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Computer-Aided Design AND APPLICATIONS

Application of 3D Image Reconstruction on Landscape Architecture in Environmental Design System

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Abstract. Computer software assistance is widely used in the field of design due to its fast response and convenience in current environmental design. Combining with semantic segmentation technology for efficient planning of three-dimensional landscape environment can effectively improve the visual effect of landscape environment planning and design. The traditional method first calculates the edge location of the environment image layout and denoises the image layout information, but ignores the filtering processing, resulting in incomplete image layout information. Aiming at the above problems, this article constructs a model of environmental image character understanding and semantic expression based on deep learning (DL), and applies it to CAD modeling of environmental design to improve the accuracy of landscape architecture 3D image reconstruction. The research results indicate that this method has good test results in landscape design of 3D images, and has obvious advantages over traditional modeling methods in operational efficiency, which provides an important theoretical basis for the analysis of landscape architecture distribution rationality. The proposed method can effectively improve the integrity of three-dimensional environmental image layout, and provide theoretical and technical basis for the construction of environmental design system.

Keywords: Environmental Design; CAD; Deep Learning; Image; Semantic Feature
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1 INTRODUCTION

CAD systems and deep learning algorithms have extensive applications in environmental design systems. CAD system can be used in all aspects of architectural design, such as design of Floor plan, elevation, section, etc. Deep learning algorithms can be used for building exterior design, interior decoration design, etc. By learning historical design data and user preference data, personalized design schemes can be automatically generated. CAD systems can be used for terrain design, road design, plant design, and other aspects in landscape design. Deep learning algorithms can be used to optimize landscape design schemes, such as automatically recommending suitable plant species for planting, and automatically adjusting landscape layout based on user preferences. CAD systems can be used for furniture layout, lighting design, color schemes, and other aspects in interior design. Deep learning algorithms can be used to automatically generate personalized interior design solutions, such as automatically adjusting furniture size, color matching, etc. based on user preference data. CAD systems and deep learning algorithms can be combined to achieve realistic environmental design in virtual reality environments. For example, using a CAD system to create a virtual environment model, and then using deep learning algorithms to automatically adjust parameters such as materials and lighting in the model to achieve more realistic environmental effects. CAD systems play an important role in environmental design, helping designers create and modify design solutions more efficiently, and allowing them to better control and manage workflow. Through CAD systems, designers can easily create and edit 2D and 3D images, as well as add and edit information such as text, images, graphics, and annotations. In addition, CAD systems can also be integrated with other software such as Revit, SketchUp, AutoCAD, etc. to support more complex architectural design, construction, and management work. In summary, CAD systems play an important role in environmental design, helping to improve design efficiency, accuracy, and quality. Influenced by urban environmental design and national history, it has played a very important role in integrating traditional cultural connotation. The quality of three-dimensional space environment image is gradually improved, and the simulation effect is more realistic, which gradually replaces the traditional hand-drawn design. In the process of environmental image collection, the image is easily affected by factors such as equipment quality and illumination, and there will be some problems in image quality, so it is necessary to enhance the characteristics of landscape three-dimensional images. In the practical application of computer image design and visual design technology, not only a certain algorithm is used, but different algorithms are combined to use their respective advantages to complete the work of image design and visual design.

As an important technology in computer vision perception, semantic segmentation brings more challenges than classification and detection tasks. The purpose is to give any pixel in the image a corresponding category label and realize the pixel-level prediction task. DL is essentially a mathematical model that simulates human brain neurons. Its structure includes a multi-layer perceptron with multiple hidden layers, and the output of each layer can be used as the input of the next layer. Combined with efficient planning of three-dimensional landscape environment based on DL semantic segmentation technology, the visual effect of landscape environment planning and design can be effectively improved. Its principle is to transfer the underlying features layer by layer like the neural network of the brain, and transform the input underlying features into more abstract and advanced features, thus discovering the inherent distributed features of the data.

For environmental designers, the innovation and growth of high technology greatly expands the thinking space of design, enriches the inspiration materials and expression methods of design, and provides a platform for environmental designers to exert their infinite creativity. Landscape expression and CAD complement each other, and the methods and thinking of environmental design and expression also need to be updated with high technology. The traditional image segmentation method is mainly based on some characteristics of the image, such as dividing the image into several regions according to the information such as shape, color, scene and contrast, so as to extract the interested target. However, in some pictures with complex background, the feature recognition extracted by this method is low, and the final segmentation effect is poor. In this article, a model of environmental image character understanding and semantic expression based on DL is constructed, and it is applied to CAD modeling of environmental design.

This article mainly studies the application of CAD system and DL algorithm in environmental design system, and its main innovations and contributions are as follows:

(1) In this article, a 3D spatial environment image layout optimization model based on DL and CAD is proposed. The environment image layout is decomposed by wavelet, the filter coefficient values are extracted, the vector set of the environment image layout features is collected, the signal variance of the environment image is estimated, and the noisy environment image is optimized.

(2) The model uses the semantic features of individual language text to modify the batch normalized parameters of the visual feature map of the image generator, which enhances the visual semantic embedding and solves the problem that the generated image in the text-generated high-definition image is difficult to contain text details and maintain the semantic diversity of the image.

