Hindawi
Scientific Programming
Volume 2022, Article ID 4127924, 7 pages
https://doi.org/10.1155/2022/4127924

Research Article

Dynamic Modeling of Influencing Factors and Change Trend of College Students' Mental Health Based on Big Data

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Received 19 January 2022; Revised 10 March 2022; Accepted 23 March 2022; Published 18 April 2022

Academic Editor: Sheng Bin

With the great changes of social development environment and the lack of psychological preparation of many students, many college students have many psychological problems in the process of adapting to the environment. If the problem cannot be solved in time, it will seriously affect their future adaptation and mental health. In order to solve the psychological problems of college students, the networked dynamic model constructed by using big data modeling technology can realize the system functions required by users and model the model accordingly. The main research direction of this paper is to study the influencing factors and change trend of college students' mental health under the background of big data. In the network-oriented scenario, the missing value of the data is supplemented, and the sequence prediction technology is added to the data. Finally, by adding corresponding data samples to the improved big data dynamic model, the results of the addition completion method and data sequence prediction technology are analyzed.

1. Introduction

Big data dynamic modeling technology now involves a wide range of fields, and its social applicability is very high. Because big data dynamic modeling technology belongs to mathematical modeling, the core content of this technology is also difficult (Yang Yankun et al., 2021) [1]. With the historical development of big data dynamic modeling technology, many researchers have also conducted in-depth research, development innovation, and various application experiments on modeling technology. The innovative big data dynamic model realizes the high-speed processing of data and is gradually applied to all walks of life. Although the big data dynamic modeling technology improves the data processing rate, it will also have the problem of data error, but the development trend of this modeling technology is still very long-term (DI VAIO Assunta et al., 2021) [2]. Big data dynamic modeling technology is the development hotspot of today's society. With the rapid development of network and the simplification of software development, big data dynamic modeling technology has been promoted to various fields. The modeling technology has also evolved into dynamic models suitable for different fields.

Foreign researchers have studied big data dynamic modeling technology earlier, so the introduction of technology and methods of this technology is relatively mature. Big data dynamic modeling technology originates from mathematical modeling (Zhang Bin Xin et al., 2021) [3]. Then the technology is applied to medical, aerospace, education, and other industries. Big data dynamic modeling technology is inseparable from the Internet of things and the Internet. In the field of education, the system mainly analyzes, classifies, and assimilates the data generated by students, which can enable the observer to display the input relevant data more intuitively (Huemer Matthias et al., 2021) [4]. In the process of dynamic model data processing, we should follow the principle of data timing. By adding the corresponding data processor, the data error can be reduced and the data can be accurate. The model can also make corresponding command operations on the data in the system (Fisher Jennifer et al., 2021) [5]. Through the combination of big data and dynamic modeling technology,

the mathematical model that only stays in books is changed into a networked dynamic model system that can adapt to data. We can regard the big data dynamic system as a huge database with a large amount of data and number of data processors. Observers can realize the automatic analysis, transformation, and output of data through the system.

This paper is mainly composed of three parts. The first part briefly introduces the application of big data dynamic modeling technology in college students' mental health and the development status of big data dynamic modeling technology abroad. The second part mainly focuses on the modeling research of students' mental health data in the big data dynamic model and the prediction technology of time series. The third part is the analysis of the research results of modeling and the prediction technology of time series.

2. Related Work

Big data dynamic modeling technology has been proposed by researchers long ago. This technology is produced under the development of the Internet, which promotes the development and application of big data dynamic modeling technology (Huang Haosheng et al., 2021) [6]. Big data dynamic modeling technology first appeared in the 1990s and then appeared in nature and sciences (Wei Yigang et al., 2021) [7]. Since 2008, many academic newspapers have published many special issues on this technology, which makes big data dynamic modeling a hot academic performance direction. Under the dynamic model based on big data, it reflects the data scale of the system and goes beyond the traditional way of collection and storage. Then came the big data dynamic model suitable for analyzing complex human data. The normal model was first applied to process human behavior data, but the results were not satisfactory (Choi Sowon et al., 2021) [8]. Later, the problem was overcome by adding corresponding methods and technologies to the model. Combined with the final model, it is applied to the field of education to analyze students' learning efficiency. Big data and the dynamic system studied in this paper represent the embodiment of human new thinking and the trend of updating technology in the information age (Belov Vladimir et al. 2021) [9].

