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Retraction

Retracted: Analysis of the 3D Application Evaluation System of Landscape Based on Hybrid Cooperation of VR and AI

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] L. Niu and F. Han, "Analysis of the 3D Application Evaluation System of Landscape Based on Hybrid Cooperation of VR and AI," *Scientific Programming*, vol. 2021, Article ID 4595808, 11 pages, 2021.

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Research Article

Analysis of the 3D Application Evaluation System of Landscape Based on Hybrid Cooperation of VR and AI

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The traditional urban landscape planning and design method cannot integrate the design into the whole planning scene and cannot express the planning effect of multiple schemes and large scenes in an efficient, intuitive, and coordinated way. With the development of computer science and technology, virtual reality technology based on AI is playing an important role in many aspects of urban landscape planning and design. In this paper, on the basis of 3D visualization landscape planning and design, 3D visualization urban landscape modeling is carried out using VR combined with the constructed deep neural network (DNN) to establish a 3D database and virtual scene model of the landscape, and 3D representation of the virtual scene landscape is realized. The designed solution allows the user to grab the object and release it into the workspace. If any placement is needed, the user can pick up the layer again and move it to a new location. Finally, the simulation experiment and its result analysis were conducted to effectively analyze the site of the real model and its matching rate, to realize the integration of the 3D image, 3D stereo, and system integration technology, and to finally complete the landscape design task.

1. Introduction

Virtual reality technology emerged at the end of the 20th century and is a comprehensive information technology integrating a series of technologies such as computer technology, multimedia technology, network technology, parallel processing technology, and sensor technology [1, 2]. People create and experience a variety of virtual worlds through virtual reality technology. With the growing maturity of virtual reality technology, this technology has slowly started to be used in various design fields, providing great convenience for designers to realize their own design ideas, improving design quality and design efficiency [3]. On the other hand, today's constant innovations in science and technology, especially in computers, hold promise for the use of computers for large image data processing. Image digital recognition technology is an innovative technology that uses digital image processing technology as its own basis for the recognition of experimental content using a computer [4]. As technology in the field of AI, the main process is divided into three steps, image acquisition, image processing, and image recognition [5]. The features of the landscape in landscape images can be collected using special tools, such as cameras, and then the information collected can be analyzed using computer technology to complete the identification or design of the landscape images [6].

In the actual landscape design, all aspects should be fully considered, not only to realize the effect of the design structure but also to coordinate and match the surrounding environment as well as the landscape design, etc. [7, 8]. Once the final design plan is determined, then extensive modifications will increase the cost. If virtual reality technology is used, it allows users to experience the program more realistically, and once it is determined, extensive modifications can be avoided and costs reduced [9]. Therefore, before the realization of landscape design, the design plan should be improved, and virtual reality technology should be used to promote the scientificity and feasibility of landscape design.

Only by integrating landscape design and virtual reality technology, 3D characteristics can be highlighted;, in addition, the designers concerned to clarify whether the design scheme can use virtual reality technology to achieve the final effect, to ensure the operability of the design content. The use of virtual reality technology to design the landscape can effectively save a lot of labor and greatly reduce costs.

Convolutional neural networks (CNNs) are one of the most popular and innovative techniques in the context of big data, and they contain unique processing methods that have been utilized in many fields and scenarios [10], especially in the area of image processing discussed in this paper. Landscaping technology is the use of computers to collect image features contained in images such as landscape images or photographs and use these features for landscape recognition. Landscaping is categorized under the category of image recognition, where the image to be experimented with is viewed as a high-dimensional random vector, and the resulting data are mapped to a low-dimensional feature space [11].

Landscape architects concerned can expand the scheme according to its own specificity or change the details of the design scheme to make it more reasonable and then improve and update it to form the final design scheme [12]. In addition, although virtual reality technology cannot be fully realized but can be more comprehensive, a more perfect display of the content of the drawings guides users to experience the landscape design content, experience the process of guiding users according to their actual needs and the landscape design content of the unreasonable, and puts forward views and opinions, so that landscape designers can make users and designs achieve good interaction, so that designers can reshape the design works [12].

The use of virtual reality technology combined with deep learning technology to design the landscape can effectively save a lot of manpower, greatly saving costs, while the designer can also adjust or modify the plan according to their own needs, and thus closer to the actual needs of the user for the landscape effect, to achieve good interaction between the user and the design [13]. Such an interactive approach will greatly reduce landscape design time, make the design more responsive to the actual needs of users, improve the design more comprehensively, and make it easier for designers to reshape the design.

In summary, this paper uses virtual reality technology combined with the constructed deep neural network (DNN) to establish a 3D database and virtual scene model of the landscape in the 3D visualized landscape planning and design and carries out 3D visualized urban landscape modeling to achieve a 3D representation of the virtual scene landscape [14, 15]. Finally, the simulation experiment and its result analysis were conducted to effectively analyze the site of the real model and its matching rate, to realize the integration of 3D image, 3D stereo, and system integration technology, and to finally complete the landscape design task.