Research content and chapter arrangement: The first section is the introduction, which introduces the significance and methods of applying DL and CAD technology to environmental design in the information age; The second section is related work, which introduces; The fourth section is model test and analysis, and the feasibility of applying the proposed algorithm to computer-aided environmental design system is proved by simulation experiments. The fifth section is the conclusion, which summarizes the work done by this article on the research of environmental design system, and points out the limitations of this work and the future research direction.

2 RELATED WORK

Deng et al. [1] designed VR real-life tourism interactive systems for virtual tourism products in different scenic areas. Based on point cloud processing algorithm, network segmentation scene layout pixel analysis was carried out, and the intersection model system and browsing of VR interactive tourism attractions were implemented. It has high precision and 360-degree video shooting and browsing value. Gao et al. [2] conducted large-scale reconstruction of building scenes based on laser scanned images. It effectively covers ground and aviation scenes, and lays out laser scanning space for scenes with rich textures. The results indicate that images and laser scanning have the effectiveness of complete scene reconstruction on the dataset of ancient buildings. Kang et al. [3] conducted an environmental reconstruction analysis of three-dimensional indoor spaces. The Iterative reconstruction datum data set of indoor environment is analyzed by providing rich semantic geometric indoor models. In the existing real environment, the problem of the effectiveness and robustness constraints of the indoor environment is solved. Li et al. [4] conducted 3D layout of garden landscapes through digitization and spatial geometric exchange of computer planar graphics. It converts the color information and spatial coordinates of multiple 3D graphics. Improved the efficiency of landscape construction. Li et al. [5] conducted micro environmental construction for sustainable development of public landscape resources. A performance variable evaluation standard for 3D landscape models was constructed through image recognition analysis of green space landscapes.

Lidberg et al. [6] used machine learning to improve the humidity index and water depth of wetland soil. The different mapping levels were determined through the overall summary of the exponential threshold of the computer dataset. Wetland soil is of great help in improving the landscape. Lin et al. [7] conducted immersive roaming experiments on three-dimensional landscape scenes. A three-dimensional scene transformation design was carried out for the ecological environment transformation of the lake area landscape. Make and Gupta [8] performed 3D reconstruction calculations on X-ray images. Through the analysis of the Committed step of the 3D model of the computer image, the alternative methods of the 3D model with significantly low radiation exposure in the model reconstruction process are summarized. Punnappurath and Brown [9] actively explored image compressors using deep learning networks. Due to non-linear image fidelity errors, it analyzed the linear image analysis results of computer vision tasks. It tested the fidelity error of deep network clustering and the error analysis of original reconstruction, and used image depth training network for a general framework explanation. Ruheili and Hajri [10] analyzed the practical teaching effect of 3D printing in landscape architecture projects in garden style. By designing the landscape architecture plane using intelligent 3D models, the visualization effect of garden landscapes has been improved. Shim and Yu [11] conducted network heterogeneity strategy analysis for image classification parameterization. A network model for language translation was constructed using different integrated network paths to address technical issues in the budget.

Wu and Yan [12] used the method of edge map information calculation for the digital platform display of three-dimensional landscapes. The prevention plan adopts discrete elevation calculation to preserve the framework of landscape design images. Through the stability analysis of the seed points of the image jitter problem of low visual rendering rate, the clarity and accuracy of Garden design are improved. The layout of room space has a significant impact on the application of real estate and furniture design scenarios. Yan et al. [13] planned a single image indoor scene 3D automatic layout solution. Nonlinear optimization of the scene was carried out using 3D layout image topology automation recognition technology. Zhang [14] carried out the section input design of Floor plan, and analyzed different drawing rendering techniques of machine learning. Through the serialized transformation of the collected architectural plane graphics, the pixel transformation technique of 3D space model construction is completed. Zhang and Zhang [15] analyzed the issue of architectural heritage protection in digital landscapes. By collecting data protection of garden architectural heritage through each digital image sharing technology, it constructs digital management restoration rules in the landscape field from a digital perspective. Zhang et al. [16] improved the fidelity of the overall room design by constructing a three-dimensional virtual visual representation of interior design. Adaptive mapping technology and object plane tracking were used to perform indoor reconstruction of relevant points and key point edge matching. The results indicate that the effect of CAD virtual 3D vision is very good despite the color fusion effect. Zhao et al. [17] constructed a classification framework feature for motion computer images. The signal conversion framework was used as a sample topic for performance and robustness analysis. This method not only preserves the three-dimensional framework features of computer signals, but also enhances the classification simulation strategy of spatial features. Zhu [18] integrated artificial intelligence to analyze the 3D reconstruction visualization model of ancient buildings. And academic summaries were conducted on key architectural nodes. The problems of high cost, long construction period and poor Data and information visualization of 3D models in buildings are solved. This algorithm summarizes the structural design of ancient buildings.

3 METHODOLOGY

3.1 Deep Convolution Neural Network (CNN)

Convolutional Neural Networks (CNN) have extensive application value in environmental design, mainly including the following aspects:

Interior design: Deep convolutional network can help Interior designer predict the effect of interior space more accurately. By inputting CAD drawings or images of indoor spaces, deep convolutional networks can generate high fidelity indoor renderings, helping designers iterate and optimize design solutions more quickly.

Architectural design: Deep convolutional networks are also widely used in architectural design. By inputting CAD drawings or images of buildings, deep convolutional networks can generate rendered images of buildings, helping designers more accurately predict the actual effects of buildings. In addition, deep convolutional networks can also assist architectural designers in designing exterior and interior spaces.

