Design of Cultural and Creative Product Images Based on Color Feature Analysis

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Abstract. Informatization has brought value recognition in terms of aesthetic feeling of product design and emotional resonance. Because of the strong subjectivity of artificial annotation, it is inevitable that the search results will be different because of everyone's different understanding when searching for images. The application of computer aided design (CAD) and human-computer interaction (HCI) has become possible in the process of image feature extraction and matching of Wenchuang (cultural and creative) products. This not only improves the work efficiency of designers, but also avoids the search errors caused by subjective factors. In this article, the influence of interactive experience on the design of Wenchuang products is briefly considered, and then the interactive design of Wenchuang products is further analyzed, pointing out that the practical and artistic characteristics of products should be given in the design of Wenchuang products, so as to provide reference for the design of Wenchuang products. The system test results show that the algorithm has higher accuracy in the classification and retrieval of Wenchuang product images, which is 22.44% higher than that of HSV model, and the recall is increased by 19.33%, which can improve the HCI experience of image retrieval and has practical application value.

Keywords: Color Characteristics; Wenchuang Products; Image Retrieval; Computer Aided Design
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1   INTRODUCTION

Due to the rapid growth of sci & tech, large-capacity storage equipment and digital information equipment are flooding people's lives, and the vigorous growth of multimedia technology and network technology makes information data show a geometric series growth trend. 3D scanning

technology is a technology that can quickly and accurately obtain information about the shape and structure of objects. Through laser scanning, Structured light scanning, multi view shooting and other methods, three-dimensional data of objects can be obtained and converted into a format that can be processed by computers. Cultural heritage is a reflection of a country's history and culture, with extremely high value and importance. However, many cultural heritage sites have been damaged or lost due to time, natural factors, or human activities. In order to protect and preserve this cultural heritage, using modern technologies such as 3D printing or 3D scanning for replication is an effective method. Balletti and Ballarin [1] import 3D data into Computer-aided design software for further analysis, modification and manufacturing. In addition, these data can also be used for virtual reality and augmented reality applications to provide interactive experiences and displays of cultural heritage. Image classification is an important research branch of image processing. How to make the most of the information of color, texture and morphological characteristics of images and effectively extract the targets in the region of interest directly affects the quality of image classification. Color is an intuitive visual feature, which has the advantages of insensitivity to rotation and translation changes and strong robustness, and can be easily used in content-based image classification. Immersive virtual reality in the context of industrial Design education is the future in the eyes of educators. Bernardo and Duarte [2] believe that immersive intuitive learning experience, helping them better understand and master the relevant knowledge and skills of industrial design. Specifically, immersive virtual reality technology can simulate the real design environment, and improve the learning effect of students. For example, in industrial Design education, students can use virtual reality technology to simulate the real product design process, so as to better master the skills and methods of product design. In addition, immersive flexible learning methods. Students can freely choose their learning content and progress according to their own needs and schedule, improving their autonomy and efficiency in learning. Because of the strong subjectivity of artificial annotation, it is inevitable that the search results will be different because of everyone's different understanding when searching images. This makes the manual marking method cannot meet the actual requirements in many practical situations. As far as the current development situation is concerned, the design of Wenchuang products must not simply emphasize aesthetics and knowledge, but also highlight the characteristics of practicality and interest of the times in order to deepen the application of Wenchuang products. In the case of manual design, because information search is through brain knowledge retrieval, manual retrieval of books and materials, design standards and norms, etc., its processing efficiency is low and the design cycle is long. Therefore, it is an urgent requirement for the growth of product design to realize some degree of design automation, shorten the design cycle, reduce the design cost and improve the design quality. Entertainment products can try to innovate content and attract the attention of the audience. This may include reinterpreting classic works, combining traditional and modern elements, or creating new original works. In addition to content innovation, entertainment products can also attract audiences through form innovation. This may include adopting innovative stage designs, utilizing new technologies such as augmented reality or virtual reality, or attempting new forms of performance. Effective marketing strategies can help attract more viewers. This may include using social media for promotion, using data analysis to understand audience needs, or collaborating with other brands for promotion. Chen et al. [3] provide unique services such as personalized explanations, interactive performances, or optimize venue facilities such as adding interactive areas or providing more comfortable seating. Collaborating with partners in different fields can bring new ideas and resources. This may include collaborating with other art groups, academic institutions, or communities. Deng et al. [4] conducted factor analysis for the teaching of visual aesthetic color matching design methods. By calculating the quantitative interval of color images and evaluating the evolutionary distribution of fitting information, an adaptive cross mutation adaptation function was constructed. To follow certain design and color matching principles to achieve a color scheme that is beautiful, harmonious, and in line with user visual habits. When selecting colors, consideration should be given to the matching effect between different colors and their combination with other design elements such as text and images. Generally speaking, color matching should avoid conflicts and confusion to produce clear, concise,

