Hindawi
Advances in Mathematical Physics
Volume 2022, Article ID 7380776, 9 pages
https://doi.org/10.1155/2022/7380776

Research Article

Intelligent Image Analysis and Recognition Method for Art Design Majors

Guoqiang An

Visual Communication Design, Yeungnam University, Gyeongsan-si, Gyeongsangbuk-do 38541, Republic of Korea

Correspondence should be addressed to Guoqiang An; anguoqiang@yu.ac.kr

Received 30 July 2022; Revised 27 August 2022; Accepted 7 September 2022; Published 24 September 2022

Academic Editor: Miaochao Chen

Art design major is a relatively important course in college teaching. It involves a wide range of directions. Advertising art, landscape art, interior design, etc. are closely related to people's lives. Art design has appeared in all aspects of people's lives. However, a new art design program is time-consuming and human resources for art design. Different art designs will contain relatively similar characteristics, which can alleviate many difficulties for art designers. However, it is also a relatively difficult task to discover the relationship between the characteristics of the art and design only by artificial means. Image recognition technology can assist designers to discover and find the relationship between artworks, and these related features can assist designers to design. In this study, an intelligent image recognition method for intelligent art design is designed using the VB-CNN-GRU method. It can identify patterns, shapes, color matching, and text features of artistic design products. The research results show that the VB-CNN-GRU method can accurately complete the intelligent image recognition task of art design major. The VB-CNN-GRU method has specifically higher accuracy in art design image recognition than the single VB-CNN method. The maximum prediction error of VB-CNN-GRU in art design image recognition is only 2.37%. For the four characteristics of art design, it can better assist designers to complete related designs.

1. Introduction

Art design is a relatively broad profession, and its scope is also relatively wide. It mainly includes advertising design, interior design, clothing design, and product modeling design. With the improvement of people's living standards and the improvement of people's aesthetic ability, people's pursuit of products does not only focus on the quality of the products themselves [1, 2]. An excellent advertising design or product design is often an important factor for people to choose products. In today's society, it can be found that art- and design-related products have spread all aspects of life. For advertising design, designers often need to use the patterns, colors, and words contained in advertising products to attract consumers' attention. In this materially abundant society, people have a lot of choices for the necessities of life. People are often attracted to advertising art design, which reflects the importance of advertising art design. The success of advertising art is that it can immediately attract people's attention, which puts forward more requirements for advertising designers. Advertising design needs to meet the preferences of most people for aesthetic ability [3, 4]. For the art of landscape gardens, more and more local governments and developers focus on the artistic design of landscape gardens. The layout, shape, and color matching of landscape gardens are important factors that affect people's pursuit and preferences. Interior design is also the research object that art design majors have more contact with, and interior design is also an art design that people need to contact every moment. The interior is not only a place for people to rest and live but also a place to reflect aesthetics. Effective interior design can keep people happy, which can make people more actively pursue the beauty of life and the feeling brought by art design. From the above analysis, it can be seen that the scope of art design is relatively wide, and it also involves people's daily life. This further illustrates the importance of art and design majors for social development. The factors of artistic design are mainly reflected in the pattern, shape, color, and character characteristics of the artwork. However, the process of artistic design is

relatively long and complicated, which brings a great challenge to the designer. Similarly, there are many common features between art and design. If designers can find commonalities between art and design, they can then be improved and enhanced by using relevant art design templates [5, 6]. This art design method will not only improve the efficiency of design but also be more targeted for art design products [7, 8].

Since there are many commonalities in the artistic design of different objects, it is necessary to find many commonalities in the artistic design. The traditional way of artificial appreciation is that it is difficult to find the common relationship between artistic design and products. This is the factor art appreciation is a perceptual thing, and different people have different appreciation abilities. However, if the relationship between artistic design elements and products is processed into data, it is possible to quantitatively analyze the correlation between artistic design features and products from a data perspective [9, 10]. Image recognition is an important method to identify products. Image recognition technology has also been demonstrated in many areas of life, such as transportation, education, and medical care. The principle of the image recognition method is to process the color and pattern of the research object into data, which can use the intelligent algorithm to find the relationship between the relevant features of the image [11, 12]. For art design majors, it can also use image recognition technology to identify patterns, colors, and other characteristics of artworks. After the relevant features of these artworks are converted into data, intelligent image recognition methods can find the relationship between the artistic design elements and the product. This also provides more reference for the designer's artistic design. At the same time, the image recognition technology of art design needs to use big data technology to identify and predict the characteristics of artworks.

