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Research on Quantifier Trading System Based on Time Series

Yunyu Li*

Shanghai Maritime University, Shanghai, China
**Corresponding author: yl1090923@163.com*

Abstract: *Due to the continuous development and growth of domestic and international securities market, investors are more inclined to use professional trading tools to manage investments. So, for major institutions and investors, the transaction strategy of gradually formulating and managing liquidity assets will be meaningful. Therefore, we developed three models: the first model is price prediction model; the second model is investment return based model, and the third model is risk control model. firstly, the daily price data of gold and bitcoin given in the topic for the five-year trading period from November 9, 2016 to October 9, 2021 are preprocessed with missing values, etc., while first-order differences are performed, and the ARIMA model is used to verify the validity of the predicted prices by validating the original series of data with smooth and intrinsic trends. Next, the ARIMA parameters are fitted using historical data, and XGBoost machine learning training data are introduced to triple-fold cross-validate the results, combining ARIMA and XGBoost machine learning to derive predicted prices for daily gold and bitcoin transactions, laying a good foundation for the establishment of the return model and the risk model. We determine the rise and fall of gold and bitcoin in each trading day based on the predicted price data of gold and bitcoin in the next 5 days, and get the median M0.5 of the rise and fall, which reflects the expected return in a specific period by the increase or decrease of the rise. Then, according to the Apriori algorithm, the frequency item set is obtained. According to the plus positioning function, the investment income amount is obtained, and the investment revenue is combined based on this strategy. The result of the benefit is shown in Fig 9. The optimization of the model's accuracy and maximization of the model's accuracy and maximization of investment strategic revenue is proved by the comparative analysis of the prediction model and the revenue of the investment.*

Keywords: *ARIMA Model; price forecast; dynamic planning model; risk control model*

1. Introduction

With the development of financial markets at home and abroad, market traders and investors need intermittent buying and sell liquidity assets to obtain higher income and avoid risks. In order to make more scientific and reasonable, provide reference for our investment behavior, and standardize investment links It is a common means in today's financial market.[1] In this process, market traders and investors can use model simulated financial markets to customize investment methods for volatility assets and refine investment behavior for investment methods of fluctuating assets. Based on this, establish a suitable model, develop a reasonable scientific daily best investment strategy, is critical to obtaining the maximized investment returns [2]. This article determines the best trading strategy with the maximum investment returns and the minimization of the risk is the purpose. First, establish a gold and bitcoin ARIMA prediction model.[3] Use the existing historical data to sequence the gold and bitcoin time series through the Spass software, and then predict the price of gold and Bitcoin within the 31st trading day through the ARIMA algorithm.[4] Secondly, this paper calculates the real-time revenue data of the transaction by studying the magnitude of the price and decline in the price of gold and bitcoin, and is calculated based on the predictive price data, and find real-time revenue data after the transaction. Finally, the basic risk control model is established in all the above speeches and discussions. [5] is equipped with the parameter size of risk indicators through the linear planning equation, and adjustment, the measurement of the rising decline is increasing during risk. Based on the determination of investment strategies, we have summarized the simulation method and some parameters, and convey strategies, models, and results for market traders.

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2. Gold and Bitcoin Price Prediction Model

2.1 Predictive analysis

There are many uncertain factors in investing in gold and bitcoin.[6] Therefore, this paper establishes a time series prediction model, predicting the price of two products, and better identifying the best investment strategy throughout. First of all, the time series diagram obtained through the spass is as follows:

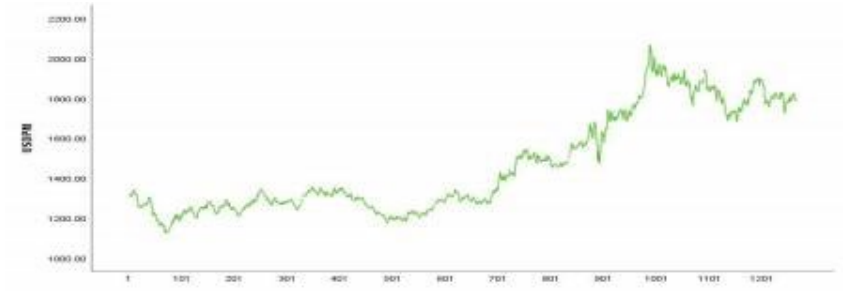

Figure 1: Gold time sequence diagram

Figure 2: Bitcoin time series

It is visually seen by the above Figure 1 and Figure 2, the time series of gold and bitcoin, so this article is a first-order differential of the original data, so that the original sequence is stable, and the ARIMA model prediction analysis is used.

