018.12.31. And 0.8 of the data are training set while another 0.2 are rest set. Using the method SVM this paper has referred in section 3. To observe the efficiency and performance of the model, this paper chooses the coefficient of determination which called R^2 of the result as the score. R^2 can be calculated in the equation:

For a set $\{y_i \in R | i = 1, 2, 3 \dots\}$ which are observation result, and $\{d_i \in R | i = 1, 2, 3 \dots\}$ are prediction value.

The mean is:

$$\bar{y} = \frac{1}{n} \sum_i^n y_i \quad (3)$$

And the total square summation is:

$$v = \sum_i (y_i - \bar{y})^2 \quad (4)$$

And the residual square summation:

$$u = \sum_i (y_i - d_i)^2 \quad (5)$$

The R^2 equation is:

$$R^2 = 1 - u/v \quad (6)$$

To have a more precise acknowledge of the result, author make another group called compare group which labelled the stock data by random and apply SVM to both groups to compare their score. The true group reach 0.7 and the compare group reach only 0.2 (Table 1), this state that the model has a relatively good performance.

Table 1 Results

group	Compared group	Experimental group
score	0.2	0.7

4. Conclusion

This paper use SVM to identify the cup and handle pattern and check the effect of the model. The result of this study shows that this model performs well in the condition of 60-days' time window. And gaussian radial function perform well in this model.

To find cup and handle pattern from a large number of stocks matters for many investors, it's a boring and repetitive thing to scan such a large number of stocks to find which one is needed. And this model can help them receiving time. After receiving historical data, investor can just run this model to have a rough scan of stocks, then manually find out the exact one. this model can relate to some port of the historical stock data, then automatically give the stock that appears cup and handle pattern.

However, it's a further plan to make a extend of this model, which can receive historical stock prices data and give the result that which stock has this pattern. This model is built based on 60-days' time window. However, in real life, the cup and handle pattern may be longer than 60 days, so. It's necessary to make more models based on different time windows. And combined them all, built a model that can tell all different time windows, which is necessary for further discussion in the future study.

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