The dynamic modeling technology in the United States is the fastest developing in the world, and the earliest practical application of technology is also in the United States (Bhawra Jasmin et al., 2021) [10]. As we all know, the United States has always been at the forefront of the world in the field of aerospace. The United States applies this technology to the construction of spacecraft. At that time, only qualified engineers could ensure the quality of various parts produced, but the personnel were too few, and the less qualified engineers could not fully ensure the product quality. In order to change the current situation of too few human resources, dynamic modeling technology is integrated into the production chain (Raj Bawa et al., 2021) [11]. Through the addition of this technology, the production personnel can compare the returned parameter diagram with the standard parameters, which greatly improves the quality of production parts.

German dynamic modeling technology is widely used in the field of medicine. In order to increase the success rate of difficult surgery, some researchers use sensors to detect doctors' behavior data. Dynamic modeling technology is added to the production of sensors and high-precision medical devices. Through the addition of dynamic modeling technology, relevant developers can observe the relevant data generated in the process of developing products in real time (Mu'azam Shah et al., 2021) [12]. However, the research and development cost of the product is very high, it cannot be produced on a large scale, and the process of detecting doctor behavior data is also very long. Later, in order to solve the above problems, relevant researchers will make product materials for replacement. The production cost is reduced. Through the combination with dynamic model, medical devices are widely used in the process of surgery (Al Dmour H. et al., 2021) [13].

Dynamic modeling technology is widely used in sales industry in China. There is one of the largest online shopping platforms in China, "Taobao". "Taobao" shopping software is a comprehensive sales platform with a very large scale (Huang et al., 2021) [14]. During use, users will enter the name of the product they want to buy in the navigation bar and browse the final product to buy. Through a certain user's search keyword for a period of time, the dynamic model within the software will carry out data statistics. Through the analysis of the data collected and purchased by the system, the user's purchase of goods will be predicted on the home page of the software. Finally, it is pushed to users through pictures and links.

This paper studies the influencing factors and changing trend of college students' mental health by using time series data modeling technology. In the big data network scenario, the system adds a data missing value completion algorithm. Research and innovation contributions include the following: the designed big data dynamic model shows good system performance when completing random and continuous missing data, reduces the difficulty of addition, and improves the system processing speed. The research also adds a method of predicting data error. The system mainly predicts the time series data of deep clustering. The addition of the algorithm enables the system to run efficiently in the face of large-scale datasets. Through the addition of the above system functions, the whole big data dynamic system has high application value.

Dynamic modeling technology is mainly used in the financial industry in the UK. Britain's finance was not very developed in the past, mainly through manual processing of relevant statistical work. With the rise of modeling technology, British researchers combine models with stock data. Through the classification and processing of the data through the model, the relevant data generated every day can be quickly classified and saved, and finally the data can be displayed in the form of line chart by connecting the computer. Subsequently, the technology is continuously upgraded and applied to all parts of the financial industry, which reduces the amount of manual work. The reference of this modeling technology has also directly promoted the speed of financial development in the UK (Gaur Loveleen

et al., 2021) [15]. The above is the development history of dynamic modeling technology and its development direction in various countries. Through the above contents, this paper studies the influencing factors and change trend of college students' mental health.

