Application of CAD Virtual Reality Technology in Bank Financial Business System

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Abstract. Virtual reality (VR) is a comprehensive integration technology, in the reality of Internet finance is growing stronger and stronger, the integration of information technology and Internet VR technology will also have linkage with the financial field. The financial business system has a wide range of application prospects. In order to solve the problems of large turnover of traditional bank counter staff and small customer reception volume, the concept of virtual bank and smart counter is no longer a 'mirror', and has become an urgent need of the banking industry. Banks are seeking solutions based on their own characteristics. The purpose of introducing or integrating new technology is to solve the industry pain points, but the application of new technology is bound to bring many new difficulties. Only by locking the pain points and overcoming the difficulties, can virtual bank become a product available to everyone. 'VR + distributed system' creates a new banking scene, realizes the upgrade from traditional online banking to virtual reality banking. Eliminate traditional bank outlets and builds intelligent virtual reality outlets. The head-mounted terminal system realizes the security and personalizes marketing of virtual reality technology in banking business. From the perspective of marketing, the most suitable products can be recommended according to the customer status by analyzing the information acquired through behavioral model, which can realize the marketing mode of 'personal customization, thousands of faces.'

1 INTRODUCTION

A bank is a place that provides financial services, which is essentially a service industry. Its services to customers are mainly reflected in two aspects: financial products and customer experience. With the rapid rise of fintech, the business model and service model of traditional banks have become increasingly unable to meet the needs of customers and the development trend of the market. It has become the primary task of banking and financial industry to promote business innovation and development by means of science and technology. At present, virtual reality (VR) has made Google, Samsung, Microsoft, SONY and other major technology companies 'crazy money', VR applications should also become a new gold spot, the film and television entertainment, games, education, finance and other fields have been widely used. With the further maturity of virtual reality technology and products, the financial industry, which is highly integrated with information technology, also began to play VR across the industry, and began to develop and apply this technology. Tunowski [1] mentioned that the reason why virtual reality technology is so attractive to financial institutions is that virtual reality can convey boring content to customers in the form of vision and transform it into an immersive experience, which is convenient for customers to understand financial products and optimize business procedures, and bring more performance to the institutions. The development and popularization of VR technology will become another important Internet interface after PC and smart phone. As Internet finance grows stronger and stronger, VR technology, which integrates information technology with the Internet, will also link with the financial field, so as to make transaction interaction virtualization, delivery and settlement scenarios, data analysis visualization and financial education simulation. Ahmad et al. [2] mentioned that the deep integration of VR technology and financial industry will be the common development trend of both in the future. At present, the application of virtual reality technology in the financial field mainly focuses on the enhancement of interaction of emerging financial customers, user experience and financial education, and the service scope is too narrow. In the future, efforts should be made to launch differentiated financial VR application products, further expand the scope of application scenarios, and build a larger interactive space platform, so as to better cultivate the market and improve its share. Production environment is a colossal system, bank need real-time data exchange is an important data processing and operation center, computer room construction and environmental facilities also increase at a rapid pace to form the computer as the core of banking system, computer room equipment running state are in good condition can directly affect the banking business. Therefore, the monitoring and management of the equipment room is the most important part of the bank's work. But the high noise, high radiation and high voltage of the machine room environment also bring harm to human health. Virtual machine room environment simulation using VR technology will bring the following benefits to managers and on-duty personnel: After virtual machine room environment, Web3D technology will dynamically display the operating status and general information of equipment in the machine room, including temperature, humidity, smoke alarm, UPS status monitoring, and can start the alarm according to the predetermined value. The on-duty personnel or technical personnel can check the application system exceptions in real time without entering the equipment room and solve the problems timely. So, through the way of interaction of computer room environment carries on the omni-directional stereo view using VR technology room related people in the office can be like into the room to carry on the inspection, check the distribution monitoring, monitoring and alarm in time to master all room facilities and running situation of the software system to reduce the personnel on duty of operational strength to improve work efficiency, optimize management mode.