At the current stage, intelligent image recognition methods are relatively mature. For different research objects, it needs to be continuously adjusted according to the data characteristics and data forms of the research objects, which is a convenient way [13, 14]. The most common applications of intelligent image recognition algorithms are convolutional neural networks (CNN) and variants of CNN. With the advancement of computer performance and the needs of researchers for algorithms, the speed of CNN variants update is relatively fast, which provides more convenience for the application of different research objects [15, 16]. CNN is also a kind of big data technology, and its commonality with big data technology is to deal with cumbersome data and complex relationships between data. The speed and ability of humans to process data is often limited. The emergence of big data has changed people's life and production activities. In actual work and life, the data characteristics of most research objects often contain temporal characteristics at the same time, and big data methods also contain methods for dealing with temporal characteristics. Most researchers will use the long short-term memory (LSTM) algorithm to process the temporal characteristics of the data, which has the ability to memorize the data. It can also fuse data at different times according to the contribution of the data to the feature. There are also many variants of the LSTM method, which are also based on the needs of researchers for feature extraction capabilities or computing time. In a word, the emergence of big data technology has provided more convenience for the research of art design [17, 18]. Researchers only need to adjust the relevant layers and related structures of big data algorithms, and it no longer needs to deal with complex underlying codes. Continuing advances in computer performance have also dispelled researchers' concerns about the amount of data.

This research discusses and designs an image intelligence recognition and analysis method related to art and design, which mainly applies variational Bayesian convolutional neural network and GRU method. At the same time, it analyzes the four characteristics of pattern, color, shape, and text of art design related majors. This study will introduce image recognition methods for art and design professionals from 5 different chapters. Section 1 mainly studies the importance of the art and design profession and the background of intelligent algorithms for image recognition. Section 2 describes the current research status of art design related elements and research objects. Section 3 studies the process and working principle of the intelligent image recognition method applied in the art and design profession. Section 4, as the focus of this study, analyzes the accuracy of the VB-CNN as well as the VB-CNN-GRU method in predicting four characteristics of artistic design. Section 5 illustrates the practical application value of image intelligence algorithms for art and design professionals.

2. Related Work

Art design will involve advertising design, product design, and landscape garden design and other fields, and it has been involved in many aspects of people's daily life and production activities. Art design will have a certain impact on people's appreciation level and purchasing ability. The characteristic elements involved in artistic design are also more complex. Many researchers have presented research and discussion on the related theory of art and design and the application of art and design. Wang and Zhu [19] mainly studies the relationship between art design management and enterprise management. The scope of art design is relatively broad. It applies wireless communication technology and Internet technology to the research of enterprise management and art design. This research aims to realize an intelligent art design system using wireless communication technology and internet method. The research results show that the creative ability of art design based on this Internet management model has been greatly improved. Compared with the traditional management mode of art design, the management ability has increased by 10.61%. This method can better guide the artistic design of enterprise management and the artistic design of products. Yang [20] analyzes and studies the teaching system of art design, which is why the traditional education system of art design has relatively big defects, which is a method that lags behind high-tech technology. It uses the method of 3D virtual simulation to establish an online art teaching management system. At

the same time, it uses support vector machine and simulated annealing algorithm to design an efficient art design teaching system. The research results show that this system has relatively high accuracy and relatively low error. At the same time, this intelligent art design system also has specific practical application value in engineering. For the actual online teaching of art design, this intelligent system is also worth promoting. Dong [21] already believes that the advancement of high technology is conducive to improving the progress in the field of art and design. It has also found that sensor systems can assist art designers in efficient art product design. In this study, an art design system is designed, which can integrate various sensor systems, signal acquisition and processing systems, and extraction functions of art design features. It verifies this art design method is based on artificial intelligence method using the actual data value of parent-child restaurant. The research results show that the multisensor system can accurately and quickly acquire and process the relevant features and patterns of artworks. This intelligent art design system can improve the work efficiency of designers, and it can also assist designers to design more valuable artworks. Dong [21] realizes that virtual reality technology has been widely used in many fields, and it has also achieved great success in different research objects. It considers the application of virtual reality technology in art design and the teaching work of art design majors in colleges and universities. It takes the bamboo forest as the research object to carry out the simulation modeling of this characteristic and realizes the virtual reality technology of the bamboo forest. In this system, lighting and scene rendering can assist the artistic design of the bamboo forest. The research results show that this kind of art design technology based on virtual reality can not only improve the realism of artworks but also play a great role in art teaching in colleges and universities. Feng [22] mainly studies animation art in the field of art design. It uses new technology and new media technology to study the animation theory, dimension, and cognitive experience of animation in the process of animation art. And it uses the edge computing method to study the design theory and related properties of animation art. This research method can improve the management and sharing techniques of animation art design. This research mainly uses the deep neural network method to extract four characteristics such as patterns of art design majors. This is an intelligent method, which can provide designers with a relatively fast and accurate reference.

