

# Construction and Application of a Landscape Design Teaching Platform Driven by Artificial Intelligence

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## ABSTRACT

Landscape design is a measure of the development of urbanization process and the improvement of people's happiness index. The process of urbanization will involve landscape design. The study and teaching of landscape design is the core teaching method of landscape design research. However, with the diversified development of landscape design schemes and the characteristics of landscape 3D schemes, traditional landscape teaching schemes can no longer meet the needs of students and teaching, which also limits the effect of students' understanding and learning of landscape design schemes. Digital technology has been widely used in the field of landscape design, and has shown good results. This research uses the artificial intelligence method of digital technology to study the relevant factors in the teaching task of landscape design. This article mainly discusses three characteristics of students' design preference, landscape layout, and landscape pattern in landscape design teaching, which are also important factors affecting landscape design.

## KEYWORDS

artificial intelligence, landscape design, platform construction, teaching research

## INTRODUCTION

With the continuous development of urbanization and the improvement of people's living standards, landscape design has become an important task and field. Landscape design with a relatively high level can not only improve people's happiness in life, but also promote the utilization of urban land (Na, 2021). Landscape design is not only a beautiful landscape of the city, but also a reflection of the cultural information of the city (Jović & Mitić, 2020). Landscape design can integrate the rich historical and cultural information of the city into the landscape design scheme, and it can also provide more leisure places for people's lives, which enhances people's pursuit of happiness in life (Geffel, 2021). It can be seen that landscape design has added more elements to urbanization construction,

DOI: 10.4018/IJWLTT.336483

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not only improving land use efficiency, but also improving more aesthetic factors. However, there are many factors in landscape design. It is not only a 3D (three-dimensional) effect, but also involves the layout, scheme, color, and satisfaction of residents of the landscape design. Therefore, many universities have carried out the teaching task of landscape design, which is also a demand to meet the urbanization process (Xiao, 2021). The teaching task of landscape design is relatively complex, and it is difficult for students to experience the 3D stereoscopic effect of landscape design by traditional teaching methods (Song et al., 2019). Students and teachers can only learn some design elements of landscape design and outline features of landscape design, and it is difficult for them to learn the internal characteristics of landscape design (D’Uva & Eugeni, 2021). This is the disadvantage of traditional teaching methods (Bianconi et al., 2019). Computer virtual reality technology and digital technology have shown good performance in the design of landscape design (Xin et al., 2020). This is also due to the development of computer computing and storage performance. Computer technology can assist artificial methods to discover related designs in landscape design factors and internal characteristics (Liu & Nijhuis, 2020). This research considers the application of computer virtual reality technology and digital technology in landscape design teaching, which can promote students’ learning efficiency and interest in landscape design, and is also the general trend of landscape design development (Lybrand et al., 2019).

The computer virtual reality method is a method of displaying 3D graphics, which allows students to observe the internal features of stereoscopic images and different structures more intuitively. Landscape design is also an image with a large number of 3D structures, and most of the landscape design methods are realized by computer virtual reality technology. This research uses computer virtual reality technology to carry out 3D imaging and rendering of the teaching plan of landscape design, which shows the internal factors and rendering effects of landscape design to students. This also saves teachers’ lesson preparation time. The layout features between landscape designs are difficult to show through 2D renderings using computer virtual reality technology. Computer virtual reality technology also integrates multi-sensor systems and people’s visual and auditory senses. Landscape design researchers can realize the interaction with the tactile and auditory sense of landscape design through the computer system, which allows students to truly experience landscape design layout features and rendering effects. The application of this method in landscape design teaching can promote students’ enthusiasm and learning of landscape design (Rossi et al., 2018). Whether for teachers or students, computer virtual reality technology is a relatively useful computer-aided technology. However, computer virtual reality technology does not only show the characteristics and factors related to landscape design to students, but it can also achieve interaction with students. Computer virtual reality technology cannot help students and teachers to discover the characteristic relationships between landscape design, which also limits students’ in-depth understanding of landscape design teaching content (Soti et al., 2018). Computer virtual reality technology can display the 3D structure of landscape design, while artificial intelligence technology can learn the relevant data relationships of 3D landscape elements.

Artificial intelligence technology has shown great advantages in extracting the characteristics of research objects, and it is also widely used in life and production (X. Li, 2020). The benefits of artificial intelligence approaches are also being felt. If artificial intelligence methods are applied to the teaching of landscape design, it can help students and teachers discover the relationship between the layout, pattern, and people’s preferences of landscape design (Zhang, 2020). The purpose of landscape design is to meet people’s needs for layout, pattern, and satisfaction. Artificial intelligence methods have derived more mature algorithms, which provides more convenience for the application of artificial intelligence methods in landscape design teaching (Mohamed et al., 2020). The two most used algorithms in artificial intelligence methods are convolutional neural networks (CNN) and long short-term memory neural networks (LSTM). With the continuous expansion of computer memory, the data of relevant factors of landscape design teaching can also be saved in large quantities (Nguyen et al., 2020). However, both traditional convolutional neural networks and long short-term memory neural

networks suffer from the problem of data volume (Zuo, 2020). In order to apply artificial intelligence technology to research objects with large amounts of data, they have designed a variety of methods to reduce the amount of parameter computation, including the variational Bayesian convolutional neural network (VB-CNN) used in this study and the gated recurrent unit (GRU) method, which allows for deeper training on landscape design data with a large amount of data, which is also beneficial for extracting more spatial and temporal features of landscape design (Zhang & Wang, 2021). VB-CNN is a new neural network structure that combines Bayesian theory with CNN. It can consider prior knowledge of factors related to landscape design, which requires less data sets for landscape design than CNN methods. The functions of GRU and LSTM methods are similar, and both can be used to extract temporal relationships in landscape design. However, GRU has a simpler structure, which can reduce training time.

