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Evaluation of the Influence of "Village Super League" and "Village BA" on the County Economy of Hunan Province Based on Network Analysis and XGBoost Model

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Abstract: The "Village Super League" and "Village BA" can have an impact on the economic influence of counties in Hunan Province, but their evaluation accuracy and evaluation time still need to be improved. This study uses network analysis methods to analyze the connection and communication channels established between village level football and basketball leagues in counties. At the same time, the XGBoost model is used to evaluate the economic impact of counties participating in sports leagues and examine their performance in socio-economic indicators. This study has found that village level football and basketball leagues have played a positive role in influencing the county economy. Through experiments, it is found that the accuracy of the model in this paper is between 94% and 99%. We observe that these leagues promote the economic cooperation and resource flow between counties, and strengthen the contact and communication between regions.

1. Introduction

With the growing importance of sports in society, more and more places are beginning to realize the positive impact of sports activities on economic development. In China, village-level sports league, as a new form of sports activities, is regarded as an effective way to promote rural economic development and social progress. However, in the county area of Hunan Province, the specific evaluation and research on the economic influence of "Village Super League" and "Village BA" are relatively limited. Therefore, the purpose of this study is to use network analysis and XGBoost model to deeply explore the potential and role of these sports leagues to the county economic development in Hunan Province.

This paper uses network analysis and XGBoost model as research methods, which has important significance and value. XGBoost model, as a machine learning algorithm, can evaluate the economic impact of counties participating in sports leagues, providing us with accurate and reliable prediction results. By comprehensively applying these two methods, we can comprehensively understand the contribution of the "Village Super League" and "Village BA" to the economic influence of counties in Hunan Province, and provide scientific basis for local governments to

formulate relevant development strategies.

The structure of this paper is as follows: First, we will introduce the theoretical basis and method of network analysis, and describe in detail how to analyze the contact and communication of village football and basketball leagues in Hunan Province. Secondly, we will explain the principle and application of XGBoost model, and show how to use this model to assess the economic impact of counties participating in sports leagues. We will then present the results of the study, including the findings of the network analysis and the evaluation of the XGBoost model, as well as the interpretation and analysis of these results. Finally, we will summarize the main findings of the study, and discuss its implications for the development of county economy in Hunan Province and prospects for future research.

2. Related Work

Many scholars have done research on “Village Super League”, “Village BA” and economic impact assessment. Based on the sample data of listed companies in Shanghai and Shenzhen heavily polluting industries, Xie Qiaoxin carried out a quasi-natural experiment with the Green Credit Guidelines to investigate the incentive effect of green credit policies on enterprises' green innovation and the influence of enterprises' economic influence on the relationship between them. He found that green credit policy had a significant incentive effect on enterprises' green innovation [1]. As one of the big provinces, Heilongjiang Province has rich tourism resources, among which ice and snow tourism resources are extremely rich, and its ice and snow tourism resources have brought great benefits to the economic development of Heilongjiang Province. Ma Zhongquan made a detailed analysis and discussion on the economic influence of the ice and snow tourism industry in Heilongjiang Province [2]. Taking the collaborative governance of mass events as the research object, Chen Xiaohu discussed the collaborative governance of mass events under the background of sports and travel integration. Through the literature review method and case study method, he analyzed the organization and management mode and operation mechanism of Guizhou Village Super Tournament, and summarized the key elements of its collaborative governance. He found that Guizhou Village Super Tournament adopted the mode of cooperation between the government and multiple social entities, in which the government played a leading and supervisory role and the community and non-governmental organizations were important partners [3]. Taking the two events as the research object, Huang Xiong built the value chain model of "village BA" and "Village Super League" by drawing on Porter's value chain model, and then analyzed the core competitiveness of the event from the aspects of demand generation, organization and operation, policy conditions and cultural atmosphere. The value of the two events is mainly reflected in enabling the integrated development of the sports industry, boosting rural revitalization, and promoting the coordinated development of mass sports and competitive sports [4]. Lu Zhentian took "Village BA" and "Village Super League" in Guizhou, the success benchmarks of China's rural brand sports events in recent years, as examples, and extracted and analyzed the successful experience and practices of a sports event from the three main links: planning, organization and marketing, so as to provide reference for building other rural brand sports events [5]. Zheng L proposed the development path of combining rural sports with traditional national sports [6]. Li J studied the impact of changes in rural sports economy service model on rural sports economy service model [7]. Van Hoyweghen K assessed the direct and indirect effects of the addition and continuation of employment in rural areas on welfare [8]. Tutuba N B described the existing commercial ecosystem in rural areas and proposed a new commercial ecosystem [9]. Ofem B investigated the effects of entrepreneurial orientation and cooperative participation on organizational performance of rural economic development [10]. These studies provide a good

reference for this paper, which will be further studied.