3. Image Recognition and Analysis Scheme and Research Principles for Art Design Majors

3.1. The Importance of Big Data Technology for Image Recognition in Art Design. The research goal of this research is to realize the recognition and analysis of images related to art design using intelligent algorithms. Art and design majors occupy an important position in today's life and production. This study mainly analyzes the four characteristics of pattern, color, shape, and text involved in the process of artistic design. Patterns and colors are relatively intuitive features. The four characteristics of pattern, color, text, and model selected in this study are the four most important characteristics in the art design profession; and they are more important for the design of art design works. For artistic design, text and modeling features can reflect the artistic value and emotional information reflected by the artwork. For works of art, it reflects more artistic value and people's appreciation for works of art. However, the patterns and combinations of colors and shapes of artworks are ever-changing, which leads to the specific and nonfixed characteristics of artworks. This research will use the method of image recognition to study and appreciate the four characteristics of artworks. Image recognition is a kind of intelligent engineering that is common in modern life. It can use data to identify relevant features. Most image recognition tasks rely on algorithms in the field of artificial intelligence. Big data technology can convert the image of artwork into data form, and it can use the form of distance and correlation to identify relevant artwork features. It is difficult to discover the artistic value and related characteristics of artwork images by relying solely on artificial vision. Big data technology can find relevant features very well. Therefore, big data technology is a crucial algorithm for image recognition and analysis of artworks, and it can also quantitatively analyze the image features of artworks, which is a way that cannot be achieved by manual means.

3.2. Application and Design of Big Data Technology in the Field of Art Design Image Recognition. Through the above analysis, this research needs to use big data technology to realize the image feature recognition of artworks. This research analyzes and recognizes four related characteristics of pattern, shape, color, and text of artistic design. Since it is difficult to collect artwork related images in real life, this study chooses a variational Bayesian convolutional neural network algorithm to identify these four characteristics of art design. CNN is an algorithm widely used in the field of image recognition, and the VB-CNN algorithm is mainly used in the research object of small data sets. At the same time, the text and modeling characteristics of artworks have a great relationship with the changes of time. This is because artworks also have an inevitable connection with the political economy of the times, and they also have many temporal characteristics. This study also considers art designing temporal features for image recognition. Figure 1 analyzes and illustrates the flow and scheme of the application of big data theory in art design theory. The scope of artistic design is relatively wide. This study selects the design of automobiles and furniture as examples, which are two common works of art in reality. In this intelligent recognition scheme, it needs to collect four characteristics of artwork, pattern, shape, text, and color as the basis of neural network algorithm. The related data of these four features are processed and input to the input layer of VB-CNN for convolution operation. Then, when the data is feature extracted, it needs to be input into the GRU neural network for temporal feature extraction. Finally, it will send the relevant results to the art researcher in the form of a computer or mobile phone APP.

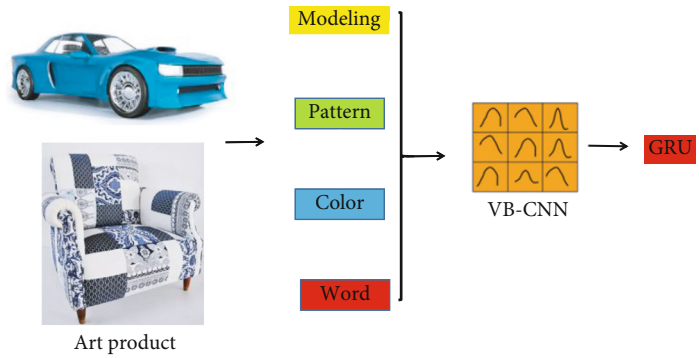

Figure 1: Design scheme of VB-CNN and GRU method in the field of artwork image recognition.

3.3. Principle and Introduction of VB-CNN Algorithm and GRU Algorithm. The biggest difference between VB-CNN and CNN methods is that the weights and biases of VB-CNN are different. The VB-CNN method can fully consider the influence of historical information of artwork features, which is the so-called prior knowledge, which can improve the prediction accuracy of the research object. Considering the difficulty of collecting artwork image recognition datasets, this means that artwork image features will exist in smaller datasets, and the VB-CNN method can exert its own advantages in small datasets. Figure 2 shows the distribution of weights and biases for the differences between VB-CNN and CNN methods. The weights of the VB-CNN method exist in the form of a probability distribution, which will be processed using approximation and variational methods. The VB-CNN method is more favorable for processing small datasets compared to the CNN method.

Through the above research and analysis, it can be found that the changes in the characters and patterns of artworks are also closely related to the changes of the times, and the patterns and styles of words are related to contemporary economic and political factors. This shows that artwork image recognition and analysis also take into account the temporal characteristics of features. Both GRU and LSTM methods are better algorithms for dealing with temporal features. However, the GRU method has a relatively small number of parameters when calculating the parameters. The LSTM method is different from the CNN method. There is no weight sharing mechanism in the LSTM algorithm. Therefore, this study considers the application of the GRU method. Figure 3 shows a schematic diagram of the division of the four features of the artwork image, which will be divided according to the distance relationship between the data.

3.4. The Derivation Process of Variational Bayesian Method and the Description of GRU. There is a big difference in principle between the VB-CNN method and the CNN method. There is also a gap between the VB-CNN and the CNN method in the content of the convolution operation. The derivation process of the VB-CNN method is described below.