This research uses computer virtual reality method and artificial intelligence method to design a landscape design teaching platform. The artificial intelligence methods used in this research are mainly VB-CNN method and GRU method. The VB-CNN method mainly extracts and predicts the spatial features in the teaching task of landscape design. The GRU method mainly extracts and predicts the time factor in the teaching task of landscape design. In order to realize the construction of an intelligent landscape design teaching platform, this research is mainly divided into five different aspects to introduce the application of artificial intelligence methods in landscape design teaching tasks. Section 1 introduces the problems existing in the teaching of landscape design, the background of computer virtual reality technology and the background of artificial intelligence technology. Section 2 (Related Works) studies and introduces the research status of landscape design schemes and the characteristics of influencing factors. The platform construction and workflow and artificial intelligence methods of computer virtual reality technology and artificial intelligence methods in landscape design teaching are studied and explained in Section 3 (Application). Section 4 (Result Analysis and Discussion) analyzes the accuracy of artificial intelligence methods in the task of predicting and extracting relevant factors in landscape design teaching. Section 5 (Conclusions) illustrates the research value and use value of artificial intelligence methods and computer virtual reality technology for landscape design teaching (Zhang & Wang, 2021).

## RELATED WORKS

With the development of computer technology, people have applied virtual reality technology and computer-aided systems in different landscape designs. Virtual reality and computer-aided systems are both important technologies in today's landscape design teaching tasks. Landscape design also involves more elements and influencing factors. The teaching method of landscape design is also different from the traditional teaching method. A large number of researchers have analyzed and studied the influencing factors of landscape design and the application of digital technology in landscape design. Sun et al. (2020) explored the design elements of ice and snow related landscapes, which are mainly related to the landscape design of coastal cities. They analyzed the characteristics and laws of ice and snow landscape design, and also analyzed the visual and aesthetic features of ice and snow landscapes. They designed and researched in combination with the ice and snow landscape characteristics of coastal cities. The research results show that the ice and snow landscapes in coastal cities have specific and beautiful visual aesthetic characteristics. This research also provides a certain reference value for the design of ice and snow landscapes. Peng (2021) studied urban landscape design goals, landscape design techniques, and the impact of digital technology on urban landscape design. They designed a neural network technology to study the application of digital methods in urban landscape design to wireless sensor technology. They also explored the spatial influences and the influence of external conditions in urban landscape design. The research results show that digital technology will have a greater impact on urban landscape design methods and schemes, and it can also promote the generation of new urban landscape schemes. This digital technology can also avoid the

waste of urbanized land, and this research has reference significance for the design of urban landscape. Tian (2022) found that landscape design not only requires good aesthetic value and innovation, but also can attract people's attention. The research shows that landscape design also needs to achieve the design effect of the scheme, which is a more difficult task. Based on virtual reality technology and computer-aided system, this research studies the landscape design scheme and implementation effect drawing. The results of the study found that 3D rendering technology as well as virtual reality methods can facilitate the design and implementation process of landscape schemes. Computer-aided systems are also necessary systems for landscape design. This research promotes the application of computer-aided systems and virtual reality methods in landscape design. Cai et al. (2022) recognized that landscape design and landscape preferences are important factors in landscape design. They used the method of conjoint analysis to study the relationship between landscape elements and landscape preferences, which is related to research and design from the perspective of people's aesthetics. The results of the study show that squares, vegetation, roads, and seating are some of the design factors that people pay more attention to, and the conjoint analysis method is more feasible than the univariate method in the study of landscape design. This research helps landscape architects to find more suitable landscape design elements according to people's preferences for landscape. Z.Li et al. (2018) studied the advantages and feasibility of the application of computer virtual reality technology in the teaching of landscape design. They explored the conceptual modeling process of landscape design using SketchUp virtual modeling technology. They also analyzed the advantages of virtual reality technology and the current situation in landscape design teaching. The research results show that computer virtual reality technology can improve the efficiency of landscape design teaching, and it can also assist in solving difficult problems in landscape design schemes. Computer virtual reality technology can also improve students' understanding of 3D landscape design solutions. This research can promote the application of virtual reality technology in landscape design. Through the research, it can be found that digital and virtual reality technologies have been widely used in landscape design and landscape design teaching, which is also a development trend in the field of landscape design (Cao, 2022).

Virtual reality (VR) technology enables users to experience a simulated environment through immersive visualization, while artificial intelligence (AI) enables machines to learn from data and make smart decisions. Together, VR and AI offer unique opportunities for designing and teaching landscapes. For example, VR technology can create virtual landscapes for students to explore and interact with, while AI algorithms can analyze the students' interactions and provide personalized feedback to help them improve their designs. In addition, AI can be used for data analysis, predicting user preferences, and reducing the need for human interpretation of design specifications.

By integrating AI and VR technologies, we can create intelligent landscape design systems that are capable of generating autonomous designs and supporting automated simulations. This not only saves time but also encourages innovation by allowing designers to focus on exploring new ideas and concepts. Moreover, this integrated approach enhances the learning experience by providing students with hands-on access to complex systems and real-world scenarios, which helps them develop critical thinking skills and problem-solving abilities.

In summary, the combination of VR and AI offers promising prospects for landscape design education and practice. Their joint application can facilitate data analysis, personalization, and automation, among others, and together they support more efficient and intuitive landscape design processes.

