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ARTICLE

The Stronger and Weaker Bull-bear Point Algorithm to Find the Opportunity of Buying Stocks Based on Big Data

Congdian Cheng[1*], *Yao Fu*[2]

[1] *School of Intelligence Technology, Geely University of China, Chengdu 641400, China*
[2] *Central Primary School of High-Tech Industrial Zone, Dalian 116000, China*

ABSTRACT

Study and develop the machine learning algorithm to find the opportunity of profiting in high probability for the investor to buy a stock based on the analysis of big data. In the first place, a preparative algorithm to find the bull-bear points is established. And then, basing on the preparative algorithm, a weaker bull-bear point algorithm and a stronger algorithm bull-bear point algorithm to find the opportune time of buying stock are respectively developed. What we have done in the present work can advance the development of the stock study and the quantitative technology.

Keywords: Forecast; Stock market; Average line; Big data; Algorithm; Profit

1. Introduction

The study on predicting the stock market and finding favorable buying points has been a term of research work that is widely concerned for many years. Under the promotion of the trend of computer, many scholars have discussed this problem from the perspective of big data and quantitative technology.

Luo, S. [1] briefly introduced and discussed the research and application of machine learning in stock prediction. Appati, J.K. [2] proposed a deep learning scheme to predict the stock price by bridging the long short-term memory (LSTM) with gated recurrent unit (GRU). Aiwen, R. [3], based on the Shanghai Composite Index during the trading days from January 1, 2016 to December 31, 2016, established a method to predict the return rate of the Shanghai Composite Index by the time series, under the pattern of big data. Budiharto, W. [4] developed a big data analysis model to forecast Indonesian

*CORRESPONDING AUTHOR:
Congdian Cheng, School of Intelligence Technology, Geely University of China, Chengdu 641400, China; Email:zhiyang918@163.com

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stock prices during COVID-19, which implements the prediction by carrying out statistical calculation with R language and long short memory neural network LSTM. Harel, A. and Harpaz, G. [5] developed a model of using conceptual machine learning to predict stock prices and made a certain related discussion. Li, J. [6] basing on the observation that in the traditional stock prediction method the perspective is single and the importance of various characteristics of the data cannot be fully considered, put forward a method to predict stock price movements through machine learning based on multi-perspective features; and made test and comparison by experiments, the results shown their method is better than the traditional prediction method. Zheng, B. et al [7] developed a technology of big data to analyse the dependence relation between the changes in the financial flow of a company in a certain plate of the shanghai stock market and the changes in the stock price of the company, and provided also a method of purchasing stocks according to the obtained research results. Note that due to the limitation in the intake technology, the storage technology and the computing technology of data, the previous research works on the buying point and selling point of stocks, which are done from the perspective of the moving average, failed to give full play to the role of big data method and quantitative technology, Xu, X. et al [8] based on quantitative technology, big data analysis and moving average, designed algorithm RFPO to find the buying point and selling point of stocks, and made the empirical analysis and inspection. Later, Fu, Y. et al [9] developed the work of Xu, X. et al [8], they proposed algorithm SPMO to find the buying point and selling point, and also made the empirical analysis and inspection.

This paper continues to discuss the quantitative technology to find the favorable buying points of stock through the analysis of big data, at which the investor can have a high probability of profit after they buy the stock. First, we establish a preparative algorithm, which is called bull-bear point algorithm in present work. And then, based on the preparative algorithm, we designed two algorithm to find the favorable buying point and selling point of stocks, the one is called weak bull-bear point algorithm and the another is called strong bull-bear point algorithm.

2. Materials and methods

2.1 Mathematical formulation

As the beginning, from the perspective of mathematical modeling, we firstly make clear the problem that we are go into study and explain the variables that we need to design the algorithms.