There is a differential pressure between convolution operations and fully connected neural networks and LSTM methods. The convolution operation will involve parameters such as filters and sliding steps, and these parameters will also satisfy certain mathematical relationships. Equation (1) shows the relation satisfied by the convolution parameters.

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

Variational Bayesian convolutional neural networks also involve more convolution operations. Equation (2) shows the guidelines for the convolution operation. VB-CNN also contains network layers such as convolutional layers and pooling layers.

$$\delta^{l-1} = \text{conv2}\left(\text{rot180}\left(W^l\right), \delta^l, 'full'\right)\phi'\left(v^{l-1}\right). \tag{2}$$

For the characteristics of pictures, Chinese characters, and shapes in the recognition of artistic design patterns, this research will convert them into the form of data. Since VB-CNN requires input as well as label data, Equation (3) and (4) show the representations of relevant features for artistic design image recognition.

$$x = \{x_1, x_2, x_3, \cdots \cdots x_N\}, \tag{3}$$

$$y = \{y_1, y_2, y_3, \cdots \cdots y_N\}. \tag{4}$$

VB-CNN is a kind of convolutional neural network that calculates after the basis of prior knowledge, and Equation (5) shows the correlation between prior knowledge and posterior knowledge of VB-CNN.

$$P(y^*|x^*, X, Y) = \int p(y^*|f^*)p(f^*|x*, X, Y)df^*. \tag{5}$$

Since the integral operation of Equation (5) has certain difficulties, it requires certain approximation and variational operations for the computational performance of the computer. Equation (6) shows the procedure for

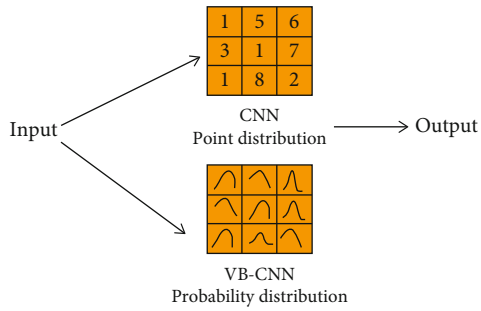

Figure 2: Schematic diagram of the difference in weight distribution between VB-CNN and CNN.

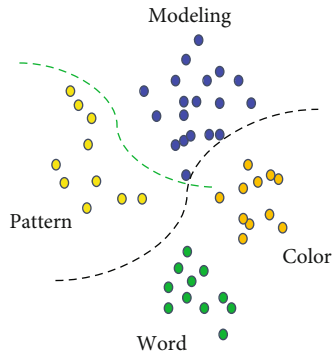

Figure 3: Schematic diagram of artwork data division.

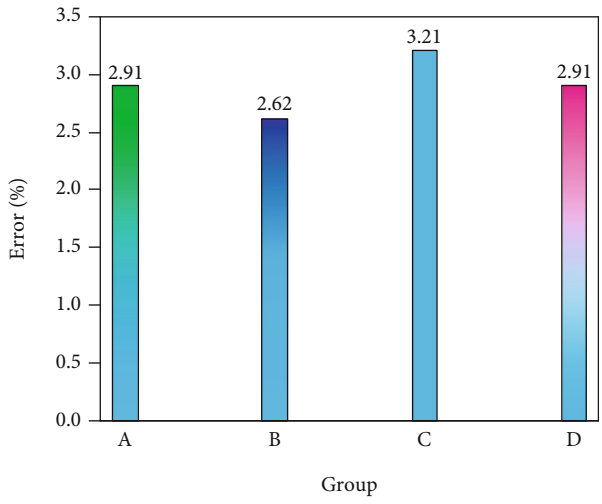

Figure 4: Four feature prediction errors for art design image recognition using a single VB-CNN approach.

approximate computation of variational Bayes.

$$P(y^*|x^*, X, Y) = \int p(y^*|f^*)p(f^*|x*, \omega)p(\omega|X, Y)df^*d\omega. \tag{6}$$

Equation (7) shows the calculation of the KL divergence introduced by the variational Bayesian method, which is also an approximate calculation criterion for a posteriori knowledge.

$$\ell_V = \int q(\omega)p(F|X, \omega)\log p(Y|F)dFd\omega - KL(q(\omega)\|p(\omega). \tag{7}$$

Equation (8) shows a variational and approximation form of the VB-CNN method, which facilitates the calculation of the distribution and parameters of prior knowledge and posterior knowledge.

$$L \approx \frac{1}{2\sigma(f)^2}\left\|y' - \hat{y}'\right\|^2 + \frac{1}{2}\log\sigma(f)^2 + \frac{1}{2D}\sum_{i=1}^{D}\left(p_d\|M_d\|_2^2 + \|b\|_2^2\right). \tag{8}$$

GRU is a variant of LSTM method, which also mainly consists of different gate structures. Equations (9) and (10) show a calculation method of the GRU's update gate, which needs to update the historical state information and the current state information.