Landscape design: Deep convolutional networks can help landscape designers predict the effectiveness of landscape design more accurately. By inputting CAD drawings or images of the landscape, deep convolutional networks can generate high fidelity landscape renderings, helping designers iterate and optimize design solutions more quickly.

Urban design: Deep convolutional networks can help urban designers predict the effects of cities more accurately. By inputting CAD drawings or images of cities, deep convolutional networks can generate high fidelity city renderings, helping designers iterate and optimize design solutions more quickly.

In summary, deep convolutional networks have extensive application value in environmental design, which can help designers predict design effects more quickly and accurately, thereby optimizing design solutions.

The first layer of neural network is the input layer, with the hidden layer in the middle. The hidden layer can be connected in series in multiple layers, and the third layer is the output layer. Each connection has weights and biases that need to be trained. Complex neural networks have thousands of connections and huge parameters. CNN can simulate the mechanism of animal visual nerve and recognize images. The appearance of CNN can avoid complex feature engineering and reduce the work of data preprocessing. Moreover, CNN is invariant to translation, rotation and scale. The structure of depth CNN model is shown in Figure 1.

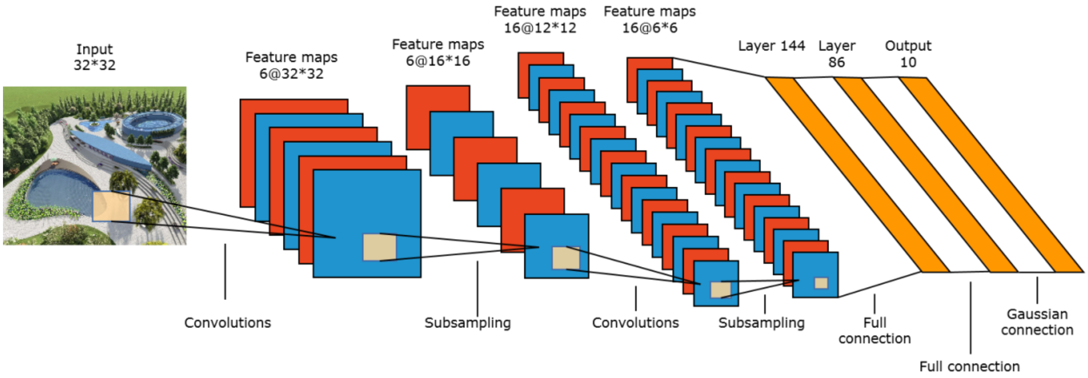

Figure 1: Structure of depth CNN model.

In CNN, data samples, network structure, objective function and optimization method are all very important. With the sharp increase of images, the saturated nonlinear activation function has been unable to meet the task of image classification. Therefore, this article uses ReLU activation function. ReLU activation function is a kind of unsaturated nonlinear activation function, and it is also the most widely used function in neural network at present. It can improve the training efficiency of the model and the classification performance of the model.

The rationality analysis of landscape architecture distribution based on grid projection can be achieved through three-dimensional image analysis. Divide the landscape area into several grids, each representing an area. By analyzing the landscape characteristics and building distribution within each grid, the rationality of building distribution can be evaluated. Use a 3D image acquisition device for image acquisition. Obtain high-precision 3D images of landscape areas, such as laser scanners or drones. Iterative reconstruction is performed on the collected 3D images to obtain the 3D model of the landscape area. Then project the 3D model onto the grid for projection analysis, and evaluate the landscape features and building distribution within each grid. For example, it is possible to analyze the conflict between buildings and landscape elements (such as vegetation, water bodies, etc.), as well as the balance of building distribution. Finally, evaluate the rationality of the results based on projection analysis. Evaluate the rationality of building distribution. If there are significant conflicts between the distribution of buildings and landscape elements, or if the distribution is uneven, it may be necessary to reconsider the design plan. Based on the analysis results, propose optimization suggestions. For example, adjusting the distribution of buildings, adjusting the position or density of landscape elements, etc., in order to achieve a more reasonable distribution of landscape buildings. In summary, three-dimensional image analysis based on grid projection can help landscape designers and architects evaluate the rationality of building distribution and propose optimization suggestions, thereby better achieving environmental design goals.

Based on the original network, this model combines the features of each word in the input language text with the generated visual feature map to increase the word-level feature input of natural language text. Moreover, the similarity of each word feature of the input text will be calculated with the feature map of the generated image, and the multi-model similarity loss function will be obtained for the training of the generator. By strengthening the input of word-level large features in natural language texts and supervising the generator, the whole model can generate more high-definition fine-grained images. Through continuous learning and training, CNN can find its regularity from a large number of environmental design data of unknown patterns, especially it can handle any type of data. Usually need to meet:

$$m = \sqrt{x+y} + R(10) \tag{1}$$

$$R^{-}(X) = \{U_2, U_3, U_4, U_5, U_7\} \tag{2}$$

$$R_{-}(X) = \{U_2, U_4, U_5\} \neq \varnothing \tag{3}$$

Therefore:

$$\rho(X) = 1 - \frac{|POS_C(X)|}{|R^{-}(X)|} = 0.6 \tag{4}$$

If $X = \{U_2, U_3\}$, it is not definable because:

$$R^{-}(X) == \{U_2, U_3, U_5, U_7\} \tag{5}$$

$$R_{-}(X) = \{x \in U | R(x) \cap X \neq \varnothing\} \neq \varnothing \tag{6}$$

In order to solve the problem of too many parameters, CNN effectively reduces a large number of parameters by using the spatial structure relationship and improves the training efficiency of back propagation. The error function is the difference between the data of the visible layer obtained from the hidden layer and the original input layer, and the parameters are adjusted by the gradient of the error function.