The production and management systems of banks are numerous, and the products are emerging in endlessly. Therefore, training is part of the daily work of banks. Traditional training methods cannot enable employees to master quickly. Andries and Sprincean [3] mentioned that cash-oriented production systems, in particular, can have disastrous consequences if graduates are not well trained. Through the virtual business production system and related application

system, the teller can more accurately and quickly grasp the business knowledge on the counter, accelerate the speed of duty. Therefore, the advantages of applying virtual technology to training and management performance: Often upgrade production system and the presence of new products, and strong risk, as the new employees in new and old employees, through practice of virtual reality systems, like real mount guard, will face different types of customers, can be practiced answering questions, how to marketing products, after the mount guard, also may carry on the review on the summons accounting supervisor. Managers also played a supporting role in hiring decisions by replaying the training process. In the training of the economic management system and other products, we can communicate with the training teacher in real time through video, animation, text, voice and so on, just like the on-site training. Banks that use VR technology are further advanced than online banks. Users can wander freely in a branch, read promotional folds, consult the lobby manager for services such as inquiry, payment and transfer, and discuss financial services with financial personnel as if they had face-to-face communication. Banks can observe and understand customers more comprehensively through virtual reality, so as to discover VIP customers. Customers can grasp financial information in time through immersive real-time communication, and avoid the fatigue of running to the bank.

2   THEORETICAL BASIS OF VIRTUAL REALITY TECHNOLOGY

Virtual reality is an integrated information technology that integrates computer graphics and image processing, Internet, sensors, multimedia, human-computer interaction, simulation system and other technologies. Virtual reality technology was first applied in the military field. Since this century, with the matching of computer hardware technology and computer software system, the application of VR has been extended to many civilian fields. For example, industrial design and planning, e-commerce and product display, virtual teaching, experiments and training, virtual surgery, simulated human organs and so on. This paper discusses the application of virtual reality in banking business system.

Immersive and human-computer interaction of interest is the essence of virtual reality characteristics of time and space environment real idea is the ultimate goal, through the virtual reality technology, customers need not attend can experience financial services, such as business advisory services, investment advisory services, non-cash business experience and new equipment, etc., not only reduces the cost of banking services, and it improves the customer experience.

To realize virtual reality, people can immerse themselves in the virtual environment created by computers, which can be realized by hardware or software. Idasz-Balina et al. [4] mentioned that The hardware must be equipped with corresponding hardware devices. Specifically include:

(1) Tracking system. The task of the tracking system is to detect the position and direction of the head, body and hand of the virtual reality system in real time, so that the data can be fed back to the control system to generate images that change with the line of sight. It includes two electromagnetic tracking system, acoustic tracking system, optical tracking system, etc.

(2) Haptic system. The key factor to create 'immersion' effect in virtual reality system is that users can operate virtual objects with their hands or other active parts of the body and feel the reaction force of virtual objects during operation. Data gloves, space balls and data suits can meet the requirements of six degrees of freedom in three-dimensional space.

(3) Audio system. Auditory environment system consists of speech and sound synthesis equipment, recognition equipment and sound source location equipment. Auxiliary information provided by auditory channel can enhance the user's perception of the environment.

(4) Image generator. Image generation and display in VR environment, image generation and display technology is very important.

(5) Measurable display equipment. It can generate an immersive virtual reality environment, such as headset display, handheld stereoscopic display equipment, etc., which can generate stereoscopic feeling in binocular vision.

In software, VRML can be used to build the scene model of the real world has nothing to do with hardware, it is only a software technology to achieve virtual reality. On the realization of virtual reality, as a result of the above equipment is expensive and penetration rate is very low at present on the network so most of the VR system used the VR, which needs only picture lifelike interactive special equipment, although this makes the function of the VR, but compared with the traditional human-computer interface is already has gone up. With the advent of large-scale applications in the network era, the market is becoming more and more urgent for the application of virtual reality technology, which also promotes the development of various VR technologies.

