

The Construction of Wushu Cultural Communication System Driven by Intelligent Technology in the Age of Big Data

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ABSTRACT

As an important part of the excellent traditional culture of the Chinese nation, Chinese Wushu condenses the wisdom of the Chinese nation, contains the genes of Chinese culture, and has important communication value. Based on the big data Hadoop technology, the article proposes a content recommendation design scheme for all-media communication of wushu cultural communication, and introduces the LFM model and MBGD algorithm to construct an intelligent recommendation model of wushu cultural communication content under the framework. Then, based on Lasswell's 5W model, the fsQCA method was utilized to explore the relevant factors affecting the effect of martial arts cultural communication. When the number of hidden factors of LFM-MBGD intelligent recommendation model is 55, its RMSE is 0.92, and the HR@K value of the model can reach 62.12%. The consistency level of the existence and non-existence states of each conditional variable of the communication effect of wushu culture is less than 0.8, and the overall coverage rate and the coverage rate of each path are higher than 0.85. The wushu culture communication system driven by intelligent technology can start from building an online resource base of wushu culture, broadening the communication paths of wushu culture, sounding the laws and regulations of wushu culture communication, and building the brand of wushu to improve the communication effect of wushu culture.

Keywords: Hadoop technology, LFM model, MBGD algorithm, 5W model, Wushu cultural dissemination

1. Introduction

Wushu, as a part of Chinese traditional culture, occupies an important strategic position in global cultural communication. Wushu culture has an advantage over other cultures in global dissemination, because the carrier of wushu culture is wushu competition as a sport, which is easier to get people's attention [1-3]. And wushu as a sports program compared to other sports in the world has its unique advantages, the world's other sports, such as boxing, wrestling, fencing, etc. have their own unique technical characteristics [4-6], but none of them can be like wushu as the most comprehensive, the

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most systematic expression of a variety of forms of offensive and defensive technical content, so in the era of big data, spread the culture of wushu, so that it will become a charismatic Chinese cultural brand name is a problem that must be thought about [7-9].

With the rapid development of big data, intelligent technology has become an important way of cultural dissemination, especially the rise of short-video live broadcasting platforms, which provides new opportunities for the inheritance and dissemination of traditional culture. The characteristics of intelligent technology include strong interactivity, fast dissemination speed, wide audience coverage, and diverse communication content [10-13]. By constructing a wushu culture dissemination system, it not only spreads faster and wider, but also attracts more young people's attention and participation, which is of great significance for protecting and inheriting the national wushu culture and promoting the national spirit. At the same time, wushu culture can also go out of the country, enhance cultural confidence and international influence through the international dissemination of intelligent technology, and show its unique charm to the world [14-17].

As the essence and spiritual symbol of Chinese culture, Chinese wushu should build a wushu cultural communication system that conforms to its own cultural characteristics, so as to do its best to tell a good Chinese story, disseminate Chinese culture, and show China's image. This paper analyzes the value of wushu cultural communication driven by intelligent technology and the turn based on the theory of combing wushu cultural communication and layering. Hadoop technology is introduced to design a content recommendation design scheme for martial arts cultural communication, and the LFM-MBGD model is constructed to realize the intelligent recommendation of martial arts cultural communication content. In order to study the influencing factors of the effect of martial arts cultural dissemination, the single factor necessity and group factor of each conditional variable are analyzed by fsQCA method, which provides an example data basis for the construction of martial arts cultural dissemination system.

2. Wushu Cultural Communication Driven by Intelligent Technology

With the arrival of the era of big data, people's access to information has shifted from traditional media such as newspapers and television to the use of digital technology and the Internet to obtain information from emerging media such as cell phones and computers. With the continuous development and progress of information technology, the Internet has been used in all aspects of people's food, clothing, housing and transportation, and people have entered the era of big data. Chinese traditional wushu carries rich cultural connotations and shoulders the important mission of presenting China's image in cultural exchanges. Chinese martial arts not only has a unique and deep cultural heritage, but also its function of strengthening the body and toning the mind and body has been praised for thousands of years. However, in the trend of the era of big data, how the Chinese martial arts culture can stand firm and further carry forward has become the proposition of this era, which is still a topic worthy of in-depth study and reflection by contemporary people.

2.1. Cultural Diffusion and Stratification of Martial Arts

2.1.1. Dissemination of martial arts culture. Wushu culture is a traditional Chinese culture centered on technical skills and based on traditional Chinese philosophical thought, including artifacts, forms of inheritance and folklore closely related to martial arts, as well as the national spirit embodied in them. Wushu culture is an important part of culture, and wushu communication is the existence and expression of wushu culture. Therefore, the communication of martial arts culture refers to human behavior in the process of transferring information about martial arts culture or the operation of the information system of martial arts culture. It may include a variety of communication media and means for the interaction and exchange of martial arts cultural information. Wushu cultural communication is a cultural communication and cultural phenomenon [18].

Wushu cultural communication is different from general culture, and its deep culture is reflected in the level of philosophical connotation, way of thinking and values, and exists more in the spiritual and subconscious level. It also needs to be based on living, learning and internalization before it can be understood. Therefore, in terms of understanding and grasping, wushu culture is undoubtedly puzzling and profound, and it is difficult to clarify the essence of its connotations if it has not been digested through deep insights, which also brings about difficulties in the dissemination of wushu culture. For the dissemination of wushu culture, how to break away from the traditional shackles of dissemination and truly integrate into the modernized society and the lifestyle of the new era is the key to breaking through the barriers of dissemination and developing in a pioneering manner.

2.1.2. Layered theory of martial arts culture. After combing through the relevant literature on wushu culture, it is found that relevant scholars, in their studies exploring the level of influence of wushu culture, based on the need for cultural influence measurement, formulated a measurement index system from the levels of cultural structures such as material, behavioral and spiritual, empirically measured the level of influence of wushu culture in China, and quantified the differences in the regional distribution of wushu cultural influence indices and their explanatory mechanisms. Based on the existing relevant studies, this paper divides the wushu culture into three levels, namely, material culture, behavioral culture and spiritual culture, the details of which are shown in Figure 1.