3.2 Understanding and Expression of Semantic Features of Three-Dimensional Images in Environmental Design CAD

In environmental design CAD, understanding and expressing the semantic features of 3D images is crucial for the accurate transmission and subsequent processing of design information. For 3D images, various features can be extracted from different angles, such as points, lines, faces, volumes, etc. These features should reflect the design information in the image as fully as possible for subsequent processing and analysis. The extracted features need to be expressed using appropriate mathematical models, such as using vectors to represent line features and polygons to represent surface features. These mathematical models should be able to accurately reflect the geometric information and topological relationships of features. Feature matching often requires matching the features between different images during 3D image processing and analysis. Therefore, it is necessary to design an effective feature matching method to match the features between different images. In environmental design CAD, feature fusion often requires the fusion of 3D images from different sources. Therefore, it is necessary to design an effective feature fusion method to fuse the features between different images and form more complete and accurate design information. In summary, for the understanding and expression of 3D image semantic features in environmental design CAD, in-depth research is needed from the aspects of feature extraction, feature expression, feature matching, and feature fusion, in order to facilitate subsequent processing and analysis.

Image semantic segmentation refers to marking the pixels occupied by the objects in the image according to their categories, forming a number of unrelated regions, and each region has obvious differences in characteristics. The task of image semantic segmentation still belongs to the problem of image segmentation in essence, and its fundamental purpose is to capture the advanced semantic information contained in the image efficiently and accurately, and finally realize the accurate segmentation of the given image. Compared with the traditional image segmentation, the difference is that it is based on the image semantics to delimit the outline and region of the target in the image, not just through the image pixels. In many DL-based tasks, feature fusion is an important means to determine the network performance. Especially in the task of semantic segmentation, a good feature fusion structure not only determines the performance effect of the network, but also affects the running speed and memory occupation of the network to some extent. Images have many different characteristics, such as texture, spatial structure and color. According to these characteristics, images are divided into different regions. In this way, each region has its own characteristics, and there are different characteristics between regions.

Usually, in CNN, feature maps located at different levels of the network contain different levels of semantic and location information. With the deepening of the network from left to right, it can be seen that with the deepening of the network, the network can better identify more detailed semantic information, while the shallow network can identify more information such as color blocks and contour edges. Edge is a very important index in image segmentation. In an image, the set of pixels between every two connected regions is called edge, which means the beginning and end between regions. At present, the mainstream semantic segmentation network uses feature fusion to capture the semantic features of environmental images. However, this fusion method only fuses the features between some layers, and does not consider all the feature information in the network, resulting in the serious loss of information during the backward propagation of shallow features. The residual network model structure of environmental image character extraction is shown in Figure 2.

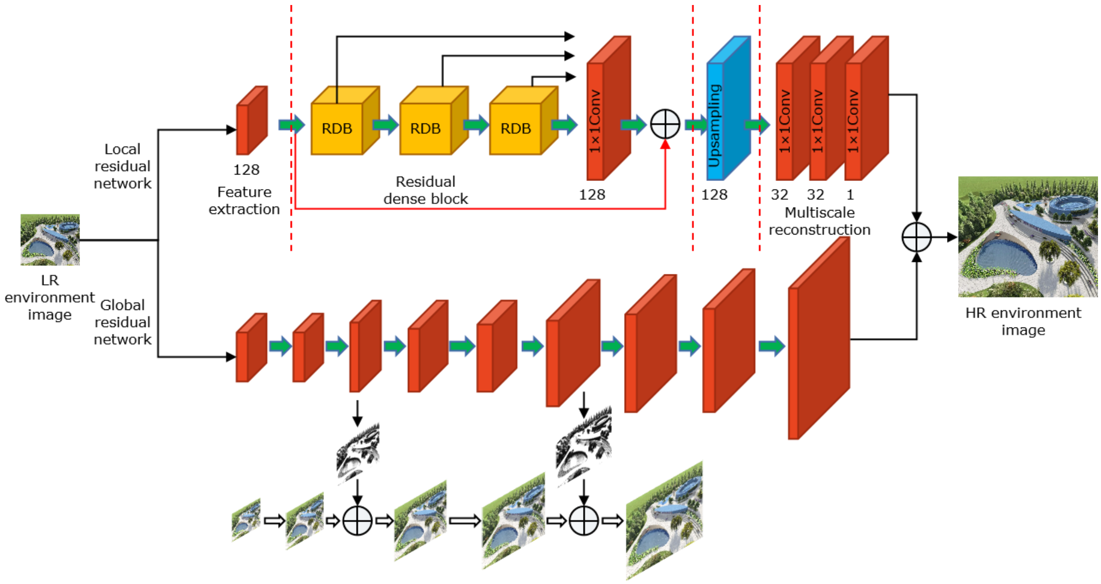

Figure 2: Structure of residual network model for environmental image character extraction.