Through professional instruments and equipment mapping method establish a scaled down bank branch model. Imitate the physical network design including the gate, hall, counter, ATM and virtual teller. When the model is projected by the equipment, customer information verification is required when the customer enters the door. The virtual three-dimensional space in the lobby provides users with guidance or process guidance, and the counter is the specific business handling office. AR - based virtualization technology breaks through the space limitation of real network. We can expand the model. The functional structure of the virtual banking system is shown in Figure 1.
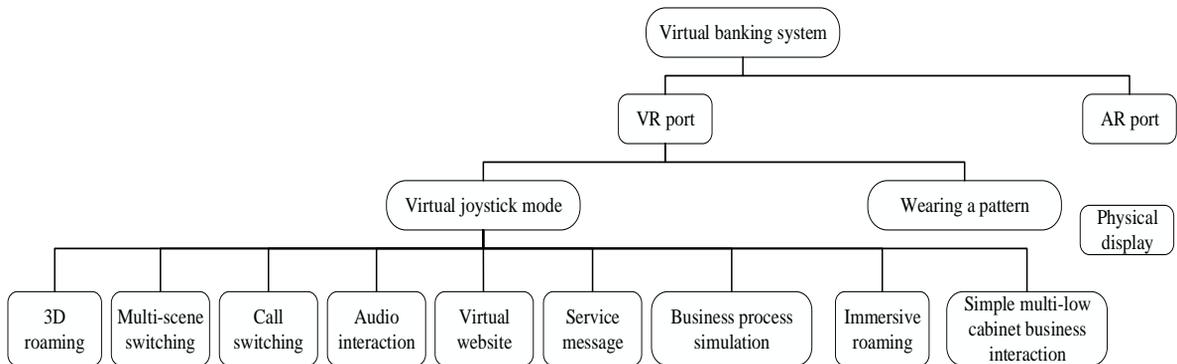

Figure 1: Functional structure diagram of virtual banking system.

In order to build an immersive payment environment, panorama is an efficient way to model the environment. Panorama generally builds an environment larger than the normal and effective perspective of both eyes through photos, videos, 3D models and other forms of expression. It is a new image information organization mode that can express complete information of the surrounding environment. Al-Dmour et al. [5] mentioned that compared with the observer, it is a three-dimensional and multi-angle graphic environment built on the image. Using panorama for environment modeling is not only more realistic than geometric VR modeling, but also has almost no effect on running speed due to its complexity of details. In addition, today's VR devices with the largest shipments and the widest popularity are based on mobile phones. As mobile phones are inferior to PC-based VR devices in terms of refresh rate, CPU performance and other hardware conditions, the efficiency of panorama will be more widely used in mobile VR applications. The entire virtual scene designed in this paper is generated according to the following steps:

(1) The collected discrete images or continuous videos are used as basic data to form panoramic images after processing;

(2) Organize panoramic images into virtual panoramic space through appropriate spatial model;

(3) To build objects in the panoramic space, that is, 3D models, 2D models, etc.

(4) Control processing of objects through some scripts, so that these objects bring friendly interactive experience to users.

Based on the above VR modeling, users can conduct a series of behaviors and operations in the real environment, such as forward, backward, and 360-degree circumnavigation, in the constructed virtual scene, with strong immersion and friendly interaction. The flow chart of virtual banking system service introduction is shown in Figure 2. In summary, virtual reality is realized through software technology as described above. The specific application of virtual reality in banking and financial business system and its benefits are discussed below.
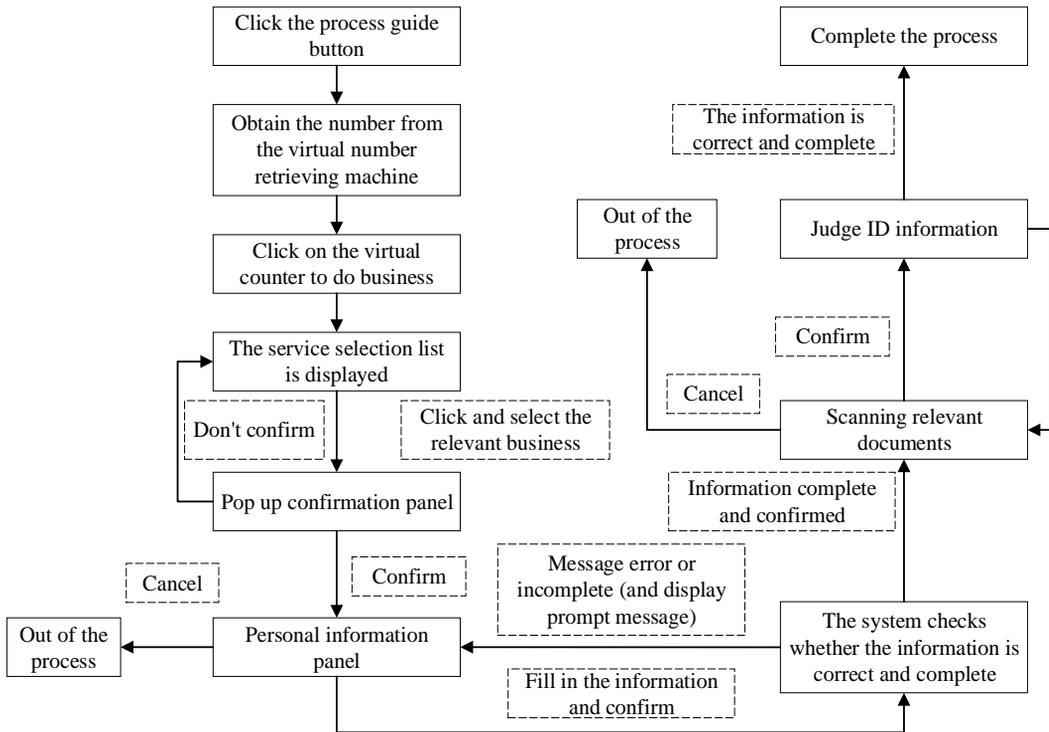