2. Related Work

Currently, the model design of landscape scenes, through VR or AI, contributes to advance innovation. In a large number of problems, the configuration of landscape scenes is upgraded and solved using computer innovation [5, 16]. Landscape scene measurement recreates, utilizes the view, and visualizes the scene of a rising degree [8]. Rafiq et al. [17] uses intelligent landscaping rather than intuitive perceptual structures to think about design ideas; when faced with similar static picture designs, many believe this would be a range of alternatives. A survey of intuitive 3D landscape scene models has likewise shown to be useful for media representation of different landscape types [18]. Portman et al. [19] examined GIS-based layout dialogues for 3D landscape models and feasible improvement markers using smart VR.

We use deep learning models to drive landscaping research, creating large-scale realistic video explorations and models while evaluating the soundness of a landscaping design [20]. For example, hand-drawn viewpoints are drawn using CNN for watercolor painting, advanced photo acquisition, and discrepancy in confirmation using semantic contrast to cross 3D models [21, 22]. We introduce intelligent visual rendering, based on data-driven deep learning models suggesting an influence on the final choice of creation. Meanwhile, in the field of computer-generated reality, many researchers have conducted related studies [23, 24]. Stimulation with Unity 3D allows us to access the sky, territory, water, clarification of development strategies for trees and flowers, and professional help in the use of VR innovations in nurseries [25]. Building models for landscape design based on GAN-generated natural scenes, vivid visual dramatization, and task scenes provide an assessment of human biological systems [26].

3. Materials and Methods

Virtual reality technology creates a virtual reality environment for the learner. The corresponding learning tasks are designed based on the existing experience and knowledge of the environmental landscape in the VR environment [6]. To accept a task, we select a character to enter the learning environment and use a VR device to complete the task; the proposed AI combined with the VR scheme in this paper is shown in Figure 1. In this environment, each learner is an individual and their organs are completely immersed in the virtual reality environment, isolated from the real world. It allows us, for example, to realize the true meaning of the wind and the natural world. Immersion in virtual reality technology is an experience in a situation that the learner cannot experience in the real world.

3.1. Environmental Image Preprocessing. The virtual reality environment is a minimal distraction and easy [27]. The user controls the gripping, pitching, and positioning of the virtual reality object. VR user interface with various tools was used for in-depth learning of the model around the building. It grabs the layer from the left side of the tool holder and places it in the workspace shown in Figure 2. Users can run it standing or sitting, using applications and operations. It has a calm environment that allows the user to fix points of the

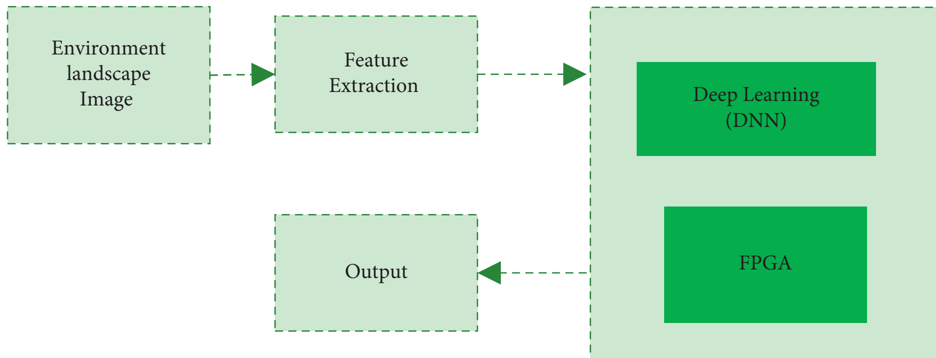

Figure 1: Block diagram of the proposal.

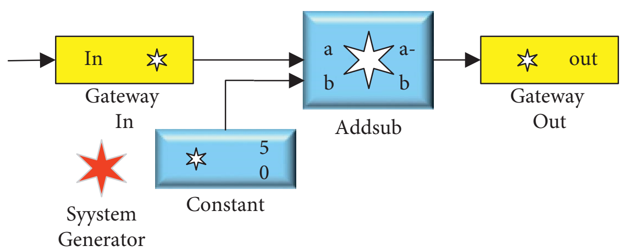

Figure 2: Virtual image processing.

baseline and turn on the virtual reality. VR was used with various tools for user interface for in-depth learning around the building model.

3.2. Feature Extraction. Structural elements are also a prerequisite for building deep models based on virtual reality technology and are central to the integration of virtual reality technology and deep learning concepts. These components include participants, virtual reality interaction platforms, interactive tools, resource sharing, and common purpose [28]. Specifically, participants refer to learners, instructors, and industry experts. Learners complete the core and subject matter of the learning task through learning. It is collected by teachers and industry professionals to assess student learning, provide guidance and support to learners, and actively explore and guide students to deepen their knowledge. Virtual reality interactive platform is a learning environment that uses information technology and virtual reality devices to provide learners with online communication. It is also a profession for sharing learning resources. The interactive tool is a medium of communication between participants. It can provide functions such as online search, transfer, and download resources to build knowledge and help participants. Resource sharing includes resource building and resource sharing, as shown in Figure 3.

The resource structure collects learning videos, documents, images, and other resources through the learning platform to form systematic learning materials for learners. Resource sharing is a learning discussion forum where learners share their knowledge and experience [16, 25].

From deep learning groups for daily tasks and common goals by learning the same topics and objectives, learners learn knowledge based on a specific learning path. Team members fully demonstrate their subjective efforts to achieve the ultimate learning goal.

