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Research on the Application of Virtual Reality Technology in the Elderly Sports Industry in the Era of Big Data

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Abstract: The rapid development of artificial intelligence technology has resulted in the growth of every single technology under it such as machine learning and deep learning technologies. This research focus on the Immersive Technology names as Virtual Reality and Big data and how they both are correlated in the aspects of elderly sports. The trainer of any virtual reality technology in geriatric sports faces significant obstacles in monitoring and doing exercises, training, monitoring the player's actions, and food monitoring. The coach uses the most up-to-date information technology to keep track of the player within that regard. The coach and also the players are taught how to use mobile applications to communicate with one another in an interactive way. Also, even if the athlete is located in a rural place, the coach might recommend some monitoring tools to be acquired and used for ongoing checking of a player's activity. In this research, neural network model has been used to analyze the application of Virtual Reality Technology in the elderly sports Industry in the era of big data. The results provided an accuracy of 99.89% in evaluating the performance.

Keywords: *Artificial intelligence, Big data, Elderly sports, Virtual reality*

1. Introduction

Immersive multimedia or computer-simulated reality (also known as virtual reality or VR) creates a simulated environment in which a user can act as if physically present in a particular real-world or fictional setting. Sensations such as sight, touch, sound, and smell can all be synthesised in a VR environment. Workers in radioactive, space, or poisonous areas may use telepresence to migrate to a safe VR environment where they could safely handle hazardous items. [1] Scientific visualisation allows the researcher to get visual feedback from their computations in real time and guide the solution process. The medical community is replacing plastic models with computer simulations of the human body in order to conduct cutting-edge research. The advantages of using a flight simulator in education and training have been demonstrated. When compared to traditional planes, they are more cost-effective to run and less dangerous for passengers. They also make it possible to practise dangerous manoeuvres that would be impossible with real planes. [2] The user's point of view is totally integrated into the virtual environment thanks to the Immersive VR System. In an immersive system, a virtual room or cave is created by using big projection panels. The degree of immersion in completely immersive systems is affected by a number of factors, including as the display's contrast and brightness, its refresh rate, and the size of the field of view. The user of this variety is outfitted with HMDs (HMD). The least immersive form of VR technology is a non-immersive system. [3] The desktop approach allows users to access the VE via a gateway or window on a computer screen. Conventional tools like keyboards and mouse, as well as 3D interaction devices like the Space Ball and the Data Glove, are used for interaction. An emerging use for VR technology is in semi-immersive systems. Depending on the desired level of immersion, a semi-immersive system can use a large monitor, a large screen projector system, or several television projection systems. [4] As a result, semi-immersive systems give users a higher sense of presence and an enhanced understanding of size than do fully-immersive systems. VR in sports can be defined as the use of computer-generated imagery to imitate a real-world sporting event in a way that makes the participant feel both physically and psychologically immersed in the experience. There are many different definitions of VR but this one emphasises the computer-simulated aspect and interactivity of the virtual environment. Additionally, it intends to showcase the user's perspective on how VR can be used in sports (athlete). [5] The system is said to have achieved success in eliciting realistic responses from users of virtual environments when it successfully created the impression that the events were truly happening to the users. Thus, the usage of a computer-generated environment is crucial to VR. In other words, the virtual world or its components will adapt to the player's movements. However, specifying how the virtual environment is presented to the athlete should be avoided because it could create technological barriers for the use of VR in sports. [6] (HMD). The CAVE is a big cube of screens that the user enters to immerse themselves in a virtual environment. A head-mounted display (HMD) is a piece of equipment worn over the eyes that blocks all outside light and vision. The virtual environment can be viewed in stereo 3D on one or more tiny screens. When the HMD is used in conjunction with head tracking, the user is able to see parts of the virtual world that are outside of their current field of view simply by turning their head. [7] Although both the CAVE and the HMD have some of the same characteristics of an immersive system, the HMD has gained more traction because to its smaller size, portability, and lower price tag.