From the above literature review, it can be seen that artificial intelligence technology is rarely used in landscape design education tasks. This may be limited by computer performance and related technologies. However, artificial intelligence technology brings new ideas to the teaching tasks of landscape design. This research applies computer virtual reality and artificial intelligence technology to landscape design teaching tasks. Not only can students intuitively observe the true structure of landscape instances, but also students can use data relationships to learn landscape factors.

## **APPLICATION OF COMPUTER VIRTUAL REALITY TECHNOLOGY AND ARTIFICIAL INTELLIGENCE METHODS IN THE CONSTRUCTION OF LANDSCAPE DESIGN TEACHING PLATFORM**

### **The Significance of Artificial Intelligence Technology for Landscape Design Teaching Platform**

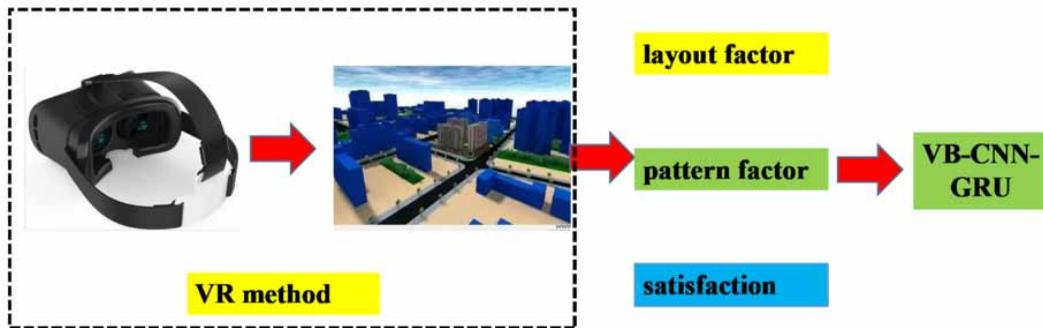
This study has considered the application of the VB-CNN method and the GRU method in the landscape design teaching platform. The VB-CNN method can not only extract spatial features such as layout and pattern in landscape design teaching, but also reduce the amount of parameter calculation in landscape design. The GRU method can predict and extract temporal features in landscape design teaching tasks. The layout and patterns in the teaching process of landscape design are affected by time. These influencing factors mainly include the policy of land use and the changes in people's requirements for landscape patterns. There is also an inevitable connection between these factors and the landscape design scheme. In the manual method it is difficult to obtain the relationship between landscape design factors and time. The GRU method can perfectly extract and predict the time characteristics of landscape design factors. For different urban areas or different communities, the layout and patterns of landscape design are different. However, these external factors are also related to the factors of landscape design. The VB-CNN method can successfully extract and predict the correlation of spatial factors of landscape design. In a word, the artificial intelligence method can extract and predict the spatial and temporal characteristics of the 3D landscape design scheme constructed by computer-aided reality, which is beneficial for students and teachers to understand and learn the teaching tasks of landscape design.

In summary, VB-CNN and GRU methods can be used to extract spatial and temporal factors in landscape design teaching tasks, respectively. They can also be used to map nonlinear data relationships in landscape design teaching.

### **The Construction of Landscape Design Teaching Platform and the Principle of Intelligent Method**

This research uses the VB-CNN and GRU methods in the computer virtual reality technology and artificial intelligence methods to study the layout factors, pattern factors, and student preference factors in the landscape design teaching platform. The VB-CNN method is a combination of a variational Bayesian method and a convolutional neural network method, which can reduce the training parameters and reduce the training time in landscape design-related factors. The computer virtual reality method is responsible for displaying the landscape scheme and 3D stereoscopic effect in the teaching of landscape design. Artificial intelligence technology is mainly responsible for predicting and extracting the characteristics and correlations of landscape design-related factors. Figure 1 shows the scheme and workflow of the landscape design teaching platform. It can be seen from Figure 1 that the first step of the landscape design teaching platform designed in this study is to use computer virtual reality technology to reconstruct and infuse the landscape plan, which forms a relatively intuitive landscape teaching content. After the 3D teaching content of landscape design is designed, this research uses data cleaning and data processing methods to classify the factors in the landscape design scheme. Landscape design factors are divided into layout factors, pattern factors, and student preferences. Then, this study uses the VB-CNN and GRU methods to extract and predict the relevant factors of landscape instructional design. When the parameters of the VB-CNN and GRU methods are trained, this landscape design platform is used in the actual landscape design teaching. The data related to the three different factors in landscape design teaching are non-linearly mapped in VB-CNN, and then GRU is used to learn the relationships of landscape time series. The output characteristics are predicted values of three landscape factors.

Figure 1. Application of computer virtual reality and artificial intelligence methods in landscape design teaching platform