3.3. Deep Learning Classification. The core aspect of this paper is DNN built as shown in Figure 4. This feature allows the user to grasp objects and release them into the workspace. If any placement is needed, the user can pick up the layer again and move it to a new location. In this feature, it is simple to ensure that the user can interact with the application in a familiar way. The element of familiarity is especially important for new virtual reality users. All new users are unfamiliar with the environment as it is designed to interact to minimize the learning curve. The layer is discarded. The user picks it up and then lifts it in any direction. It applies to the physical object at that point, causing it to drop to the ground, touch the ground, and disappear. In this way, the user can quickly discard irrelevant layers and intuitively change the structure of the model. DNN is shown in Figure 4.

For the characteristics and features of landscape design images, a training sample, validation sample, model layers, and fusion method are proposed to build a complete CNN model. The model is able to extract potential information about the grayscale spatial distribution of target pixels in landscape design images and achieve accurate recognition of targets. The target image data are composed of pixel gray values [29], and the target features are mainly reflected by the spatial distribution information of different pixel gray values, such as the distribution relationship of target pixels and the regional distribution relationship of target and clutter. This feature extraction method acquires the landscape design image containing the complete target and then uses it as the input layer feature image. Therefore, the designed model, which is based on the improvement of VGG16 [30], and different data features are selected separately during the training process, and then the blocks in the model are fused, which improves the accuracy of target recognition. And based on this, the prediction module is added to improve the recognition ability of the model. In these models, the convolutional layers all use the same convolutional kernel parameters; for example, the convolutional kernel size (kernel size) used in the convolutional

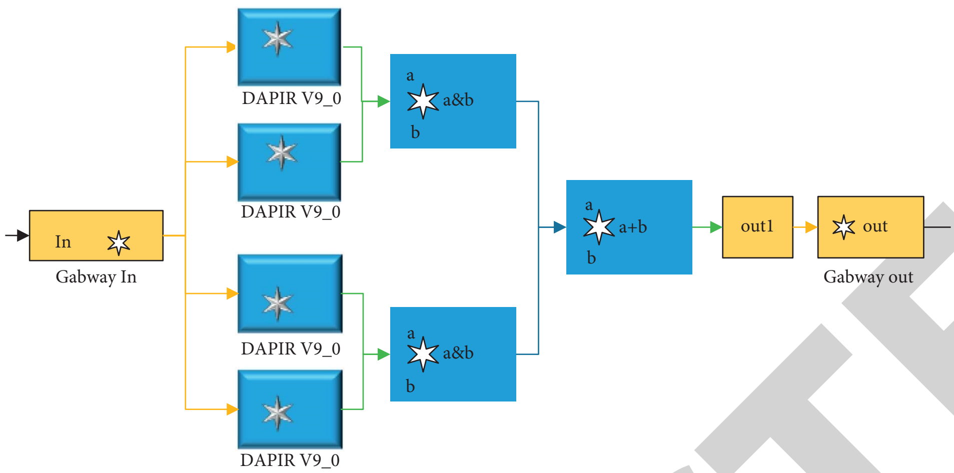

FIGURE 3: FPGA-based feature extraction.

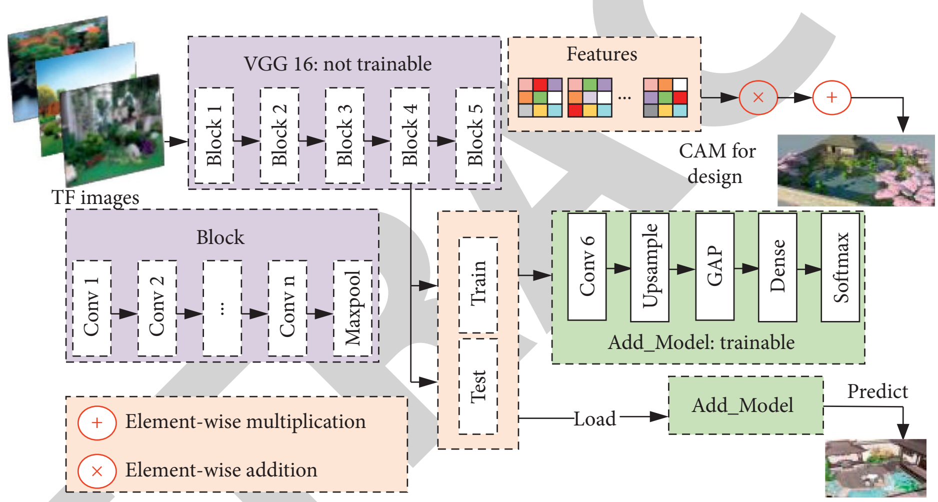

FIGURE 4: Flowchart of CNN-based landscape design images (TF: time-frequency; CAM: class activation map).

layers is 3; i.e., both width (width) and height (height) are 3, and 3 ∗ 3 is the small convolutional kernel size, which is used together with other parameters (padding = same), so that each convolutional layer (tensor) keeps the same width and height as the previous layer (tensor) with the same width and height as the previous layer (tensor). Using the same pooling kernel parameters, the pooling kernel parameters of the CNN model are chosen to perform target detection based on the distribution of target pixel grayscale values [31]. Pixel points of the image should focus on and highlight the transport target; in other cases, the mean value of the target can be extracted more accurately, so a mean pool is used to train the CNN target detection model. The model consists of multiple convolutional and pooling layers (stack), which makes it easier to form a deep network structure. The advantages of the overall model can be summarized as simple filtering, easy to analyze, and easy to use.

