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Research Article

Research on Data Analysis of Digital Economic Management under the Background of Big Data

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In order to study the application of big data in the field of digital economy, data management improves the needs of business model to a certain extent and responds to the pace of rapid development of science and technology and the transformation of business model in special times, so as to promote economic development. Based on the information extracted from the software system log, this study introduces machine learning algorithms such as spatial convolution and fuzzy multicolumn convolution, deduces the interaction between visitors and software according to the system software access log, wavelet algorithm, and denoising algorithm, deduces the data value index of the secondary market, constructs the simulation software under Matlab, and compares it with the previous system, By improving the prediction sensitivity of interaction and the prediction coupling of data value, it is confirmed that the system improves the efficiency of data management, so as to achieve the purpose of digital economic management and promote economic development and progress.

1. Introduction

In recent years, with the development of computer science and technology, big data has become a new type of technological reform. In the process of scientific and technological innovation, it has subverted the conventional technical mode and broken the dilemma that traditional technology is difficult to develop sustainably.

When big data was used to describe network search in the early days, it needed to process or analyze a large number of data. It was a hot subject in academic and computer research at that time. In subsequent related data research, such as data warehouse, data security, data analysis, and data visualization, it has become the focus of various fields.

McKinsey, a world-renowned consulting firm, was the first to define "big data": data has penetrated into every industry and business functional field and become an important production factor. People's discussion and application of large quantities of data indicate the emergence of new production initiatives and the change of new consumption concepts.

The enterprise's operation mode changes with the development of the times. How to face difficulties in special times and the transformation of operation mode brings more vitality to the enterprise. Taking the retail industry in the epidemic situation in 2019 as an example, this paper describes the forced transformation of the retail industry, the use of big data technology to convert the previous offline sales to online sales, and profound changes have taken place through the operation mode and consumption mode, so as to seek a breakthrough for enterprise development [1]. Digital economy is the concept of economics. It is a process in which human beings integrate resources directly or indirectly through big data to make them play a role, so as to promote economic development. In this paper, the role of "blockchain + big data" is to promote the transformation of old and new economic models, as well as major reforms in economic operation and daily life style, so as to achieve the purpose of improving the level of national economic development [2].

Russia is a country with more land and fewer people and has land advantages. This paper analyzes the data of global agricultural development, puts forward the digital agricultural system, establishes the relationship between its elements and the external environment, and develops a

private method to implement major adjustments to agricultural planning and evaluate the economic efficiency and risks brought by the digital innovation and development of regional crop production [3].

The digital economy has attracted worldwide attention, and foreign countries have also applied the digital economy to various fields. This is because the traditional management is not perfect in data application, resulting in incomplete information collection in all aspects, which can only be managed manually, resulting in backward management of the overall system. After integrating the information through big data, the required data can be extracted. It can more accurately solve the needs of enterprises.

With the popularization and application of big data, digital economy has become the driving force of global economic development, promoting the transformation of human economic form and reducing social transaction costs. Starting from the international environment, this paper analyzes the development direction and benefits of some important international organizations in the field of digital economy, so as to analyze the current situation of China's digital economy development and make progress from all aspects. This paper demonstrates and puts forward some suggestions to promote the development of China's digital economy [4]. Sadyrin et al., national economic transformation, proposed the application of digital technology to enterprise economic activities. The application of big data technology in digital economy has involved many financial fields. This paper discusses how to effectively use big data in financial analysis and apply big data to various management decisions to effectively improve its efficiency [5].

The application of big data not only breaks the disadvantages of conventional models, leads enterprises to open up new business models, promotes economic development, but also improves decision-making efficiency [6]. This study deduces the data value index of the secondary market according to the information extracted from the software system log, deduces the interaction between the visitor and the software according to the system software access log, as well as the wavelet algorithm and denoising algorithm, and realizes the purpose of economic management with a new model.

2. Structure and Evaluation Logic of Digital Economy Market

The emergence of big data has been applied to physics, biology, environmental ecology, and other fields, as well as finance, communication, military, and other industries. However, it has been paid more attention because of the development of the Internet industry in recent years [7].