Let S be a stock. We respectively use P_i^l, P_i^h, P_i^o andP_i^c to denote the bottom price, the ceiling price, opening price and closing price. Put $\overline{P}(i)=\left(P_i^l+P_i^h+P_i^o+P_i^c\right)\big/4$,which is called as the four-point average share price of the trading day *i*. Use (*i*+*j*) to denote the *j* th trading day before the trading day *i*. ((*i*+1) denotes the first trading day before the trading day *i*, …, (*i*+*j*) denotes the *j* th trading day before the trading day *i*.)

Put $\overline{P}(i,l)=\dfrac{1}{1+2+\cdots+l}\sum_{j=1}^{l}\overline{P}(i+j)\cdot(l-j+1)$.

We call it as the linear-weighted four-point average stock price of *l* th trading day before the trading day *i*.

Let S be a stock. Suppose an investor buys one hand of the stock in the trading day *i*, and the holding period is no more than *f* trading days. Use $O(i,f)$ to represent the income available within the *f* trading days after trading *i*. We consider the problem how to make $O(i,f)\geq v$, denoted by S-SPMP(*f*, *v*), and by SPMP(*f*, *v*) in convenience. Here *v* is a positive real number to express the expected earnings.

2.2 Technical clue

For algorithm RFPO of the literature [8] and algorithm SPMO of the literature [9] mentioned above, obviously, if *L*, *l* is too small, the amount of data is not sufficient, and the result of the algorithm can not fully reflect the intension of the process. On the other hand, if the calculation speed is too slow, the answer can not be obtained in time, and the result does not meet the actual needs. Therefore *L*, *l* must be fully large, and the calculation speed must be fully fast. That is, from the perspective of big data, we must quickly absorb large amounts of data, and quickly process large amounts of data, the two algorithms will work well. Hence, the two algorithms fully demonstrate the power of current big data and quantification technologies.

The present work tries to develop the technical methods of literature [8] and literature [9]. From the horizon of the so-called bull-bear point and with the technical approach of the two literatures, we further explore the algorithm to solve the problem S-SPMP(*f*, *v*) in large probability. We first design a preparatory algorithm SA, called the bull-bear point algorithm. Then, based on the preparatory algorithm, we establish a weak bull-bear point algorithm A1 and a strong bull-bear point algorithm A2 successively, to look for the high probability profit buying point.

Remark 1: For convenience, the mentioned quantity for buying the stock is always understood to be one hand. In practice, it can be adjusted by multiplying the corresponding coefficient.

2.3 The bull-bear point algorithm

For a stock S and a trading day *i*, a price is called(v, f)-bull-bear point, bull-bear point for briefness, if the price allows buying below it to make an expected profit *v* in the next trading day *f*, while buying above it not to achieve this goal. For a set of trading days, the problem to find all the bull-bear points of this set of trading days is denoted by P-PATP(*f*, *v*). Next, we establish a preparatory algorithm SA to solve the problem P-PATP(*f*, *v*), which is called the bull-bear point algorithm.

Algorithm SA

Problem: P-PATP(*f*, *v*).

Input: $f, L, v, \varepsilon, P_i^h, P_i^l;\ i = 1, 2, \cdots, f+1, f+2, \cdots, L+f$.

(Here, $f, L, v, \varepsilon > 0$; f denotes the expected trading time span, *L* denotes the tracked number of trading days, *v* denotes the expected earnings level within *f* trading days, P_i^h and P_i^l denotes respectively the highest price and the lowest price of trading day *i*.)

Output: $1 \times (L+f)$ − order matrix *Y* with the following FC condition.

(FC condition: in trading day $i\,(> f)$, (1) when $P_i^l \le P \le y_i$ and $P_i^l \le y_i \le P_i^h$, if you buy a hand of stock S at the price *P*, you will earn at least *v* in the future *f* trading days, where y_i is the *i*-th component in the matrix *Y*; (2) when $y_i' \ge y_i + \varepsilon$, y_i' does not satisfy (1), that is, in a sense, y_i is the maximum value that meets (1).)

Process:

For $i = 1+f, 2+f, \cdots, L+f$, take the following terms in turn.