The steps of landscape design algorithm is given as follows:

Step 1: initialize the input image.

Step 2: apply the preprocessed images for analysis, cluster the images to evaluate the values, and partition the images.

$$V_i = \frac{\sum_{K=1}^{N} \left(U_{ik}\right)^m X_k}{\sum_{K=1}^{N} \left(U_{ik}\right)^m}, \tag{1}$$

V_i is the input cluster center. U_{ik} is the grayscale value.

Step 3: find the image values and neighborhood values and identify the output data. Train and check the values using deep neural networks.

$$u_{ik}\begin{cases} 1 \\ 0 \end{cases} d_{ik}^{(t)} = \min_{1\le j\le nc}\left\{d_{ik}^{(t)}\right\}, \tag{2}$$

u_{ik} is the data partition degree value.

Step 4: check the condition of the convergence value.

$$\|Ut - 1 - Ut\| < \varepsilon. \tag{3}$$

Step 5: analyze the image and classify the environmental landscape values.

Step 6: end.

3.4. FPGA. To provide more accurate results and real-time object recognition, for example, in applications such as robotics and self-driving cars, the size of CNN needs to be increased by adding more neural network layers [13, 31]. However, the changing new NN layers lead to more complex DNN structures and deep DNN models. Thus, millions or billions of operations and parameters as well as large computational resources need to be trained, and the resulting large DNNs need to be evaluated. Such a request represents a General Purpose Processor (GPP) computational task. Therefore, hardware has been used to improve the throughput of gas pedal DNNs, such as graphics processing specialized integrated circuits (ASICs), field-programmable gate arrays (FPGAs), and units (GPUs) [20]. DNNs are trained offline using a back-propagation process. The offline trained cellular neural network is then used for feedforward processing to complete the cognitive task. Therefore, the speed of feedforward processing is crucial. A convenient feature of CNN is that each feature-mapped neuron shares its weight with all other neurons. Performance comparison of the model is shown in Table 1.

The authors' argument is that access to mobile data is not a result of computing the highest energy consumption of off-chip DRAM memory [32]. In other words, the energy cost of memory access and data movement (which adds up to most DNN operations) typically exceeds the energy cost of computation.

Therefore, FPGA circuits for DNN gas pedals require careful consideration of this to achieve efficient architectures in terms of time and power. In this work, the current state of the art in implementing deep learning networks using FPGAs as gas pedals is reviewed. It highlights implementation challenges and design directions used to address these challenges. It also provides future recommendations to maximize the performance of FPGAs as deep learning network gas pedals.

4. Site Analysis Based on the 3D Realistic Model

In this paper, we use SuperMap software [33] to browse and analyze the 3D real-world model.

4.1. 3D Measurement. The model can be measured by using the measurement tools, such as horizontal distance, ground-dependent distance, spatial distance, height, spatial area, and ground-dependent area (Figure 5). The elevation of a point can be measured, and the relative height difference of a complex terrain can be measured directly. By clicking 2 or more points, you can measure the distance between 2 points, and you can also measure the distance or area between multiple points.

4.2. Daylight Analysis. Sunlight is an important influencing factor in landscape garden design, which has an impact on planning the spatial layout of the site, road landscape, planting design, and selection of garden materials [34]. Through sunshine analysis, the distribution pattern of the sunshine intensity of the site can be obtained, providing a basis for making full use of the favorable conditions of sunshine and avoiding unfavorable factors. Setting the time in the software, such as the winter solstice or the summer solstice, the sunshine situation at different times of day can be automatically simulated in the software. Figure 6 shows the results of regional local insolation analysis.

Table 1: Performance comparison of the model.

Technique	PCA	SVM	Our model
Sensitivity (%)	71.9	76.6	95.3
Specificity (%)	70.4	77.1	91.3
Accuracy (%)	85.8	91.5	96.7

4.3. Line of Sight, Field of View Analysis. The main purpose of the visibility analysis is to ensure that there is a clear line of sight between important viewpoints and the landscape and that the appropriate spatial scale is maintained between buildings [35]. There are 2 main ways of analysis: one is to discuss the line of sight between 2 points, whether the target point can be seen from the viewpoint location; the other is the view area analysis, which analyzes all the visible range of the viewpoint. The green part in Figure 7 is the area that can be seen, and the red part is the area that is blocked from view; the result shows that most of the site can see the top of the tower, but only the local site can see the complete tower, and these sites will be important overlook points and viewpoints within the design scope.

4.4. Profile Analysis. Using the profile analysis tool, you can quickly get a profile of the site. By drawing a straight line under the 3D scene, a profile line that is consistent with the surface change of the real model data can be output. If the profile line encounters plants or buildings, the contour line of plants and the contour line of buildings will also be formed in the final profile (Figure 8). This is the most direct way to study geomorphology [36], feature contours, and topographic changes of the site and is more convenient and efficient than the traditional method of using contour lines to draw profiles.