Figure 2: Flowchart of virtual banking system service.

3   APPLICATION OF VIRTUAL REALITY TECHNOLOGY IN BANKING BUSINESS

The informatization construction of modern commercial bank has experienced the development from electronization, informatization to network. With the continuous innovation of financial technology, the virtual bank in the future is gradually becoming possible from imagination. Burghardt et al. [6] mentioned that the mode of virtual bank is diversified, and there is no accurate and specific description at present. To put it simply, the financial services provided by commercial banks are the marketing and service of financial products to customers by special account managers in specific business places. Abstractly, it consists of three elements: place, personnel and product. This paper, combining the development of information banking, Internet finance and financial services, illustrates the business site virtualization, customer manager virtualization, product visualization, and puts forward a future virtual bank construction mode.

3.1 Virtual Reality Bank based on Virtual Reality and Distributed System

Distributed virtual reality system (DVR) is a system that connects multiple users in different physical locations to a virtual environment and realizes real-time multi-person interaction. It is the product of the organic combination of VR technology and distributed system. In the past, VR communication was basically in man-machine communication. Although the continuous development of technology enhanced the sense of immersion of pictures, the biggest difference from reality is the lack of interaction between people. With DVR, we can achieve real human interaction in different geographical locations, greatly reducing the difference between virtual and real. The technology can be used in private banking services and VIP financial services [7].

When DVR is commercialized in banks, its application scenarios are very wide, and many services can be provided from reality to virtual environment, which is a great opportunity for banks to create new scene finance. The essence of scene finance is to integrate financial services with customers' life scenes, so that finance can be displayed in daily life in an intuitive and convenient way, and customers' demand for financial services can be enhanced. This requires commercial banks to complete the transformation from a single financial intermediary to a diversified cross-border service provider. There is a huge space for the integration of finance and the development of the scene. In order for VR to become the third largest computer platform after PC and smartphone, it must change the current closed environment and have the function of human interaction. From the perspective of the bank, on the one hand, DVR can turn the scene finance into a visual thing, and share the feelings of the virtual world with real friends, weakening the difference between realities and virtual, which is more suitable for scene construction than PC or mobile phone. On the other hand, through DVR, most services can ignore the limitation of physical location, and banks can reduce costs and improve effects in developing scene finance.