(1) Set $P^h = P_i^h, P^l = P_i^l, P = P^h$.

(2) Set $P := P - \varepsilon$.

(3) (i) $P \ge P^l$, if $P + v > \max_{i-f \le j \le i-1}\{P_j^h\}$, return (2); if $P + v < \max_{i-f \le j \le i-1}\{P_j^h\}$, put $y_i = P$. If $i \le L+f$, handle the next i; otherwise, go to final Step.

(ii) $P < P^l$, put $y_i = 0$. If $i \le L+f$, handle the next *i*; otherwise, go to final Step.

Put $y_i = 0, i = 1, 2, \cdots, f$. Output *Y*.

2.4 Weak bull-bear point algorithm

When most of the bull-bear points in the recent *L* trading day are above an *l* trading day weighted moving average $\overline{P}(i,l)$, and the process has strong stability, it is more likely to buy under $\overline{P}(i,l)$ to obtain profit *v*. Based on this fact, we can first find a weighted moving average $\overline{P}(i,l)$ so that the recent bull-bear points above the moving average as far as possible; and then take the stock price below it as the opportunity to buy. The following weak bull-bear point algorithm is designed on the basis of this idea.

Algorith A1

Problem: $\text{S-SPMP}(f, v)$

Input: $ml, L, f, Y; P_i^l, P_i^h, P_i^o, P_i^c,\ i = 1, 2, \cdots, ml + L + f; P_0; r$.

(Here, ml, $3 \le ml \le L$, is an integer, which represents the maximum of the span l with the alternative weighted moving average; the meanings of $L, f, P_i^l, P_i^h, P_i^o, P_i^c$ are the same as the bull-bear point algorithm; Y is the output of the bull-bear point algorithm, which is the $1\times(L+f)$ -order matrix obtained by the bull-bear point algorithm; P_0 represents the current price; $r\in(0,1)$ is a scale parameter.)

Output: Yes (Recommend to buy at the current price) ; No (Recommend not to buy at the current price).

Process:

Set $N=\left|\{y_i\neq 0: i=1+f,2+f,\cdots,L+f\}\right|$.

If $\frac{N}{L}<\frac{1}{3}$, output No; otherwise, carry out the next step. ($\left|A\right|$ represents the cardinality of the set A.)

Compute $\overline{P}(j)$, $j=1,2,\cdots,ml+L+f$.

For $l=3,4,\cdots,ml$, take the following terms.

(1) Put $n(l):=0$.

(2) For $i=f+1,f+2,\cdots,f+L$, carry out the following items.

(i) Compute $\overline{P}(i,l)$.

(ii) If $\overline{P}(i,l)<y_i$, Put $n(l):=n(l)+1$.

Find l^* to make $n(l^*)=\max\{n(l): l=3,4,\cdots,ml\}$. Output l^*. Then carry out the next step.

If $\frac{n(l^*)}{N}\leq r$, output No; otherwise carry out the next step.

$P_0<\overline{P}(0,l^*)$, output Yes; otherwise, output No. Stop.

2.5 Strong bull-bear point algorithm

This section optimizes the above weak bull-bear point algorithm. Through adding a curve formed by the sum of the lowest price mean and a certain parameter δ, and considering the lower part of this curve and the curve $\overline{P}(i,l^*)$ as the buying opportunity, we establish a strong bull-bear point algorithm. The weak bull-bear point algorithm above consider the lower part of the curve $\overline{P}(i,l^*)$ as the buying opportunity; the range of this buying point is generally larger, so it will often results in losing a lot of better opportunities to buy stocks from the range; that is, it is likely that many times the stock price drops significantly after buying, so that the operation according to algorithm A1 can not fully profit. In order to overcome this weakness and choose a better buying point, we try to add a condition that is to find an appropriate minimum moving average and to take the stock price below it as a necessary condition for us to choose the buying point. On the other hand, fearing that there are few opportunities below the minimum moving average, we also consider choosing an appropriate positive real number δ, and then taking the stock price below the sum of the lowest price mean and δ as the necessary condition to buy. The curve formed by the sum of the lowest price mean and a certain parameter δ is constructed based on the idea above.