Many people do not know what digital mode is. It refers to the form of promoting the development of economic structure by using digital knowledge and information as the main body, high-tech information network as the carrier, and information and communication technology as the means to improve efficiency [8].

According to the white paper, in 2017, China's total digital economy was more than 28 trillion yuan, with a year-on-year nominal growth of nearly 20% and a GDP ratio of more than 30%. It shows that this economic model has become the driving force to promote China's economic growth in recent years [9]. In the long run, when the proportion of digital economy GDP will exceed 50%, China will fully enter the era of digital economy [10].

If the digital sharing interactive system is regarded as an economic system, the natural person participants in the economic system, in addition to the data manager, only include two roles: visitors to the software platform software and traders in the big data asset secondary trading market. Visitors obtain relevant data information through software and trade in the secondary market through resource integration, so as to achieve benefits. The whole architecture is to collect, store, extract, manage, and analyze large-scale data, so as to obtain relevant information efficiently and quickly.

In Figure 1, visitors obtain information through the software system or exchange information through the software system, and the relevant information data are stored in the software background. The interaction volume and price can be fed back from the access log. After data analysis and processing, these data can provide reference value for the operation of enterprises and provide services for their circulation and transaction in the subsequent secondary market, so as to realize digital data management. Wavelet transform is the process of de quantization. Different units are transformed and compared.

The footprints left by visitors on the software platform form an access log. A large amount of data can be obtained according to the access log information. After processing, it is related data assets and resources that can be circulated in the secondary market. The main reference object of this research is access log, and even the whole research is carried out around access log.

2.1. Deduce the Interaction between Visitors and Software according to the Access Log. The access log mentioned above is the main core of the whole research. The access log left on the software system is the key of the whole architecture and the core of the management of digital economy. The correlation between access log and output can be deduced through the following formula.

The evaluation mode of interaction between visitors and software is deduced according to the access log, as shown in formula (1):

$$X_i(t) = \gamma_T \bullet T_i + \gamma_S \bullet S_i(t) + \gamma_P \bullet P_i(t) + \gamma_G \bullet G_i(t). \quad (1)$$

Among them, $X_i(t)$ is the weighted result of data trigger amount of user I at time t; $S_i(t)$ is data submission amount of user I at time t (submit method); $P_i(t)$ is the amount of data logs of user I at time t (post method); $G_i(t)$ is the data usage of user I at time t (get method); T_i is the other data trigger amount of user I at time t: γ_T, γ_S, γ_P, and γ_G are weighting factors of the above four evaluation factors.

In the actual economic treatment, the equation needs to be processed by linear integration after accumulation, as

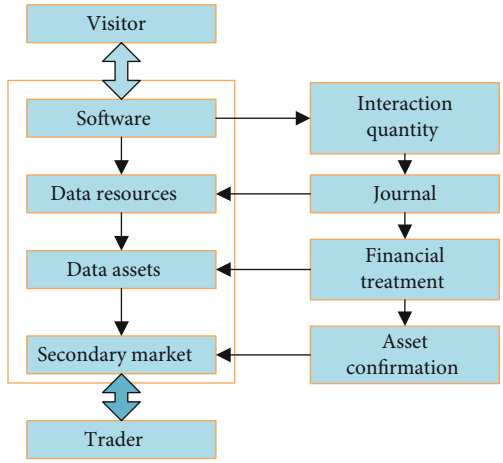

Figure 1: Structure of digital economy market.

shown in formula (2):

$$S_X = \int_m^n \sum_{i=1}^{r} X_i(t)dt. \tag{2}$$

Among them, S_X is the access log evaluation factor; m, n is the time period threshold of integral function; r is the number of users investigated by the integral function. The meanings of other mathematical symbols are the same as those above.

According to the above principles, machine learning algorithms such as spatial convolution and fuzzy multicolumn convolution are introduced to push forward the time t axis for a certain period to form multiple interaction prediction values based on depth Iterative Regression from T1 to TN. the algorithm logic is shown in Figure 2.