In order to effectively improve the effectiveness of image layout optimization design in three-dimensional space environment, firstly, gradient calculation method is used to locate the image layout in three-dimensional space environment. The use of Gaussian Laplace joint transformation instead of Gaussian smoothing filter can achieve optimization of image layout and prevent weakening of image layout information. This method has strong optimization design ability, but the optimization process is relatively complex. The edges of an image have two important elements, namely direction and amplitude.

Introducing the Harris operator to extract local features of 3D artificial vision images, thereby minimizing the objective function and completing the enhancement of local features of 3D artificial vision images. This method has high efficiency in image feature enhancement, but when using existing methods to enhance 3D landscape images, it is unable to extract scale invariant 3D landscape image features, which can easily lead to significant error in image feature enhancement. Based on the slope change of the ridge line, search for feature points of the landscape 3D image from local extreme points, and construct triangles to calculate the feature parameter values of the landscape 3D image. Determine the similarity range of characteristic parameter values for landscape 3D images, and on this basis, complete the feature enhancement of landscape 3D images. Although this method has strong anti-interference ability in the process of feature enhancement, its application has great limitations and cannot be widely applied. The image selected in this article can be decomposed by complex domain wavelet to construct the average energy eigenvectors of sub-band signals with different scales and directions for each subband signal. And use these three feature vectors as the feature vectors for selecting images for classification. The larger the scale of the feature image, the finer the grid, and the higher the detection accuracy of small objects.

Assume that $f^{''}(x,y)$ represents the original landscape three-dimensional image, $x^{'}_{jui}$ represents the neighborhood of any pixel $c^{'}_{sg}$ in the landscape three-dimensional image, $w^{'}_{wer}$ represents the number of values of each image character, and $b^{'}_{wep}$ represents the total number of pixels in the image. The image is enhanced in frequency domain:

$$E^{'}_{qwu} = \frac{b^{'}_{wep} \times f^{''}(x,y)}{x^{'}_{jui} * c^{'}_{sg}} \times \left\{ w^{'}_{wer} \oplus e^{'}_{gtu} \right\} \tag{7}$$

Where $e^{'}_{gtu}$ represents the distribution state of image gray value. $(x+a, y+b)$ represents the disturbance point of the image, and $(x+a, y+b)^{kl}$ represents the corresponding point of (x,y) and $(x+a, y+b)$. Form a new image gray scale:

$$b^{''}_{poi} = \frac{(x+a, y+b)^{kl}}{(x,y)\times(x+a, y+b)} \oplus \frac{\xi^{'}_{uio}}{O^{'}_{hjk}} \tag{8}$$

Assume that $\iota^{''}_{pol}$ represents the first-order differential function of the image, $v^{'}_{wer}$ represents the intrinsic property of the image, and $d^{'}_{sgh}$ represents the amplitude-frequency characteristic function. Give the gray features of the image:

$$e^{'}_{yup} = \frac{d^{'}_{sgh} \pm \iota^{''}_{pol}}{v^{'}_{wer}} \mp d^{'}_{sgh} \tag{9}$$

Assume that ∂'_{uip} represents the variance of the original image block merged with each adjacent basic image block, and c'_{wepp} represents the proportion of each image block in the whole image. The enhancement function of image edge gray contrast is obtained:

$$r'_{rti} = \frac{c'_{wepp} \pm \partial''_{uip}}{h'_{tu}} \times f'_{rty} \tag{10}$$

Where h'_{tu} stands for mask operator and f'_{rty} stands for texture feature of low frequency part.

The shallow layer of a network has a large spatial resolution because when processing images, the network usually divides the image into multiple small blocks, each composed of multiple pixels. In the shallow layer of the network, each neuron is usually only associated with a small piece of the image, so the input it receives is only related to the pixels within that small piece. This means that each neuron is only interested in a small portion of the image, so their spatial resolution of the image is low. However, as the depth of the network increases, each neuron begins to associate with smaller image blocks, thus their spatial resolution of the image gradually increases. At the deeper level of the network, each neuron is usually only associated with one or several pixels of the image, so their spatial resolution of the image is very high.

The landscape image layout with noise is divided into layout blocks with a given scale, and the distance is used as the measure of structural similarity between landscape image layouts. Overlapping several image blocks whose image layout distance is less than a given threshold to form an image layout matrix Z, obtaining a set of processed image layout blocks Y through three-dimensional transformation of the image layout matrix Z, and finally performing weighted average on all image layout blocks in each group Y to obtain a preliminary estimated image layout Y:

$$Y_b = \left(\sum\sum \omega_h Y\right) / \left(\sum\sum \omega_h X\right) \tag{11}$$

Where X represents the characteristic function of an image layout block in the interval [0,1], and the image layout block set Y and the weight function ω_h are expressed as:

$$Y = T_{3d}^{-1}\left\{h\left[T_{3d}(Z)\right]\right\} \tag{12}$$

$$\omega_h = \begin{cases} 1/\left(\sigma^2 N_h\right) & if \ N_h \\ 1 & else \end{cases} \tag{13}$$

Where $h\left[T_{3d}(Z)\right]$ stands for three-dimensional transformation of image layout, T_{3d}^{-1} stands for inverse three-dimensional transformation form of image layout, d stands for spatial dimension, and h stands for hard threshold shrinkage coefficient.