4.5. Program Showcase. Whether the landscape planning scheme can harmoniously coexist with the surrounding environment and whether the vertical design is closely integrated with the current topography of the site are the key concerns of landscape planning and design. The traditional expression is mainly based on effect drawings, which place the planning and design scheme into a fictitious environment, and the effect is often gorgeous, but it differs greatly from the field situation of the site and loses the meaning of practical application [19, 33]. And in a real three-dimensional scene, the designer can better grasp the design direction, so that the design plan is appropriate to the site,

Figure 5: Distance measurement.

Figure 6: Daylight analysis.

Figure 7: View field analyses based on the top of the tower.

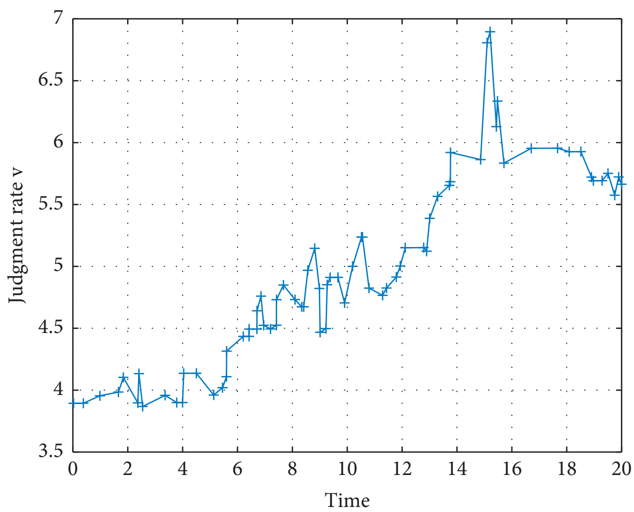

FIGURE 8: Planing surface analysis.

FIGURE 9: Landscape planning scheme overlays.

according to the characteristics of the site design, and in the style is also easier to maintain consistency and thus early detection of defects in the planning scheme. Traditional design using 3dMax model or SketchUp model [37] cannot be directly imported into GlS software [18]; through the AI software corresponding plug-in, the coordinates will be unified, both to achieve the overlay display of the planning scheme and the status qua scheme and to use the roll-up function to compare multiple schemes. Figure 9 shows the effect of overlaying the landscape design scheme with the current situation model.

The Chinese garden designed by the model in this paper is shown in Figure 10. It can be clearly seen that the design focuses on the Chinese "courtyard three entry" layout, creating a triple entry ritual, one garden gate, two courtyard gates, and three house gates. The public and private spaces are reinforced by the gate and court to define the group and shape the sense of homecoming ceremony. The landscape is symmetrically laid out with the landscape nucleus as the axis, "one center, one axis, and three zones" to create a sense of ritual and ceremonial landscape. The design of this project follows the Chinese garden's emphasis on "the origin of the place and the origin of the water" and the rule of "although made by man, it is like the opening of heaven": the water system, regardless of its size, must be twisted and turned. The "gathering is broad, scattering is lingering" of the garden in Jiangnan is interpreted to the fullest. In the design of this case, the traditional and modern elements are combined in the design of the Chinese garden, and this concept is carried through the whole design, from the front garden to the backyard, and the rich cultural temperament of the Chinese garden is exquisite and meticulous. Through the waterscape and then into the courtyard, the layout of the inner garden of "Qingquan Shi Liu" is unpredictable, with rocky hills, pavilions, and willows and pines. It is like a landscape painting made by waving ink. Different from the painting, "garden" is a three-dimensional space and contains flowers, trees, ponds, fish, houses, stacked stones, and other combinations formed by each other. Regarding the density of objects in different landscape designs, it is necessary to grasp the rationality of the design. For example, a compact place does not appear crowded, and there are some objects in an open place. Such a design will bring a relaxing mood and vision, visual enjoyment.

5. Experiment

In order to prove the validity of the proposed method for judging the rationality of landscape design and 3D image simulation, we need to design experiments for verification. The 3D image modeling analysis platform for the rationality of landscape distribution was constructed in Windows 8 environments. Since the Point Grey Flea 2 camera [20] has a resolution of 640 pi, 60 frames of images provided by the Landscape Institute were selected for the experiment.

Through 3D image for reasonable acquisition identification analysis and calculating different matrix objective function values, if the function value is larger, then the garden landscape judgment analysis is more accurate; if the function value is smaller, it means that the garden landscape design reasonableness judgment is not accurate. Based on this, the design judgment process is shown in Figure 11.

5.1. Image Feature Points' Matching Number and Matching Rate Results and Analysis. The reasonableness of landscape design is compared using the 3D image simulation judgment method and the traditional deep estimation judgment method, respectively. Whether the number of image feature points extracted can judge the accuracy of 3D image simulation of landscape, the key factor is how to accurately match the corresponding attribute feature points of a landscape garden image [18]. Also, these two judgment methods are used to compare the number of feature point matching and matching rate of landscape garden, and the results are shown in Table 2.

As can be seen from Table 2, the number of feature point matches and the matching rate of the landscape obtained using the traditional deep estimation judgment method are lower than those of the 3D image simulation method used in this paper, and the number of image feature points is simpler in the steps performed in the matching process. The 3D

Figure 10: Chinese courtyard landscape design.