As shown in Figure 2, the basis function of the spatial convolution algorithm is shown in formula (3); the node function of FNN fuzzy neural network selects the sixth-order polynomial depth Iterative Regression basis function, as shown in formula (4); the node function of multi column fuzzy neural network selects the logarithmic depth Iterative Regression basis function, as shown in formula (5).

$$y = \int_{-\infty}^{+\infty} g(x)q(t-x)dt. \tag{3}$$

Among them, $g(x)$ is the convoluted array function; $q(t-x)$ is the convolution kernel function; t is the convolution pointer; x is the convolution control variable; y is the convolution result.

$$y = \sum_{i=1}^{n}\sum_{j=0}^{5} A_j x_i^j, \tag{4}$$

$$y = \sum_{i=1}^{n}(A\bullet\log_e x_i + B) \tag{5}$$

Among them, x_i is the input value of the ith node of the previous neural network; y is the output value of this node; n is the number of nodes of the previous neural network; A and B are variables to be regressed, which refer to the variables to be regressed of the jth-order polynomial.

In the figure, the user's access log in a certain period is analyzed, and the machine learning algorithms such as spatial convolution and fuzzy multicolumn convolution are introduced to predict the interaction between the visitor and the software. This study is mainly aimed at the impact of data management on the economy and deduces the interaction volume and price trend of a product through the data obtained from the access log.

2.2. Deduce the Data Value Index of the Secondary Market according to the Interaction Volume Data. The interaction volume data is the total information production of the network platform. The correlation between the interaction volume data and the data value index of the secondary market is subtle. If they are intuitive and lack a direct logical relationship, but after denoising, it is concluded that the data signal-to-noise ratio is very low, the data value index of the secondary market can be deduced according to the interaction volume.

In Figure 3, wavelet transforms the interactive data, refines the data through translation, and pulls back the curve deviated from the original axis, which can finally meet the analysis requirements by itself. After the difference noise reduction, the unavailable information is eliminated to obtain a credible correlation function. Due to the complexity of the information obtained, it is necessary to convert different units when comparing. Wavelet transform is a dimensionless process and a new transformation analysis method.

In the actual data processing, the lightweight data processed by wavelet transform can form the characteristic matrix through Fourier transform. At the same time, the original data needs to be Fourier transformed to form the original characteristic matrix, so as to provide sufficient data to be measured for the subsequent fuzzy neural network.

Daubechies (DBN) wavelet is adopted for wavelet transform, and its basis function is as follows: (6)–(8):

$$p(y) = \sum_{k=0}^{n-1} C_k^{n-1+k} y^k, \tag{6}$$

$$C_0(\omega) = \frac{1}{\sqrt{2}}\sum_{k=0}^{2n-1} h_k e^{-jk\omega} = \sqrt{\left(\cos^2\frac{\omega}{2}\right)p\left(\sin^2\frac{\omega}{2}\right)}, \tag{7}$$

$$\psi(y) = \int p(y)p(t-y)dt. \tag{8}$$

Among them, n and k are the pointer variables; y is the controlling dependent variable; ω is the transformed periodic dependent variable; $\psi(y)$ is the final function of wavelet transform; $p(y)$ is the wavelet transform control function; C is the wavelet transform factor function; e is the natural constant.

In the process of denoising, unnecessary data are processed, and queue interference factors can better obtain

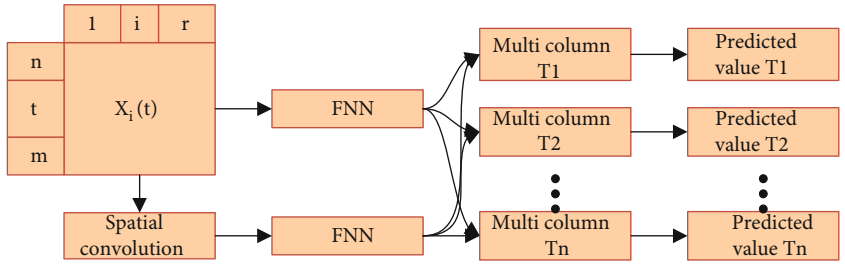

Figure 2: Logic diagram of data prediction algorithm.

