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Design and Analysis of a Rural Accurate Poverty Alleviation Platform Based on Big Data

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ABSTRACT
Poverty alleviation has always been the focus of China's work. According to the survey, the poverty population in rural areas has been reduced to a large extent, and the unemployed have had the lowest historical record in history. Big data technology is a new technology that has slowly emerged in recent years. The use of big data technology to create a visual platform for rural poverty alleviation is a relatively new idea at this stage. And we use the Map-reduce-based big data missing value filling algorithm, which is designed to solve the data loss phenomenon in the query process. It greatly improves search quality and improves a series of problems in the current platform for accurate poverty alleviation and visualization.

KEY WORDS: Big data technology; missing data filling algorithm; rural poverty alleviation platform

1 INTRODUCTION

THE national policy of precision poverty alleviation is a basic national policy of Xi Jinping's general state policy, which is in line with China's basic national conditions and for the sake of farmers (Liu Y et al 2016). The introduction of this national policy will not only help improve the living standards of working people in China, but also have an important influence on the implementation of policies such as the One Belt and One Road in China (Zhou K et al 2016). After this basic national policy was put forward, all walks of life and the people's governments at all levels responded actively. The tasks assigned by the higher people's government were effectively completed, and the work efficiency of the lower-level people's government was improved. It laid a solid foundation for effective and successful completion of this basic national policy (Jin J et al 2017). Especially in recent years, as the precision poverty alleviation policy had been going on for several years, the performance appraisal on precision poverty alleviation is in full swing. However, this performance assessment is only in the macro aspect. Although the investigation department will also conduct investigations in practice, this investigation does not form a good negative feedback mechanism. According to the results of the investigation, the effective improvement of future work is a code of conduct that all walks of life have followed. However, in the work of the precision poverty alleviation, this practice has not been well inherited. This is mainly due to the lack of a complete platform to carry out this negative feedback mechanism (Wen-Bo YU et al 2017). On the other hand, on the assessment work of rural poverty alleviation, these tasks have been able to use the relevant systems and software for simulation and actual assessment at the current stage. This has greatly reduced the work of the staff in practice and reduced the staffing of the assessment staff. The assessment work has brought great convenience (Luo CL et al 2018). Therefore, establishing a rural poverty alleviation platform based on big data is not feasible under the current technology level and the answer would be yes, and this work is highly feasible (Zhang Q et al 2017).

Based on the shortcomings of our country's accurate visualization platform for poverty alleviation in rural areas at present, relevant scholars in China have conducted relevant research. However, in the practice of precision poverty alleviation, it is known that there are many factors that help poverty-stricken families return to poverty, and the final result is also tragic. What's more important is that some of these factors cannot be quantified specifically. What we are doing is reducing the probability of such a result from the macroscopic aspects, but the importance of starting from the root is ignored (Bo P et al 2016).

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The specific contributions of this paper include: A literature survey about various existing missing data on filling algorithms, and to analyze their advantages and disadvantages. An effective Map-Reduce to missing data filling algorithm is proposed. The main functions of the rural poverty alleviation platform were analyzed and designed. The occurrence of errors is effectively avoided by this algorithm and platform. The accuracy of poverty alleviation is greatly improved and great contributions to precision poverty alleviation is made.

The rest of this paper is organized as follows: Section 2 discusses related work, followed by the Map-Reduce algorithm to fill the missing value algorithm of big data and the rural precision poverty alleviation platform based on the Map-reduce big data missing value filling algorithm is designed in Section 3. Experimental results and result analysis of the algorithm are arranged in Section 4 and Section 5 concludes the paper with a summary and future research directions.

2 RELATED WORKS

THIS paper uses a Map-Reduce-based algorithm for filling missing values of big data. This algorithm can reduce the loss value in a user behavior detection, and it not only has a positive feedback mechanism, but also has a negative feedback mechanism. This platform not only has an effective perception of the agricultural product trading market, but also can work with companies to recommend poor people's intelligence to their appropriate work (Tang L et al 2017). This will set the wings for the construction of a rural poverty alleviation platform. Big data technology is used to realize the daily behaviors of poor households and the daily behaviors of poor households are detected. Poor households are avoided to return to poverty for some avoidable reasons (Yuan J et al 2017).

Big data technology is an emerging and advanced technology. We divide the poverty population in the four regions and into seven different groups based on individual needs. Then we perform distributed computing to calculate the behavior of the poor. This paper considers the use of big data technology to create a visual platform for rural poverty alleviation. We choose a big data missing value filling algorithm based on the Map-reduce. After experimental verification, the algorithm can improve a series of problems in the current platform, solve the data loss phenomenon in the query process, and achieve accurate poverty alleviation.