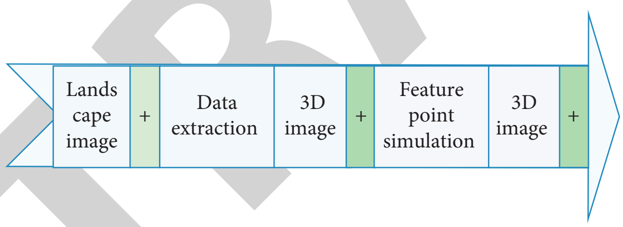

Figure 11: Judgment task flow.

Table 2: Matching number of 3D image feature points and matching rates.

Group	Traditional methods		Our method	
	Number of matches (pc)	Matching rate (%)	Number of matches (pc)	Matching rate (%)
A	540	30.25	540	15.28
B	350	25.61	350	13.61
C	360	24.32	360	20.12
D	320	27.02	320	14.32
E	280	21.34	280	20.15
F	256	30.16	256	9.38

image simulation method has a high feature point matching rate, which fully justifies the use of this judgment method.

Using the comparison results in Table 2 as the basis, the two judgment methods were used to compare the effect of the 3D image simulation of the garden landscape, and the results are shown in Figure 12.

From Figure 12, it can be seen that the distribution of the landscape obtained by using the 3D image simulation judgment method is more reasonable, the main reason is that, in the judgment process, the feature points are matched with high precision, and the feature points are assigned to clusters, and the simulation points are analyzed according to the assigned image features, and the judgment of the rationality of the landscape design is completed based on the analysis results.

5.2. Judgment Rate and Accuracy Comparison Results and Analysis. The data were collected in the landscape environment, and the rate analyses of the conventional method

(a) (b)

Figure 12: Comparison of the effect of two judgment methods on the simulation of the garden landscape. (a) 3D image simulation judgment method. (b) Traditional judgment method.

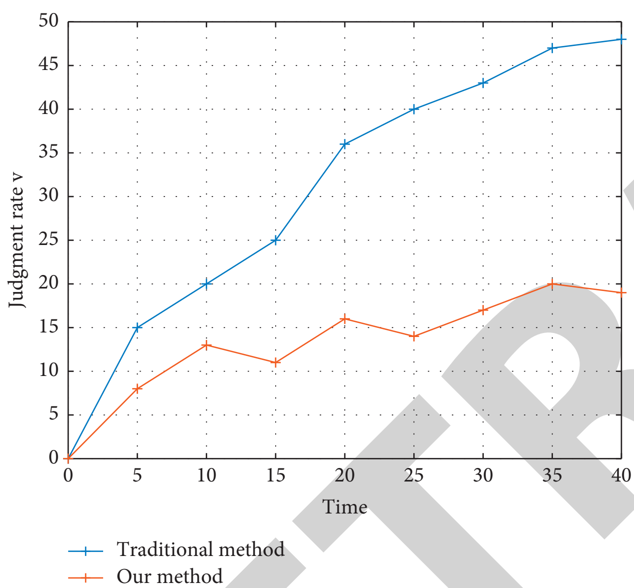

Figure 13: Two methods to determine the rate comparison results.

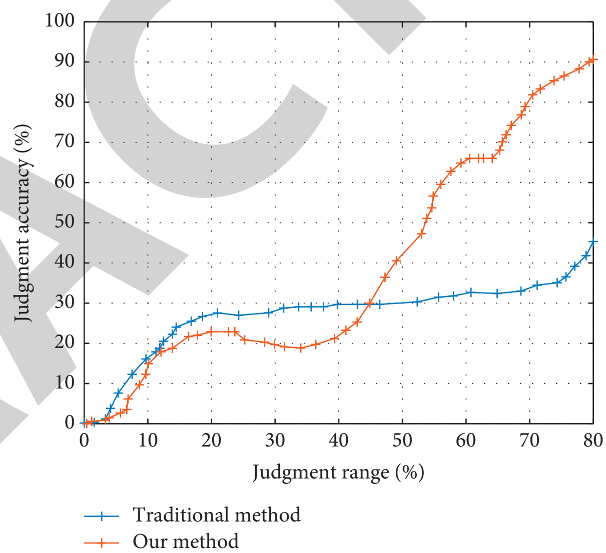

Figure 14: Results of accuracy.

and the method of this paper were judged, as shown in Figure 13.

As can be seen from Figure 13, when the time is in the range of 0–10, the judgment rate of the traditional method gradually increases, but it is always smaller than that of the 3D simulation method; when the time is in the range of 10–15, the judgment rate of the traditional method starts to decrease. In the subsequent time, the traditional method has been showing an up-and-down trend, and the fastest rate is only about 1/2 of the fastest rate of the 3D image simulation. From this, it can be seen that the speed is slow and low when using the traditional method to judge the reasonableness of the landscape, while the rate is faster with the 3D image simulation judgment method. The comparison results of judgment accuracy are shown in Figure 13. As can be seen from Figure 13, when the judgment range is within 20%, the accuracy of the traditional method and the method of this paper is not much different, and the accuracy of the traditional method is higher than the method of this paper; when the judgment range is 20% to 45%, the accuracy of the traditional method is significantly higher than the method of this paper. However, with the gradual expansion of the range, the accuracy of the three-dimensional image simulation judgment method used in this paper gradually improves, while the accuracy of the traditional method is always maintained at about 40%. Thus, it can be seen that the 3D image simulation judgment method is more accurate than the traditional method of judging the reasonableness of landscape design.

