Construction of a Sharing Mode Based on VR Technology in the Context of Big Data

Fei Chen
School of Big Data, Chongqing Vocational College of Transportation, Chongqing, China

*Corresponding author e-mail: wyji@bjtu.edu.cn

Abstract. With the advancement of science and technology in recent years, the era of big data has gradually matured, and the era of intelligence has gradually penetrated into ordinary life. The improvement of technology around the world not only promotes the improvement of the quality of human life, but also has a direct impact on the operating mode of companies in all walks of life. Intelligent products are gradually replacing simple manual work projects. As the core technology of computers, VR technology has been widely used in various fields of social life. As the most imaginative and promising industry in the 21st century, virtual reality technology will completely change people's lifestyles. Virtual reality technology (English name: Virtual Reality, abbreviated as VR) is a new practical technology developed in the 20th century, including computers, electronic information and simulation. Including all technologies, the basic realization method is the computer VR environment to make people feel immersed in the environment. With the development of social productivity and science and technology, the demand for VR technology in various fields also increases. VR technology has made considerable progress and has become a new field of science and technology, and a proposal to establish a shared model system has been proposed. It aims to improve the state of the technology research and development industry and solve its pain. By combining VR technology with sharing, we will promote the reform of the sharing model, open public scientific and technological knowledge resources to those in need, expand the depth of access to technical knowledge, and increase the difficulty of current Internet knowledge. It aims to solve and improve the quality and satisfaction of people's knowledge needs.

Keywords: VR Technology; Sharing Model Construction; Big Data; Intelligence

1. Introduction
Virtual reality literally means the combination of virtual reality and reality. In theory, virtual reality technology (VR) is a computer simulation system that allows you to build and experience a virtual world. By creating a simulated environment, users can be immersed in the environment [1]. VR technology uses data in real life and outputs various electronic signals generated by computer technology. By combining it with equipment, it becomes a phenomenon that people can feel. These phenomena can be objects in reality, materials that we can't see with the naked eye, and represented by
three-dimensional models, these phenomena can be seen directly [2]. It is called virtual reality because it is not a thing, but because it is a real world simulated by computer technology. VR technology has won the recognition of more and more people. Users can experience the most real feeling in the virtual reality world. Due to the authenticity of the simulated environment and the real world, it is difficult to distinguish between true and false, making people feel that they are facing reality [3]. In addition, virtual reality also has all human perception systems, such as hearing, vision, touch, taste and smell. Finally, it has a powerful simulation system that truly realizes the interaction between humans and computers, allowing people to operate at will in the virtual environment process and obtain the most authentic feedback of the environment. Because of its virtual reality technology, multi-sensitivity and interactivity, it is loved by many people [4].

Shared service is the most popular form of financial management and corporate management in enterprise groups since the era of intelligence. In this model, the accounting operations scattered in various regions and entities were initially concentrated to maintain the consistency of accounts and reports [5]. Nowadays, due to the rapid development of technology, the sharing mode is also advancing with the times. In the context of big data, a sharing mode based on VR technology has been launched. The integration of VR technology into the sharing mode can make the shared content substantive, making it easy to find specific needs. Information is also developing rapidly with the rapid development of current technology [6]. However, while the sharing model based on VR technology is developing rapidly, there are more and more problems. Building a sharing model based on "big data + VR technology + blockchain" has certain advantages in model application, and has certain effectiveness and Necessity [7].

Since VR technology is applied to a shared model, there are unavoidable problems. First of all, because the informatization construction has not yet been completed, the big data technology as the core technology of the sharing model must be based on rich data. Therefore, the degree of development of the sharing model depends on the completion of the market informatization construction [8]. In the current Chinese market, there are large differences in the completeness of basic information among various industries such as e-commerce companies, logistics companies, and computer research and development companies related to Internet technology. The level of informatization of enterprises is relatively high, the basic information data is relatively complete, and the level of informatization of industries such as medical, industry, and education that are relatively shallow with Internet technology is low, and the level of informatization construction of the industry is relatively low [9]. Second, there are information security risks. The sharing model is a new economic model, which is based on the temporary transfer of use rights, and integrates social resources, such as social leisure products, education and medical care, and labor. What people obtain through transactions is the temporary transfer of specific social resources. It is a kind of use right, but there is no complete use right and complete ownership of the product. Due to the separation of product use right and ownership, it is difficult for users to control the product after losing the temporary use right, and the risk of user information leakage may occur [10].