3.2 Intelligent Virtual Reality Dot-based on Virtual Reality and Artificial Intelligence

Artificial intelligence is a technical science for simulating, extending and expanding human intelligence. The combined use of artificial intelligence and VR will have a great impact on improving customer service experience and intelligent network construction. From the client side, VR brings customers a brand-new service experience. VR has the sense of immersion brought by three-dimensional vision, but it is not much different from smartphones or PCS in business handling. In order to improve customer engagement, it must change its service content. Artificial intelligence is a very important influencing factor [8]. The biggest characteristic of customers handling banking business through VR is the experience of immersion. In order to improve this immersion, it is necessary to give customers an intelligent product with a sense of dependence. Design an intelligent financial assistant, as long as users enter the VR system, can provide real-time financial services for customers, long-term use can make users rely on VR bank greatly increased. Compared with smartphones and PCS, VR's AI assistants are visual, not just a tool for handling banking, but more of a financial steward. In addition to sensory improvements, AI is also better at providing services. Artificial intelligence has been used in businesses such as intelligent investment, intelligent credit granting, etc. Compared with human beings, artificial intelligence is more rational and faster in data processing, which is destined to shine in the financial field. VR has changed the external environment, and artificial intelligence has provided it with internal wisdom. The new mode generated by mutual integration is more in line with the customer-centered service.

Banks can combine physical elements such as real bank buildings, business halls and workplaces to construct virtual bank branches by using virtual reality technology, artificial intelligence technology and communication technology. In the virtual space, customers feel like walking in the real bank hall, where counters, tellers, self-service devices and financial products are clear at a glance. Customers can roam the virtual bank branches either in traditional ways or in precise location by intelligent voice navigation. Customers can not only see the hall, counter, teller, self-service equipment and financial products, but also according to what they see, the business can be real-time dynamic display of relevant information, such as customer business view,

investment portfolio and investment trial calculation data. Not only can they communicate with bank employees in real time, but they can also communicate with other customers in real time, and they can also consult with intelligent investment advisors for investment advice. In addition to consulting services, customers can also handle online transactions, such as portfolio investment transactions, transfer, and remittance and payment services.

3.3 Head-worn Terminal System based on Virtual Reality and Biological Recognition

Today, biometrics is one of the most widely used technologies in the financial sector, ranging from fingerprint unlocking to face payment. The combination of VR and biometrics can be analyzed from two perspectives. Products and services of commercial Banks is the most important sales channels of the business premises, by VR technology to break the traditional bank branches of regional restriction, can in the existing physical network virtual VIP area, cash, precious metals and financial service area of the three dimensional space, or even create a virtual branches directly, not limited by geographical location, space, by wearing VR equipment, customers can switch between various functional areas and outlets at will [9].

Biometrics use the inherent characteristics of the human body as a key, which is usually impossible to copy and not easy to lose. It is more secure than identity authentication by keys, passwords, magnetic stripe cards and other means. At present, the mainstream biometrics are fingerprint recognition and gradually emerging face recognition and voice recognition, which can be realized on a smart phone. While wearing VR devices by collecting information to the customer's face and pupil information, thus can realize face recognition and iris recognition a combination of two kinds of identification, such as the course of iris recognition rate at 0.0001%, lower than the rate of fingerprint recognition and face recognition course several orders of magnitude, and the high precision identify in the customer immersed in the virtual world can be completed, there is no need for customers to deliberately operate, and the effective integration of VR and biometrics realizes the coordinated development of customer experience and account security [10]. Biometrics can capture a large number of behavioral characteristics of customers, such as changes in facial expressions, constriction of pupils and even changes in heart rate and temperature, which are almost impossible for bank marketers to observe, but will be fully exposed under the recognition of VR headsets or other external devices. By analyzing the obtained information through behavioral model and recommending the most suitable products according to customers' status, the marketing model of 'customized, thousands of faces' can be realized. The resource sharing rate and utilization rate of virtual reality technology is shown in Figure 3.
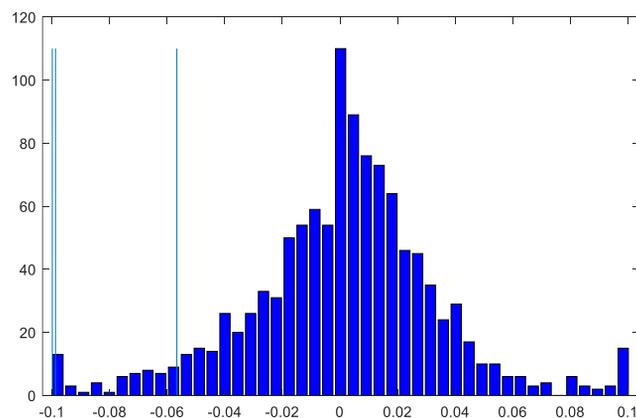

Figure 3: Resource sharing rate and utilization rate of virtual reality technology.