3. Method

3.1 Development of "Village Super League" and "Village BA"

From the national "Village BA" trials for three consecutive championships, and then to the Southeast Division of the strong promotion to the top eight, Hunan Yongxing County Matan Town basketball team has become a local business card, with the fire Matan "the largest town in southern Hunan" culture revitalization popularity. In the past, the cultural industry in Matan Town was not so rich, and since the Matan Town basketball team defended the provincial, municipal and county "village BA" trials for three consecutive championships, it directly ignited the heat for the construction of rural civilization and the revitalization of rural culture. How to use the flow and heat of Matan Town basketball team winning successive championships in provincial, municipal and county trials, stimulate the vitality and kinetic energy of the town's sports cause, and boost the revitalization of rural culture has become a major event on the agenda of the Party committee and government of Matan Town in Yongxing County.

According to Guo Jianming, Secretary of the Party Committee of Matan Town, Matan Town basketball team won the 2023 Hunan Province and the United States Rural Basketball game (Village BA) and the final championship of the national (Hunan) trial, under the initiative of the relevant leaders of the Municipal Party Committee, Matan Town has started the preliminary construction work of the open-air basketball court site selection, planning and design that can accommodate more than 6,000 people, in order to build a strong sports town and promote the revitalization of rural culture with competition to promote literature, production and prosperity. In Caojia village, Matan Town, the comprehensive cultural service center, Party and mass service center, cultural activity room, farm library and other grass-roots public service position resources are coordinated and integrated, and the facility functions are improved, equipped with sports and fitness facilities to meet the development needs of villagers for culture and sports life, outlining a gorgeous picture of rural culture revitalization. In Gaocang Village, Matan Town, constantly strengthening the support and training of grassroots cultural teams, cultivate a group of rural cultural talents who understand literature and art, love sports, and have nostalgia, and make the countryside "live" by mining local cultural elements, so that villagers can gather together, and let the life of the elderly and villagers "fire" up.

3.2 XGBoost Model

XGBoost is a powerful machine learning model based on gradient boosting algorithm and decision tree technology, with excellent predictive performance and feature importance evaluation ability. In economic impact assessment, due to the large amount of data and complex correlation relationships involved, its efficient performance makes it an ideal choice [11-12].

XGBoost can help identify which features are most crucial for influencing economic indicators, thereby helping decision-makers better understand and explain the sources of influence. This ability is of great significance for formulating economic policies, investment decisions, and market forecasting [13-14]. It has advantages such as efficient performance, feature importance assessment, and generalization ability in economic impact assessment. It provides decision-makers with a powerful tool to accurately predict and explain changes in economic indicators, thereby supporting wiser decision-making and strategic planning [15-16].

3.3 Economic Impact Assessment Based on Network Analysis and XGBoost Model

Conducting network analysis of Hunan county economy, build a network map between villages by investigating and collecting social network data among different villages in Hunan county. This network diagram can show the connections and cooperation patterns between villages. Network analysis methods were used to calculate network attributes such as village centrality index, community structure and influence [17-18]. Conducting economic data collection, collect related economic data, including village GDP, employment rate, industrial structure, tourism income and other indicators, which reflect the economic status and development level of the village. Table 1 shows the survey data:

Table 1: Survey data

Village Name	GDP (thousands of yuan)	Employment Rate (%)	Industry Structure	Tourism Income (thousands of yuan)
Village A	1200	85	Agriculture: 30%	100
Village B	800	78	Industry: 40%	80
Village C	1500	92	Service: 50%	120
Village D	600	70	Agriculture: 60%	50
Village E	1000	81	Industry: 20%	90