Algorith A2

Problem: $\text{S-SPMP}(f,v)$

Input: $ml,L,f,\delta,Y;P_i^l,P_i^h,P_i^o,P_i^c$, $i=1,2,\cdots,ml+L+f;P_0;r$.

(Here, δ is an appropriate scale parameter; the significance of other inputs except δ is the same as that in algorithm A1.)

Output: Yes (Recommend to buy at the current price) ; No (Recommend not to buy at the current price).

Process:

Call algorithm A1 to find out l^*.

Compute $\overline{P}(i,l^*)$, $i=0,1,2,\cdots,1+f,\cdots,f+L$.

For $l'=3,4,\cdots,ml$, carry out the following terms.

(1) Compute $\overline{P}^l(i,l')=\frac{1}{l'}\left(\sum_{j=i+1}^{i+l'}P_j^l\right)$ $i=0,1,2,\cdots,1+f,\cdots,f+L$.

(2) Put $n(l'):=0$. For $i=1+f,2+f,\cdots,f+L$, if $y_i<\min\left\{\overline{P}^l(i,l')+\delta,\overline{P}(i,l^*)\right\}$, put $n(l'):=n(l')+1$.

Find l^{**} such that $n(l^{**}):=\max_{3\leq l'\leq ml}\left\{n(l')\right\}$.

If $P_0<\min\left\{\overline{P}(0,l^*),\overline{P}^l(0,l^{**})+\delta\right\}$, output Yes; otherwise, output No.

Remark 2: Roughly, δ is chosen on the principle that there is sufficient i to make $P_i^l<\overline{P}(i,l^*)-\delta$. It is more difficult to optimize δ at a high level, which is a problem worthy of further research.

3. Conclusions

On the basis of literatures [8,9], the weak bull-bear point algorithm and the strong bull-bear point algorithm, to find stock buying points through big data analysis with computer, are presented. Relevant experiments show that in general, the strong bull-bear point algorithm performs better than the weak one. This work aims to roughly explore how to develop the quantitative technology for doing the stock trade based on big data and to promote the development of related research. It is a meaningful and worth pursuing work to further engage in the study.

Conflict of Interest

The authors declare no conflict of interest.

References

[1] Luo, S., 2021. Review on the application of machine learning in stock forecasting. Academic Journal of Business and Management. 3(4), 27–30.
DOI: https://doi.org/10.25236/AJBM.2021.030407

[2] Appati, J.K., Denwar, I.W., Owusu, E., 2021. Construction of an ensemble scheme for stock price prediction using deep learning techniques. International Journal of Intelligent Information Technologies. 17(2), 1–24.

[3] Rui, A., 2021. Big data business actual analysis: stock price prediction based on time series model. Modern Economics & Management Forum. 2(2), 63–71.

[4] Budiharto, W., 2021. Data science approach to stock prices forecasting in Indonesia during Covid-19 using Long Short-Term Memory (LSTM). Journal of Big Data. 8, 47.

[5] Harel, A., Harpaz, G., 2021. Forecasting stock prices. International Review of Economics and Finance. 73, 249–256.

[6] Li, J., Du, J., Xue, Z., 2021. Research on stock forecasting based on multi-view stock features (in Chinese). Journal of Nanjing University (Natural Science). 57 (1), 68–74.

[7] Zheng, B., Cheng, C., Wang, L., 2020. A method of correlation and prediction of stock preice trend (in Chinese). Journal of Mudanjiang Normal University. (2), 8–11.

[8] Xu, X., Wang, L., Cheng, C., 2020. A method of finding stock buying point based on moving average price and big data analysis (in Chinese). Statistics and Application. 9(1), 1–6.

[9] Fu, Y., Cheng, C., Wang, L., 2020. An approach to find the point of buying stock based on big data. Journal of Business Administration Research. 3(2), 37–41.