4   SYSTEM PERFORMANCE VERIFICATION AND ANALYSIS

Virtual reality can simulate the real world, and can also fuse the real world with the virtual world. On the one hand, the financial services of virtual banks can be used to replace the financial services of physical banks by establishing unified standards of virtual banks, thus reducing the capital input and labor costs of physical banks. On the other hand, augmented reality technology can be used to display customer portraits and product recommendations in real time through holographic window display and head-display glasses, reducing communication costs and time costs and obtaining more marketing opportunities. The financial business management conditions at risk value distribution is shown in Figure 4.
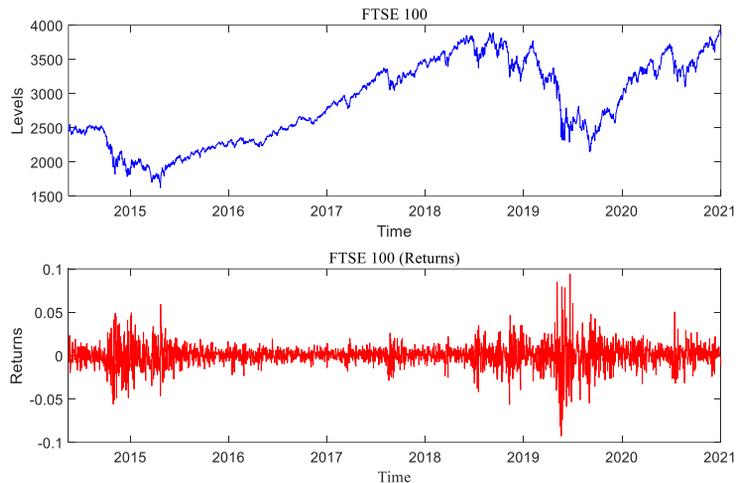

Figure 4: Financial business management conditions at risk value distribution.

By simulating scenarios closely related to customers, banks enhance customers' intuitive feelings and improve their willingness to deal with business. Through SIMS, customers can be aware of the risks that may occur at each stage of life, so that customers can plan for the future. By simulating driving risks, customers can understand the risks that driving habits may bring, so that customers can consider the best combination of insurance. Through financial management community games, customers can intuitively understand financial products, returns and influencing factors, so that customers can have a more intuitive and three-dimensional understanding of financial products and expected returns, so as to choose their preferences of financial portfolio. The evaluation of bank business efficiency based on cloud model is shown in Figure 5.

Financial product innovation using virtual reality technology will be another breakthrough for financial industry product innovation. The introduction of virtual reality, abstract investment advice can be more intuitive and stereo, such as Banks can through virtual reality and artificial intelligence technology to simulate the client's future and every stage of life events or potential risk, so that the customers for their own future reasonable planning, and combined with each life stage appropriate financial products or insurance products. The comparison between theoretical curve and sample approximation prediction curve is shown in Figure 6.

Banks can make virtual reality content to meet the needs of intelligent device use guidance, business management process guidance, business training and fire drill. Intelligent device operation guide Enables customers to simulate interaction with intelligent devices, understand the operation process of intelligent devices, and operate devices directly. Business handling process guidance to simulate the real business handling process, customers can not only communicate with the teller, but also experience the business handling process. Business training simulates the real business management process, which can not only explain the operation process of each