2. Apriori Algorithm

2.1. Apriori Algorithm Idea

The realization of Apriori algorithm is based on the breadth-first search strategy. The main idea of the Apriori algorithm is to scan the database and use the iterative method to calculate the support of each candidate item set and the minimum support to find out the frequent itemsets, and then generate association rules based on the minimum confidence.

Among them, rule support and confidence are two very important concepts. For rules X and Y, the support calculation method of $X \Rightarrow Y$ is:

$$\text{Support}(X \Rightarrow Y) = P(X \cup Y)$$

(1)
X⇒Y’s confidence calculation method is:

\[
\text{Confidence}(X \Rightarrow Y) = \frac{P(Y|X)}{P(X)} = \frac{P(XY)}{P(X)}
\]

(2)

Assuming that there are a total of N blocks in the number of blocks, the minimum support is \( \text{Min\_sup} \), and the number of transactions in each block is \( D_p \), the calculation formula for the local support count of each block is:

\[
\text{sup\_p} = \text{Min\_sup} \times D_p (p = 1, 2, 3, \ldots, N)
\]

(3)

In the process of finding local frequent itemsets, it needs to go through two stages, connecting step and pruning step.

Connecting step: If frequent k-l-itemsets perform \( L_{k-1} \) self-connection operations, there are itemsets \( I_A, I_B \), suppose \( I_A \in L_{k-1} \), \( I_B \in L_{k-1} \). Represents the \( I_j[f] \) item in item set \( i \). Among them, \( I_1[1] < I_2[2] < \cdots < I_l[k - 1] \), the \( L_{k-1} \) connection conditions are:

\[
(I_1[1] = I_2[1]) \land (I_1[2] = I_2[2]) \land \ldots \land (I_1[K - 1] < I_2[2])
\]

(4)

Pruning step: In order to reduce the size of the candidate item set, you can first perform the pre-pruning operation according to the pre-pruning strategy of the local candidate item set.

The time complexity of the traditional Apriori algorithm is:

\[
O(\text{DB}_N) + \sum_{k \geq 2} (O(L_k \times L_k) + O(L_k \times C_{k+1}) + O(M + C_{k+1}))
\]

(5)

Assuming that there are \( n \) nodes in the \( \text{P\_Apriori\_BP} \) algorithm, when calculating the support, the number of comparisons is reduced and the number of transactions after ignoring is \( m \), then the time complexity of the \( \text{P\_Apriori\_BP} \) algorithm is:

\[
\frac{(O(\text{DB}_N) + \sum_{k \geq 2} (O(L_k \times L_k) + O(L_k \times C_{k+1}) + O(M + C_{k+1})))/n}{m}
\]

(6)

2.2. The Shortcomings of the Apriori Algorithm

Although the Apriori algorithm has been widely used in various fields, there are many shortcomings and deficiencies in the traditional Apriori algorithm, which cause the efficiency of the algorithm to decrease, as follows:

1. The algorithm needs to scan the database multiple times. Every time the algorithm generates a frequent itemset, it will perform a database scan. If there are too many frequent itemsets, it will take a long time, which will reduce the overall performance of the algorithm.
2. The traditional serialization algorithm increases the I/O cost of the algorithm, and the processing capacity of a single machine is severely reduced in the face of massive data.
3. The number of candidate sets generated by the algorithm’s self-connection process is too large. During the self-connection process, if the value of \( k \) is too large, it will consume too much time in the first \( k-1 \) comparisons of the algorithm. When the value of \( k \) is 50 when connecting, then \( -1 \) candidate item sets will be generated, which shows that the efficiency of the algorithm is extremely low in this case.

2.3. Design of Apriori Algorithm

In the process of implementing the sharing mode based on VR technology, the program's processing of data is generally processed according to rows by default. Doing so does not change the original nature of the data, and their contrast relationship is also unchanged, due to the sharing model. The core
architecture in the VR technology is HDFS and VR technology, and for VR technology, its core is the two functions of Map and Reduce, so our understanding and writing of these two functions is very important. In order to realize a complete sharing mode program, it must go through the design of Map function and Reduce function. When the shared mode program is executed, the records in the file are parsed into the form of <key, value> key-value pairs, where key represents the line number, and value represents the record of the line. Hadoop will start a job every time a frequent itemset is sought. In this job, each Map function not only processes one data block, the output result of the Map is used as the input of Reduce, and Reduce will reduce the key-value pairs of these inputs. This feature of the sharing model greatly simplifies distributed programming and provides convenience for developers.