The XGBoost model is used for prediction and analysis, and the village network attributes and economic data obtained from network analysis are taken as characteristics, and the economic indicators of villages are taken as targets to build the XGBoost model. The basic form of the XGBoost model can be expressed as:

$$F(x) = \Sigma(f\_m(x)) \tag{1}$$

m represents the index of the decision tree, $f\_m(x)$ represents the prediction output of the m-th decision tree, and the basic form of the loss function is:

$$Loss = \Sigma(l(yi, F(xi))) + \Omega(F) \tag{2}$$

$l(yi, F(xi))$ represents the loss function between the predicted value $F(xi)$ and the true value yi, and $\Omega(F)$ represents the regularization term, which controls the complexity of the model. Through training and optimization of the model, the economic influence of villages can be predicted. After the model training is completed, the economic influence of other villages in Hunan county can be evaluated by using the model. By inputting network attributes and economic data of other villages, the model can output predicted economic influence indicators, which can help evaluate the potential impact of Village Super League and Village BA on the economy [19-20].

Finally, the results are analyzed and interpreted, and the economic influence of different villages is compared and analyzed according to the output results of the model. Decision makers explain the importance of each feature in the model to understand the network relationships between villages and the relevance of economic development. These analysis results provide references for

decision-makers to formulate corresponding policies and development strategies to promote economic growth and social progress in Hunan counties. Combined with network analysis and XGBoost model, this paper provides in-depth research and analysis in the economic impact assessment of Hunan counties. By comprehensively considering the social network and economic data between villages, the impact of Village Super League and Village BA on the economy can be more comprehensively understood, and decision-making support and guidance can be provided for local governments and relevant stakeholders.

4. Results and Discussion

Experiments are designed to verify the performance and effect of the economic impact assessment method based on network analysis and XGBoost model at the village level. By collecting social network data and economic index data of several villages in Hunan county, network analysis technology is used to calculate the network attributes and influence indicators among villages. The network attribute index is integrated with the economic index data to prepare the XGBoost model for training and testing. XGBoost model was used to predict the economic influence and was set as the experimental group, and the economic impact assessment method of big data analysis technology was used as the control group, and evaluation indicators such as evaluation accuracy, evaluation time and determination coefficient were selected to measure the prediction accuracy and effect of the model. The error was avoided by sample randomization, and the experiment was repeated many times to obtain stable results. The experimental results will provide reference for the application and improvement of the economic impact assessment method based on network analysis and XGBoost model, and promote the decision-making and planning of village economic development.

4.1 Evaluation Accuracy

Accuracy indicators tell us how well the model's predictions agree with the actual observations. The higher accuracy indicates that the model can predict economic influence better, that is, there is less difference between the predicted value and the actual economic influence. Figure 1 shows the experimental results:

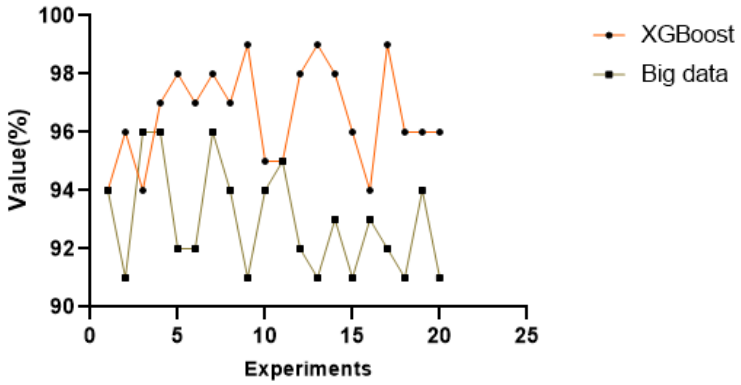

Figure 1: Assessment accuracy

In the above tests, the XGBoost model performed between 94% ~ 99 % of the evaluation accuracy, while the control big data analysis model achieved a high of 96% and a low of 91% of the evaluation accuracy. The model in this article performs better, and the XGBoost model has a high degree of flexibility to model and process various types of data. It can automatically handle missing

values, outliers, and efficiently process discrete and continuous features. In addition, XGBoost can also handle high-dimensional features and large-scale data sets, with strong fitting and generalization capabilities.