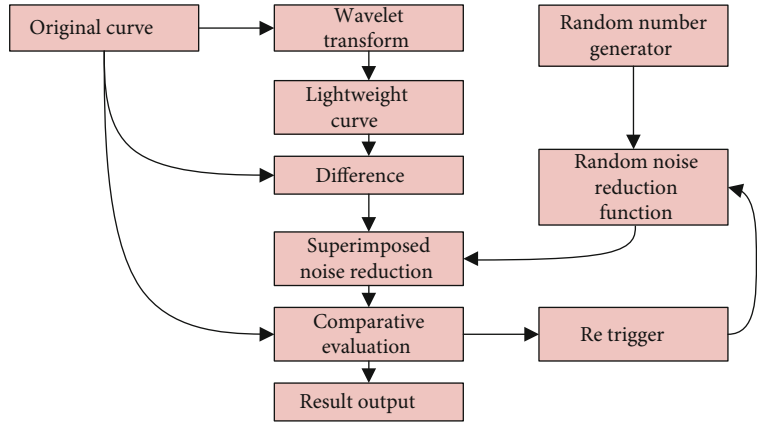

Figure 3: Logic of generation algorithm of transaction price estimation curve in secondary market.

high-quality data, so as to provide guarantee for subsequent analysis of data.

The generation algorithm of random noise reduction function is shown in formula (9):

$$\Delta F(x) = \rho_A \bullet \text{Rand} \bullet \text{Sin}(\rho_B \bullet \text{Rand} \bullet x + \rho_C \bullet \text{Rand}) + \rho_D \bullet \text{Rand}. \tag{9}$$

Among them, Rand is the random numbers with interval on [0,1]; ρ_A, ρ_B, ρ_C, and ρ_D are the interval adjustment factors of random number; x is the independent variable; $\Delta F(x)$ is the dependent variable.

The algorithm of noise reduction process is shown in formula (10):

$$F_S(t) = X_i(t) - \psi(y) + \Delta F(x). \tag{10}$$

Among them, the meaning of mathematical symbols is the same as that above.

In the formula, the dependent variables include different data structures such as t, y, and X. However, according to the conversion method of the previous formula, all dependent variables can be normalized and isomorphic, which is limited by space. Its processing method is not discussed here. Through the comprehensive use of wavelet transform, random waveform superposition noise reduction, and cyclic learning, data analysis with high coupling degree can be realized under the condition of data relationship with low signal-to-noise ratio. Because the data prediction algorithm designed in Section 2.1 has fully expanded the independent variable function, the coupled dependent variable function can realize the follow-up expansion, so as to realize the data prediction analysis based on curve estimation algorithm.

3. Algorithm Effectiveness Evaluation

The simulation software is constructed under Matlab, and the data prediction module of digital economic management information system is constructed based on the algorithm. The data prediction module of digital economic management information system supported by more mature nonlinear overall planning algorithm for complex systems in the technical market is selected with reference to the group, and the data performance of the two is compared.

3.1. Prediction Sensitivity to Interaction. Interaction refers to communication and interaction. It is built on a software system platform for sharing resources, information, or services or for mutual communication between the software system platform and users and between users and users, so as to obtain more ideas and meet some needs among users. The amount of interaction refers to all information data on the network platform.

Through the real-time interactive data of Guiyang big data asset exchange and the log data of five big data systems investigated, the software system access log records all data information of the software platform, extracts and analyzes the data information in the access log, and introduces machine learning algorithms such as spatial convolution

Table 1: Comparison of prediction sensitivity of data interaction volume of software platform (the data source is the real-time interactive data of Guiyang big data asset exchange).

Sensitivity	Submit data	Post data	Get data	Other data	Comprehensive
The system	96.32%	88.76%	92.41%	85.42%	90.74%
Previous system	90.21%	84.43%	85.38%	81.87%	85.47%
T	5.28	8.12	6.48	5.87	4.58
P	0.009	0.007	0.008	0.007	0.008

Table 2: Comparison of predicted coupling degree of software data asset value (the data source is the real-time interactive data of Guiyang big data asset exchange).