3. Modeling Method

3.1. Node Weighted Summation Model

For a node in the shared model, it often connects some nodes through different types of relationships. The symbolic representation of other nodes is the same as that of node e1. Then, we can get the vector of the head node as

$$E_{r,h} = \alpha_{r_1} - r V_{e_1} + \alpha_{r_2} - r V_{e_2} + \alpha_{r_3} - r V_{e_3} + \alpha_{r_4} - r V_{e_4} + \alpha_{r_5} - r V_{h}$$

(7)

Therefore, different contributions need to be used to measure different types of connections. The vector of the head node is expressed as:

$$E_{nationality, XiaoMing} = \alpha_{location} - nationalityV_{Beijing} + \alpha_{gender} - nationalityV_{man} + \alpha_{profession} - nationalityV_{teacher} + \alpha_{profession} - nationalityV_{programmer} + \alpha_{head node} - nationalityV_{XiaoMing}$$

(8)

The above is a specific example of how to perform weighted summation on nodes in the sharing mode to obtain the vector representation of the head node. For the general case, the vector of the head node h under the relation r is expressed as:

$$E_{r,h} = \sum_{(ix) \in c_h} \alpha_i - r V_e$$

(9)

According to Sklar's theorem, the joint distribution of random vectors (n, r2) can be expressed as:

$$F(x_1, x_2) = C(F_1(x_1) \cdot F_2(x_2))$$

(10)

Among them, $C(\cdot, \cdot)$ is the Copula dependency structure, $f_1(\cdot)$ and $f_2(\cdot)$ is the $(r_1, r_2)$ marginal distribution function of .

Correspondingly, its joint density function is:

$$f(x_1, x_2) = c(u_1, u_2) \cdot f_1(x_1) \cdot f_2(x_2)$$

(11)

Among them $u_i = F_i(x_i)$, $i=1, 2, c(\cdot, \cdot)$ is the density function of Copula, $f_1(\cdot)$ and $f_2(\cdot)$ is the $(r_1, r_2)$ edge density function of . Through formula (8), the following formula holds:

$$C(u_1, u_2) = F(F^{-1}_1(u_1) \cdot F^{-1}_2(u_2))$$

(12)

Equation 11 shows that Copula gives the joint probability that the corresponding random variables $r_1$ and $r_2$ are less than or equal to the corresponding given quantile.

Update the probability distribution of the training data set:

$$D_{m+1} = \{W_{m+1, 1}, ..., W_{m+1, f}, ..., W_{m+1}, N\}$$

(13)
\[ W_{m+1,i} = \frac{W_{mi}}{Z_m} \exp \left( -a_m y_i T_m(x_i) \right), (i = 1, 2, \ldots, N) \]  
(14)

After completing the above steps, construct a linear combination of classifiers:
\[ f(x) = \sum_{m=1}^{M} a_m T_m(x) \]  
(15)

The final data cloud processor obtained from the scientific research is:
\[ T(x) = \text{sign}(f(x)) = \text{sign} \left[ \sum_{m=1}^{M} a_m T_m(x) \right] \]  
(16)

4. Evaluation Results and Research

With the increase of exchanges with the world, the concept of shared services has gradually spread and been widely used in our country. Some Chinese enterprises have also begun to construct and try FSSC. Some leading companies in the industry have established FSSC, thereby enhancing their competitiveness. The country has also begun to attach importance to the promotion of shared service models, and has issued a number of documents and regulations at the policy level to support enterprises in building their own shared service models. This has further promoted the trend of my country's management model reform. In recent years, my country's FSSC has begun to develop at a high speed, the number has increased year by year, and the scale has expanded year by year.

In 2013, ACCA Deloitte conducted a survey on the status quo of shared services among Chinese companies and found that nearly half of the companies established FSSC to accept shared services. As shown in Figure 1.