$$g_r = \sigma(W_r[h_{t-1}, x_t] + b_r), \tag{9}$$

$$\tilde{h}_t = \tanh\left(W_h[g_r h_{t-1}, x_t] + b_h\right). \tag{10}$$

Equations (11) and (12) illustrate the calculation criteria for the reset gate of the GRU.

$$g_z = \sigma(W_z[h_{t-1}, x_t] + b_z), \tag{11}$$

$$h_t = (1 - g_z)h_{t-1} + g_z\tilde{h}_t. \tag{12}$$

4. Result Analysis and Discussion

Art design is closely related to people's life and production. People's pursuit of products is also constantly pursuing products with beautiful artistic design. The goal of this research is to use big data technology to complete the task of intelligent image recognition and analysis of features related to art design. It mainly adopts the VB-CNN-GRU method in big data technology according to the data characteristics of artistic design. Combining the actual characteristics of art design, this study selects four characteristics of art design: pattern, color, shape, and text as the characteristic objects of this study. The driving force of big data technology learning is a huge amount of data. Only if enough data is provided to big data theory, it can learn the correlation between artistic features. The selection of the data set comes from the data of multiple artistic features in Yiwu Mall, Zhejiang Province. The selection of the dataset needs to include as many artistic features as possible, so as to ensure that the distribution of weights and biases conforms to the characteristics of most artistic products. Therefore, it needs to fully consider the source of the dataset. It performs preprocessing and data cleaning process on the collected data sets of different artworks, and these data will be further processed into

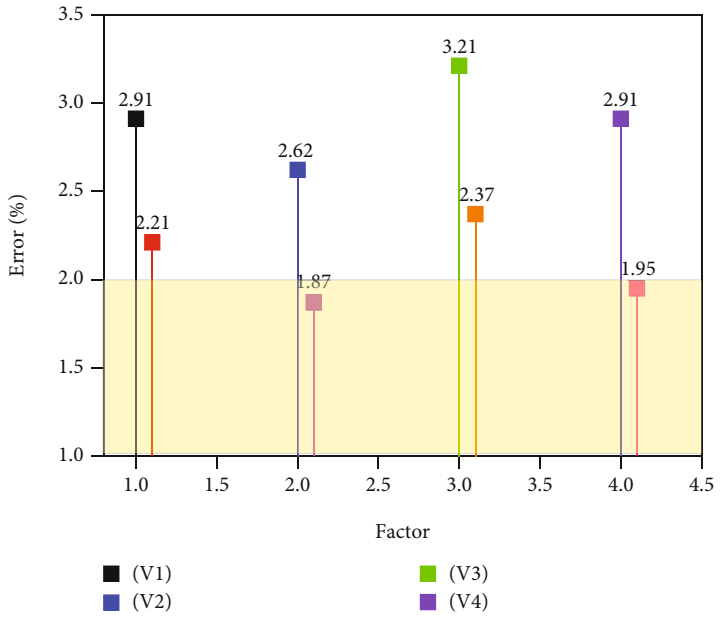

Figure 5: Four feature prediction errors for art design image recognition using VB-CNN-GRU method.

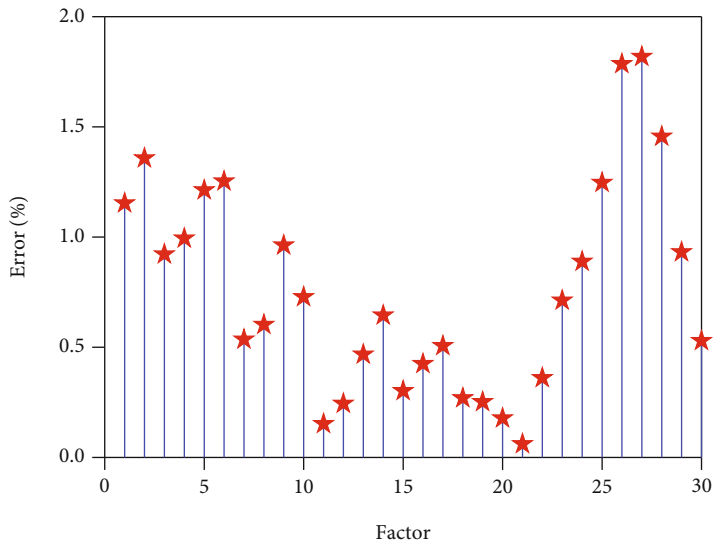

Figure 6: Prediction error distribution of modeling features for art design image recognition.

data of the same distribution and the same interval, which is beneficial to the training of the VB-CNN-GRU method.