5.3. Experimental Conclusions. As observed from Figure 14, the number of matching feature points and the matching rate of the landscape obtained by the traditional deep estimation judgment method are lower than the 3D image simulation method used in this paper, the speed is slower, and the rate is lower when judging the reasonableness of the landscape, while using the 3D image simulation method has a higher matching rate of feature points and a faster judgment rate, which fully proves the reasonableness of using this judgment method.

6. Conclusions

With the development of computer science and technology, VR based on AI is playing an important role in many aspects of urban landscape planning and design. In this paper, in 3D visualization of landscape planning and design, 3D visualization of urban landscape modeling is carried out using virtual reality technology combined with the constructed DNN to establish a 3D database and virtual scene model of the landscape and achieve a 3D representation of the virtual scene landscape. The simulation experiments show that the effective site analysis of the real scene model and its matching rate is improved to realize the integration of 3D image, as well as system integration technologies.

Data Availability

The dataset used in this paper are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest regarding this work.

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References

[1] W. Chen, L. Zhao, Q. Kang, and F. Di, "Systematizing heterogeneous expert knowledge, scenarios and goals via a goal-reasoning artificial intelligence agent for democratic urban land use planning," *Cities*, vol. 101, Article ID 102703, 2020.

[2] Z. Zhang and B. Bowes, "The future of artificial intelligence (AI) and machine learning (ml) in landscape design: a case study in coastal Virginia, USA," *Journal of Digital Landscape Architecture*, vol. 4, pp. 2–9, 2019.

[3] P. Shan and W. Sun, "Research on 3D urban landscape design and evaluation based on geographic information system," *Environmental Earth Sciences*, vol. 80, no. 17, pp. 1–15, 2021.

[4] B. Cantrell, Z. Zhang, and X. Liu, "Artificial intelligence and machine learning in landscape architecture," *The Routledge Companion to Artificial Intelligence in Architecture*, Routledge, London, UK, 2021.

[5] R. Li, Q. Liu, J. Gui, D. Gu, and H. Hu, "Indoor relocalization in challenging environments with dual-stream convolutional neural networks," *IEEE Transactions on Automation Science and Engineering*, vol. 15, pp. 651–662, 2017.

[6] Z. Zhao, D. A. Klindt, A. Maia Chagas et al., "The temporal structure of the inner retina at a single glance," *Scientific Reports*, vol. 10, no. 1, p. 4399, 2020.

[7] C. Shousong, G. Xiaomin, W. Xiaoguang, and C. Ying, "Notice of violation of IEEE publication principles: research on urban land price assessment based on artificial neuralnetwork model," *IEEE Access*, vol. 7, pp. 180738–180748, 2019.

[8] K. Raaphorst, I. Duchhart, W. Van Der Knaap, G. Roeleveld, and A. Van Den Brink, "The semiotics of landscape design communication: towards a critical visual research approach in landscape architecture," *Landscape Research*, vol. 42, no. 1, pp. 120–133, 2017.

[9] T. Yigitcanlar, K. C. Desouza, L. Butler, and F. Roozkhosh, "Contributions and risks of artificial intelligence (AI) in building smarter cities: insights from a systematic review of the literature," *Energies*, vol. 13, no. 6, p. 1473, 2020.

[10] R. Righi, S. Samoili, M. López Cobo, M. Vázquez-Prada Baillet, M. Cardona, and G. De Prato, "The AI techno-economic complex system: w," *Telecommunications Policy*, vol. 44, no. 6, Article ID 101943, 2020.

[11] D. Li, H. Li, W. Li, J. G. Jun, and E. Z. Li, "Application of flipped classroom based on the rain classroom in the teaching of computer-aided landscape design," *Computer Applications in Engineering Education*, vol. 28, no. 2, pp. 357–366, 2020.

[12] F. Xu and Y. Wang, "Color effect of low-cost plant landscape design under computer-aided collaborative design system," *Computer-Aided Design and Applications*, vol. 19, no. S3, pp. 23–32, 2021.

[13] M. Zhang and X. Deng, "Color effect of landscape architecture design under computer aided collaborative design system," *Computer-Aided Design and Applications*, vol. 19, no. S3, pp. 13–22, 2021.

[14] X. Ma, P. Guo, J. Zhu, and J. Zhao, "An optimization method for urban landscape design and artistic value analysis by using vr technology," *Boletin Tecnico/Technical Bulletin*, vol. 55, no. 11, pp. 533–539, 2017.

[15] X.-B. Fu, S.-L. Yue, and D.-Y. Pan, "Camera-based basketball scoring detection using convolutional neural network," *International Journal of Automation and Computing*, vol. 18, no. 2, pp. 266–276, 2021.

[16] R. A. Minhas, A. Javed, A. Irtaza, M. T. Mahmood, and Y. B. Joo, "Shot classification of field sports videos using alexnet convolutional neural network," *Applied Sciences*, vol. 9, no. 3, p. 483, 2019.