2.2 Establish an ARIMA prediction model

This paper uses the time series ARIMA model, and the price data of the original trading day gold and the ratio of the Bitcoin makes the data to a smooth sequence. This paper predicts the price of gold and Bitcoin corresponding to T0 after 0 days, and then the original 30 data prediction prices of 1, 2, 3, 4, and 5 trading days, ie T1 The corresponding price of T2, T3, T4, T5 is as follows Table 1:

Table 1: Price prediction form

T	T0	T1	T2	T3	T4	T5	Predicting average
Bitcoin Predictive value	617.398	724.934	765.056	1003.645	1026.523	1345.286	913.807
Gold Predictive value	1262.715	1156.238	1198.807	1251.203	1250.014	1253.531	1228.75133

By the above method, the price prediction of gold and bitcoin trading day, and the average value is evaluated, and the result of the integrated prediction of the multi-cycle time series is better, so this model can be used to establish a dynamic planning of dynamic planning. Policy provides research direction. The above model can be used in the investment policy forecast next trading day.

2.3 Prediction fit based on XGBoost machine learning

We build the XGBoost regression model by training set data, calculate the characteristic value importance by establishing XGBoost. Further, the established XGBoost regression model is applied to

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the training, test data to obtain the model evaluation results. Therefore, since XGboost has randomness, each running result is different. If this training model is saved, the subsequent data can be uploaded directly into the training model to calculate the prediction. Based on this price for the future of each trading day. From the graphic, it can be intuitively seen that the real value value and the predicted value are relatively close, and the combination R2 = 0.999 is very close to 1, so the result of the XGBoost prediction is very good.[7] We adopt a triple confirmation to avoid the XGBoost model prediction process, due to the unreasonable division of data, resulting in fitting in the final training set. The data visualization is as follows Table2 and Fig 3, Fig 4.

Table 2: Machine learning training fit results

MSE	RMSR	MAE	MAPE	R^2
9726.708	98.624	57.235	0.89	0.999
44249.348	210.355	131.156	0.586	1

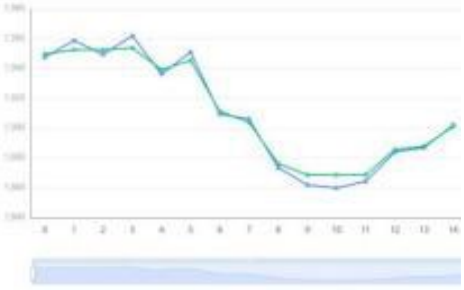

Figure 3: Cross-validated gold

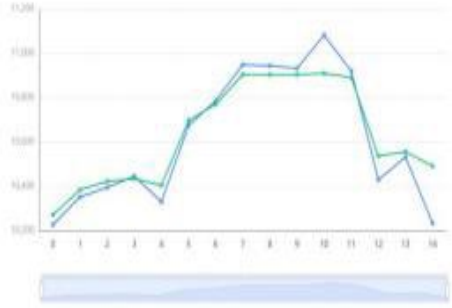

Figure 4: Cross-validated bitcoin

3. Investment income model based on dynamic planning

3.1 Dynamic planning problem analysis

From the question of this article, I hope to find the best trading strategy for the day of gold and Bitcoin, and will come to tomorrow, today's data is added to the original price data, continue to predict and look for the best. Trading methods, retrofitting, this is a typical dynamic planning process. According to the prediction of the original data, the calculation analysis is adjusted on the day of the day, and then continuously pushed until September 10, 2021

3.2 Model solving process

Based on the prediction model, it can be found that the short-term data has volatility, so the magnitude of the increase and decline in gold and bits. For investment, it is usually purchased when the price is rising, and the price fell. Through the relevant rule algorithm, according to the relevant rule algorithm, the number of subsets, 3 times, 4, 5, 6 rises and declines, M1 M2 M3 M4 M5 M6, N1 N3 N4 N5 N6 respectively the statistics are as shown Fig 5, 6, 7 and 8.