business, but also carry out practical operation assessment for new employees. The fire drill simulates the real physical place, and the employees participating in the drill feel as if they are on the scene. They can train the firefighting skills of firefighters, on the other hand, they can carry out the real fire drill, and examine the firefighting consciousness and reaction ability of enterprises and employees. The comparison of raw data with regression prediction data is shown in Figure 7.
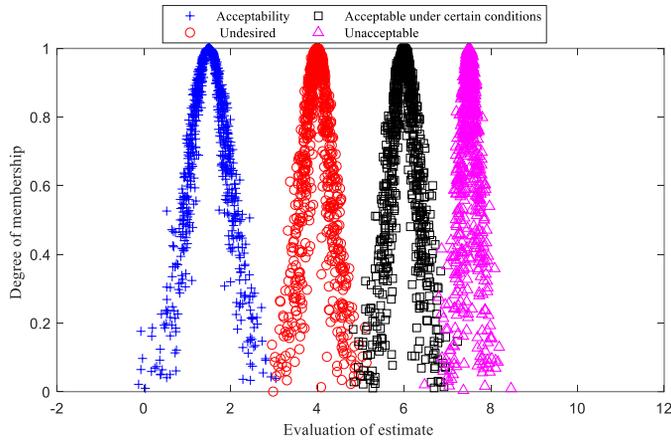

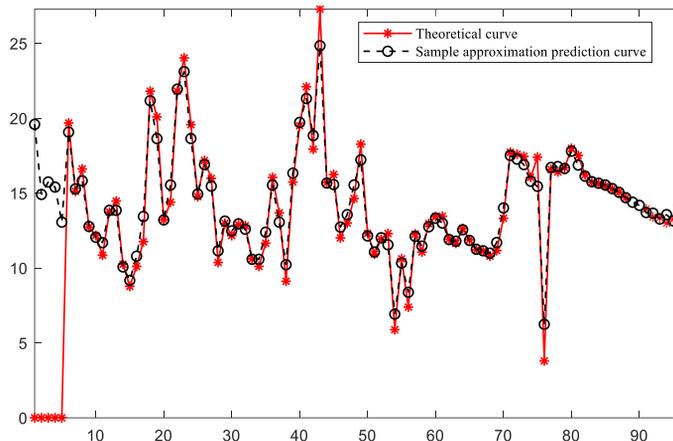**Figure 5:** Evaluation of bank business efficiency based on cloud model.

Figure 6: Comparison between theoretical curve and sample approximation prediction curve.

5   CONCLUSION

The development of technology and the abundance of financial products will provide us with convenient, private and low-cost financial services anytime, anywhere, portable in the future. Therefore, it is a huge project to apply VR technology to the banking system to realize scene simulation and intelligent interaction. At the present stage, the application of financial VR needs to be improved in industrial planning, technological upgrading and product enrichment. With the application of big data, biometric technology, cloud computing and other technologies in the financial field, the integration of virtual reality and banks will bring technical changes to the financial innovation of banks, and customers will feel, experience and participate in finance more. Virtual reality technology also has broad application scenarios in the banking industry. Tailored

personal financial services and asset allocation for each customer's different financial needs to maximize the customer's differentiated needs. Virtual bank will break the limitation of time and material resources, change the way customers handle financial services, further realize the diversification of banking services, save the cost of manpower and material resources, and let customers get more and better experience.
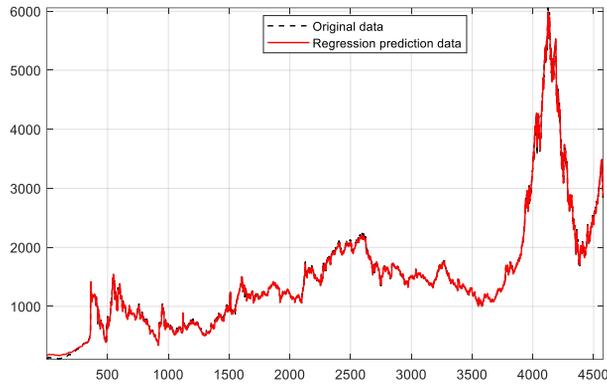

Figure 7: Comparison of raw data with regression prediction data

The establishment of virtual bank has been the general trend, as a technical means, AR is undoubtedly a powerful tool to create virtual bank. As the young generation is more and more capable of accepting new products and technologies, its increasingly vigorous demands for interactive innovation, individuation and diversification will trigger the application demand of virtual reality technology in the banking industry. The continuous development of software and hardware technology will make the application cost of virtual reality lower and lower, the application scope is wider and wider, and the application value and application prospect in the banking industry will be bigger and bigger.