The Map-reduce based missing data filling algorithm is based on the Map-Reduce used in this paper. This algorithm not only has a good error data repair function, but also has the function of reducing false data. It shows good performance in the platform studied in this paper (Staub B et al 2017).

3 METHODOLOGY

3.1 Design and Analysis of the Rural Accurate Poverty Reduction Platform based on the Map-reduce Big Data Missing Value Fill Algorithm

FROM the above sections we know that the precise poverty alleviation work has now reached its most difficult period. This is mainly manifested in the fact that many poverty-stricken households who have been lifted out of poverty are returning to poverty. The main reason for this problem is the lack of means to detect the daily behavior of the poor households. In this difficult period of precision poverty alleviation, the use of information methods to establish a precision poverty alleviation platform in rural areas is a very important task. In the research of this paper, the Map-reduce-based big data missing value filling algorithm, which is an algorithm that can avoid false values is used in the actual detection. The main function of this algorithm has two aspects. First, it can effectively detect user data. This detection can detect the user's daily behavior data and fill in the missing data in the user data, effectively avoiding the wrong value in the collected data. Another major function is to make mistakes that are worth correcting. This correction is a positive feedback mechanism. First, the algorithm uses the previous data to predict the trend of later basic data. Then the detection system is used for testing. Self-correction after detection of errors is done to automatically to correct the error value. In addition, in the design process of this platform, we have referenced a lot of already-designed platform designs. The design of these platforms has a great reference for the design of our rural poverty alleviation platform. This data has also been collected and organized. The table below shows the two typical platforms for rural poverty alleviation:

From the design and analysis of the above-mentioned two typical comparatively accurate poverty alleviation platforms in rural areas, we can clearly see that the coverage areas of the two platforms are very different, which in turn leads to great differences in the design functions of the two platforms. From the above table, since Guizhou is in the Yunnan-Guizhou Plateau, there are many jungles and mountainous areas, and traffic is not very convenient. Therefore, many rural populations are engaged in agricultural activities following the change of the seasons, when the weather is not good, and they will have no surplus food at home, like the 2008 snowstorm. The impact of this natural disaster is very significant for the rural population. Therefore, the technical composition of precision poverty alleviation in rural areas in Guizhou has the cloud computing and GIS systems. The GIS system is a geographic information system that enables real-time detection of climate and enables

Table 1. Two typical Platform Designs for Accurate Poverty Alleviation in Rural Areas.

Province	Subsystem composition	Technical composition	Platform function	Application function
Guizhou	Flipchart operations, precise management, precise helping,	Cloud computing, GIS	Data collection and data analysis	Control and dispatch of poverty relief and fund supervision of project
Gansu	The object of poverty alleviation, the measures of poverty alleviation, the effectiveness of poverty alleviation,	Mobile terminal, Internet plus	Data collection and statistics	Participatory poverty alleviation project reporting,

effective prediction of future climate. This system can be effectively combined with mobile terminals, which means that the general public can also use this information system for effective agricultural activities and bring great convenience. Looking back at Gansu's rural poverty alleviation platform, this platform uses the Internet+, which is very suitable for such places as Gansu rural areas. Farmers use the Internet+ function to conveniently sell their own agricultural products on the Internet and then carry out logistics transactions, which brings great convenience to farmers. Moreover, this platform has a function to display the effectiveness of the poverty alleviation, and it can be used as a reference for people to push more successful cases on the Internet and mobile terminals, which has a very high reference value.