3. Methodology

3.1. Research on Time Series Data Missing Completion Algorithm of College Students' Mental Health under the Background of Big Data. The data under a complete network is very important for the development of big data dynamic system. The research object of this paper is human, and the data samples are relatively complex compared with the system, due to the loss of time series data in the actual reference process. For example, the system fails during data processing, resulting in the loss of internal data. The lack of data will interfere with the analysis and processing of data. Once the data is lost seriously, the experimental results will also deviate greatly. In order to solve the problem of data loss, this paper refers to the missing value completion technology of time series data. With the reference of this technology, the whole big data dynamic system improves the data completion accuracy. In traditional methods, the model is regarded as tensor, and the data is restored by combining tensor decomposition. However, the decomposition of high-order tensor data under traditional methods requires a lot of time and cost. These shortcomings make the traditional methods not able to be widely used in large-scale networks. Aiming at the loss of continuous sample data, this paper adopts the batch time series data completion algorithm GAN in the dynamic system. Time series data contains a lot of information, but it is usually invisible. Common problems associated with time series are unordered timestamps, missing values (or timestamps), outliers, and noise in data. Among all the problems mentioned, batch time series processing continuous sample data is more difficult, because the traditional interpolation method (a technology to process missing data by replacing missing values to retain most of the information) is not suitable for processing time series data. GAN can help the system complete the net missing value of lost data in the context of big data. By learning the data distribution of the existing mental health related data, GAN can automatically judge the nature of the sample data and then deal with the large-scale and continuous loss of data.

In order to analyze the impact of different sample data on timeliness and completion performance, firstly, the big data dynamic modeling is set as tensor, so the time series data completion problem is simplified to tensor data completion problem. Then, through the learning training of GAN, the trained GAN completes the missing data of the system. In order to reduce the calculation time, the gradient descent method is added to optimize the model. In the process of tensor dynamic modeling of time series, it is difficult to calculate, but the constructed big data dynamic model inherits the structural advantages of cube. The big data dynamic system is in the single time granularity mode, and the data nodes need to be calculated. The main calculation process is to arrange and measure the data. In order to save measurement time, the adjacent nodes are measured uniformly. The big data dynamic system is in the multi-time-granularity mode and measures the data nodes with large time interval. It is mainly measured by GAN completion algorithm. The improved tensor completion algorithm is shown in Figure 1.

As can be seen from Figure 1, the main goal of the tensor completion algorithm we added is to use a large amount of data to train GAN. The data can be automatically completed through GAN's learning. GAN's powerful data information learning function enables it to automatically synthesize data through external conditions. In the learning process of GAN, the output data of the discriminator is mainly used for judgment. In order to make the data output by the discriminator correct, the following formula is adopted:

$$\max_{W^D} {}_{X\sim p_x}E\left[\log D\left(X;W^D\right)\right] + {}_{X\sim p_x}E\left[\log\left(1-D\left(G(z);tW^D\right)\right)\right]. \quad (1)$$

After calculating the expected value of the data, the loss function compares the data and obtains the difference between the tensors. After learning, GAN enables discriminator D to automatically judge the difference between tensors. In addition, you should also learn in the generator. The relevant formula is as follows:

$$\min_{W^G} E_{Z\sim P_Z}\left[\log\left(1-D\left(G(z);tW^G\right)\right)\right]. \quad (2)$$

After obtaining the minimized data results, the generator and discriminator adjust each other continuously and finally achieve the ultimate goal of data analysis and discrimination. The overall objective function of GAN is as follows:

$$\begin{aligned}\min_{W^G} + \max_{W^D} & E_{X\sim P_X}\left[\log D\left(X;W^D\right)\right] \\ & + E_{Z\sim P_Z}\left[\log\left(1-D\left(G(z);tW^G\right)\right)\right].\end{aligned} \quad (3)$$