In order to analyze the characteristics of products related to art design, this study first uses a single VB-CNN method to analyze the accuracy of the application of big data technology in the field of image recognition of art design products. This method of analysis is also to illustrate that the four characteristics in art design are also closely related to time. Figure 4 illustrates the prediction error distributions for four features of artistic design images using a single VB-CNN method. In general, most engineering studies consider 5% as an acceptable margin of error. If the error exceeds 5%, it means that the model cannot meet the requirements of art and design majors. Although the VB-CNN method has relatively high accuracy on small datasets, it also cannot extract the temporal features of the research objects. This also results in lower prediction errors if the study subjects have high temporal correlations. It can be seen from Figure 4 that the VB-CNN method has certain feasibility in predicting the four image features of art design, and it can meet the image recognition task in the field of art design. However, it can also be seen from Figure 4 that the values of the four features related to art design are also maintained at a relatively high level, which is unfavorable for the recognition of actual art design images.

In order to further compare the accuracy of the VB-CNN method and the VB-CNN-GRU method in the field of art design image recognition, this study also analyzes the

prediction errors of the GRU method in predicting four characteristics of art design images. Figure 5 shows the prediction error distributions for four features of artistic design images using the VB-CNN-GRU method. From Figure 5, it can be intuitively seen that the prediction errors of the four features of art design image recognition have been significantly reduced after using the GRU method. This can illustrate two points. There is a strong temporal correlation between the words, patterns, and colors of artistic designs. GRU method can improve the accuracy of art design image recognition. For practical engineering applications, the VB-CNN-GRU method is more conducive to completing the image recognition task of art and design majors. The prediction error of text features is reduced from 3.21% to 2.37%. The prediction error of pattern features is also reduced from 2.91% to 2.21%. The prediction errors of the four kinds of artistic design image recognition have been reduced to different degrees.

Through the above analysis, it can be found that VB-CNN-GRU is more suitable for the prediction and extraction tasks of art design image recognition-related features. In the following research and analysis, this study selected the VB-CNN-GRU method to analyze the relative accuracy and reliability. During the VB-CNN-GRU training process, the four features of artistic design are trained and tested separately. In this study, 30 sets of different art design-related data were selected to analyze the accuracy separately. Figure 6 shows the prediction error of the VB-CNN-GRU method in predicting the modeling features for artistic design image recognition. There is a large fluctuation in the error distribution of the model features, which indicates that the 30 sets of test sets are widely sourced and contain different types of artwork, which leads to relatively large fluctuations for the model features. From Figure 6, it can be seen that most of the prediction errors of modeling features are distributed within 1.5%, which can fully illustrate the reliability of the VB-CNN-GRU method in predicting the modeling features of artistic design. For the actual art design field, this margin of error is also acceptable. Only a small part of the error will be between 1.5% and 2%. There are also a small number of modeling features whose prediction error is less than 1%. Overall, the modeling features of artistic designs can be identified and analyzed by the intelligent algorithms provided in this study.

For the four characteristics of artistic design, the pattern characteristic is a relatively intuitive one. When people choose art products, they pay more attention to the patterns and color matching of artworks. Therefore, the prediction and recognition of the pattern features of artistic design is a more important task for the image recognition task of artistic design. Figure 7 illustrates the linear correlation coefficients of the predicted values of the pattern features of the artistic design. To more accurately illustrate the performance of the method proposed in this study, it uses the blue curve to illustrate the distribution of data points. The blue line represents the distribution of 95% confidence intervals for pattern features. The pattern feature distribution of the art design major is on both sides of the linear function, indicating that the predicted value of the pattern feature has a point

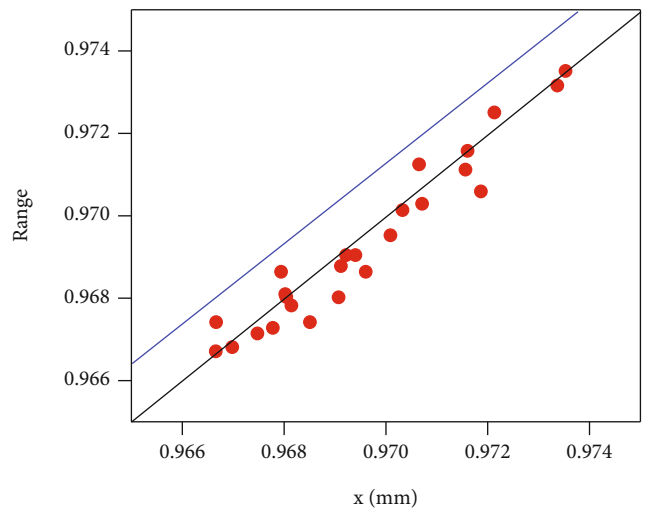

Figure 7: Linear correlation coefficients of predicted values of pattern features for artistic design image recognition.

larger than the actual value, and it also has a point smaller than the actual value data. If the predicted value of the pattern feature of the artistic design is in good agreement with the actual value, the data points will be distributed on both sides of the $y - x$ linear function, and the closer the data point is to the $y - x$ function, it will indicate the pattern feature of the artistic feature. It is better captured by the VB-CNN-GRU method. It can also be seen from Figure 7 that the 30 data points of the pattern feature of artistic design are well distributed on both sides of the $y - x$ function, which meets the requirements of the linear correlation coefficient. The linear correlation coefficient of the pattern features of artistic design even reached 0.98, which is enough to illustrate the practicability of the VB-CNN-GRU method in the recognition and analysis of pattern features of artistic design.