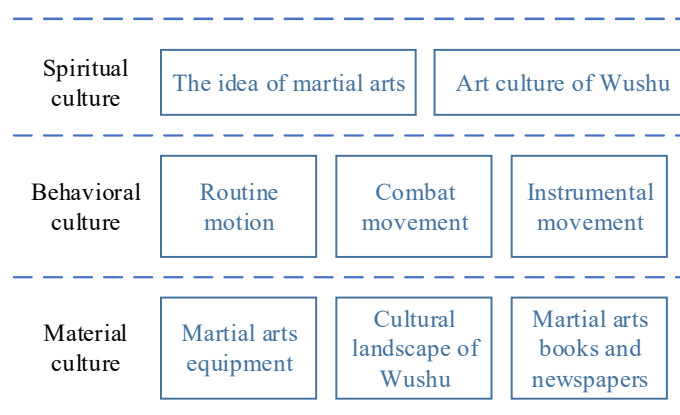


Fig. 1. The theory of cultural stratification of martial arts

As an important part of martial arts culture, martial arts material culture is the expression of people's activities and material forms in martial arts culture. According to its different material cultural characteristics, it can be roughly divided into three categories, namely, martial arts equipment such as martial arts instruments and costumes, martial arts cultural landscape and martial arts books and newspapers. Wushu behavioral culture refers to the cultural phenomena formed by people in the practice of wushu, including but not limited to wushu techniques, wushu movements, wushu organizations, wushu activities and other aspects. In general, they can be divided into three categories according to their forms of movement, i.e., gongfu movement, set movement (including single practice, pair practice and collective practice), and combat movement. The spiritual culture of wushu refers to the spiritual connotation expressed through wushu, which mainly contains the category of wushu thinking concepts and the category of wushu art and culture.

2.2. Communication Models and Communication Effectiveness Theory

2.2.1. Lasswell 5W model. The key of Lasswell's 5W communication model lies in the ability to enable the communication subject to clearly recognize the purpose of communication, accurately grasp the audience preferences, and convey the appropriate information to the audience through the appropriate channel, so as to achieve the best communication effect [19]. The content framework of

Lasswell's 5W theory is shown in Figure 2, which mainly includes who, say what, in which channel, to whom and with what effect.

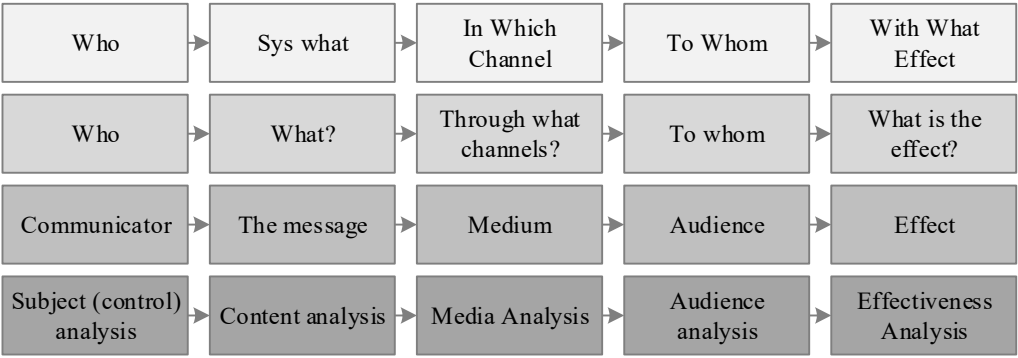


Fig. 2. Lasweer 5W theory

The 5W model treats messaging as a purposeful behavior aimed at influencing the recipients (audience) of its message. The communicator, as the starting point and center of communication activities, can be an individual in mass communication who collects, processes and disseminates information as a communicator in the communication process. The content of communication, i.e., the information that can be conveyed to the audience by the subject of communication, enables the target audience to effectively access the information and satisfy their own desires or needs. The communication medium is the tool for information transfer between the subject's communication and the audience's reception. The development of big data and intelligent technology has broken the information barriers between traditional media and dissolved the communication boundaries between media media geography, culture, language, time and space. The communication audience, as the receiver of information, is one of the motives and central links of communication activities. The communicator and the audience are relative in the communication activity, and can play a role in feedback information under certain conditions, and adjust the content and mode of communication. The effect of communication refers to the process in which the audience obtains the information of the communicator through the media, causing changes in their own ideas and behaviors.

2.2.2. Communication Effectiveness Theory. The theory of communication effect is the main theoretical basis for this paper to explore the communication system of martial arts culture. Only by analyzing the communication effect driven by intelligent technology can we explore the innovative ways suitable for modern martial arts cultural communication.

The so-called communication effect refers to the effective results of communication activities on the knowledge, attitude and behavior of the audience in the process of information and information dissemination. The communication effect actually reflects how deep the communication activity can realize the communicator's information dissemination purpose. This means that the audience will have different results in cognition, attitude, emotion and behavior after receiving the information communicated by the communicator. In the field of mass communication, most scholars agree that the communication effect of information can be divided into three different levels according to its logical order and different results. The first level is the cognitive level, the dissemination of information information on the role of the audience, the audience's cognition and information whether the complete transmission of reception has a direct impact. The second level is the emotional and attitudinal level, the dissemination of information information on the audience's understanding of things, attitudes and emotions have a certain impact. The third level is the behavioral level, the dissemination of information will affect the audience's words and deeds, thus producing a certain model imitation effect. From the level of information dissemination, we can see that the information

dissemination has experienced three levels of cognition, attitude and action, which is a process of gradually deepening and increasing the dissemination effect. These three levels of information dissemination effect are reflected in the micro information dissemination process as well as in the macro social information dissemination process.

2.3. Intelligent Technology-Driven Wushu Cultural Communication

2.3.1. Intelligent technology empowers the dissemination of martial arts culture. Chinese Wushu is an important treasure of the Chinese nation that has been passed down for thousands of years and occupies an important cultural position in society. As a classic Chinese traditional cultural imprint, the building of Chinese Wushu communication capacity is of great significance in accelerating the construction of a sports powerhouse and a cultural powerhouse. Accompanied by the rapid development of science and technology, big data and intelligent technology is constantly penetrating in all fields of society and economy. For the dissemination of Chinese martial arts culture, big data intelligence technology has shown great potential for application. The value and function of big data intelligent technology empowering the dissemination of Chinese martial arts culture are shown as follows:

1) Innovate the dissemination field of Chinese Wushu culture. Along with the continuous maturation of intelligent technology, the realizability of Chinese Wushu culture dissemination in the virtual field is gradually improving. VR, AR, MR and XR based on intelligent technology have the dual characteristics of “immersive experience” and “depiction of imagination”, which can create a more effective virtual field for the dissemination of Chinese martial arts culture.