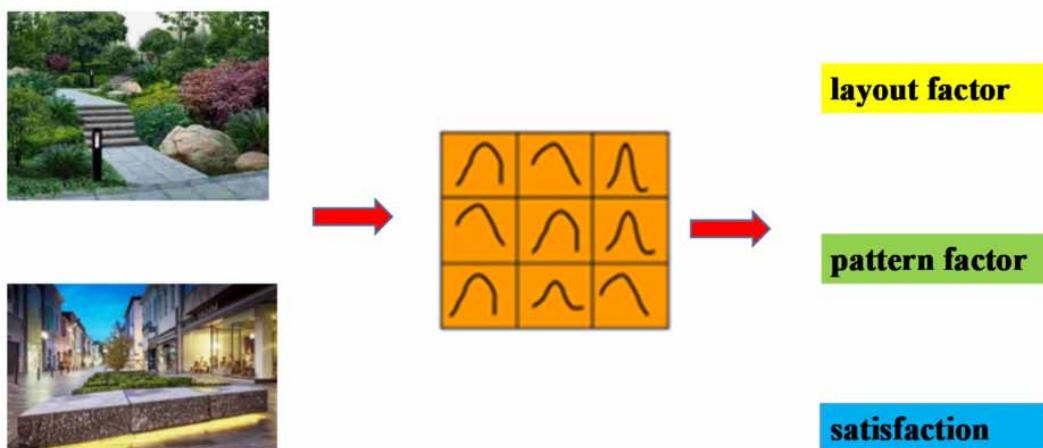


### Work-Flow of VB-CNN Method and GRU Method

Although the CNN method can extract the features of the research object, it can also analyze the correlation between the characteristics of the research object. It has been successfully applied in the fields of traffic flow control, medical image analysis, and building face recognition. However, the traditional CNN method has relatively high performance for computer computing. If the network level of CNN is too deep, it requires a lot of computing resources and computing time. For practical engineering and practical applications, the large amount of computation time is often intimidating, which limits the application of CNN methods in landscape design teaching (Wang & Chen, 2022). After the teaching content related to landscape design is designed as a 3D image, it contains a large number of factors and data. In order to reduce the amount of parameter calculation in the iterative process of CNN, this study considers applying the variational Bayesian method to the CNN neural network, which forms the VB-CNN neural network. Figure 2 shows the structure and schematic of the VB-CNN method. The weights in the VB-CNN structure appear in the form of probability distributions in forward and reverse propagation, while CNN performs gradient calculations in the form of data values. Due to the existence of probabilistic forms, it takes into account the impact between data.

The GRU method is also a method to reduce the amount of parameter computation, and GRU can also more accurately extract the temporal characteristics of the relevant research objects. The GRU method is also similar to the traditional LSTM method, which is mainly composed of different gate

Figure 2. The Structure and schematic of the VB-CNN method



structures. However, the reason why the GRU method can reduce the amount of parameter calculation is that the gate structure of the GRU method is reduced by two. However, the function of the gate structure in the GRU method is similar to that of the four-gate structure in the traditional LSTM method. Figure 3 shows a schematic diagram of the working principle of the GRU method. The time factor is transferred between different GRU neural network layers. As can be seen from Figure 3, GRU consists of two gating structures, mainly including update gates and reset gates. Compared to the traditional LSTM structure, it has reduced two gating structures. The two gating structures will remember highly correlated historical information.

### The Expressions for Variational Bayesian and GRU Methods

The variational Bayesian method is a method of distributing the weights in the neural network in the form of probability, which can take into account the prior knowledge of the research object. This guarantees the accuracy of predictions on small datasets. In this study, the derivation process of variational Bayesian method is carried out on the basis of CNN. Due to the difficulty in collecting data sets related to landscape design teaching, this can lead to the situation of small data sets. CNN has proven its advantages in large datasets, which requires VB-CNN to solve the problem of small datasets for landscape design.

Expression 1 establishes the relationship between prior knowledge and posterior knowledge of landscape design-related factors, so that the distribution of weights and biases can be presented in probabilistic form. The integration of Expression 1 is difficult for a computer, which requires approximation. Expression 2 shows the approximate operation process of prior knowledge.

$$P(y^* | x^*, X, Y) = \int p(y^* | f^*) p(f^* | x^*, X, Y) df^* \tag{1}$$

$$P(y^* | x^*, X, Y) = \int p(y^* | f^*) p(f^* | x^*, \omega) p(\omega | X, Y) df^* d\omega \tag{2}$$

For the integration process of Expression 2, it still has great difficulties, which requires further variational approximation operations. This study considers the approximate operation method of the KL divergence method. Expression 3 shows the KL divergence approximation operation process.

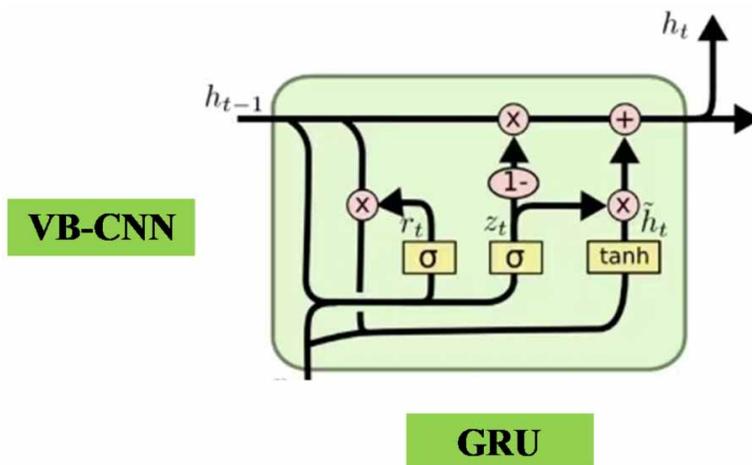


Figure 3. The schematic diagram of the working principle of the GRU method

$$\ell_V = \int q(\omega)p(F|X, \omega) \log p(Y|F)dFd\omega - KL(q(\omega)||p(\omega)) \quad (3)$$

After Expression 1 is processed by a series of variational and approximation processes, it becomes the form shown in Expression 4, which is relatively easy for the computer to calculate, and also facilitates the calculation of the distribution of weights and biases.

$$L \approx \frac{1}{2\sigma(f)^2} \|y' - \hat{y}'\|^2 + \frac{1}{2} \log \sigma(f)^2 + \frac{1}{2D} \sum_{i=1}^D (p_d \|M_d\|_2^2 + \|b\|_2^2) \quad (4)$$