(1) Do a good job in industrial planning to meet the requirements of The Times. Compared with the wave of international financial institutions stepping up investment in VR technology layout, the pace of China's financial industry lags far behind. Therefore, we should pay more attention to the application dynamics of VR technology in the global financial industry, integrate the development of financial VR industry into the long-term planning of financial services, and clarify the development goals. Timely encourage and guide financial institutions to strengthen cross-border cooperation with high-tech enterprises and advanced machine and tool manufacturers, and continuously promote the application of VR in the financial field.

(2) Accelerate technological upgrading and expand application scope. Basic parts and software technology are the weak links of China's virtual reality industry, and there is a big gap between China and foreign countries. Therefore, we should effectively promote the combination of production, learning and research to create a good development environment. Concentrate superior resources. Make breakthroughs in core technology, enhance the voice of the industry and occupy the core position of the industrial chain. It is necessary to establish a business model that takes application as the core and radiates up and down the industrial chain, so as to promote the application development in the financial field and produce a demonstration effect.

(3) Enrich product types and improve user experience. At present, financial VR products mainly interact with target customer groups through head-mounted display devices. However, the lack of products leads to a narrow range of service objects. After the customer experience, there is too much novelty and not enough stickiness and loyalty. So. It is suggested to enrich the product

types. Expand application scenarios and build a larger content platform space to improve productivity and market engagement and gain better revenue from it.

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REFERENCES

[1] Tunowski, R.: Sustainability of commercial banks supported by business intelligence system, Sustainability, 12(11), 2020, 4-17. https://sci-hub.et-fine.com/10.3390/su12114754

[2] Ahmad, S.; Miskon, S.; Tlili, I.: Modeling of business intelligence systems using the potential determinants and theories with the lens of individual, technological, organizational, and environmental contexts-a systematic literature review, Applied Sciences-Basel, 10(9), 2020, 5-13. https://sci-hub.et-fine.com/10.3390/app10093208

[3] Andries, A.-M.; Sprincean, N.: Cyclical behaviour of systemic risk in the banking sector, Applied Economics, 53(13), 2020, 1463-1497. https://sci-hub.et-fine.com/10.1080/00036846. 2020.1822511

[4] Idasz-Balina, M.; Balina, R.; Chrostowska-Juszczyk, G.: The determinants of cooperative banks' community service-empirical study from Poland, Sustainability, 12(5), 2020, 2-12. https://sci-hub.et-fine.com/10.3390/su12051885

[5] Al-Dmour, H.-H.; Algharabat, R.-S.; Al-Dmour, R.-H.: Investigating the impact of ECRM success factors on business performance Jordanian commercial banks, Asia Pacific Journal of Marketing and Logistics, 31(1), 2019, 105-127. https://sci-hub.et-fine.com/10.1108/apjml-10-2017-0270

[6] Burghardt, A.; Szybicki, D.; Cygan, R.: Programming of industrial robots using virtual reality and digital twins, Applied Sciences-Basel, 10(2), 2020, 2-12. https://sci-hub.et-fine.com/10.3390/app10020486

[7] Mueller, F.; Deuerlein, C.; Koch, M.: Intuitive welding robot programming via motion capture and augmented reality, Ifac Papersonline, 52(10), 2019, 294-299. https://sci-hub.et-fine.com/ 10.1016/j.ifacol.2019.10.045

[8] Fechter, M.; Schleich, B.; Wartzack, S.: Comparative evaluation of WIMP and immersive natural finger interaction: a user study on CAD assembly modeling, Virtual Reality, 26(1), 2022, 143-158. https://sci-hub.et-fine.com/10.1007/s10055-021-00543-0

[9] Lopez, J.-M.-G.; Betancourt, R.-O.-J.; Haro, F.-R.: Incorporating virtual reality into the teaching and training of grid-tie photovoltaic power plants design, Applied Sciences-Basel, 9(21), 2019, 2-12. https://sci-hub.et-fine.com/10.3390/app9214480

[10] Wang, P.; Bai, X.-L.; Zhang, J.: 3DGAM: using 3D gesture and CAD models for training on mixed reality remote collaboration, Multimedia Tools and Applications, 80(20), 2020, 31059-31084. https://sci-hub.et-fine.com/10.1007/s11042-020-09731-7