2) Optimize the communication services of Chinese martial arts culture. Due to the limitations of cultural differences, communication channels and other factors, the audience's cognition of wushu culture often stays on the surface, and lacks understanding of its profound cultural heritage and inner philosophical thinking. By optimizing communication services, the value and charm of wushu culture can be delivered more accurately, misunderstandings and prejudices can be eliminated, and the popularity and recognition of wushu culture can be improved.

3) Expanding the subject of Chinese Wushu dissemination. The emergence of intelligent technology has greatly reduced the entry threshold of the dissemination subject, so that folk wushu enthusiasts, wushu-related enterprises can become the dissemination subject, and gradually create a “decentralized” Chinese wushu culture dissemination atmosphere with full participation.

4) Increase the supply of Chinese martial arts communication content. Intelligent data analysis and mining technology in intelligent technology can efficiently integrate text, pictures or audio and video content of Chinese martial arts techniques, comb traditional martial arts techniques more intelligently and systematically, and form a database of Chinese martial arts. By digging deep into the content of Chinese martial arts culture and combining users' personalized preferences to realize the intelligent recommendation of martial arts, it lays the foundation for improving the quality of the content of martial arts culture dissemination.

2.3.2. Intelligent Technology-Driven Shift in Martial Arts Communication. Chinese martial arts, as an important part of the excellent traditional culture of the Chinese nation, unites the wisdom of the Chinese nation, contains the genes of Chinese culture, and has important communication value. Big data intelligent technology set network technology, artificial intelligence technology, virtual reality technology and augmented reality technology is equal to the realization of the digital ecology of the interaction between the real world and the virtual world, in this new digital ecology, the existing communication model will be subverted, the new communication pattern will be reconstructed, and more possibilities will emerge in the form of the communication of martial arts culture. The communication turn of Chinese martial arts culture driven by intelligent technology is shown in Figure 3, mainly from the three dimensions of concept, mode and effect. Sorting out the intelligent

technology-driven wushu cultural communication steering can open up a new space for wushu cultural communication and wushu cultural exchanges, help the international communication of wushu in the future, and serve the construction of the community of human destiny.

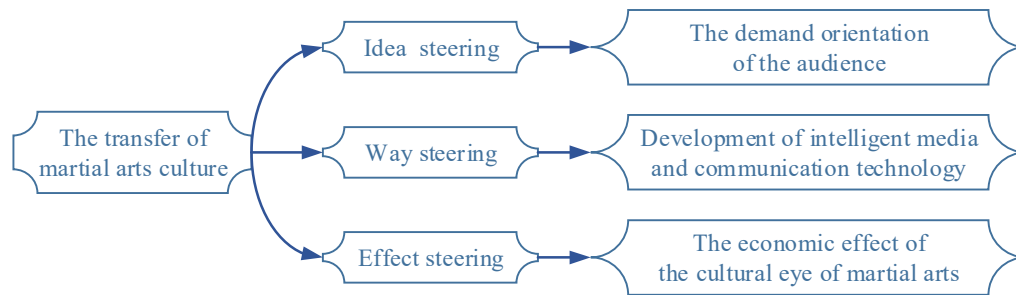


Fig. 3. Intelligent technology drives the transfer of martial arts

3. Technology-driven Wushu Cultural Communication Intelligent Recommendation

In general, information overload is a typical feature of today's society, and an effective way to solve information overload is content intelligent recommendation. Intelligent recommendation needs to be based on the audience's interests, behavioral preferences for correlation, clustering, and then use the homogeneity to find similar users and products to implement recommendations. At present, the research on the implementation of accurate content recommendation in martial arts communication has not yet been reported, mainly because the rise of content recommendation is relatively short, but the successful practice of commodity recommendation and other content recommendation can be empowered for martial arts communication. Big data and artificial intelligence have given rise to the intelligent matching of information and user needs, and deep insight into the behavior and needs of users in specific scenarios and intelligent recommendation of the information and services they need can effectively improve the efficiency of martial arts cultural communication.

3.1. Recommended Program for Wushu Cultural Communication Content

3.1.1. Big Data Hadoop Technology. Hadoop is an open source architecture used to process big data, influenced by Google's file system and architecture, Hadoop uses a distributed file system HDFS to store the data and analyze the data using the MapReduce programming model, the data storage in HDFS uses a master-slave architecture model [20].

HDFS stores files by slicing them into a number of data blocks. The default size of a data block in Hadoop is 128M, and these data blocks are scattered and stored on each DataNode in the Hadoop cluster. The storage steps are as follows:

1) The user establishes a connection with NameNode through the client and sends a file upload request. Then, the corresponding HDFS directory is checked to see if there is a file with the same name, and if so, the file cannot be uploaded normally. If both the user has upload privileges and the file does not exist in the corresponding HDFS directory, NameNode sends feedback to the client, indicating that the file can be uploaded.

2) After the client receives the information that the file can be uploaded, it slices the file according to the data block size set by HDFS. Then, it sends a request to upload the first data block to NameNode to get the available DataNode address.

3) After the NameNode receives the data block upload request, it allocates the data blocks according to the replica mechanism and network topology of the Hadoop cluster. In a Hadoop cluster, data blocks are stored in three different racks or servers by default to realize distributed storage.

4) After the client receives the DataNode address, it establishes a connection with the DataNode and then uploads the first data block to that DataNode. When the first data block is successfully uploaded, the client resends the upload request for the second data block to the NameNode, which returns the DataNode address to the client and repeats the upload operation until all the data blocks are uploaded.

3.1.2. Content Recommendation Design Program. The wushu culture dissemination design scheme in this paper is based on the current situation research of cable TV network, all-media wushu culture content resources and user demand, and conducts demand analysis of all-media recommendation scheme from five dimensions: user, terminal, application, content and channel. Including the function and performance of the recommendation scheme, user information and behavioral data collection, all-media martial arts culture content resources classification needs analysis, etc., to study the method of user demand and content resource association. The overall architecture of the intelligent recommendation program for all-media content of martial arts culture designed in this paper is shown in Figure 4, which can intelligently recommend adapted martial arts culture content for different user terminals, have intelligently recommended presentation content for each martial arts culture communication content, and adopt a more suitable channel to provide for each content.