After training and learning GAN, a big data dynamic model should be constructed. The extracted data letter can be used as a tensor in the designed model system. It can also be combined with GAN to jointly process multiple types of data and improve the stability in time and space in the process of data processing. The data probability value, network depth, and algorithm formula generated in the dynamic model are as follows:

$$\begin{aligned} N^{DCL} &= \max_{i=1,\ldots,N}\alpha(I_i), \\ \alpha(n) &= \left\{\begin{array}{c}\text{argmax}_a\alpha \coloneqq \{\alpha|\forall\beta\in \text{Z}\colon n=\beta 2^{\alpha}\} \\ \text{argmax}_a\alpha \coloneqq \{\alpha|\forall\beta\in \text{Z}\colon n+1=\beta 2^{\alpha}\}\end{array}\right\}, \\ \beta(n) &= \left\{\begin{array}{c} n/2^{\alpha(n)} \\ n+1/2^{\alpha(n)}\end{array}\right\}. \end{aligned} \quad (4)$$

After constructing the stability of the dynamic model, the specific structure in the model is further described. In the process of data input, the system can map the data into a vector by linear method and form a tensor through the sequential arrangement of multiple vectors. The mathematical expression is as follows:

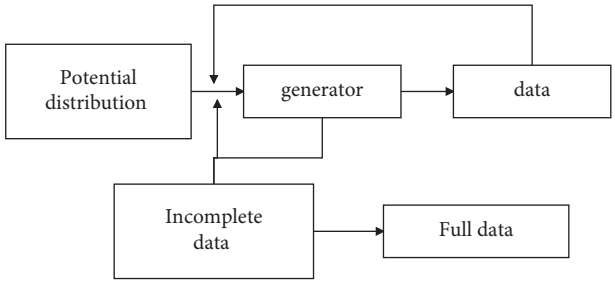

Figure 1: Flow chart of improved tensor completion algorithm.

$$O^{(0,k)} = \left(\text{Reshape}\left(W_Z, I_1^{\text{out}(0)} \times \ldots \times I_N^{\text{out}(0)} \times I^{\text{out}(0)}\right)\right). \quad (5)$$

In the operation system inside the model, the relevant expression formula of the output data of each layer is as follows:

$$O^{(l,k)} = g\left(W^{C(l,k)} \otimes O^{(l-1)} + b^{(l,k)}\right), k \le N^{out(1)}. \quad (6)$$

Through the layer by layer transmission of data in the system, the output tensor of each layer is multiplied. The kernel quantity of data is also required. The calculation formula is as follows:

$$I_i^{out(l)} = \begin{cases} 2I_i^{out(l-1)}, l < \alpha(I_i) \\ I_i, l < \alpha(I_i) \end{cases},$$
$$N^{out(l)} = \begin{cases} N^{out(l)}/2, 1 \le l < N^{DCL} \\ 1, L = N^{DCL} \end{cases} \quad (7)$$

After the internal construction of the model is completed, combined with GAN, we can recover the data together with the system by finding the hidden data code. In order to ensure that the recovered data can remain the same, the gradient descent method is added to update the data iteratively. For the small element quantity missing in the data, the element value of the data at the same location shall be completed.

3.2. Research on Time Series Prediction Technology of College Students' Mental Health under the Background of Big Data. With the development of network, almost all the business in human life has been transferred to the whole network. In other data related to human mental health, generally only the improvement of sequence prediction accuracy in limited time is considered, and the prediction of sequence in different time is not considered. The dynamic system of big data is mainly implemented in the network, and the attributes of data nodes in the network also change greatly. How to efficiently process and analyze multi-changing-sequence data is also a difficulty. Therefore, this paper will study the time series prediction technology of college students' mental health under the background of big data.

In the various algorithms studied by relevant scientists in the past, it can not really deal with the time series of data. This paper presents a reliable network method in the time series prediction technology of college students' mental health data. This method mainly includes data depth clustering method and depth prediction method. With the addition of the two methods, the system can predict multi-time-series of large-scale data. The main research contents are as follows.

3.2.1. Clustering Module. Deep clustering mainly uses the periodic performance of data processing in the network and puts forward the method of triple generation based on this feature. As the name suggests, triples are composed of three groups of data. A time series data classification method is also proposed, which can be combined with computer to generate data images. On the basis of the above, the ternary loss function CNN is also proposed, mainly for systematic learning within the big data dynamic system. After the vector results of time series data are obtained, the traditional clustering method is added to cluster the vectors.