Text features are an expression of recording artistic design products. Art products of different periods will contain different forms of written expressions. Text is also a relatively easy-to-understand art compared to patterns, colors, and shapes. However, the text features of artistic design will contain relatively strong temporal correlation. Figure 8 is the analysis and explanation of the distribution curves of the predicted and actual values of the text features of artistic design. In Figure 8, the area in the middle of the two curves represents the prediction error of the text features of the art design profession, which can reflect the effectiveness of the VB-CNN-GRU method. If the area of this part is relatively small, this means that the accuracy of this method is relatively high. In general, the predicted value of the text features of artistic design is in good agreement with the trend of the actual value, although there are more peaks and valleys for the text features of artistic design for 30 different sets of data. The reason for the relatively large fluctuations in the text features of art design majors may be that these text features are derived from the feature data of different artworks, which is to verify the generalization ability of the VB-CNN-GRU method. The predicted value of the character feature of

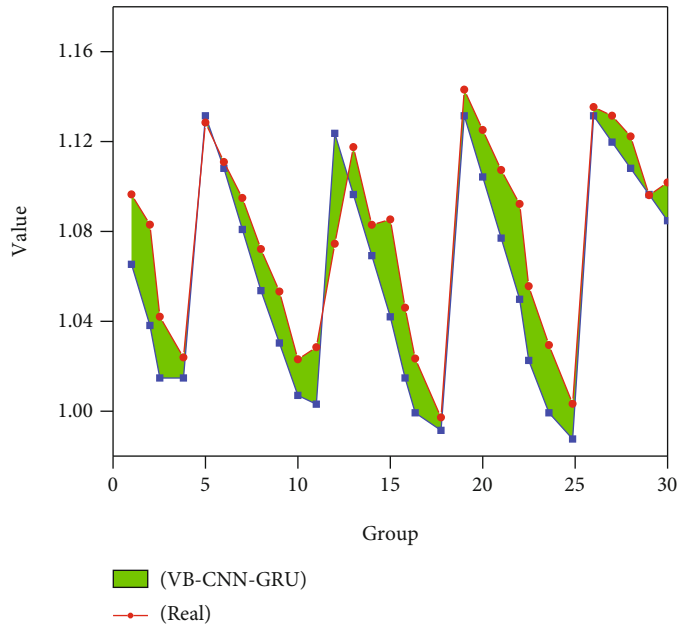

Figure 8: Distribution of predicted and actual values of text features for art design image recognition.

artistic design is also in good agreement with the actual value. This shows that the VB-CNN-GRU method predicts and recognizes the temporal correlation and nonlinear relationship of text features very well. For the recognition and analysis of the actual art design text features, the VB-CNN-GRU method also has enough information to complete the image recognition task of art design.

5. Conclusions

The field of art design is relatively wide, which probably includes many life-related fields such as advertising design, landscape garden design, and interior design. With the improvement of people's living standards and the improvement of aesthetic ability, when people buy products, they often take the product's artistic design characteristics as an important criterion. It can be seen that art design has penetrated deep into people's lives, which further illustrates the importance of art design. Art design involves features such as pattern, color, text, and shape. The relationship between these features is relatively complex, and it is difficult to discover the relationship between the features of art and design in the way of human experience. This brings a certain degree of difficulty to the design ideas of art designers. The design between different art designs also has a certain reference, which requires finding an efficient art design mining method. The VB-CNN-GRU method can extract image-related spatial and temporal features of art and design professionals, which can assist designers to find art and design-related features that cannot be extracted by artificial methods.

This research fully studies the application of image recognition technology in the art and design profession. At the same time, considering the advantages of VB-CNN and GRU methods in extracting image features, this study also designs a variational Bayesian convolutional neural network method to study the image recognition method of artistic design. It mainly analyzes the four characteristics of pattern, text, shape, and color in the field of art design. First, it uses a single VB-CNN method to analyze the prediction errors of four features in the field of art and design. Although the prediction errors of the four characteristics related to art and design are within the acceptable range in the art and design field, the four largest values still reach 3.21%. Then, this study analyzes the VB-CNN-GRU method in predicting the art and design The reliability of four features such as pattern and shape, the prediction errors of these four features have been significantly reduced, and the largest error is only 2.37%. This can illustrate the specific reliability of the VB-CNN-GRU method in the image recognition of artistic design. In the actual art design task, it only requires the designer to provide the artwork to the dog official, and it can predict the relevant features according to the intelligent art image recognition method designed in this study, which is an efficient and accurate method.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] Y. Han, "Application analysis of Chinese traditional cultural elements in modern environmental art design," *Modern Horticulture*, vol. 2019, no. 2, pp. 115-116, 2019.