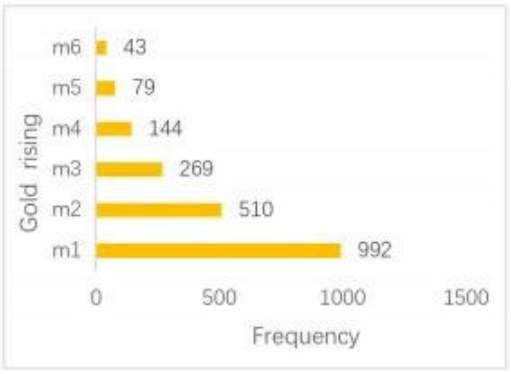

Figure 5: Number of gold rises

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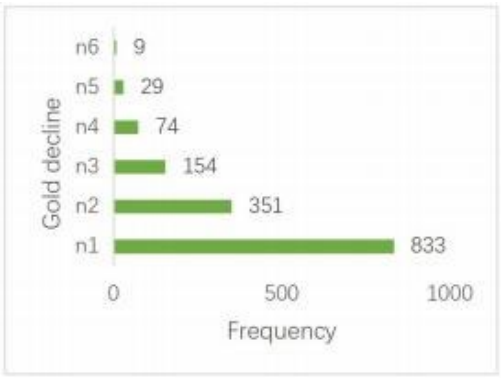

Figure 6: Number of gold fell

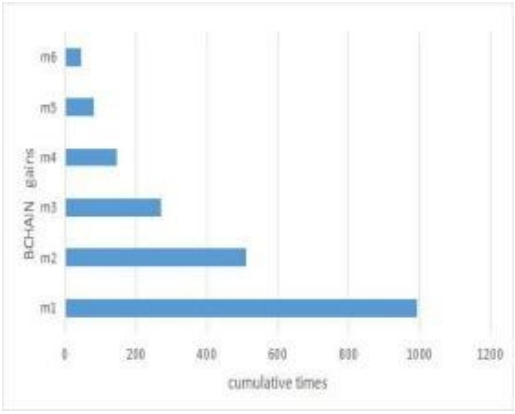

Figure 7: Number of Bitcoin rises

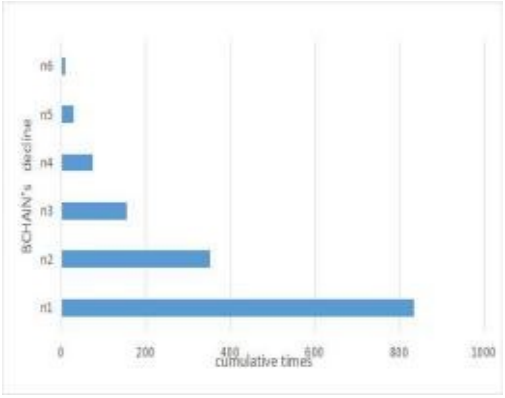

Figure 8: Number of Bitcoin fell

In order to see the magnitude of gold and bitcoin rising and decline, this paper followed by statistical tools to find rising and decline, as shown Fig 9 and Fig 10.

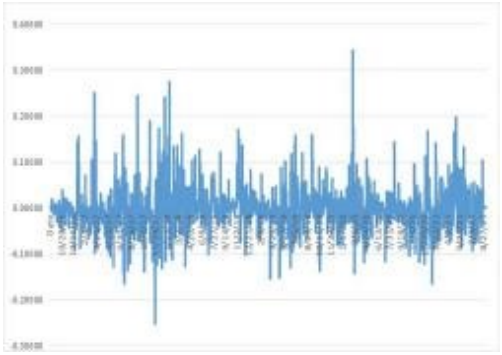

Figure 9: Bitcoin rising fell

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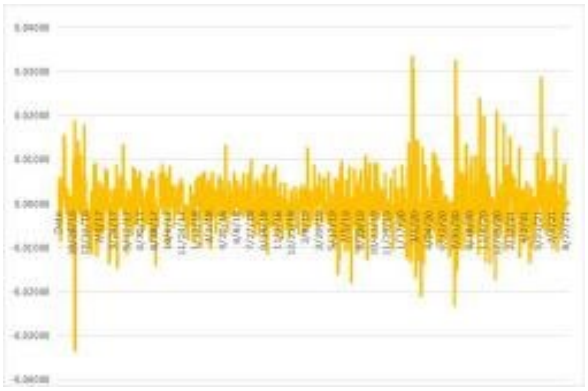

Figure 10: Gold rising fell

The above figure can be intuitive, the gold price amplitude has risen more than 90% of the number of continuous increases, and the number of continuous declines is also 4 times, the maximum value of the rising range is 0.022, the maximum fell maximum is 0.0221. Bitcoin prices have risen over 90% of the number of more than 90%, and all of its continuous fell is 3 times, and the maximum amplitude of rising is 0. 1102, the maximum fell is 0.0856.[8]In order to better quantify the impact of the rising decline on the position, the gold continuous increase or the number of consecutive declines is m, and the number of consecutive rises or continuous decline is M, the maximum accumulated increase is, the maximum accumulated fell is in the ideal state, it is assumed that each of the prices of gold and Bitcoin have their respective increases and decline Q0ul, When the M is lowered, the position is added each time, and if it rises the next day Q0ul Profit.