For the VB-CNN method, it is also a supervised learning method, which requires label data as well as input data. Expression 5 and Expression 6 show the composition of the dataset of landscape design teaching-related factors, which are mainly input data and label data.

$$x = \{x_1, x_2, x_3, \dots, x_N\} \quad (5)$$

$$y = \{y_1, y_2, y_3, \dots, y_N\} \quad (6)$$

The VB-CNN method is similar to the CNN method, and it also requires a convolution operation, which involves the calculation of the parameters of the convolution layer. Expression 7 shows the calculation process of parameters such as filter and slip step size.

$$w' = \frac{(w + 2p - k)}{s} + 1 \quad (7)$$

The gate structure of the GRU method is changed from 4 to 2 gate structure compared to the LSTM method. However, the GRU method can still select and retain historical information. Expression 8 and Expression 9 show the calculation process of the reset gate of GRU, which is mainly similar to the functions of the input gate and forget gate of LSTM.

$$g_r = \sigma(W_r[h_{t-1}, x_t] + b_r) \quad (8)$$

$$\tilde{h}_t = \tanh(W_h[g_r h_{t-1}, x_t] + b_h) \quad (9)$$

Expression 10 and Expression 11 show the calculation method of the update gate of the GRU, which is mainly responsible for updating the historical information and the distribution of the weight of the current state information, and it can also control the output of the information.

$$g_z = \sigma(W_z[h_{t-1}, x_t] + b_z) \quad (10)$$

$$h_t = (1 - g_z)h_{t-1} + g_z \tilde{h}_t \quad (11)$$

The VB-CNN method is a combination of variational Bayesian and convolutional neural networks, which can be used to extract and predict layout and pattern factors in landscape design teaching. Compared to traditional CNN methods, the VB-CNN method reduces training parameters and computational complexity, thereby improving efficiency. In landscape design teaching, the VB-CNN method can be used to identify spatial features in landscape design schemes, such as the position and

size of landscape elements, to help students better understand the connections between the elements of landscape design and deepen their understanding of landscape design.

The GRU method is a neural network capable of processing time series data, which can be used to predict and extract temporal features that affect landscape design. In landscape design teaching, the GRU method can be used to identify features that change over time in landscape design schemes, such as regional policies in different periods, changes in people's landscape patterns, etc., in order to help students better understand the relationship between landscape design and time. In addition, the GRU method can also extract and analyze the impact of time factors on landscape design schemes, helping students better understand the causal relationships in landscape design schemes.

## RESULT ANALYSIS AND DISCUSSION

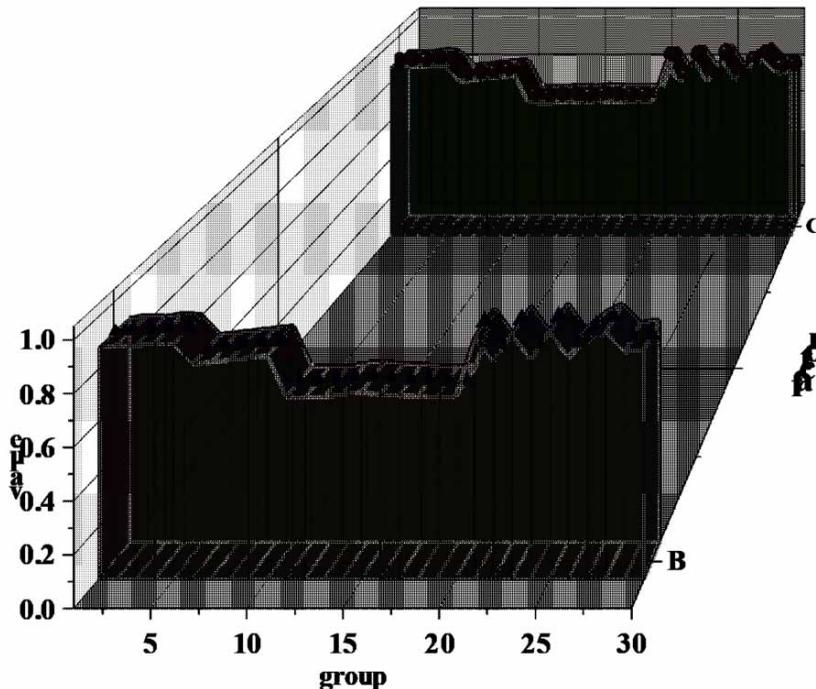
Through the workflow of the above-mentioned landscape design teaching platform, it can be found that the data set of relevant factors in landscape design teaching plays an important role. It is the data source for the VB-CNN method and the GRU method to find the best weights and biases. VB-CNN and GRU methods require a large amount of data to establish the relationship and mapping relationship between different factors. At the same time, the dataset of landscape design teaching related factors needs to go through the process of data cleaning and data feature preprocessing. Accurate and real data sets will speed up the training speed of VB-CNN and GRU methods, and it can also quickly find the direction of minimizing the speed-up and decrease. It can also establish the relationship between accurate landscape design plans and layout factors, pattern factors, and people's preference factors. In the landscape design teaching platform, the training and testing of artificial intelligence methods is a key point, so the dataset is also crucial for the landscape design teaching platform. In order to collect landscape design datasets with more factors, this study selected Wuhan City as the source of the datasets. As an important city in the country, Wuhan has relatively complex terrain and landscape architecture types, which can provide more data on layout, patterns and people's preferences for the landscape design teaching platform. This article divides the collected landscape design data of Wuhan into training sets, test sets, and validation sets, with the relevant ratio set at 7:2:1. The validation set is used to adjust parameters during the VB-CNN-GRU training process.