[17] M. Rafiq, G. Rafiq, R. Agyeman, G. S. Choi, and S.-I. Jin, "Scene classification for sports video summarization using transfer learning," *Sensors*, vol. 20, no. 6, p. 1702, 2020.

[18] Z. Lei, S. Shimizu, N. Ota, Y. Ito, and Y. Zhang, "Construction of urban design support system using cloud computing type virtual reality and case study," *International Review for Spatial Planning and Sustainable Development*, vol. 5, no. 1, pp. 15–28, 2017.

[19] M. E. Portman, A. Natapov, and D. Fisher-Gewirtzman, "To go where no man has gone before: virtual reality in architecture, landscape architecture and environmental planning," *Computers, Environment and Urban Systems*, vol. 54, pp. 376–384, 2015.

[20] A. Haldorai, A. Ramu, and S. Murugan, "artificial intelligence and machine learning for future urban development," *Computing And Communication Systems in Urban Development*, Springer, Berlin, Germany, 2019.

[21] E. G. Xydas and L. S. Louca, "Identification of kinematic traits in 3d reaching tasks with the use of a haptic nine-hole peg-board test: comparison between healthy people and people with multiple sclerosis," in *Proceedings of the IEEE Ras & Embs International Conference on Biomedical Robotics & Biomechatronics*, IEEE, Scottsdale, AZ, USA, October 2008.

[22] W. Liu, C. C. Yan, J. Liu, and H. Ma, "Deep learning based basketball video analysis for intelligent arena application," *Multimedia Tools and Applications*, vol. 76, no. 23, pp. 24983–25001, 2017.

[23] C. Yufu, "Application and value analysis optimization of multimedia virtual reality technology in urban gardens landscape design," *Boletin Tecnico/Technical Bulletin*, vol. 55, no. 15, pp. 219–226, 2017.

[24] Z. Mai, "Application pattern innovation and value analysis of virtual reality assisted technology in urban landscape design," *Boletin Tecnico/Technical Bulletin*, vol. 55, no. 17, pp. 788–794, 2017.

[25] Z. Zhou, "Construction simulation analysis of landscape design based on virtual reality technology," *Revista de la Facultad de Ingenieria*, vol. 32, no. 14, pp. 526–531, 2017.

[26] Y. Liu, S. Chen, B. Guan, and P. Xu, "Layout optimization of large-scale oil-gas gathering system based on combined optimization strategy," *Neurocomputing*, vol. 332, pp. 159–183, 2019.

[27] X. Fu, K. Zhang, C. Wang, and C. Fan, "Multiple player tracking in basketball court videos," *Journal of Real-Time Image Processing*, vol. 17, no. 6, pp. 1811–1828, 2020.

[28] C. Zhang, T. Xie, K. Yang et al., "Positioning optimisation based on particle quality prediction in wireless sensor networks," *IET Networks*, vol. 8, no. 2, pp. 107–113, 2019.

[29] E. Kim and S. Park, "Three-dimensional visualized space and asset management system for large-scale airports: the case of Incheon international airport," *International Journal of Architectural Computing*, vol. 14, no. 3, pp. 233–246, 2016.

[30] P. Xu, J. Zhao, and J. Zhang, "Identification of intrinsically disordered protein regions based on deep neural network-VGG16," *Algorithms*, vol. 14, no. 4, p. 107, 2021.

[31] Y. Liu, S. Chen, and B. Guan, "Layout optimization of oil-gas gathering and transportation system in constrained three-dimensional space," *Chinese Science Bulletin*, vol. 65, no. 9, pp. 834–846, 2020.

[32] J. Hernandez-Orallo, "AI safety landscape from short-term specific system engineering to long-term artificial general intelligence," in *Proceedings of the 2020 50th Annual IEEE/IFIP International Conference on Dependable Systems and Networks Workshops (DSN-W). IEEE*, Valencia, Spain, July 2020.

[33] B. Mahaseni, E. R. M. Faizal, and R. G. Raj, "Spotting football events using two-stream convolutional neural network and dilated recurrent neural network," *IEEE Access*, vol. 9, pp. 61929–61942, 2021.

[34] B. Rimal, H. Keshtkar, R. Sharma, N. Stork, S. Rijal, and R. Kunwar, "Simulating urban expansion in a rapidly changing landscape in eastern Tarai, Nepal," *Environmental Monitoring and Assessment*, vol. 191, no. 4, p. 255, 2019.

[35] V. Choutas, P. Weinzaepfel, J. Revaud, and C. Schmind, "Potion: pose motion representation for action recognition," in *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*, pp. 7024–7033, Salt Lake City, UT, USA, June 2018.

[36] M. Trinidad-Fernández, D. Beckwée, A. Cuesta-Vargas et al., "Differences in movement limitations in different low back pain severity in functional tests using an RGB-D camera," *Journal of Biomechanics*, vol. 116, Article ID 110212, 2021.

[37] S. Desai, S. T. Reeve, K. G. Vishnu, and A. Strachan, "Tuning martensitic transformations via coherent second phases in nanolaminates using free energy landscape engineering," *Journal of Applied Physics*, vol. 127, no. 12, Article ID 125112, 2020.

[38] B. Li and X. Xu, "Application of artificial intelligence in basketball sport," *Journal of Education, Health and Sport*, vol. 11, no. 7, pp. 54–67, 2021.