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Although many people in Europe maintain their vitality as they age, an increasing proportion of those living in the European Union suffer from age-related disorders and cognitive and physical deterioration. In fact, dementia is the leading cause of disability among those aged 70 and up. [8] Long-term memory, executive function, and spatial orientation are all negatively impacted by dementia. A decline in these capabilities impairs one's ability to go about performing basic life tasks. There is evidence linking a decline in autonomy to diminished well-being. [9] Unfortunately, no treatment option has proven effective in reversing the mental decline that many seniors face. Cognitive training, on the other hand, has been proven to marginally enhance global cognition in both dementia patients and healthy aged people. [10] Additionally, physical interventions like resistance training have demonstrated similar favourable benefits in both healthy and cognitively impaired seniors when used alone or in combination with cognitive interventions. Sadly, progress is frequently incremental, and not all studies report benefits.

Immersive VR is a novel and potentially useful technology for enhancing cognitive performance (VR). VR is a high-end user-computer interface that involves real-time stimulation and interactions of an embedded subject across several sensory channels (including sight, sound, touch, and even smell and taste if possible). [11] Non-immersive VR typically refers to a desktop environment, with or without additional audio. In contrast, if a user is immersed in an immersive VR experience, they are either wearing a HMD or are in a cave-based, fully automated virtual environment [12]. The degree of immersion is proportional to the number of senses engaged, the complexity of the sensory interactions, and the amount of (motor) interaction demanded. Flexible, individualised, and secure multimodal teaching is now possible with VR immersion. It accomplishes this by placing the user in a realistic environment and providing instantaneous sensory feedback, both of which contribute to a more convincing simulation. These features of VR's immersive setting create a productive learning environment that could be employed to aid in cognitive training. Few research have employed immersive VR in the elderly with the objective of improving cognitive skills, but several have used VR to train physical health or increase the appeal of interventions [13]. Indeed, it is possible that low levels of digital literacy contributed to this. Meanwhile, VR shows promise as a low-cost, high-impact option for improving seniors' cognitive abilities. This research evaluate the application of VR technology in the elderly sports in the context of big data.

2. Materials and Method

Technological advancements have paved the path in solving many complex issues that were been around to a simply accomplishable task. One such technology is the Immersive Technology. Immersive technology refers to novel approaches to developing, displaying, and interacting with apps, content, and experiences. By combining the virtual with users' look, sound, and even touch, immersive technology has revolutionized the digital experience. Immersive technologies allow people to feel as if they are in a simulated, artificial environment. The term VR refers to an environment created by a computer that simulates the physical world in every detail. Using a VR headset or helmet, one can imagine themselves in this setting. VR lets us live out our gaming fantasies as if we were the characters, practise medical procedures, and enhance the quality of sports training to achieve peak performance. VR employs a HMD that consists of two near-eye screens that are worn like eyeglasses. It's also known as "digital glasses" for short. It's a digital environment that entirely submerges the user. The realm of medical, the arts, academia, and the built environment are just few of the many that have found applications for VR technology. Using virtual reality, we may experience activities like guided museum visits and muscle dissection that were previously impossible.

The following are the three main types of VR:

- Due to the widespread use of VR, a subset of the technology known as "VR without immersion" often goes unnoticed. When using non-immersive VR technology, the user is always cognizant of and in command of their real-world surroundings. Games are an example of VR that doesn't fully immerse the user.
- With semi-immersive VR, users are only partially transported to a virtual setting. Useful for teaching and education, this form of VR takes advantage of graphic computing and big projection displays to simulate real-world scenarios.
- Definition of "Fully Immersive VR" Though VR technologies are still in the early stages of research, rapid progress means they could soon be mainstream. This sort of VR provides the most authentic three-dimensional experience possible in terms of both visuals and audio. The impression of speed and control that racing video games give the player is an illustration of the immersive nature of VR. Though VR technology was first developed for the entertainment industry, its use in other sectors is rapidly expanding.