This study firstly analyzes the accuracy of VB-CNN-GRU method in predicting layout factors in landscape design based on univariate analysis method. Layout factors can affect the land utilization of landscape design and the convenience of people's needs for landscape. If landscape architects or landscape students can learn the relationship between the layout factors of landscape design and land use and people's needs, it is conducive to the construction of favorable landscape design, which can also achieve the purpose of landscape design. To this end, this study selects 30 different layout factors of the landscape design of the community or public area to analyze the accuracy of the VB-CNN-GRU method.

Figure 4 shows the data distribution of the layout factors involved in the landscape design teaching platform. The yellow part represents the predicted value of the landscape layout factor, while the green part represents the actual value of the landscape design layout. Both of these were used to verify the predictive accuracy of VB-CNN-GRU. From Figure 4, it can be seen that there are relatively large differences in the landscape layout data of 30 different regions. The fluctuations between these data are relatively large, which can also indicate that the layout factors of landscape design are more difficult to extract and predict. However, the landscape layout factors of 30 different regions are well predicted, which shows the effectiveness of the VB-CNN-GRU method. Both the changing trend of landscape layout factors and the data of landscape layout factors are in good agreement.

This study also selects the pattern features in the landscape design of 30 different communities or public areas to analyze the effectiveness of the VB-CNN-GRU method. The pattern feature of landscape design is an important form of displaying the public culture of a city or community,

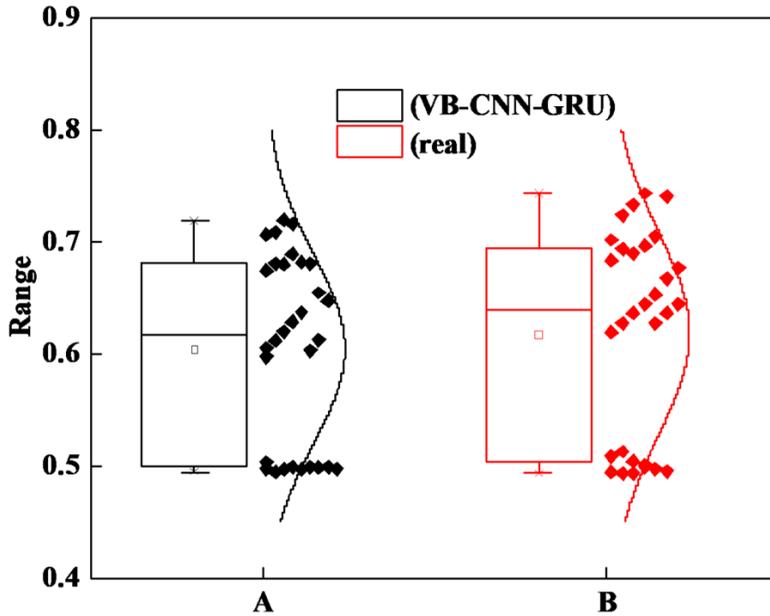
Figure 4. The data distribution of layout factors in landscape design teaching



and the landscape pattern factor can affect people's satisfaction with landscape design. For the landscape design teaching platform, if students can learn the relationship between landscape pattern factors and people's needs and urban culture, it is beneficial for students to create more creative landscape solutions. Therefore, the pattern feature of the landscape design teaching platform is also an important learning factor. Figure 5 shows the data distribution of pattern features in the landscape design teaching platform. Figure 5 shows the predicted value of the pattern factor on the left and the actual value of the landscape pattern factor on the right. Landscape design is a three-dimensional structure, and the distribution of data sets of landscape design pattern features is also related to three-dimensional structures. The box diagram can reflect the overall distribution form of the dataset, which can more intuitively reflect the distribution of predicted data. Although the actual values of the landscape patterns have a relatively large interval, the distribution between these data is also uneven. However, this does not affect the accuracy of the VB-CNN-GRU method in predicting the landscape pattern factors, and the VB-CNN-GRU method can still accurately predict the trends and data values of the landscape pattern factors. The weight and bias of VB-CNN-GRU in training data related to landscape pattern factors presents a certain distribution, which is more inclined to areas in the data set, and causes the prediction value of larger numerical areas to be smaller.

People's satisfaction is an important evaluation criterion for the success of landscape design. The main purpose of landscape design is to serve the needs of different people. This study also analyzes the relative accuracy of people's satisfaction factors in landscape design teaching platforms. If this kind of landscape design teaching platform can accurately analyze the satisfaction of landscape design for people, it can allow students to understand the preference of landscape type for people, and students will learn the layout and pattern of landscape design in a targeted manner, along with other characteristics. This study also selected 30 factors of different groups of people's satisfaction

Figure 5. Data distribution of pattern factors in landscape design teaching platform



with landscape design. Figure 6 shows the distribution of prediction errors for people's satisfaction traits. A/B/C represents three different student groups because landscape design teaching involves more types of students. This requires using different groups to demonstrate the generalization ability of VB-CNN-GRU technology. From Figure 6, it can be seen that most of the prediction errors are distributed between 2.5-3%, which demonstrates the accuracy of the VB-CNN-GRU method in predicting people's satisfaction factors in landscape design. The error of only six groups of data is less than 2%. The error of three groups of data is more than 3%. Overall, the landscape design teaching platform designed in this study can satisfy students' prediction and understanding of people's satisfaction factors.