Data collection is mainly realized through the log collection tool Flume and the structured data import tool Sqoop, and for part of the data that has been stored in relational databases such as Oracle, MySQL, etc., the data is imported to the big data platform through Sqoop. The main business data collected include martial arts cultural content resource data, authentication data, CDN data, orchestration data, media asset data, portal orchestration data, etc. Based on the open source Hadoop version, in-depth performance optimization and stability and manageability optimization have been carried out to form a set of distributed computing platforms that can be easily architected and used to easily develop and run applications dealing with massive amounts of data on Hadoop.

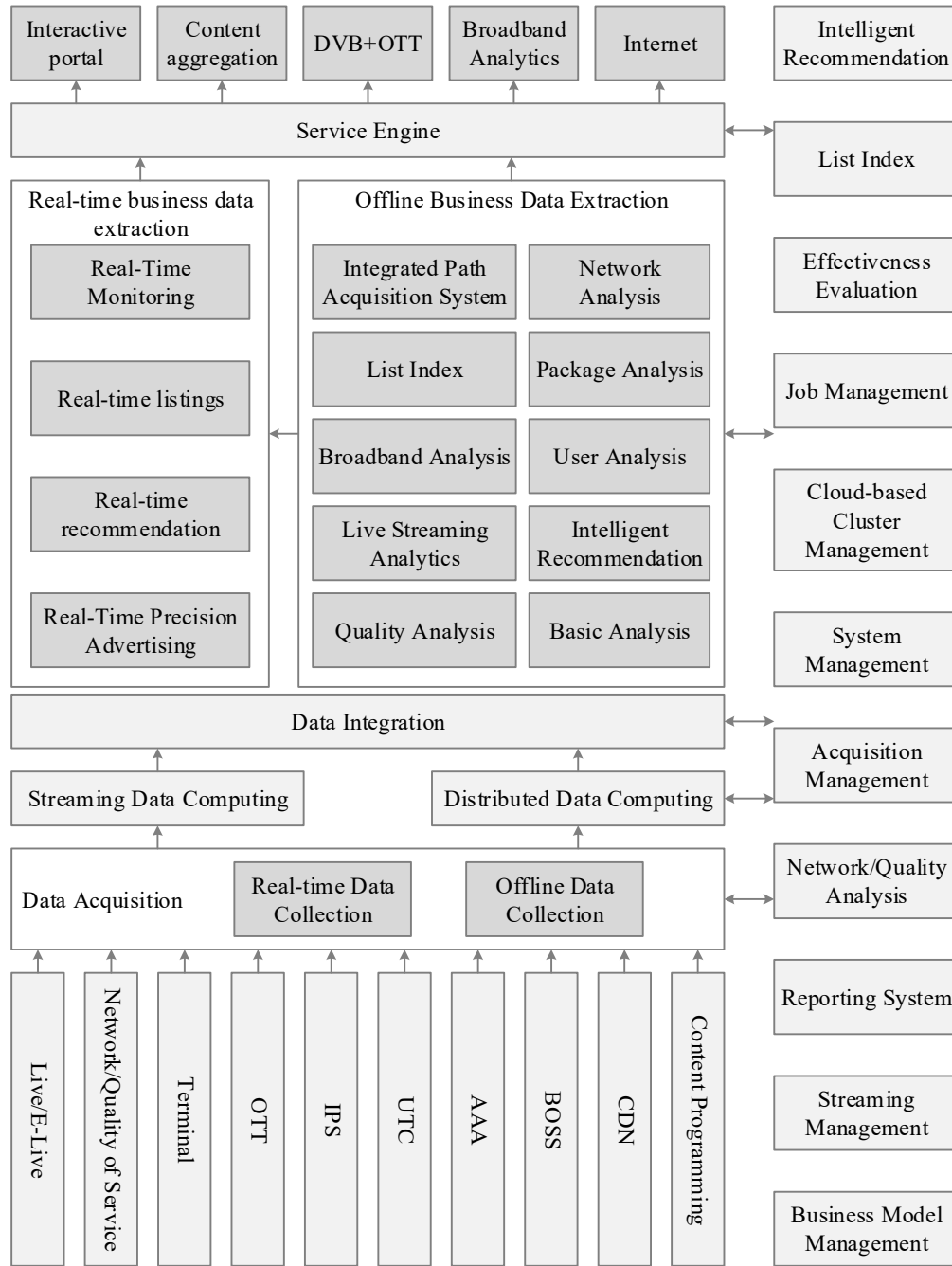


Fig. 4. The intelligent recommendation of the media content of martial arts culture

3.2. Intelligent Recommendation of Wushu Cultural Communication Content

3.2.1. **Hidden Semantic Modeling.** Hidden semantic modeling (LFM) can establish the relationship between users and items by using users' historical data, so it is feasible to apply it to the intelligent recommendation of martial arts cultural communication content [21]. We need to fill the sparse rating matrix and then recommend items with high predictive data values to users. The scoring matrix is split into two low-dimensional matrices by matrix decomposition, which is calculated as follows:

$$\hat{R} = P^T Q \quad (1)$$

where P is $f \times m$ matrix represents the user feature matrix, Q is $f \times n$ matrix represents the martial arts content resource feature matrix. P matrix represents the user's favorite degree of each

martial arts content resource feature, where the larger the value of the element means the more the user likes the corresponding martial arts content resource feature. Q matrix represents the proportion of weights that martial arts content resources have, where the larger the value of an element is the more obvious the corresponding martial arts content resource feature of that martial arts content resource. Then the prediction formula for user u 's rating of martial arts content resource i can be expressed as:

$$\hat{r}_{ui} = \sum_f p_{uf} q_{if} \quad (2)$$

p_{uf} represents the relationship between user u and feature f , and q_{if} represents the relationship between martial arts content resources i and feature f . The prediction of user u to martial arts content resource i can be accomplished if the filled matrices of p_{uf} and q_{if} can be obtained. Considering that the singular value decomposition to fill in the gaps may increase the amount of data significantly, we iterate through the gradient descent method to learn the P and Q matrices in depth by minimizing the RMSE using the data available in the training set. We define the error function as:

$$F(p, q) = \sum_{(u,i) \in T} (r_{ui} - \hat{r}_{ui})^2 = \sum_{(u,i) \in T} \left(r_{ui} - \sum_f p_{uf} q_{if} \right)^2 \quad (3)$$

Since overfitting may occur during the learning of matrices P and Q , we also need to add a regular term to the matrices to prevent overfitting, where λ represents the regularization parameter, then the new error function can be expressed as:

$$C(p, q) = \sum_{(u,f) \in \text{Train}} \left(r_{ui} - \sum_{f=1}^F p_{uf} q_{if} \right)^2 + \lambda (\|p_u\|^2 + \|q_i\|^2) \quad (4)$$