Coupling degree	Data inflection point	Opening value	Closing value	Peak value	Valley value	Comprehensive
The system	85.14%	78.65%	84.26%	92.45%	90.23%	86.15%
Previous system	78.23%	70.41%	77.56%	83.79%	80.96%	73.47%
t	4.75	5.12	6.29	5.08	4.17	5.24
P	0.008	0.007	0.009	0.008	0.006	0.007

and fuzzy multicolumn convolution to inverse the interaction between visitors and software. The reference group selects the data prediction module of the digital economic management information system supported by the more mature nonlinear overall planning algorithm for complex systems in the technical market and observes its prediction sensitivity to the interaction volume of the access log on the software.

In Table 1, bivariate t-test was conducted for two different systems, and it was found that $T < 10.000$, $P < 0.01$, with credible statistical difference; T value is the value in the output result of bivariate t verification. When $T < 10.000$, it is considered that there is a statistical difference between the two columns of data, and the smaller the T value, the more significant the statistical difference is. When $P < 0.01$, it is considered that the statistical result has a significant statistical difference, and the smaller the P value, the more significant the statistical meaning is. It shows that the system is different from the previous system, and the system improves the sensitivity of interaction prediction.

In order to more intuitively reflect the prediction sensitivity of the upper system log data to the interaction volume, visualize the data in Table 2 to get Figure 4.

In Figure 4, sensitivity refers to the proportion of all true positive data in all positive data. Although the difference between this scheme and the previous system algorithms is not great, the prediction sensitivity of the overall interaction volume is relatively satisfactory. Among them, the prediction sensitivity of submit data reaches more than 96%. Today's Turing test standard, neural network has more than 95% sensitivity, that is, its machine learning ability has fully met the needs of data management. These data can provide reference value for enterprises in operation and provide services for circulation and trading in the subsequent secondary market.

3.2. Prediction Coupling of Data Value. The data source is the real-time interactive data of Guiyang big data asset exchange and the log data of five big data systems investigated. The data cycle is from January 2019 to June 2021. In a three-and-a-half-year data cycle, analyze the data within a certain time limit and explore the prediction coupling degree of software system log to data value.

As shown in Table 2, bivariate t-test was conducted for different systems, and it was found that: $T < 10.000$, $P < 0.01$, with believable statistical difference. It shows that the system significantly improves the prediction coupling degree of software data asset value on the basis of the previous system. The data obtained from the software system log not only has high sensitivity to the prediction of interaction volume, but also has a certain correlation to the coupling degree of software data asset value prediction, so as to improve the accuracy of software data asset value.

In order to more intuitively reflect the prediction coupling degree of the upper system log data to the value of software data assets, visualize the data in the table to get Figure 5.

In Figure 5, after the influencing factors in the data are removed through the wavelet exchange algorithm, the data more conducive to the research is obtained. Through the data, the software data asset value is predicted to obtain a higher coupling degree, which is conducive to the analysis of big data and improves the efficiency of data management.

4. Summary

Now China's scientific and technological level has entered a stage of rapid development. The changes of the times have led to the transformation of economic model [11]. In recent years, the traditional economic model has gradually declined, and the changes of market environment and business mode have promoted the reform of economic system. The cross-border integration of Internet information data on major data industries and the innovation of application technology data have promoted the development of digital industry and produced relevant big data background. It