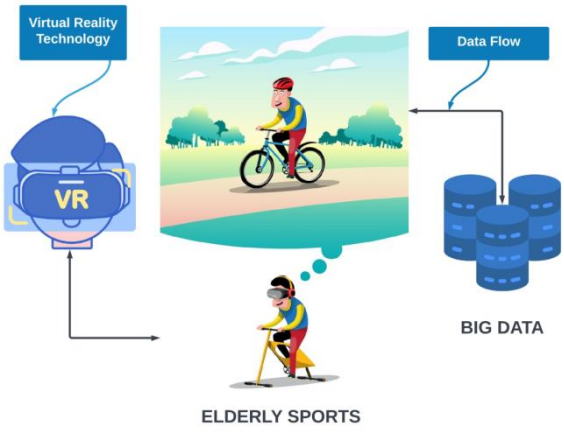

Figure 1. Graphical representation of VR elderly sports that utilizes Big data.

The graphical representation of VR elderly sports in the era of Big Data is illustrated in Fig. 1. A neural network algorithm is deployed in this study. A neural network is a collection of algorithms designed to mimic the way the human brain processes information in order to identify patterns in data. Neuronal systems are what are meant by "neural networks" here. They apply machine perception to classify sensory data by assigning labels to it or grouping it into categories. All real-world data, such as pictures, sounds, texts, and time series, must be converted into these numerical patterns contained in vectors. NN acts as a layer of classification and clustering on top of the data you manage and save. They help classify data when trained on a labelled dataset, and they also aid in the categorising of unlabeled data based on similarities across sample inputs.

The quantities and symbols on which a computer operates are known as data; data can be recorded on magnetic, optical, or

mechanical media and communicated by electrical impulses. Big data is a form of information, but its scale is commensurate with its magnitude because it represents an ever-expanding collection of information. Because of its size and complexity, conventional data storage and processing methods are inadequate. Geriatric fitness is a branch of medicine that is centered on the health and disease of the elderly. A geriatric fitness expert is a cross between a fitness instructor and a physiotherapist. They are specifically trained to work with the elderly to promote physical fitness while collaborating around the client's ailments. VR has several medical applications and also creates a secure environment in which to conduct activities. An assessment of the effectiveness of VR among elderly populations indicated that it can be used to reduce the risk of falls as well as improve the emotional and social well-being of the elderly. Hospital health files, medical reports, medical examination results, and information gathered by healthcare testing machines such as electrocardiogram machine data are examples of big data sources in the healthcare industry. Training is an essential way VR is modernising healthcare. VR creates an environment in which people can learn and grow in real-world situations. Professionals who need to perform extremely precise operations can practise in VR without being in the middle of an emergency. And practitioners who need to become acquainted with the healthcare setting can do so without added stress. The technology is also used in cognitive behaviour therapy, which helps patients with irrational fears and anxieties to work through their issues in a safe environment. Although medical education is thought to be a slow industry to adopt new technologies and trends, VR has shown a lot of promise.

For a Deep Neural Network (DNN), the learning procedure is similar to a regular NN algorithm, with four phases divided into various phases as follows:

The first phase of the forward communications process is comprised of the stages below.

(1) Input a sample from the testing dataset into the network.
(2) Locate the exact output that matches.

Depending on the power architecture and outcome, the input data will be turned into convolution layers at this point. A minor change is decided to add to the weight component of each input throughout the network simulation analysis to reach the desired accurate output.

The back-propagation learning process is the second phase, and it entails the following phases.

(1) Calculate the gap between real and projected efficiency.
(2) To distribute and adjust the set of weights, the learning & development technique is employed.