We use the partial derivatives of the parameters to get the fastest direction of gradient descent, and optimize the corresponding parameters after a certain number of iterations to obtain a smaller error function. The parameters we need to optimize in Eq. (4) are p and q , and the following partial derivatives are taken for these two parameters. The specific formula is as follows:

$$\frac{\partial F}{\partial p_{uf}} = -2q_{if}e_{ui} + 2\lambda p_{uf} \quad (5)$$

$$\frac{\partial F}{\partial q_{if}} = -2p_{uf}e_{ui} + 2\lambda q_{if} \quad (6)$$

Then the update formula for p , q can be expressed as:

$$p_{uf} = p_{uf} + \alpha (q_{if}e_{ui} - \lambda p_{uf}) \quad (7)$$

$$q_{if} = q_{if} + \alpha (p_{uf}e_{ui} - \lambda q_{if}) \quad (8)$$

where α represents the learning rate and λ is the regularization parameter.

3.2.2. Small Sample Gradient Descent Algorithm. Minibatch gradient descent (MBGD) is an algorithm commonly used in optimization theory as a compromise between batch gradient descent as well as stochastic gradient descent [22]. Some of the samples are selected in each iteration as a small batch of samples into the training of the convolutional neural network, where the iterative strategy for updating the network parameters is:

$$\theta_{r+1} = \theta_r - \eta \cdot \nabla_{\theta} E(\theta) \Big|_{\theta=\theta_r} \quad (9)$$

where, η is the learning rate and r is the number of iterations.

In the process of small batch gradient descent algorithm to update the parameters, the training samples need to be divided into several copies, the number of samples in each copy is called the batch size, after each training of all the samples in the packet, the cross entropy gradient is calculated to adjust the parameters of the network, which largely improves the iteration speed.

3.2.3. LFM-MBGD Recommended Models. For the intelligent recommendation scheme of Chinese martial arts cultural communication content, in order to realize the intelligent recommendation of martial arts cultural communication content, this paper intends to combine LFM with MBGD algorithm, and constructs the LFM-MBGD intelligent recommendation model of Chinese martial arts cultural communication content.

The LFM-MBGD intelligent recommendation algorithm mainly utilizes the matrix decomposition technology to realize the prediction filling of the user-item sparse rating matrix, which solves the sparsity problem of the recommendation algorithm very well. At the same time, much of the data obtained in this part is used in the real-time recommendation module. Firstly the intelligent recommendation algorithm based on the LFM Hidden Semantic Model under MBGD algorithm uses the user rating table in the database to calculate the list of user's recommendations about martial arts cultural content resources and the similarity matrix. The recommendation generation of martial arts cultural content dissemination resources is accomplished by the LFM-MBGD intelligent recommendation model. The main steps are as follows:

Step1 Create a Spark Session and load Chinese martial arts cultural content resources and user behavior data.

Step2 Do a Cartesian product of UserID and ProductID to generate the ancestor of UserID and ProductID.

Step3 Predict the ratings of the two meta-ancestors by the LFM model trained by MBGD algorithm.

Step4 Sort the predicted recommended list of Chinese martial arts cultural content resources in descending order.

Step5 Push the K Chinese martial arts cultural content resources in descending order.

Step6 Save the results of LFM model under MBGD algorithm in the UserRecs topic of MongoDB, and then realize the intelligent recommendation of Chinese martial arts cultural content resources.

4. Wushu Cultural Communication Content Resource Recommendation and Communication Effects

Under the background of the era of big data and intelligent informationization, if we want to build a Chinese wushu cultural communication system, enhance the communication ability of Chinese wushu, improve the cultural appeal and cultural influence of Chinese wushu, and accomplish the strategic intention of Chinese wushu to “go out”, we must pay attention to the research on the fusion of intelligent technology and the cultural communication of Chinese wushu and make firm commitment to the role of intelligent technology in empowering the cultural communication of Chinese wushu. We must pay attention to the research on the integration of intelligent technology and the dissemination of Chinese wushu culture, and firmly emphasize the role of intelligent technology in the dissemination of Chinese wushu culture. At the same time, on the basis of integrating the excellent cultural communication resources of Chinese wushu, carry out online and offline cultural communication, grasp the internal and external environment of Chinese wushu cultural communication, build intelligent + wushu cultural communication information dissemination program, and accurately serve the public's social needs for spiritual culture.

4.1. Validation of Wushu Cultural Communication Content Recommendations

4.1.1. Impact of hidden factors on accuracy. The number of recommended hidden factors is determined by matrix decomposition in the hidden semantic model, and the difference in the value of the number of hidden factors will affect the recommendation accuracy of the LFM-MBGD intelligent recommendation model to a certain extent. In this paper, we make a dataset by downloading short videos related to martial arts on the Internet, and choose the root mean square error (RMSE) as the evaluation index to study the effect of different numbers of hidden factors on the recommendation of martial arts cultural resources. Figure 5 shows the results of the influence of the number of hidden factors on RMSE.

With the increase of the number of neighbors, the RMSE of the LFM-MBGD intelligent recommendation model for the content recommendation of Chinese martial arts cultural resources shows a decreasing trend, and the recommendation accuracy rate gradually improves, which shows that more neighbors are involved in the calculation of the prediction scores, which contributes to the improvement of the algorithm accuracy. However, with the further increase in the number of neighbors, the error of the algorithm changes little and tends to be stable. Then examine the number of hidden factors, as the number of hidden factors continues to increase, the number of classifications is increasing, and the accuracy of the recommendation algorithm is improving. However, when the number of hidden factors is 45 and the number of neighbors is 60, the error of the algorithm does not differ much, and the error of the algorithm tends to stabilize as the number of potential classifications increases. When the number of neighbors and the number of hidden factors are both 55, the experiment takes the smallest root-mean-square error, and the RMSE is 0.92. Therefore, when the number of hidden factors and the number of neighbors of the LFM-MBGD intelligent recommendation model are both set to 55, it can enable the LFM-MBGD intelligent recommendation model to obtain the optimal recommendation accuracy when recommending the contents of the Chinese wushu cultural resources, and to further expand the audience's understanding of the content types of the Chinese wushu cultural resources. Chinese martial arts cultural resources content type.