[2] P. A. Arrighi and C. Mougenot, "Erratum to: towards user empowerment in product design: a mixed reality tool for interactive virtual prototyping," *Journal of Intelligent Manufacturing*, vol. 30, no. 2, p. 755, 2019.

[3] M. Dong, X. Zeng, L. Koehl, and J. Zhang, "An interactive knowledge-based recommender system for fashion product design in the big data environment," *Information Sciences*, vol. 540, no. 5, pp. 469–488, 2020.

[4] B. R. Mo and Z. J. Zhong, "The practice and exploration of Lingnan architectural form language in environmental design teaching-taking the environmental art graduation design teaching of Guangzhou City academy of fine arts as an example," *Art Grand View*, vol. 12, no. 12, pp. 120-121, 2019.

[5] S. Al Hashimi, A. Al Muwali, Y. Zaki, and N. Mahdi, "The effectiveness of social media and multimedia-based pedagogy in enhancing creativity among art, design, and digital media students," *International Journal of Emerging Technologies in Learning*, vol. 14, no. 21, pp. 176–190, 2019.

[6] N. McCartney and J. Tynan, "Fashioning contemporary art: a new interdisciplinary aesthetics in art-design collaborations," *Journal of Visual Art Practice*, vol. 20, no. 1-2, pp. 143–162, 2021.

[7] D. Mourtzis, "Simulation in the design and operation of manufacturing systems: state of the art and new trends," *International Journal of Production Research*, vol. 58, no. 7, pp. 1927–1949, 2020.

[8] M. Hermus, A. Buuren, and V. Bekkers, "Applying design in public administration: a literature review to explore the state of the art," *Policy & Politics*, vol. 48, no. 1, pp. 21–48, 2020.

[9] M. Sclater and V. Lally, "Interdisciplinarity and technology-enhanced learning: reflections from art and design and educational perspectives," *Research in Comparative and International Education*, vol. 13, no. 1, pp. 46–69, 2018.

[10] E. Knight, J. Daymond, and S. Paroutis, "Design-led strategy: how to bring design thinking into the art of strategic management," *California Management Review*, vol. 62, no. 2, pp. 30–52, 2020.

[11] D. Yang, D. Di Stefano, M. Turrin, S. Sariyildiz, and Y. Sun, "Dynamic and interactive re-formulation of multi-objective optimization problems for conceptual architectural design exploration," *Automation in Construction*, vol. 118, no. 5, p. 103251, 2020.

[12] W. Chen, A. Haque, and K. Sedig, "Design of interactive visualizations for next-generation ultra-large communication networks," *IEEE Access*, vol. 9, no. 99, pp. 26968–26982, 2021.

[13] H. Koyuncu, "Determination of positioning accuracies by using fingerprint localisation and artificial neural networks," *Thermal Science*, vol. 23, Suppl. 1, pp. 99–111, 2019.

[14] M. Duan, K. Li, X. Liao, and K. Li, "A parallel multiclassification algorithm for big data using an extreme learning machine," *IEEE transactions on neural networks and learning systems*, vol. 29, no. 6, pp. 2337–2351, 2018.

[15] L. Peng, L. Wang, D. Xia, and Q. Gao, "Effective energy consumption forecasting using empirical wavelet transform and long short-term memory," *Energy*, vol. 238, no. 1, article 121756, 2022.

[16] G. Li, X. Zhao, C. Fan, X. Fang, F. Li, and Y. Wu, "Assessment of long short-term memory and its modifications for enhanced short- term building energy predictions," *Journal of building engineering*, vol. 43, no. 9, article 103182, 2021.

[17] A. Mohamed, M. K. Najafabadi, Y. B. Wah, E. A. Zaman, and R. Maskat, "The state of the art and taxonomy of big data analytics: view from new big data framework," *Artificial intelligence review*, vol. 53, no. 2, pp. 989–1037, 2020.

[18] A. Sherstinsky, "Fundamentals of recurrent neural network (RNN) and long short-term memory (LSTM) network," *Physica d-nonlinear phenomena*, vol. 404, no. 5, article 132306, 2020.

[19] X. Wang and Y. Zhu, "Intelligent art design management based on wireless communication microprocessor and nobile internet," *Wireless communications & Mobile Computing*, vol. 2022, no. 6, article 5012875, 12 pages, 2022.

[20] C. Yang, "Online art design education system based on 3D virtual simulation technology," *Journal of internet technology*, vol. 22, no. 6, pp. 1419–1428, 2021.

[21] D. Wenhao, "Multisensor information fusion-assisted intelligent art design under wireless virtual reality environment," *Journal of sensors*, vol. 2021, no. 6, Article ID 6119127, 10 pages, 2021.

[22] C. Feng, "An intelligent virtual reality technology in the teaching of art creation and design in colleges and universities," *Journal of intelligent & fuzzy systems*, vol. 40, no. 2, pp. 3699–3710, 2021.