In (1), the Regression Analysis (RA) in Neural Network (NN) is distinct with such a training examples (a, g, n, m)

$$K(a,g,n,m) = \sum \left\| d_{a,g}(n) - m \right\|^2 \qquad (1)$$

The total regression analysis for classification algorithm with K measures is shown in (2), where m is the eventual outcome and d seems to be the NNs range of different results

$$K(a,g) = \frac{1}{2}\sum_{i=1}^{x} K\left(a,g,n^{(i)},m^{(i)}\right) \qquad (2)$$

Finally, the multivariate logistic of this NN i,j is a multiobjective function thatε denotes the frequency with which the network i,j conform to a stable state. It develop these skills method is utilised to renew the settings. Calculating the ϑ partial derivatives of an observable point with respect to a parameter seems to be the primary purpose. The objective function's solutions are (3) and (4), which are presented below.

$$a_{i,j}^{(I)} = \sum a_{i,j}^{(I)} - \varepsilon \frac{\vartheta}{\vartheta a_{i,j}^{(I)}} J(a,g) \qquad (3)$$

In fact, the test results do not match the expected conclusion. The input signal's evidence to believe and variability must then be transmitted to convolution and blended until each production has its own gradients. Following that, weight update work is completed in order to begin a new categorization model.

The $A(d,r)$ convolution procedure is the procedure of applying a pattern function to an image that has already been pre-processed. Each p,q structure can be either a filtering or a convolutional kernels model, as shown in (4)

$$H(n,m) * A(d,r) = \sum_{i=p}^{p}\sum_{j=q}^{q} a(i,j) \int (n+i, m+j) \qquad (4)$$

Among all of $H(n,m) * A(d,r)$ are the convolutional controllers $H(n,m), \int (n,m)$, that indicate the property image and the resolution of the image centred simply on the pixel location, including (n,m). The pattern matrix and also the weight only within matrix are represented as $A(d,r), a(d,r)$

A collection of VR technology in the elderly sports photographs from various VR technologies in the elderly sports. The data is organized into three directories: train, test, and valid. There is also a csv file included for individuals who want to generate their own train, test, and validation datasets. It is an image dataset with several VR technologies in the elderly sports categories organized into their own folders.

2.1. Experimental Result

The performance recognition effectiveness of each keyframe of an activity recognition system was evaluated in both real-time and delayed modes. The recognition rate of each keyframe in such a system is depicted in Fig. 2 with a test dataset. For both late and real-time video data, PCE of such a keyframe and mean values for on the whole PCE have been detected. For human action recognition, the technique identification efficiency is 73.4%, which is satisfactory.

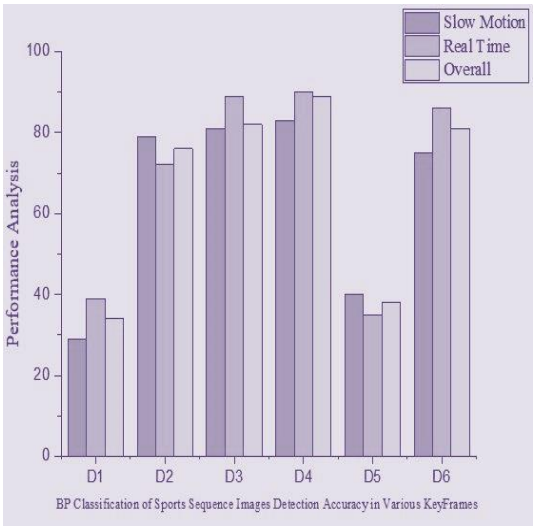

Figure 2. VR technology in geriatric sports is classified as NN.

Accuracy of Sequence Image Detection in Various Key Frames is depicted in fig. 2. According to experiments, keyframes D1 through D6 have worse detection accuracy than other frames. In such frames, similar features can be found. The NN frequency from around frame is initially extremely sluggish, but the frame velocity will steadily increase over time. Although Identifier (D1, D2, D3, D4, D5, D6) denotes the start of a detecting dataset recording in VR technology in an old sports image, whose speed restriction, and the end stage of such a rotation and its ultimate frequency, is set to 0.