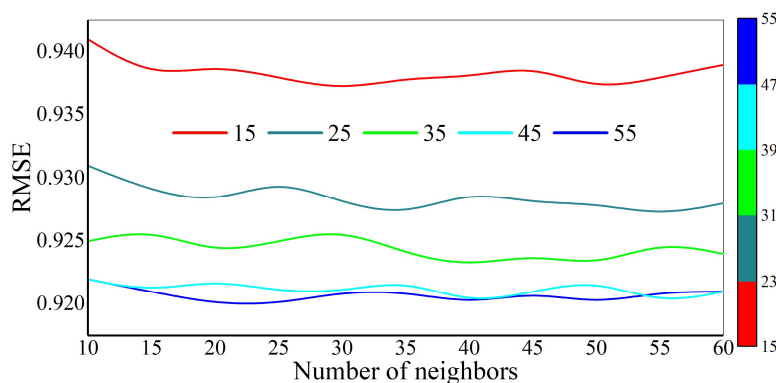


Fig. 5. The effect of the implicit factor number on RMSE

4.1.2. Comparative analysis of different algorithms. In order to verify the effect of the intelligent recommendation algorithm for martial arts cultural resources content based on the LFM model and MBGD algorithm, the experiment compares several advanced recommendation algorithms, mainly including five models such as Cluster, R-ConvMF, QPR-NN, TimeSVD, and CBAM-CNN. In order to better observe the performance effect of this paper's recommendation algorithm on the content dataset of martial arts cultural resources, MAE, RMSE, and hit rate HR@K are selected as the evaluation indexes of Top-K recommendation scenario. MAE and RMSE are used as the evaluation indexes of the experiment, and the smaller the value of the two evaluation indexes represents that the experimental prediction value is closer to the real value, and the prediction result of the model is more accurate, and

the higher the HR@K value is represents that the Top-K recommendation algorithm is more accurate. The higher the value of HR@K represents the higher hit rate of Top-K recommendation list, and the better the recommendation effect of the content of martial arts cultural resources. Figure 6 shows the comparison results of the recommendation effect of different algorithms.

Among several algorithms, Cluster and QPR-NN algorithms have worse performance results, and the MAE and RMSE values of R-ConvMF and TimeSVD are smaller than those of Cluster and QPR-NN algorithms, and the performance of the LFM-MBGD intelligent recommendation model for Chinese martial arts cultural resources content proposed in this paper outperforms the other algorithms. On the dataset, the MAE values of the LFM-MBGD intelligent recommendation model designed in this paper are reduced by 14.38%, 4.68%, 13.44%, 2.62%, and 0.63% compared to Cluster, QPR-NN, R-ConvMF, TimeSVD, and CBAM-CNN, respectively, and it can be found that the Cluster recommendation algorithm performs the worst. The recommendation algorithm in this paper is slightly better than CBAM-CNN algorithm and performs best in the experiment. In terms of the hit rate of recommending results for Top-10, the HR value of the LFM-MBGD intelligent recommendation model designed in this paper is 62.12%, which is significantly higher than other algorithms. Considering the whole experimental results, the performance of the intelligent recommendation model of Chinese martial arts cultural resource content proposed in this paper is better than other algorithms, which is due to the fact that the LFM-MBGD model uses the LFM model to pre-populate the rating data of the Chinese martial arts resource content in advance, which makes the sparse problem mitigated to a certain extent when dealing with the rating data. Moreover, the LFM-MBGD model not only analyzes the data in the scoring matrix of Chinese martial arts resources content, but also introduces a small batch gradient descent algorithm for the parameter updating of the scoring matrix, which makes the model fully learn the connection between the attribute features and scoring of the users and the Chinese martial arts resources content, and thus the prediction results on the Chinese martial arts resources content dataset have a better performance relative to other algorithms.

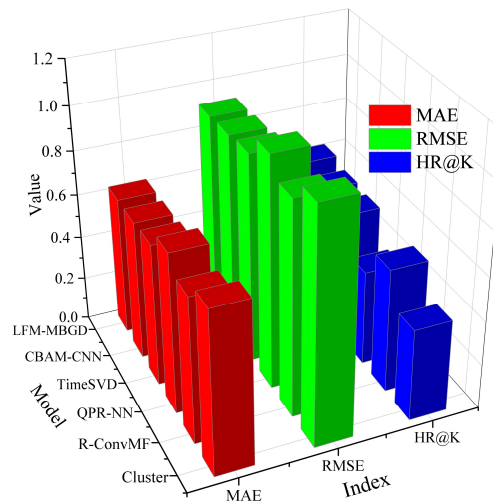


Fig. 6. Comparison results of different algorithms

4.2. Analysis of the Effectiveness of Chinese Wushu Cultural Communication

4.2.1. Effectiveness of the dissemination of martial arts culture. Based on the content recommendation design scheme of Chinese wushu culture communication driven by the former literature intelligence technology, this paper analyzes the differences in the communication effect of different types of audiences on the communication effect of wushu culture from the evaluation of the communication effect of the characteristics of the communication object. The evaluation of communication effect is carried out from four dimensions of cognition, emotion, attitude and behavior;

and multiple questions are set in the form of questionnaire. A five-point Likert scale was used to set up the questions, and the Likert 5-point scale for the degree of standardized scores from 1 to 5 corresponded to strongly disagree, less agree, average, more agree, and strongly agree, respectively.

Questionnaires were distributed and recovered on the Internet social platform, a total of 300 questionnaires were distributed and 281 valid questionnaires were recovered. The collected questionnaire data were statistically organized, and the audience's identity as the independent variable, cognitive effect, emotional effect, attitudinal effect, and behavioral effect as the dependent variable, and the ANOVA test was applied to analyze whether there was any significant difference in the relationship between the mean values of the two groups of data. The results of data analysis are shown in Table 1. The results of data analysis show that the degree of audience identity is significantly different in cognitive effect, emotional effect, attitudinal effect, and behavioral effect ($p < 0.01$), and the total score of the evaluation of the degree of audience identity and communication effect is 3.11 ± 0.56 , which is in the range between average and more agreeable. The audience's identity degree has a greater impact on the communication effect of Chinese martial arts culture. As the audience's identity degree is higher, the audience's cognitive, emotional, attitudinal, and behavioral effects on Chinese martial arts culture are also enhanced, showing a significant positive relationship.