3.2.2. Prediction Module. The prediction module is different from the prediction model of time series data in a single time. This module is mainly used to establish a prediction model for a type of data. For the clustering results of the input of the clustering module, the data samples in the group are mainly used to train and learn the prediction model in the system. Because the system has the ability of data sharing, the performance of the prediction model has been further improved.

In order to deal with the multilateral system patterns in the network, it is also found that the patterns of time series data are similar. Therefore, the main research methods start with the similar nodes of data and the direction of clustering results of time series. In order to explore the research content, the prediction model is mainly added to the system. In order to finally achieve the processing and analysis of college students' mental health related data, time series data conducive to data clustering is used to represent training and learning. The network method of time series prediction technology is shown in Figure 2.

As can be seen from Figure 2, the time series data is mainly divided into modules. Each type of data can represent a typical dataset after being grouped. Similarly, the change patterns of data nodes in a dataset are highly similar.

In the deep clustering module, the network is defined first. Due to the periodicity and recursion of time series data in big data network, it is also easy to be verified in the test of single time series data. In order to verify the periodicity of large-scale different time series data, the following formula is adopted:

$$\gamma^{sim(v)}(m) = \frac{\left|x^{(v)}(m) - x^{(v)}(m+288)\right|}{\max_{1 \le t \le T-288}\left|x^{(v)}(t) - x^{(v)}(t+288)\right|}. \quad (8)$$

The periodic subsequence can be obtained by calculating the measurement results and data similarity. In the triplet, the periodic subsequence can be marked automatically, and the objects to be learned can be distinguished automatically. In order to extract more precise data node information, the input is transformed. The triple matrix expression in the time series is as follows:

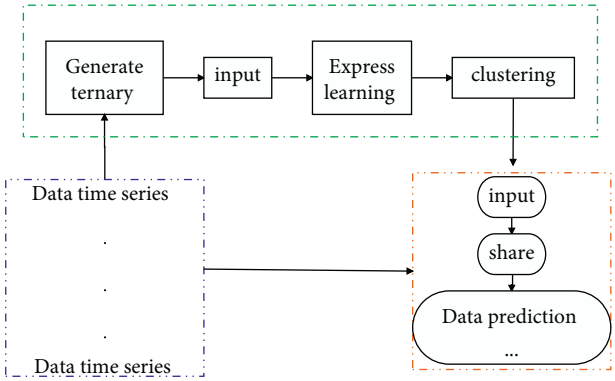

Figure 2: Schematic diagram of networked method of time series prediction technology.

$$\begin{aligned}&\left\{X^{(v1)}(d_1), X^{(v1)}(d_2), X^{(v2)}(d_3)\right\},\\&0 \le d_1, d_2 d_3 \le D-1, d_1 \ne d_2,\\&1 \le v1, v2 \le V, v1 \ne v2.\end{aligned} \tag{9}$$

After obtaining the value of the ternary matrix, the ternary loss function DNN needs to be used to further learn the specific data vector. The ternary loss function formula is as follows:

$$\begin{aligned}&\left\|f\left(X^{(v1)}(d_1)\right) - f\left(X^{(v1)}(d_2)\right)\right\|_2^2\\&\quad -\left\|f\left(X^{(v1)}(d_1)\right) - f\left(X^{(v2)}(d_3)\right)\right\|_2^2,\\&\forall\left\{X^{(v1)}(d_1), X^{(v1)}(d_2), X^{(v2)}(d_3)\right\} \in \Gamma.\end{aligned} \tag{10}$$

After defining the loss function of triples through the above formula, the time series embedding vector of college students' mental health related sample data can be carried out in the big data dynamic system. The cluster change of the returned data index on the computer is shown in Figure 3.

The contour coefficient SC of the data and the clustering trend between the three indexes of the array can be seen in Figure 3. With the increase of data, it can be obtained that the system achieves the optimal processing in three groups of data, which also confirms the triple used in this paper.