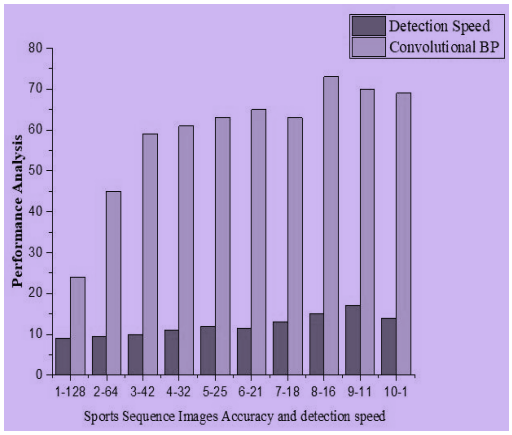

Figure 3. Sequence images of performance analysis of VR technology in elderly sports detection accuracy and speed.

The disease surveillance of a Convolutional NN algorithm is critical for picking the sequential picture correctness and detection. Fig. 3 depicts the results of a test that used a uniform random picture to assess detection precision and agility for unique recordings. Examine the effect on the model's realism while keeping other variables constant. Because when the sequence time is long for the instrument's hardware technology, a few comparison trials are required to ensure that the sampling frequency is reduced.

Table 1. VR technology in geriatric sports images: objective comparison and result analysis Between CNN with Optimization Algorithm methods, frequency increasing image pixel speed

Algorithm	Training (%)	Testing (%)	Speed(× 10ms)	Accuracy(%)
NN algorithm	98	99	0.03ms	99.89
Optimization algorithm	92	92	0.04ms	94.69

Nonetheless, based on attributes within the categorization frame, two distinct detection algorithms will identify and categorize its applicant frame. This classification necessitates the use of two classifiers, and significantly more NN computation than in the Optimization Algorithm (refer to Table 1). It also looks to be much slower than the Optimization Algorithm, which has a detection time of 0.03 ms. This is a comparison of an existing technique that is far superior than the identical NN algorithm; NN has a total accuracy of 99.89%, while Optimization Algorithm has a total accuracy of 94.69%.

The use of VR in the field of rehabilitation is exciting because of the potential it has for improving patient outcomes. Physical and occupational therapy sessions can be improved by using VR, either through non-immersive VR on a treadmill or by full-immersion VR in a CAVE, city, or park setting. Since VR was discovered to be interesting to seniors, it's possible that patients would be more likely to stick with their rehabilitation programme, leading to better health outcomes. Home-based therapies, such Tai Chi and yoga programmes in VR, are now available. Since older folks can get real-time feedback from home via VR when they're not at the clinic, employing at-home rehabilitation procedures would result in more effective rehabilitation. Since the elderly are at a higher risk of getting the COVID-19 pandemic, this may be especially crucial during the outbreak. With an increasing number of baby boomers entering their senior years, home-based VR fitness therapies may be an effective way to reduce the strain placed on healthcare providers. Physical and occupational therapists may be able to improve the quality of their therapy by seeing fewer patients per day if they are not overbooked. Furthermore, patients can be encouraged to exercise more frequently and for longer durations by incorporating VR into their in-person sessions.

3. Conclusion

In this study, we investigate the relationship between two forms of immersive technology – VR and big data (BD) – and the sports participation rates of people 65 and older. Significant challenges exist for the trainer of any VR system used in geriatric sports, including keeping track of the player's diet, behaviours, and workout routines. The coach uses cutting-edge data analysis tools to monitor the player's progress in this area. Both the coach and the players are instructed in the usage of mobile applications for two-way, real-time communication. Additionally, the coach may suggest the acquisition of monitoring technologies to be utilised for continual checking of a player's activity, even if the athlete is located in a rural area. In this study, we employ a neural network model to investigate VR's potential role in the senior sports industry in the age of big data. The results revealed a performance evaluation accuracy of 99.89%.

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