Combined with the above formula can be obtained in normal case management model, respectively, for the first, 2nd, 3, 4 times of the investment product, and the amount of Jiao warehouse is P1, P2, P3, P4, list the following:

$$p_2\left(1-\alpha\%\right)Q_{0.5}+P_1\left(1-\alpha\%\right)\left(\frac{Q_{0.1}}{m_1}\right)Q_{0.5}=0 \tag{1}$$

$$p_3\left(1-\alpha\%\right)Q_{0.5}+P_2\left(1-\alpha\%\right)\left(\frac{Q_{0.1}}{m_1}\right)Q_{0.5}+P_1\left(1-\alpha\%\right)\left(\frac{Q_{0.1}}{m_1}\right)^2Q_{0.5}=0 \tag{2}$$

$$p_4\left(1-\alpha\%\right)Q_{0.5}+P_3\left(1-\alpha\%\right)\left(\frac{Q_{0.1}}{m_1}\right)Q_{0.5}+P_2\left(1-\alpha\%\right)\left(\frac{Q_{0.1}}{m_1}\right)^2Q_{0.5}+P_1\left(1-\alpha\%\right)\left(\frac{Q_{0.1}}{m_1}\right)^3Q_{0.5}=0 \tag{3}$$

Combined with gold prices fell up to 4 times, m1=4, M0u1=-0.0221, a%gold=1%, Cumulative rising and falling amplitude. The plus amount is obtained by (1) (2) (3), and the regeneration of the plus amount is fed, and the coefficient of returns to the coefficient of the clearance and loss of the position is the same due to the same increase in the opening and the magnitude of the position. Adding a warehouse function (4), the reduction function (5) is as follows:

$$y=0.4808e^{\left(\frac{w}{M_{0.1}}\cdot m_1\right)} \tag{4}$$

$$y=0.4808e^{\left(\frac{w}{M_{0.9}}\cdot m_1\right)} \tag{5}$$

Similarly, this paper uses the same approach to gold, combined with Bitcoin fell up to 3 times, m1 = 3 M,0u1 =-0.0856, a%biticon =2%, After entering (1) (2) (3), the plus amount is obtained, the bitcoin plus a warehouse function (6), bitcoin load (7):

$$y=0.2433e^{\left(\frac{w}{M_{0.1}}\cdot m_1\right)} \tag{6}$$

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$$y = 0.2433e^{\left(\frac{w}{M_{0.9}} \cdot m_1\right)} \tag{7}$$

Finally, by calculating the cumulative rise in gold and Bitcoin, calculate the gold and bitcoin's plus amount and the increase amount, and the amount of the gaming amount and the reduction amount Perform a certain adjustment.

3.3 Dynamic planning model solving result

According to the above model process, this paper uses the push prediction price combined with the plum amount and the reduction amount, the dynamic solve process of the income will be calculated, and the initial 1000 yuan investment Bitcoin is 500 US dollars, the gold is $ 400, the cash is 100 US dollars, The final investment income is US $ 1264,482.

4. Risk control model

According to this paper, the decline in the previous five days is 4 times in five days, then we think that the next period is higher. Then, we stop adding a position or a small number of ports. When the bitcoin is less than 30, for the hedging risk to stop selling until it has reached 80 after buying.

4.1 Basic investment portfolio model risk problem analysis

For the Portfolio problem, the basic framework of this model was given as early as Markowitz, and this model has been continuously studied and improved.[8] In general, people' s investment stocks are uncertain, so it is a random variable, so the risk should be considered in addition to the expected value of the income. We measure the variance (or standard deviation) of the risks: the difference is, the greater the risk; the smaller the difference is, the smaller the risk is considered. Under certain assumptions, the variance (or standard deviation) of the benefits is measured. It is really suitable. To this end, we first calculate the mean and variance of three stock income (including covariance) standby on the data given in the table. One mean of investment funds is measured by this stock of the average income, and the variance of the benefit is measured by the fluctuation of such stock income. The larger the difference, the larger the fluctuation (the more unstable income) . The covariance of two dice revenues is expressed as the correlation between them:

1) The two covariance is 0 when it is not related.