The design and analysis of the rural poverty alleviation platform based on the Map-Reduce-based missing data filling algorithm mainly consists of the platform functional design, platform design, and push interface design. The design and analysis of the rural poverty alleviation platform based on the Map-Reduce-based missing data filling algorithm is composed of the following parts. The first is the design of the platform function. The functions of the designed platform are mainly composed of the following components: (1) Precise identification of poor households. At this stage, the identification of poor households is done by human resources. This practice not only has a huge workload in actual work, but also requires a long time for identification. Moreover, in practice, it is very easy for private staff of government workers to cause the phenomenon of non-impoverished households to the impoverished poverty. The platform designed in this paper includes employment, education, and basic information of poor households. We use the Map-Reduce-based big data missing value filling algorithm to perform distributed computing on this information, and then enter the calculated data into the database. The information on personal information, fixed assets, and bank deposits of poverty households is compared with poverty standards. Those who meet the requirements can be classified as poor households. In addition, the Map-Reduce-based missing data filling algorithm can fill in the blank data generated in the distributed computing in advance to prevent the generation of erroneous data and improve the stability of the platform. (2) Behavior and poverty alleviation demand forecast. The platform designed in this paper can predict the behavior of poor households. Its negative feedback mechanism can promptly remind the poor households of the possible consequences of the current stage of the behavior, plays a good role in monitoring their behavior to the greatest extent to avoid the phenomenon of poor households returning from poverty. In addition, this platform can be used to forecast poverty alleviation needs based on personal information provided by poor households and they have been audited. This forecast can increase the pertinence of help and reduce the causes of poor individuals' personal ability during the support process. The second issue is platform design. The rural poverty alleviation platform designed this time mainly consists of three parts: (1) The data layer. This level is at the database level. Our information in practice and in the government's personal information database is stored there. In addition to this known information, we will also allow poor households to input their own employment orientation to conduct a two-way selection between poor households and enterprises. (2) The analysis layer. We effectively compare this information with the needs of the company. Then, by synthesizing the degree of fit between the two directions, a two-way match of the needs of the poor households and the enterprises will be carried out in an attempt to increase the degree of integration between individual needs and business needs. The third is the design of the push interface. In this design, we also need personal terminal equipment so that the information on our platform can be easily transmitted to each poor household. This pushed information mainly includes cases in which poverty-stricken households have succeeded in getting rid of poverty, and there are also some specialized technical exchange methods. We believe that getting rid of poverty and getting rich also depends on education. We will organize evening schools and other schools for them to study for free. Then some more practical things to help them will be taught to accumulate technology. The specific flow chart of design and analysis of Map-reduce-based missing data filling algorithm for rural poverty alleviation platform is shown in Figure 1.

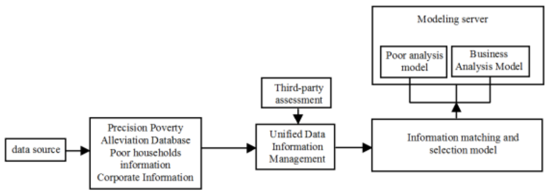

Figure 1. Design and Analysis of a Rural Precision Poverty Alleviation Platform based on Map-reduce based Large Data Missing Value Filling Algorithm.

3.2 Design and Analysis Formulae of Rural Precision Poverty Alleviation Platform based on the Map-reduce Algorithm for Filling Missing Data of Big Data

The above is the specific platform design part of the design and analysis of the rural poverty alleviation platform based on the Map-reduce algorithm for filling missing values of big data. The next part is the design and analytical formula calculation of the rural precision poverty alleviation platform based on the Map-Reduce-based missing data filling algorithm. The following is the specific formula calculation process:

The Bayesian network is a directed acyclic graph, where each node represents a variable. The directed edge between the two points represents the causal relationship between variables.

$$p(x_1, x_2, ..., x_n) = \prod_{i=1}^{n} p(x_i | \pi(x_i)) \quad (1)$$

In the above formula, π is the parent node set and x is the parent node. Probabilistic reasoning is the process of estimating unknown information from information with probabilistic properties. The value of the query variable is:

$$q^* = \arg\max P(Q = q | E = e) \quad (2)$$

In the above equation, q is the value of the query variable. For all given variables, there are equations:

$$P(X, Y | Z) = P(X | Z) \times P(Y | Z) \quad (3)$$

From the above formula, it can be exported that:

$$P(X | Y = y, Z = z) = P(X | Z = z) \quad (4)$$

In the above formula, P is a probability value, and x, y and z are three directions in space. According to the above formula, the goal of inference is to find the value that gives the following equation the maximum value q:

$$P(q_i | E) = P(q_i | e_1, e_2, ..., e_m) \quad (5)$$

In the above equation, q is the value of the query variable, e is the data, and E is the data set. Then the reasoning problem is transformed into the maximum value obtained by the following formula:

$$P\left(q_i \middle| \pi^{obv}(q_i)\right) \times \prod P\left(q_i \cup \pi^{obv}(ch)\right) \quad (6)$$

In the above formula, π^{obv} represents the set of parent nodes whose variable x is known in the Bayesian network. Figure 2 shows the coupling mechanism of industrial poverty alleviation planning:

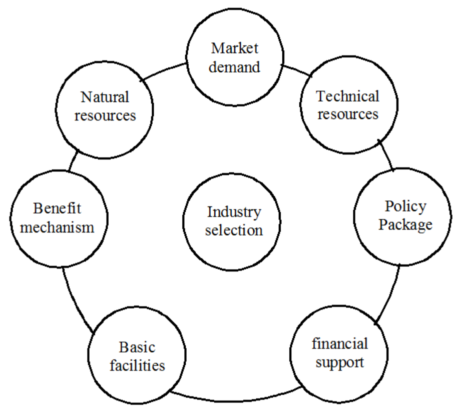

Figure 2. The Coupling Mechanism Chart of the Industrial Poverty Alleviation Plan.

The key to inference filling lies in the calculation of the conditional probability table and the inference of each missing record. The data needs to be traversed. When the data volume is large, the serial processing speed is very slow, especially when the calculation of multiple probability tables is involved. It is not realistic to put these probability tables all into memory for reasoning and filling. Probability reasoning on the Bayesian networks is the use of the independence of conditions between variables to greatly reduce the computational complexity of reasoning. All nodes in the network are independent of all non-descendant nodes given the parent node. When the Markov boundary of a node is known, including the parent node, the child node, and the parent node of the child node, the node condition is independent of other nodes in the network. This conclusion helps us to select relevant ones from multiple evidence variables for the reasoning analysis. We extract the parts that can operate in parallel from the algorithm. Table 2 shows the test table for the robustness and calculation time of this algorithm:

Table 2. Robust and Computation Time Test Table for the Large Data Missing Value Filling Algorithm based on Map-reduce.

Group	Algorithm robustness	Algorithm time
A	31	0.21S
B	49	0.32S
C	63	0.52S
D	74	0.67S

From the above table, it can be clearly seen that our proposed Map-reduce-based big data missing value filling algorithm is very robust. This is because we optimized the algorithm in the later design process. After combining the advantages of the missing values of the big data with the advantages of the algorithm, the disadvantages are also correctly handled, which reduces the probability of its algorithm crash. In addition, we have also improved the calculation time of the missing-value-filling algorithm for the big data, which has changed the problem of the long calculation time of the missing-value-filling algorithms for the big data.

4 RESULT ANALYSIS AND DISCUSSION

AFTER completing the above-mentioned process of designing and analyzing the platform of the rural poverty alleviation platform based on the Map-reduce-based missing data filling algorithm, the platform and algorithm in this section need to be tested. We first test the platform and the results are shown in Table 3.

Table 3. Design and Analysis Platform Test Table of the Rural Precision Poverty Alleviation Platform based on the Large Data Missing Value Filling Algorithm based on Map-reduce.

	Contrast accuracy	Degree of convenience
Area A	89%	7.83
Area B	92%	8.54
Area C	91%	9.22

The ccontrast accuracy of areas A, B, and C of the rural precision poverty alleviation platform test platform based on the Map reduce big data missing value filling algorithm is shown in the Figure 3.

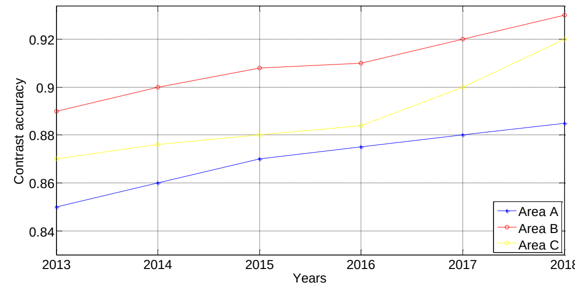

Figure 3. Ccontrast Accuracy of the Areas A, B, and C.

The degree of convenience of areas A, B, and C of the rural precision poverty alleviation platform test platform based on the Map reduce big data missing value filling algorithm are shown in the Figure 4.

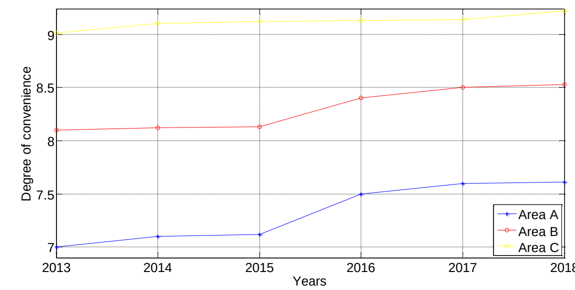

Figure 4. Degree of Convenience of the Areas A, B, and C.