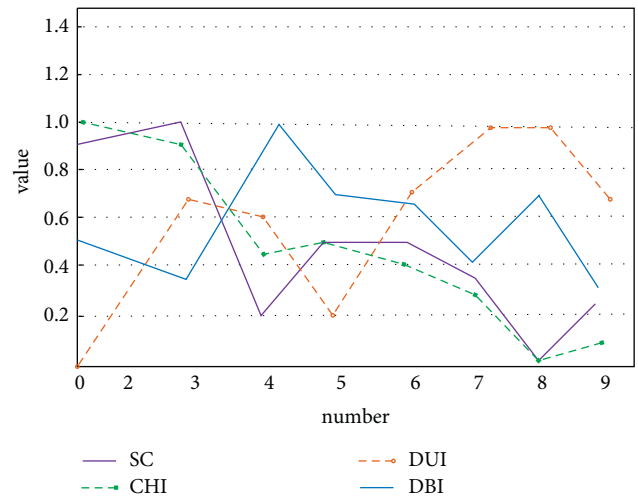

Figure 3: Data index clustering data change curve.

Based on the above clustering results, the depth clustering module is further optimized. The system optimization is mainly carried out in the prediction input and model sharing. In the prediction input, relevant algorithms to reduce the amount of data remaining are mainly added to reduce the data input interval in the system. The formula is as follows:

$$l^{in} = \max_{i \ge 1}\left\{i:\ \gamma_i^{ACC} > \gamma\right\}. \tag{11}$$

After the data input interval is reduced, the speed of data processing is also improved. In the process of model sharing, it is assumed that the time series in a set of datasets are similar. In the model sharing mechanism, each group of datasets can share data within the system, and the prediction expression of the whole network factor is as follows:

$$x^{(v,k)}\left(t:\ N^{out}:\ l^{out}\right) = f\left(x^{(v,k)}\left(t - M^{in} + l^{in}:\ N^{in}:\ l^{in}\right)\right) = f^{(k)}\left(x^{(v,k)}\left(t - M^{in} + l^{in}:\ N^{in}:\ l^{in}\right)\right), k \in \{1, 2, \ldots, k\}. \tag{12}$$

The optimized deep clustering module not only significantly improves the data prediction ability in the big data dynamic system but also increases the stability of the system.

4. Result Analysis and Discussion

4.1. Analysis of Research Results of Temporal Data Missing Completion Algorithm for College Students' Mental Health under the Background of Big Data. By adding the algorithm to complete the time series data in the system, this experiment adopts the overall designed model for data input comparison. The main purpose of this experiment is to improve the efficiency of missing data completion under the system model and to prove the design results of the missing data completion algorithm of the big data dynamic system for college students' mental health. 100 sets of different types of datasets were used in the experiment. Firstly, the mental health data samples are input into the system, and the system simply analyzes and processes the data. Then, the input mental health data samples are processed by the GAN completion algorithm in the system. GAN completes the missing data of the sample data by looking for the missing data. Finally, the system outputs the final data, and the output final data results will be displayed on the computer. Compare the proportion of random deletion and continuous deletion in the system, as shown in Figure 4.

It can be seen from Figure 4 that the designed model has less probability of data loss when processing the input

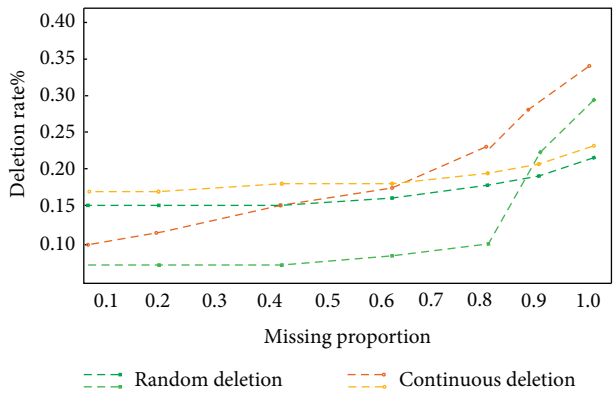

Figure 4: Missing scale comparison chart.