4.2 Evaluation Time

The evaluation time can reflect the calculation and analysis time required for the evaluation of the economic impact of the model. A shorter evaluation time indicates that the model can analyze and forecast in an efficient way and provide timely results. This is important in an economic environment that requires rapid decision making and response. Figure 2 shows the experimental results:

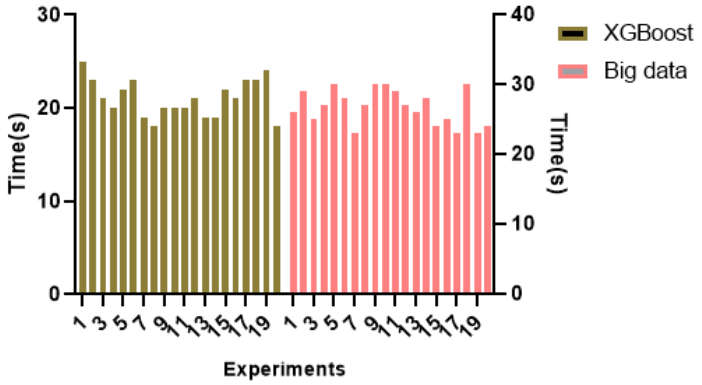

Figure 2: Assessment time

In the evaluation time test, the experimental group performed better than the control group, whose evaluation time was between 18-25s, while the control group's evaluation time was between 23-30s. XGBoost employs highly optimized algorithms and data structures to improve model training and prediction efficiency, and it uses parallel computation, approximation algorithms, and specific data structures to speed up the computation, thereby reducing evaluation time.

4.3 Coefficient of Determination

The determination coefficient measures how well the model fits the observed data. It indicates how much of the variation in the dependent variable can be explained by the model, and a higher coefficient of determination means that the model fits the data better, that is, there is more variation in the dependent variable explained by the model. Figure 3 shows the test results of determination coefficient:

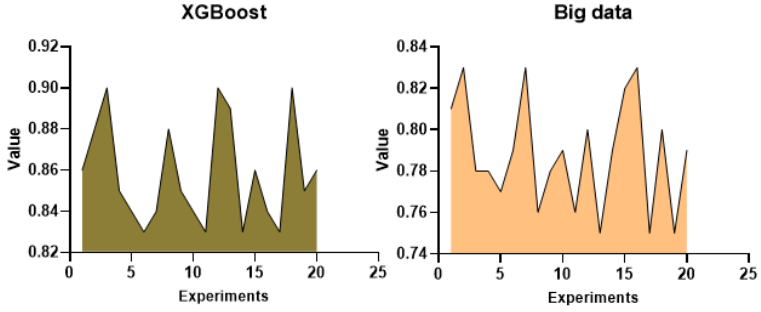

Figure 3: Coefficient of determination

The test results of the coefficient of determination show that the coefficient of determination of XGBoost model in the experimental group is between 0.83-0.90, while that of big data analysis in the control group is between 0.75-0, 83. XGBoost provides an assessment of the importance of features and automatically selects the features that have the greatest impact on the target variable. By optimizing the model's parameter and feature selection, XGBoost can better capture key features in the data, improving the model's ability to fit and interpret, which in turn can lead to higher coefficients of determination.

5. Conclusion

By using network analysis and XGBoost model, we evaluate the economic influence of counties in Hunan Province, especially the influence of "Village Super League" and "Village BA". The results show that these village-level sports leagues play a positive role in promoting county economic development. Through network analysis, we find that the village-level football and basketball leagues have established close ties and communication channels among counties, and promoted economic cooperation and resource flow among different counties. This exchange promotes the integration and coordinated development of economic activities, which in turn enhances the economic influence of the entire county of Hunan Province.

To sum up, "Village Super League" and "Village BA" have a positive role in promoting the economic influence of Hunan county. These sports leagues promote cooperation and exchanges among counties, stimulate the potential of economic development, and contribute to the growth and prosperity of county economy. Therefore, the organization and development of these sports leagues should be emphasized and supported when formulating local economic development strategies, so as to further promote the sustainable development of county economy in Hunan Province.

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