Table 1. Identification of the impact of communication effects

-	Cognitive effect	Emotional effect	Attitude effect	Behavior effect	Total
1	1.65 ± 0.66	1.93 ± 0.82	1.81 ± 0.63	1.93 ± 0.82	1.83 ± 0.71
2	2.31 ± 0.73	2.31 ± 0.73	2.38 ± 0.74	2.23 ± 0.96	2.31 ± 0.75
3	2.85 ± 0.81	2.85 ± 0.65	2.95 ± 0.59	2.53 ± 0.74	2.80 ± 0.69
4	3.74 ± 0.75	3.84 ± 0.54	3.84 ± 0.51	3.88 ± 0.63	3.83 ± 0.48
5	4.42 ± 0.84	4.94 ± 0.21	4.92 ± 0.27	4.93 ± 0.25	4.80 ± 0.24
F	141.357	163.251	198.516	162.738	171.642
P	0.002***	0.000***	0.001***	0.005***	0.000***

4.2.2. Study of single influencing factors. In order to further analyze the relevant factors affecting the communication effects of Chinese martial arts culture, this paper introduces qualitative comparative analysis (QCA) to study the influencing factors of the communication effects of Chinese martial arts culture. In QCA's single influencing factor analysis, it is necessary to analyze the influencing factors one by one to test whether there is a single conditional variable that is necessary to constitute the outcome variable. In the case of this study i.e. whether there is a conditional variable that must be present when martial arts culture dissemination is effective. In other words, without this condition, martial arts cultural communication cannot produce a good communication effect.

As for the factors affecting the communication effect of martial arts culture, this paper mainly codes the seven dimensions of perceived usefulness, perceived ease of use, behavioral attitudes, information seeking, personal identity, social interaction and entertainment needs. After assigning and calibrating the samples of wushu cultural communication cases selected in this paper according to the coding standards of communication effects, we selected "Necessary Conditions" in fsQCA software to perform calculations, and obtained the results of univariate necessity analysis on the level of communication effects of wushu culture, in which high and non-high. The results of the univariate necessity analysis of the communication effects are shown in Table 2. In the table, "~" means "not", i.e. not present.

The results of the analysis show that at the level of the communication effect of martial arts culture, the level of consistency between the presence and absence of each conditional variable is less than 0.8, so the absence of a single conditional variable is a necessary condition for realizing the high communication effect of martial arts culture. This result suggests that none of the seven conditional variables of perceived usefulness, perceived ease of use, behavioral attitudes, information seeking, personal identity, social interaction, and recreational needs are necessary to influence the high

communication effect of martial arts culture, and they cannot individually explain the formation of the results. In the univariate necessity analysis of the non-high communication effect of martial arts culture, the consistency of the behavioral attitude conditional variable, which has a role in behavioral performance, reached 0.943, which is greater than the necessity threshold of 0.8. The coverage rate of the behavioral attitude conditional variable is 0.614, indicating that this conditional variable can explain about 61.4% of the cases, i.e., 61.4% of the cases in which the martial arts culture shows a non-high communication effect are influenced by the behavioral attitude variable. According to previous studies, usually a single conditional variable is considered necessary when its consistency is higher than 0.8 and its coverage rate is higher than 0.7. A coverage rate of less than 0.7 for the behavioral attitude conditional variable means that it does not have strong explanatory power, so this study concluded that the behavioral attitude conditional variable does not constitute a necessary condition for a non-high communication effect.

Table 2. Analysis of the necessity of single variable

Conditions Tested	High propagation effect		Non-high propagation effect	
	Consistency	Coverage	Consistency	Coverage
Perceptual usefulness	0.701	0.669	0.485	0.441
~Perceptual usefulness	0.415	0.461	0.631	0.667
Perceptual ease of use	0.552	0.649	0.316	0.355
~Perceptual ease of use	0.449	0.412	0.686	0.593
Behavioral attitude	0.567	0.385	0.943	0.614
~Behavioral attitude	0.432	0.888	0.052	0.116
Information seeking	0.685	0.575	0.643	0.542
~Information seeking	0.463	0.603	0.424	0.583
Personal identity	0.447	0.612	0.298	0.386
~Personal identity	0.552	0.453	0.701	0.548
Social interaction	0.578	0.606	0.527	0.395
~Social interaction	0.613	0.635	0.638	0.426
Entertainment needs	0.432	0.571	0.375	0.411
~Entertainment needs	0.639	0.614	0.426	0.437

4.2.3. Study of portfolio influences. After clarifying that a single influencing factor cannot be a necessary condition for a high effect of martial arts cultural communication, this paper explores the intrinsic action mechanism of each variable on the effect of martial arts cultural communication through group state analysis. According to the results of the group state analysis, a total of complex, intermediate and simple solutions were generated. Among them, the intermediate solution can more intuitively reflect the path that affects the dissemination effect of martial arts culture, so it is taken as the result of this study. At the same time, combined with the simple solution, the core and edge conditions of each path are judged, and in the specific generated paths, there are a total of five explanatory paths, and according to the path coverage, the three paths with higher coverage are finally selected for analysis. Table 3 shows the results of the group analysis of the effect of martial arts culture dissemination, in the table ● indicates that the core of the condition exists, ○ indicates that the core of the condition is missing, • indicates that the edge of the condition exists, ◦ indicates that the edge of the condition is missing, and blank indicates that the condition can be dispensable.

The analysis results show that the overall coverage and the coverage in each path are higher than 0.85, indicating that each path explains the results to a high degree. From the horizontal single condition, perceived usefulness exists in all three paths, indicating that perceived usefulness is the main factor influencing the audience's communication effect about martial arts culture. From the

vertical combination conditions, the combination of the elements forms three paths that affect the audience's acceptance willingness, as follows:

1) Technology acceptance type. Corresponding to the composition of grouping 1, namely "perceived usefulness * perceived ease of use * attitude * personal identity * entertainment needs". It indicates that when the content of martial arts cultural communication has obvious usefulness and ease of use, and can satisfy the users' personal identity expression and entertainment needs, the audience will have a higher willingness to accept martial arts cultural communication. Among them, perceived usefulness and perceived ease of use are the core conditions of this path, indicating that users in this path mainly decide their acceptance willingness based on the utility value and ease of use of martial arts cultural communication content.