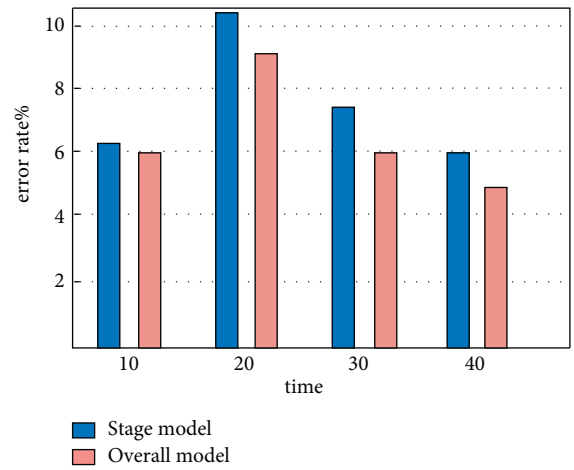

Figure 5: Prediction error rates of stage model and overall model.

mental health data samples. Although there is little difference in the probability of missing data, only a few tenths of the error probability will make the final experimental results more accurate. Experiments can also prove the advantages of GAN big data dynamic system on the temporal data completion algorithm of college students' mental health. GAN highlights that it can continuously and accurately complete the missing data in the process of high-intensity data processing and also accelerates the process of completing the data. The experiment shows that GAN big data dynamic system is very suitable for the influencing factors and change trend of college students' mental health.

4.2. Analysis of Research Results of Time Series Prediction Technology of College Students' Mental Health under the Background of Big Data. In order to further verify the application of the data time series prediction technology designed in this paper in the big data system, in this experiment, the prediction errors of phased model and complete model on the relevant sample data of college students' mental health were explored. In the experiment, 40 sets of sample datasets are prepared to prove whether the system can judge the data errors in time. Firstly, the prediction method is evaluated, and the big data network dynamic system will be used to realize the short-term prediction of sample data. Secondly, the data is input into the model with prediction time series to detect the node data of each data sample. Finally, classify and comprehensively process the predicted error data, and then complete or delete the data. The prediction error rates of the final phased model and the integrated model are shown in Figure 5.

It can be seen from Figure 5 that the error rate of prediction data of the integrated model is generally not different. On the contrary, the error rate difference between each group of the phased model is too large. There are also errors in the data predicted by the phased model, while there are no errors in the data predicted by the integrated model. The embodiment of the prediction error rate of the data can better show the stable performance of the system. It is worth noting that the network method of time series data prediction error proposed in this paper mainly uses the periodicity principle of data. Therefore, the dynamic system is not limited to processing data in network big data. The above experimental results also show the high efficiency and accuracy of the model prediction data and reduce the occurrence of data misjudgment. The error of accurate prediction data can complete the error data, and the influencing factors and change trend of college students' mental health can get more accurate results.

5. Conclusion

Modeling and design of time series data represent one of the key technologies to promote future development. Only by using the transformation rules of relevant network time series data under big data can the dynamic system under big data achieve efficient operation of data processing. This paper uses time series data modeling technology to study the influencing factors and change trend of college students' mental health. In the network scenario for big data, a data missing value completion algorithm is added to the system. The experimental results show that the designed big data dynamic model shows excellent system performance when completing random and continuous missing data, reduces the difficulty of addition, and increases the system processing speed. Based on the above research on the system and data, this paper also adds a method to predict the error of data. It mainly predicts the time series data of deep clustering in the system, including two contents: deep clustering and deep prediction. Experimental results show that the addition of the algorithm can make the system run efficiently in the face of large-scale datasets. Through the above addition of system functions, the whole big data dynamic system has high application value. However, this paper also needs to simulate and verify the proposed big data dynamic model. Therefore, in the future research, this paper also needs to further consider the actual data application effect of the research.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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