Where σ^2 stands for zero mean Gaussian noise variance, and N_h stands for non-zero coefficient retained after hard threshold filtering. The image layout Y_b is further grouped and matched to obtain the three-dimensional matrix Y_w of landscape image layout, and the original noise image layout block is matched to obtain the three-dimensional matrix Z_w according to the corresponding coordinate information of Y_w. Performing inverse three-dimensional transformation on the processed image layout matrix to obtain the processed image layout block set Y_{wi}, and finally performing weighted average on the spatial landscape image layout blocks in Y_{wi} to obtain the final estimated landscape image layout:

$$Y_f = \sum\sum \omega_{wi} Y_{wi} / \sum\sum \omega_{wi} X \tag{14}$$

The weight function ω_{wi} of the landscape image layout block set Y_{wi} is given by the following formula:

$$\omega_{wi} = \sigma^{-2} \|W\|_2^{-2} \tag{15}$$

Where W stands for empirical Wiener filtering shrinkage coefficient.

Aiming at the poor edge segmentation of environmental images, a series of morphological operations are used to improve the prediction effect of linear boundaries. Different feature fusion methods should be considered in feature fusion. The commonly used feature fusion methods include bitwise addition, bitwise maximum and parallel connection of different features. Bit-by-bit operation increases the computation of the network to a certain extent, and direct addition or maximum operation between different features will cause mutual influence and coverage between features, which will lose the fusion performance to some extent.

4 RESULT ANALYSIS AND DISCUSSION

This article conducts training and testing on PASCAL VOC data sets. PASCAL VOC data set is divided into a total of 20 categories, which is a very widely used public data set in the field of semantic segmentation. For the task of image semantic segmentation, it is generally necessary to evaluate by different indicators to analyze whether the expected processing effect has been achieved. In order to further illustrate the effectiveness of different methods, the traditional recurrent neural network (RNN) and the deep belief network (DBN) are used as comparison methods for common analysis and verification, and the quality of feature enhancement of environmental design CAD images by different methods is tested from the aspect of feature enhancement effect. The comparison of environmental design image optimization effect is shown in Figure 3.

In the process of optimizing and enhancing the features of the landscape 3D image, the image should be preprocessed by using the histogram statistical information principle of the image to obtain the points in the bounding box of the landscape 3D image model, and the gray value of each pixel in the front view should be obtained by projecting the landscape 3D image. The image based on spatial characteristics is transformed into a feature image based on frequency domain, which lays a foundation for optimizing and enhancing the characteristics of landscape three-dimensional images. Compare and analyze the time-consuming of environmental image recognition processing with different methods, as shown in Figure 4.

As can be seen from Figure 4, the time-consuming of environmental image recognition processing of traditional RNN and CNN algorithms has obviously increased with the increase of image character information, while the time-consuming of environmental image recognition based on this algorithm has obvious advantages over traditional algorithms.

Different image signals have different feature vectors. The establishment of CAD image character recognition model is mainly used to describe the mapping relationship between feature vectors and image signal types. The convergence index is used to compare the maximum clique structure mining results of this algorithm, traditional RNN algorithm and CNN algorithm, as shown in Figure 5.

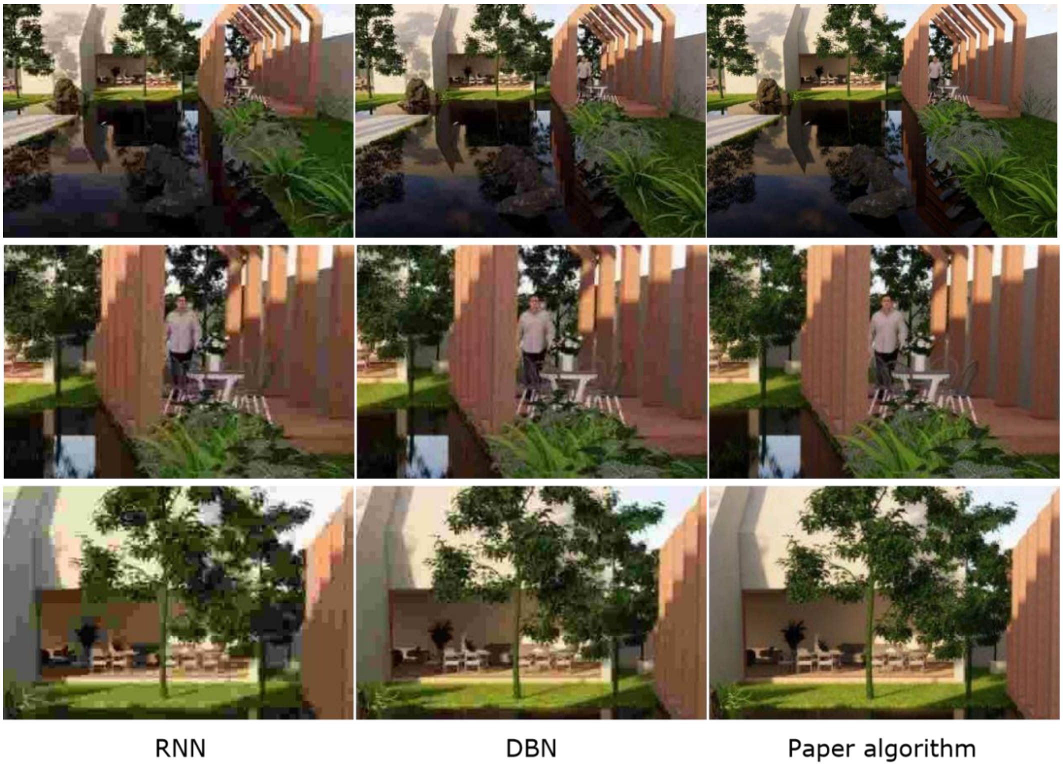

Figure 3: Comparison of image optimization effect of environmental design.