As shown in the above table, we have selected four regions for testing during this study. The climate, environment, and poverty levels in these areas are not the same or similar. The main reason for this setup is that we want to promote it nationwide. As can be seen from the above table, the selection of the four regions in our selection of platforms for the poverty-stricken households' accuracy and convenience has achieved our requirements. We then carried out statistics on the behavioral information of poor households. The statistical results are as follows:

As shown in the above diagram, we have divided the poor population in the above four areas into seven different groups based on individual needs. Then the Map-Reduce-based big data missing value filling algorithm is used to perform the distributed calculations to count the behavior of the poor. The above statistics show that our algorithm works stably. The correctness of the calculation of large quantities of information can be guaranteed, and there is not a large range of program fluctuations when calculating a large amount of information. This proves that the performance of the algorithm we choose can be guaranteed. Next, the above seven groups of the users behavior information is analyzed. The analysis results are shown in the Figure 6:

The error comparison between the traditional method and the method in this paper is shown in Figure7.

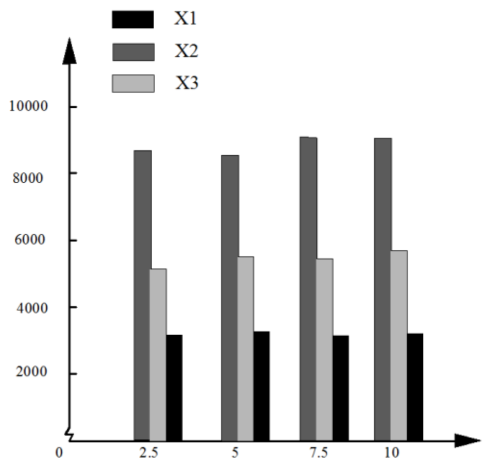

Figure5. Information Statistics Table for the Behaviour of Poor Households.

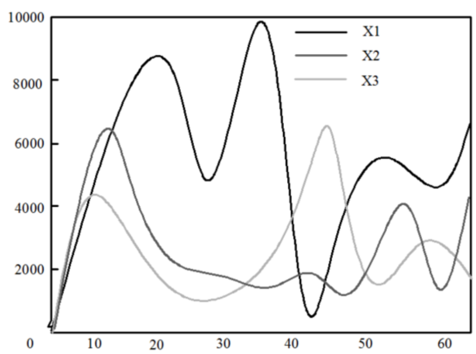

Figure 6. Users Behaviour Information Analysis Result.

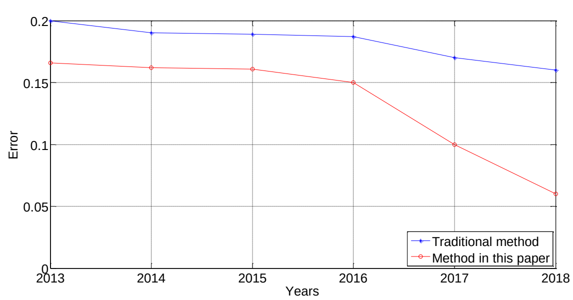

Figure 7. The Error Comparison between the Traditional Method and the Method in this Paper.

5 CONCLUSION

THE design and analysis of the rural poverty alleviation platform based on the Map-Reduce-based missing data filling algorithm mainly consists of the platform functional design, platform design, and push interface design. In the above tests, the precision poverty alleviation platform we designed this time is stable and reflects a great convenience. In addition, the Map-Reduce-based missing data value-filling algorithm in the design platform is highly efficient, and it effectively avoids the generation of errors. It greatly enhances the precision of poverty alleviation and truly allows users to integrate the big data knowledge. It is a very good algorithm to make the greatest contribution to the precision poverty alleviation. Accurate poverty alleviation work affects the lives and welfare of thousands of poor households in China and affects the process of socialist construction. As General Secretary Xi emphasized, the development of poverty alleviation has entered the sprint of "hard-bones, attacking and decisive". In less than three years, it is necessary to ensure that all poverty-stricken households are all out of poverty as scheduled. We can further use the big data technology in precision poverty alleviation, improving the entire poverty alleviation system, promoting the coordinated development of precision poverty alleviation work, and realizing a great Chinese dream!

6 ACKNOWLEDGMENT

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8 DISCLOSURE STATEMENT

NO potential conflict of interest was reported by the authors.

9 NOTES ON CONTRIBUTORS

Fan Bingxu works in the Research Center for Energy Economics, at the School of Business Administration. The research interest are management science, and agricultural economy.