2) The covariance is the positive number indicated that both positive correlation, the stronger the correlation between the covariance

3) The covariance is negatively correlated with the negative correlation. The greater the absolute value, the stronger

Remembering gold, Bitcoin A, B annual yields are R1, R2 yields, respectively, with today's benefits / tomorrow. The ri (i = 1, 2) is a random variable. The mathematical expectations and variance operators of the random variables are used in E and D, respectively, and CoV represents the covariance of two random variables.

4.2 Risk control model is established

The proportion of market traders to gold and bitcoin in the proportion of gold and bitcoin use with decision variables x1, x2. It is assumed that the proportion of A, B is Y1, Y2, and the ratio of the sold A, B is Z1, Z2. Among them, Yi and Zi (i = 1, 2) can only have a strict tanker, and xi, yi ≥ 0, i = 1, 2.

Suppose there is no other investment channel on the market, and the funds in the hand (can assume that only one unit's funds) must be used for investment of gold and bitcoin, then due to the existence of transaction costs, the constraint x1 + x2 = 1 is not necessarily It is also established (only if stock trading is not carried out, that is, Y1=Y2=Z1=Z2=0, this binding is established). In fact, the essence of this relationship is that the total funds currently hold are conserved, and in the case of transaction cost (1%), it should be expressed as follows:

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$$\sum_{i=1}^{3} x_i + 0.01\sum_{i=1}^{3}\left(y_i + x_i\right) = 1 \tag{8}$$

In addition, considering the share xi and zi between the current holding Bitcoin gold, it should also be full. Foot-standing

$$x_i = y_i - z_i, i = 1,2 \tag{9}$$

$$\begin{aligned} V &= D\left(x_1 R_1 + x_2 R_2\right) \\ &= x_1^2 DR_1 + x_2^2 DR_2 \\ &+ 2x_1 x_2 \operatorname{cov}\left(R_1, R_2\right) \\ &= \sum_{i=1}^{2}\sum_{j=1}^{2} x_i x_j \operatorname{cov}\left(R_i, R_j\right) \end{aligned} \tag{10}$$

Actual investors may face many constraints, and the yields required by considering questions are not lower than the commission.

No less than 15%, X1ER1+X2ER2≥0.15, the final optimization model is extremely small under constraints and conditions.[9] For the actual investor, it may not only hope that the risk of the desired expectation of the expected investment (the variance of the return rate) may also know how the risk changes with different investment returns, then make Final investment

Decision. This is of course possible to achieve the parameters in the constraint (currently 0.15) by constantly modifying the constraints in the above model.

5. Best Model Policy Certificate

In combination with the adjustment strategy of the above-mentioned Jiao warehouses, plus the direction of investment in the first part, the model can make the model more robust. The original data is calculated by the above-described plus strategy, the positioning strategy and investment strategy, and the simulation result is as follows Figure 11:

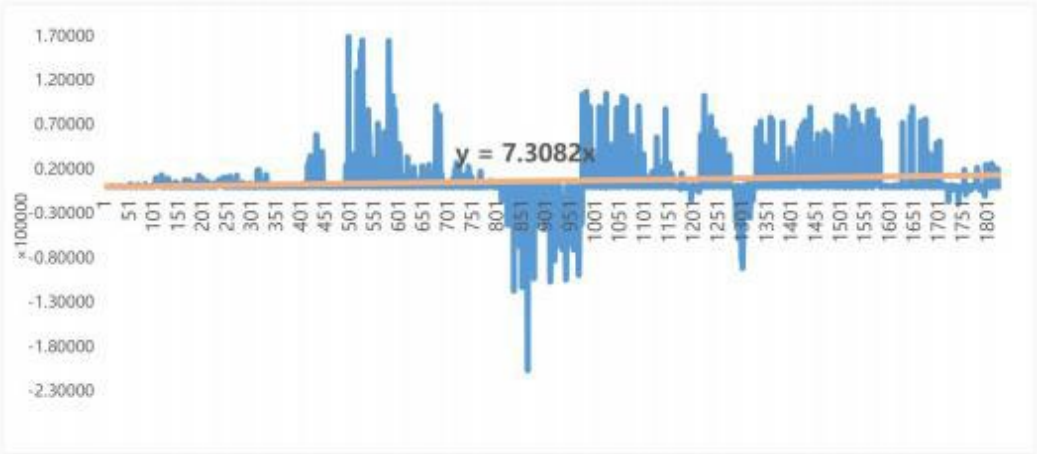

Figure 11: Gain curve

From the above figure, it can be found that the overall revenue is positive, and the orange revenue trend line Y=7.3082 can be obtained, from the whole, the income is stable over time increases. Therefore, the dynamic planning model established in this paper is the best trading model.