The performance of the layout factor, pattern factor, and people's satisfaction factor of the landscape design teaching platform is analyzed by the single variable analysis method. This study also uses the form of mean error distribution to study the global accuracy of the VB-CNN-GRU method in predicting various factors of the landscape design teaching platform. At the same time, this study firstly compares the performance of the VB-CNN method and the VB-CNN-GRU method in predicting the layout, pattern, and other factors of the landscape design teaching platform. Figure 7 shows the average error values of the three factors of the landscape design teaching platform using the VB-CNN method. It can be seen from Figure 7 that the average error of the layout factor of landscape design is 2.75%. The average error of the pattern factor of the landscape design platform is 2.52%. The prediction error of people's satisfaction factor is 2.11%. The average error of the relevant factors of these three landscape design teaching platforms can meet the needs of landscape design teaching. All three errors are distributed within 3%, which proves the feasibility of VB-CNN method in predicting the factors of landscape design teaching platform.

This study also analyzes the performance of the VB-CNN-GRU method in predicting the three factors of the landscape design teaching platform, which is to illustrate that the three characteristics in landscape design teaching also have a relatively strong relationship with time. Figure 8 shows the average error of three factors of landscape design teaching platform using VB-CNN-GRU method. Overall, the VB-CNN-GRU method is more accurate than the VB-CNN

Figure 6. Predictive error of people's satisfaction characteristics of landscape design teaching platform

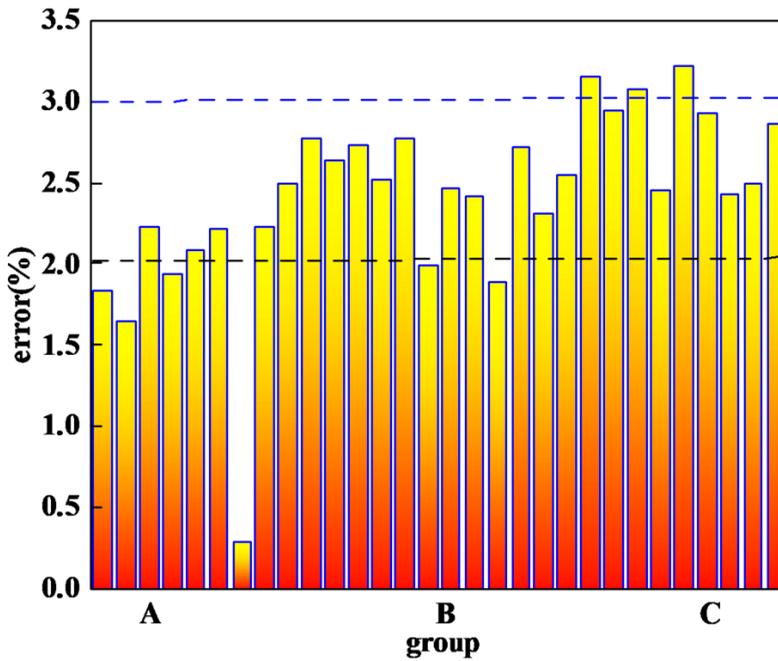
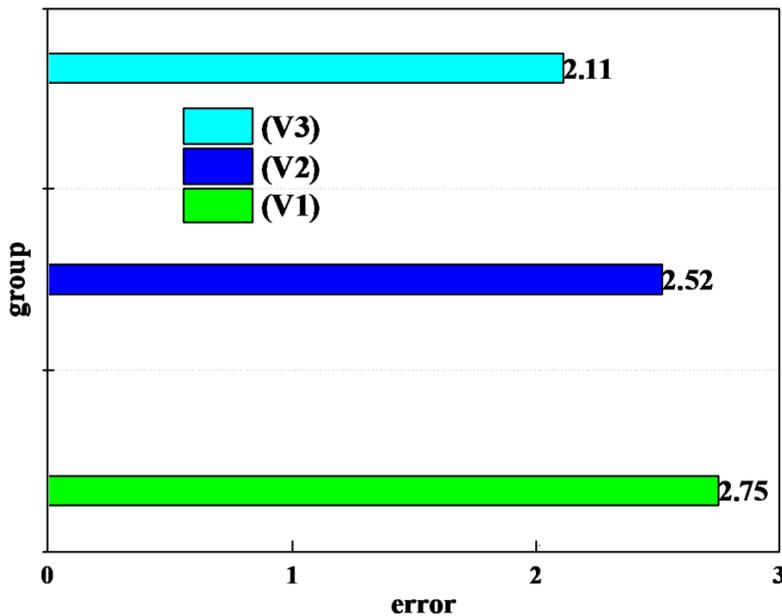


Figure 7. Average error of three factors of landscape design teaching platform using VB-CNN method



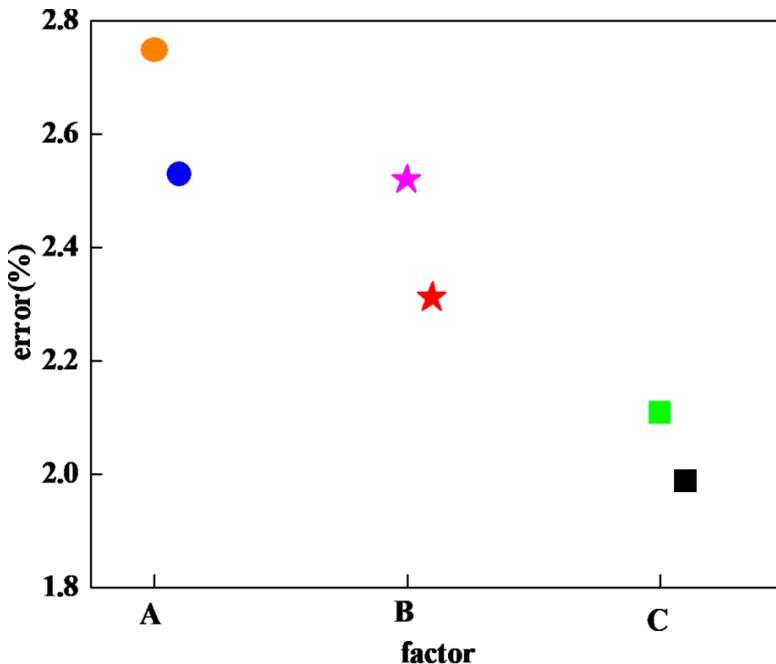
method in predicting the layout and pattern features of the landscape design teaching platform. The prediction error of the layout factor of landscape design is reduced from 2.75% to 2.34%. The average error value of the pattern factor is reduced from 2.52 to 2.13%. The average error