2) Knowledge demand type. Corresponding to the grouping 2 composition, i.e., "perceived usefulness*attitude*information seeking*personal identity*entertainment needs". It indicates that when martial arts culture provides high-quality and original martial arts information, satisfies users' needs for in-depth understanding of martial arts, as well as reinforces their identities as martial arts enthusiasts, the audience will have a higher willingness to accept martial arts cultural communication. Among them, perceived usefulness, information seeking and personal identity are the core conditions of this path, indicating that users in this path decide their willingness to accept wushu cultural communication mainly based on the practical value and ease of use of the content.

3) Entertainment and interaction type. Corresponding to the composition of grouping 3, i.e. "perceived usefulness * perceived ease of use * personal identity * social interaction * entertainment needs". It indicates that when martial arts cultural communication provides enjoyable experiences and rich social interaction opportunities to satisfy users' entertainment and social needs, the audience will have a higher willingness to accept martial arts cultural communication. Among them, perceived usefulness, social interaction and entertainment needs are the core conditions of this path, indicating that users in this path mainly accept martial arts culture out of the need for entertainment and social interaction.

Table 3. The results of the configuration analysis of the propagation effect

Variable	Path1	Path2	Path3
Perceptual usefulness	●	●	●
Perceptual ease of use	●		□
Behavioral attitude	□	□	
Information seeking		●	
Personal identity	□	●	□
Social interaction			●
Entertainment needs	□	□	●
Raw coverage	0.285	0.256	0.198
Unique coverage	0.285	0.256	0.198
Consistency	1.000	1.000	1.000
Solution coverage	0.867		
Solution consistency	1.000		

4.3. Strategic Path of Wushu Cultural Communication System

4.3.1. Building an online resource base for martial arts culture. At present, the establishment of resource databases and newline service models for wushu culture is still lacking. The dissemination of wushu culture is still mainly offline, mainly relying on wushu coaches, network and TV, supplemented by CD-ROMs and books, while few of them are publicized by well-known newspapers or TV stations, and there is almost no relevant wushu resource database, which hinders the dissemination of wushu culture. Therefore, it is necessary to make full use of the existing communication resources, open up the channels of communication, and establish a database of wushu resources as well as a special news line service model.

At the same time, the use of Internet thinking and big data means to promote the deep integration of martial arts culture and multiculturalism with the support of national policies. For example, with the help of the "Belt and Road" initiative, we can build a martial arts exchange platform for countries along the "Belt and Road", and set up a martial arts cultural exchange center to support the development of international events such as the "Belt and Road" martial arts championship and taijiquan competition, and build a platform for international martial arts exchanges and cooperation with the help of the "Belt and Road" initiative. It is also possible to focus on supporting countries or regions that are relatively lagging behind in the dissemination of wushu culture through the collection of data related to the dissemination of wushu culture in each country, supporting provinces and cities to carry out wushu targeting work, and implementing targeted wushu culture development strategies in accordance with the national conditions of different countries.

4.3.2. Building a cultural communication system for martial arts:

1) Broaden the communication channels of wushu culture and improve the screening ability of the public. In today's era, the new media should actively seek new communication channels, innovate communication methods, pursue communication strategies, try to combine with the level of high technology, integrate traditional Chinese martial arts culture with high technology, publicize and promote martial arts culture, so that more people can understand the culture of martial arts and make it popular. At the same time of increasing the communication channels of wushu, it should also improve the audience's ability to screen the information and content of wushu, so that they can recognize the authenticity of the content pushed by the new media, and can firmly identify with the wushu culture.

2) Improve the laws and regulations on the dissemination of wushu, and enhance the government's supervision. Wushu culture, as part of the excellent traditional Chinese culture, represents the image of the country to a certain extent, and should be protected by the state and the government. The best way to regulate the behavior of the communicators is to formulate corresponding laws and regulations, strengthen the supervision of the content of wushu communication, and promote the true and effective dissemination of wushu culture. Under the supervision of the state and the government, the new media should also manage the content published on their respective platforms, arrange for special personnel to conduct audits before uploading to the Internet, and at the same time set up a special section on Chinese excellent traditional culture to train relevant personnel.

3) Discover the culture of wushu and create a wushu brand. Currently, the dissemination of wushu focuses on the teaching and inheritance of technical movements, and its dissemination content is relatively single. As a colorful and historical Chinese traditional wushu, we should explore its value from various aspects and build the diversity of wushu culture to promote its inheritance and development. Combine wushu culture with Chinese elements, take the popular wushu culture as the main body, and promote the political and economic development. Wushu industry, as a branch of wushu, can also disseminate wushu culture and make wushu popular and living. For example, the design of clothing, ornaments, stationery, etc., which have the culture of wushu, and promote the spread of wushu culture with wushu element products. On this basis to create a professional martial arts brand, pulling the sporting goods economy at the same time to promote the dissemination of martial arts culture.

5. Conclusion

Based on big data Hadoop technology, the article designs a content recommendation design scheme for wushu cultural communication, and realizes the intelligent recommendation of wushu cultural communication content resources through LFM-MBGD model. Combined with the fsQCA method, it analyzes the relevant factors affecting the effect of martial arts cultural communication and proposes the strategic path of the martial arts cultural communication system.

1) When using the LFM-MBGD intelligent recommendation model to recommend the content of martial arts cultural dissemination, its RMSE is as low as 0.92 when both the number of its neighbors and the number of hidden factors are set to 55. And the HR@K value of the model is 62.12%, which is significantly higher than that of other comparison algorithms. Through the combination of the hidden semantic model and the small batch gradient descent algorithm, the accurate recommendation of the content resources of martial arts cultural communication can be realized.

2) The consistency level of the existence and non-existence status of each conditional variable of the communication effect of martial arts culture is less than 0.8, and the non-existence of a single conditional variable is a necessary condition for realizing the high communication effect of martial arts culture. fsQCA results of the overall coverage and the coverage of each path are higher than 0.85, indicating that the explanation of each path to the communication effect of martial arts culture is high.

3) The wushu cultural communication system needs to build an online resource base of wushu culture in combination with big data intelligent technology, and optimize the effect of wushu cultural communication by broadening wushu cultural communication paths, sounding wushu communication laws and regulations, and creating a wushu brand to help expand the scope of China's wushu cultural communication.

Although this paper analyzes the application of intelligent technology in the dissemination of wushu culture and the factors affecting the dissemination effect, and obtains a strategy to improve the dissemination effect of wushu culture, it fails to cover all the factors affecting the dissemination effect of wushu culture. In the subsequent research, the interactive application of influencing factors and

intelligent technology will be further expanded to provide more effective empirical insights for martial arts cultural communication.

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