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6. Sensitivity Analysis

6.1 Strategy to the level of sensitivity

In order to verify the model of this article, what changes will change in the transaction cost, so the transaction cost is the transaction amount of the corresponding gold and bitcoin is as follows Table 3:

Table 3: Influence of cost on income

Total income meter (unit)	13135602	13135466	13134553	13134243	13132833
Bitcoin transaction costs proportion of transaction amount	2%	2.4%	5%	6%	10%
Gold transaction costs account for proportion of transaction amount	1%	1.2%	5%	4%	5%

The total revenue calculated on the previous table is as follows Figure 12:

Figure 12: Total income visualization

It can be intuitive from the above figure. As the proportion of Bitcoin and Gold increases in its corresponding transaction amount, the total income will decrease, and the summary of the income of the dynamic planned investment model used in this paper is relatively stable Growth.

7. Conclusion

Based on all the research mentioned above, we conclude that the investment strategy to quantify the transaction model can help us develop a more reasonable trading strategy and to avoid risk. A relatively complete investment model is actually a collection of a series of counterparts for different situations, and our model just contains most of these collection, for future price predictions, position dynamic adjustments, and sells the conditions. The risk control of artificial interference, as well as circumvention of other risks, etc. The simplicity of the investment decision system does not represent its function is not perfect. On the contrary, she is stable, that is, it can stabilize the risk characteristics in the short-term stage. Of course, a good investment model should keep pace with the times, constantly optimize, and can train the entire investment system in the future to train to optimize the entire investment system, so that it can meet more situations.

The establishment of the investment model mentioned by the article is based on the price changes in different trading days, but the elements that can affect investment income in actual life are more than just price factors, such as black swan events, replacement or homogeneous goods. The butterfly effect caused by the price changes, the government policy should be the problem of investors, so the investment model still has a lot of room in the future, constantly changed to try to train investment. The system makes it more simple and perfect is the problem that the previous researchers should explore.

According to our empirical results, we propose quantified investment transaction strategies for representative and investment guiding significance, such as how different situations, holding or selling portfolios, combined investment, gold and bitcoin investment proportion, etc. In addition, we also write two memos to the market traders, explain our strategies, models, and results to traders. Hope our model

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and memorandum can become a market trader to survive the risk and get more benefits.

References

[1] Sang H K, Lee H S, Han J K, et al. Pattern Matching Trading System Based on the Dynamic Time Warping Algorithm [J]. MDPI AG, 2018(12).
[2] Young-Seok C. Information-Theoretical Quantifier of Brain Rhythm Based on Data-Driven Multiscale Representation [J]. Biomed Research International, 2015, 2015:1-8.
[3] Lei Y, Liu T, Zhu H. Research on the business model of distributed power trading based on blockchain technology[J]. Journal of Physics: Conference Series, 2021, 1800(1):012014 (8pp).
[4] Contreras, Ivan, Ignacio, et al. A hybrid automated trading system based on multi-objective grammatical evolution [J]. Journal of intelligent & fuzzy systems: Applications in Engineering and Technology, 2017, 32(3):2461-2475.
[5] Lam C, Yao Q, Bathia N. Estimation of latent factors for high-dimensional time series [J]. LSE Research Online Documents on Economics, 2011, 98(4):901-918(18).
[6] Yu W, Yuan W. Research on Network Trading System Using Blockchain Technology[C]// 2018 International Conference on Intelligent Informatics and Biomedical Sciences (ICIIBMS). IEEE Computer Society, 2018.
[7] Wang J, Yang Q, Jin Z, et al. Research on quantitative trading strategy based on LSTM [C]// 2020 Asia-Pacific Conference on Image Processing, Electronics and Computers (IPEC). 2020.
[8] Liao S. Comparison Research on Quantifier between Japanese and Chinese [J]. Modern Chinese, 2018.
[9] Fu Z, Jiang C. Research on Negative Construction of "One Quantifier N" in International Chinese Teaching [J]. Theory & Practice in Language Studies, 2015, 5(10):2064.