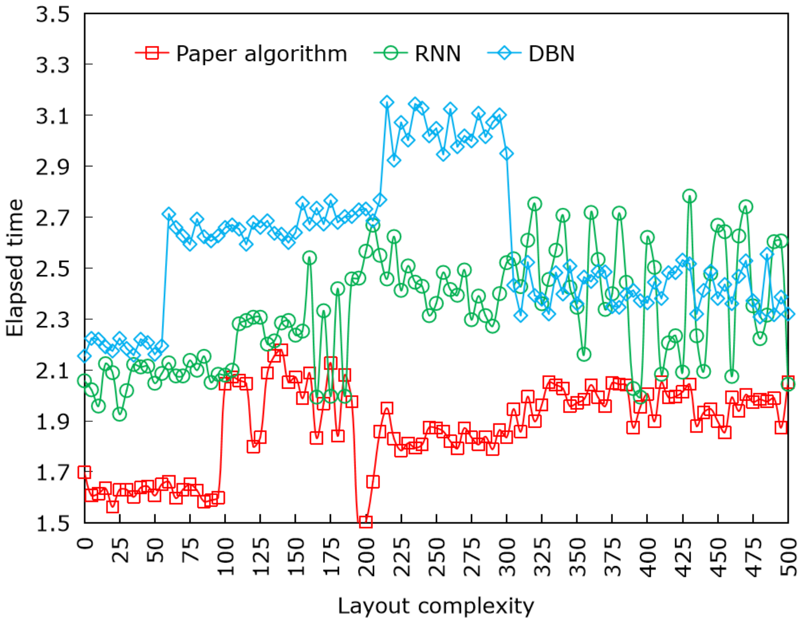

Figure 4: Time-consuming environmental image recognition by different methods.

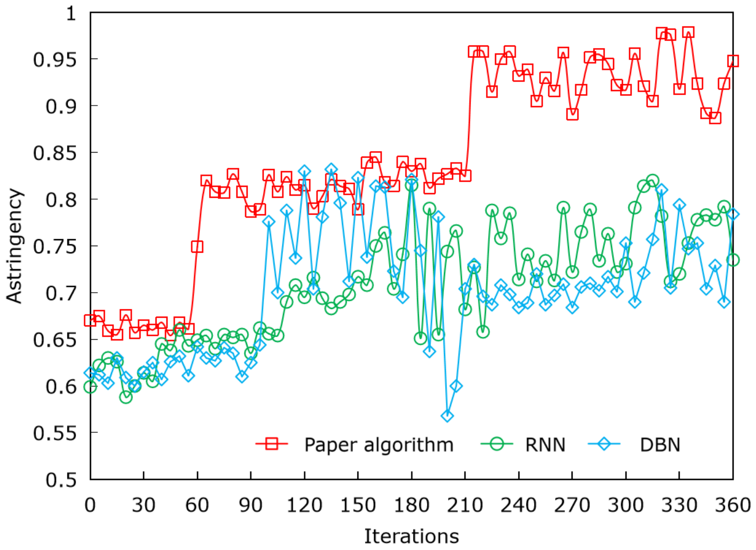

Figure 5: Comparison results of convergence.

The results show that this algorithm is more reasonable, feasible and scientific than the traditional CNN algorithm in image signal feature identification and classification. Using this algorithm to extract image characters has good optimization characteristics and rapid convergence.

Taking the local and global contrast of the image as the weight coefficient of image character enhancement, and taking this coefficient as the threshold of image character enhancement, the independent gamma correction coefficient of each pixel in image character is obtained, and the landscape three-dimensional image character is optimized and enhanced by this coefficient. Figure 6 shows the image recognition errors of different algorithms in the environmental CAD system.

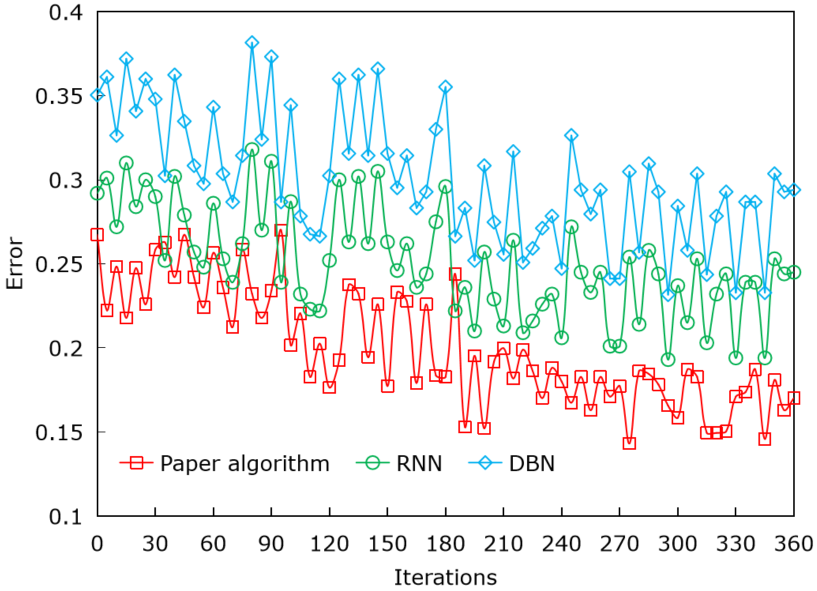

Figure 6: Errors of different algorithms.