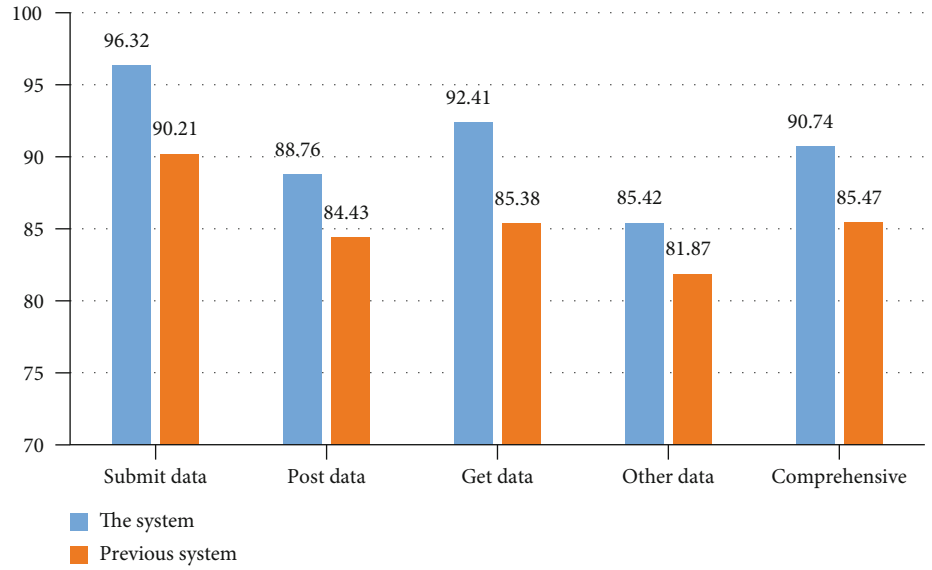

Figure 4: Visual diagram of prediction sensitivity of data interaction volume of software platform.

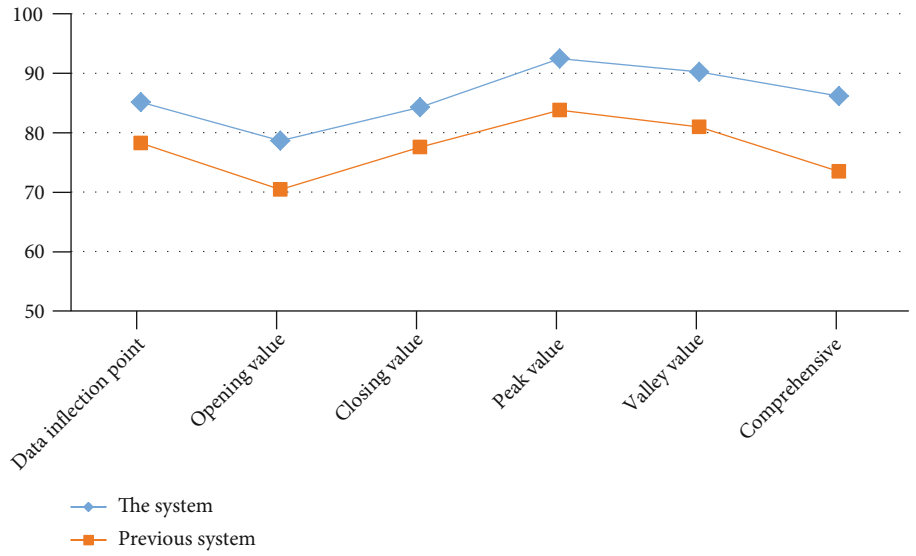

Figure 5: Visual diagram of prediction coupling degree of software data asset value.

can systematically manage scattered data, facilitate people's real life, and improve management efficiency. Quan et al., starting from the demand relationship, demonstrate the data and digital infrastructure, introduce the characteristics of digital economy, and analyze the prospect of digital economy in the future from many aspects [12].

The application of big data information management is changing the traditional life mode and business philosophy, realizing the integration and docking of digital information technology in many aspects, and promoting the development of big data information management into a new stage [13]. In recent years, the management of big data has received unprecedented attention in various fields. Only by fully mining the value trend of big data management, predicting the feasibility of big data management, and formulating effective schemes for implementation can we really transform data management into the practice of digital economy [14].

The research extracts the prediction sensitivity of software interaction volume through the software access log. The extraction of data is helpful to analyze the economic management data [15], convert the data into resource information, provide reference value for the operation, circulation, and transaction services of enterprises in the subsequent secondary market, and convert the data information into knowledge reserve and intelligent production, so as to achieve the purpose of promoting economic development. At this stage, the research of logarithmic digital economic management data is still at the level of attempt. Therefore, we need to comprehensively improve the foundation of

digital management, deeply tap and release the potential of digital economy, wait for scientific and technological progress, and further develop the application of big data in economic management.

Data Availability

The data underlying the results presented in the study are available within the manuscript.

Conflicts of Interest

There is no potential conflict of interest in our paper.

Authors' Contributions

The author has seen the manuscript and approved to submit to your journal.

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