![Shared service or outsourcing usage table](image)

**Figure 1.** Shared service or outsourcing usage table

In 2015, the National Accounting Institute conducted a survey on the sharing situation of Chinese companies. The first company in my country to establish FSSC has been successfully operated for about ten years. It has good practical experience and achieved good practical results. Some large-scale enterprise groups that have launched financial sharing services in my country have achieved certain results, effectively reducing operating costs, improving service performance, and rapidly increasing
corporate value. Taking Company A as an example, the cost of the business has been effectively reduced after the implementation of the VR-based sharing mode, as shown in Table 1.

| Table 1. Application effect of sharing mode implemented by Company A |
|---------------------------------------------------------------|
| Project                         | Before sharing | After sharing | Effect(%) |
|---------------------------------|----------------|---------------|-----------|
| Number of business processing staff (person)                  | 87             | 43            | Decrease 50 |
| Cost per unit bill (yuan)      | 15.35          | 4.34          | Decrease 50 |
| Business processing efficiency (days)                           | 6.2            | 3             | Increase 50 |
| Average number of settlement documents per day (single)        | 1300           | 2000          | Increase 50 |
| Total cost (ten thousand yuan)                                    | 619            | 269           | Decrease 50 |

In 2017, ACCA (Association of Chartered Certified Accountants) and General Electric jointly released the "2017 China Financial Shared Services Survey Report" that as of October 2017, the number of companies that have established sharing centers in my country has reached 54.76% and 42.86% of companies Plan to establish a sharing center. Among the surveyed companies that have not established a shared service center, 61.8% of the companies plan to establish a shared service center within 3 years, and 77.0% of the companies plan to establish a shared service center within 5 years. See Figure 2.

![Figure 2. Construction of Sharing Center](image)

It can be seen that the sharing mode based on information-based VR technology is already a trend, and the establishment of a shared service mode is also a necessary change for enterprises to continue to develop. It is also a new answer to the need for company A to streamline its financial structure and effectively reduce operating costs.

5. Conclusion
With the advent of the information age, as the country proposes new concepts and new directions such as intelligent manufacturing and Internet +, the innovation of sharing mode has become an inevitable
trend, whether it is in the way of design, customer requirements, and the purchase of shared information. Challenges have all been raised. Otherwise, in terms of teaching and education, the establishment of a sharing model based on VR technology is conducive to meeting the individual needs of teaching resources and improving the overall teaching effect and quality of education. In addition, through the joint construction between universities and the sharing of digital teaching resources, the demand for resource sharing is met, and the problems of resource redundancy and low availability are solved. In addition, based on the sharing model of VR technology, in the company's construction process, each node company in the supply chain emphasizes the need to share accurate, comprehensive and effective information, as well as demand information, sales information and production information. Through clear information collection, delivery, storage, analysis and feedback of shared content, share inventory information, order information, product quality information, transportation information and other information, and analyze the information process.

References
[1] Menin A , Torchelsen R , Nedel L . An Analysis of VR Technology Used in Immersive Simulations with a Serious Game Perspective[J]. IEEE Computer Graphics and Applications, 2018, 38(2):57-73.
[2] Cynthia H H , Wu H . Technology for real estate education and practice: a VR technology perspective[J]. Property Management, 2020, 38(2):311-324.
[3] Shirinkina E . VR Technology and Its Impact on Academic Performance[J]. entific Research and Development Economics, 2020, 8(3):34-37.
[4] Teng Y , Li X , Wu P , et al. Using cooperative game theory to determine profit distribution in IPD projects[J]. International Journal of Construction Management, 2019, 19(1):32-45.
[5] Riguzzi F . Speeding Up Inference for Probabilistic Logic Programs[J]. The Computer Journal, 2018, 57(3):347-363.
[6] Zaunick, HansGeorg. Developments toward a Silicon Strip Tracker for the PANDA Experiment[J]. Comparative Biochemistry & Physiology Part A Molecular & Integrative Physiology, 2018, 166(1):119-127.
[7] Wang X , Zhang Y , Leung V C M , et al. D2D Big Data: Content Deliveries over Wireless Device-to-Device Sharing in Large Scale Mobile Networks[J]. IEEE Wireless Communications, 2018, 25(1):32-38.
[8] Yudong C , Yuejie C . Harnessing Structures in Big Data via Guaranteed Low-Rank Matrix Estimation[J]. IEEE Signal Processing Magazine, 2018, 35(4):14-31.
[9] Polina M , Lucy O , Yury Y , et al. Converging blockchain and next-generation artificial intelligence technologies to decentralize and accelerate biomedical research and healthcare[J]. Oncotarget, 2018, 9(5):5665-5690.
[10] Miao C , Humphrey R H , Qian S . A cross-cultural meta-analysis of how leader emotional intelligence influences subordinate task performance and organizational citizenship behavior[J]. Journal of World Business, 2018, 53(4):463-474.