The error of this algorithm is obviously improved compared with CNN algorithm on the test set. In this article, an adaptive operator is added to the local search strategy of the algorithm, so that the local search range decreases with the iterative algorithm, and then the local search is more targeted. With the increasing number of image frames, the absolute mean brightness error of landscape three-dimensional image character enhancement using this method is always in the minimum range, and then it can be judged that the landscape three-dimensional image character enhancement using this method can ensure the clarity and accuracy of image character information enhancement, and fully meet the requirements of landscape three-dimensional image character enhancement for its clarity. The comparison of image character recognition accuracy of different methods is shown in Figure 7.

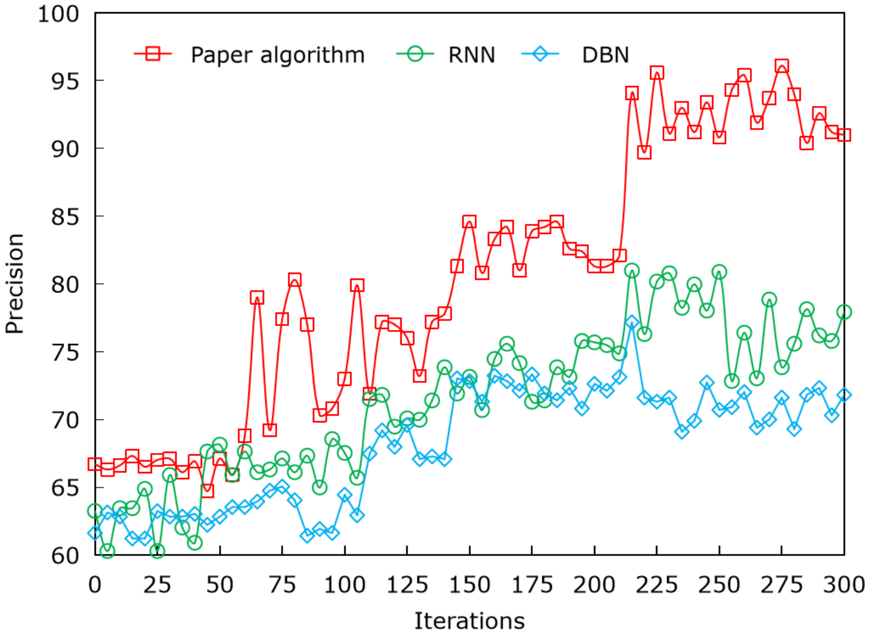

Figure 7: Accuracy of image character recognition using different methods.

The accuracy of image character recognition using this method is above 96%. The algorithm in this article makes reasonable use of the unique sparsity of environmental image signals, so that the enhancement effect is not affected by the added noise, and it has good robustness. This algorithm can avoid the situation that fixed structure neural network is easy to cause over-fitting or under-fitting. This provides a new idea to solve the problem of multi-class recognition, which is to match the groups first, then let the results of each group compete and finally get the final recognition result. The application of this method can not only reduce the work intensity and drawing loss, but also improve the design efficiency, which has considerable application prospects.

5 CONCLUSION

The growth of CAD is still moving towards a more convenient, efficient and fast direction, and the performance of environmental design also benefits from this development. In the field of environmental design, CAD can help designers complete design proposals more quickly and accurately. With CAD software, designers can create and edit 2D and 3D images, as well as add and edit information such as text, images, graphics and annotations. This allows designers to more easily complete complex layouts and designs, and to predict the final effect more accurately. In addition, CAD can also help Interior designer choose materials and colors, and analyze lighting and shadows. In terms of advertising design, CAD can help designers create more creative and expressive advertising works. Through CAD software, designers can create and edit images, graphics and text, and add special effects and animation effects. This makes advertising works more vivid, attractive, and persuasive, thereby improving the conversion rate of advertising. In urban planning, CAD can also help planners complete planning work more accurately and efficiently. Through CAD software, planners can create and edit maps, images, texts and other information, and can carry out Spatial analysis, land use planning, Transportation planning and other work. This allows planners to complete planning work more quickly and better predict the future development trends of the city. In this article, a 3D image character understanding and semantic expression model of environmental design CAD based on DL is constructed. By using the semantic features of individual language texts, the batch normalization parameters of the image generator's visual feature map are modified to enhance the visual semantic embedding and improve the accuracy of 3D image reconstruction of landscape architecture. The results show that the accuracy of image character recognition using this method is over 96%. The algorithm in this article makes reasonable use of the unique sparsity of environmental image signals, so that the enhancement effect is not affected by the added noise, and it has good robustness.

The results show that the proposed method has significant advantages in image character recognition. This algorithm can avoid the situation that fixed structure neural network is easy to cause over-fitting or under-fitting. The experiments in this study are all verified on image data sets, but the effect on video data sets is not verified. Segmentation on video data sets has higher practical significance and application value, so it is a feasible research direction to apply semantic segmentation to video sequences in the next step.

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