value of the people's satisfaction factor is reduced to 1.99%. It can be seen that the average error values of the three factors of landscape design teaching are reduced to varying degrees. This shows that the VB-CNN-GRU method is more conducive to students to learn the relevant factors and knowledge of landscape design.

In this study, we adopt artificial intelligence methods to improve the effectiveness of landscape design teaching. Specifically, we use methods such as VB-CNN and GRU to predict three important factors in landscape design teaching, namely design preferences, landscape layout, and landscape pattern, in order to achieve teaching objectives. At the same time, we also analyze the impact of the dataset of relevant factors on artificial intelligence methods in the landscape design teaching platform and analyze various factors of the landscape design teaching platform through univariate analysis. The results indicate that the VB-CNN-GRU method performs well in predicting the three factors in landscape design teaching, with an average error distribution of less than 3%. Especially in predicting the pattern characteristics of landscape design teaching platforms, the VB-CNN-GRU method performs better than the VB-CNN method. This fully demonstrates the application value of artificial intelligence methods in landscape design teaching platforms. In addition, we also discuss the impact of dataset quality on method performance. The results show that the dataset is crucial for training and predicting methods such as VB-CNN and GRU. Accurate and realistic datasets accelerate the training speed of methods, establishing accurate relationships between landscape design plans and layout factors, pattern factors, and people's preferences.

In summary, the landscape design teaching platform proposed in this study based on artificial intelligence methods has good application prospects in practice. In the future, we will continue to optimize the platform and explore more artificial intelligence methods to improve the effectiveness of landscape design teaching.

Figure 8. Average error of three factors of landscape design teaching platform using VB-CNN-GRU method



## CONCLUSION

With the acceleration of urbanization, urban landscape design has become more and more important. Landscape design can also satisfy people's pursuit of a happy life. Many universities have launched landscape architecture majors to teach related landscape architecture knowledge and programs. However, landscape design is a 3D pattern design, which involves a wide range of factors. It is difficult for traditional teaching methods to satisfy students' and teachers' understanding of landscape design. Computer virtual reality technology and digital technology are constantly integrated into the application of landscape design. It can show the relevant knowledge of landscape design to students and teachers in the form of virtual reality images, and artificial intelligence methods can also help students and teachers find the relationship between landscape design factors and urban land use and people's preferences.

This research uses computer virtual reality technology and artificial intelligence methods to build an intelligent landscape design teaching platform. At the same time, considering the number of landscape design teaching images and virtual reality image datasets, this research designs a convolutional neural network based on variational Bayesian method to study the spatial and temporal characteristics of landscape design teaching platforms. This study also compares the accuracy and feasibility of the VB-CNN method and the VB-CNN-GRU method in predicting the layout factors, pattern factors, and people's satisfaction factors in the landscape design teaching platform. The research results show that both the VB-CNN method and the VB-CNN-GRU method can extract and predict the three factors of layout, pattern, and people's satisfaction in the landscape design teaching platform. However, the VB-CNN-GRU method has higher accuracy than the VB-CNN method, which is mainly due to the fact that the VB-CNN-GRU method can extract the temporal features.

Artificial intelligence and computer virtual reality technology can be used in more fields of landscape design teaching tasks, including urban landscape design and rural natural landscape design, which has good application value. Future work should include optimizing the algorithm performance of landscape design teaching platforms, expanding dataset sources, introducing more factors to improve platform functionality and applicability, as well as conducting practical and validation on the platform, evaluating its actual effectiveness and value, and continuously improving and improving its functions to achieve better teaching outcomes. These works can be achieved through further research and exploration, making artificial intelligence algorithms more accurate and efficient in supporting the actual needs of landscape design teaching. At the same time, landscape design data from other cities can also be added to the dataset to achieve more comprehensive data statistics and analysis. In addition, introducing more factors such as urban culture and environmental parameters into the platform should help improve its functionality and applicability. Ultimately, through practice and verification, the platform will be improved and achieve better teaching outcomes.

## AUTHOR NOTE

**Data availability:** The figures used to support the findings of this study are included in the article.

**Conflicts of interest:** The authors declare that they have no conflicts of interest.

**Funding statement:** This work was supported by Henan Provincial Department of Education: Research on the development of resources for the lifelong education curriculum of Henan's "flower economy" was based on the trinity of "tourists, farmers, and students." No:[2023]70078; Henan Provincial Department of Education: Research on the curriculum system of "flower economy" was in Henan under the strategy of rural revitalization. No:2023YB0483; Zhengzhou University of Industrial Technology University-Level Key Scientific Research Project in 2023: Study on the Coordinated Development Path of Ecological Protection and High Quality Economy was in the Yellow River Basin of Henan Province. NO:2023ZD012.

**Acknowledgements:** The authors would like to show sincere thanks to those whose techniques have contributed to this research.

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