and aesthetically pleasing effects. Factors such as color unity, contrast, emotion, culture, and matching should be comprehensively considered to achieve a color scheme that is beautiful, harmonious, and in line with user visual habits. At the same time, continuous user testing and feedback should also be conducted to continuously optimize and improve the design.

Computer aided process planning of molecular products under property uncertainty is an important field of Computer-aided design (CAD). In this field, optimization strategies based on Monte Carlo are widely used. Monte Carlo optimization is a stochastic optimization algorithm that can be used to solve problems with uncertainty. Property uncertainty is a common issue in computer-aided molecular product process design. This uncertainty comes from factors such as the quality of raw materials, fluctuations in process parameters, and changes in environmental conditions. Frutiger et al. [5] used Monte Carlo optimization strategies to simulate and analyze the impact of these uncertain factors on product properties through random sampling, in order to determine the optimal process parameters. Specifically, this strategy generates a large number of random samples and uses these samples to construct a probability distribution model, which can then be used to evaluate product properties under different process parameters. Creativity is a method with innovative thinking to explore different resources and enhance the value of things, which is unique and original. Wenchuang products promote themselves through the interaction of digital media, and the integration of online and offline development has opened up a brand-new commercial market that is interactive with the Internet. In the process of image feature extraction and matching of Wenchuang products, HCI has become a possibility, which not only greatly saves people's workload, but also shortens the query time, and at the same time avoids search errors caused by subjective factors. Design automation is the automation of information processing, and computer is an information processing machine. It is under this background that CAD is produced. Common digital images in daily life, as an informative, intuitive and easy-to-understand information expression, have incomparable advantages over other information carriers such as text and sound. If there is no effective image data management method, a lot of information will be submerged in the database and cannot be retrieved when needed. Therefore, it is very necessary to organize and classify massive image data with the help of image classification technology, and develop an image management system based on this to help users store, index and retrieve image databases. In this article, the application of CAD and HCI technology in image classification and retrieval of Wenchuang products is studied, and the application mode of Wenchuang product images is innovated by combining the color feature analysis method to improve the HCI experience of Wenchuang product image retrieval in the new media environment.

Wenchuang products refer to high value-added products that are created and upgraded by relying on people's wisdom, skills and talents, as well as by means of modern sci & tech, combined with the development and application of intellectual property rights. Interactive Wenchuang products combine modern interactive technology with traditional Wenchuang forms, which has attracted people's extensive attention and narrowed the distance between people and Wenchuang products. More and more high-quality interactive Wenchuang products have entered people's lives. Image retrieval is to find images with specified characteristics or containing specified content in the target image set according to the description of image content. Generally speaking, color features are insensitive to image rotation, translation, scale, changes in shooting angle, and even various deformations, showing certain robustness. Color histogram, color moments and their derived descriptors are the most commonly used color feature descriptors. Studying the color feature fusion of Wenchuang product design can increase the highlights of Wenchuang product, make it more representative of Wenchuang product theme, enrich the expression of profound meaning of Wenchuang product, and more directly express the artistic conception with cultural connotation. In this article, the application mode of Wenchuang product image based on color feature analysis is studied, and the following innovations are made:

⊖ The technology concepts of CAD and HCI are applied to image retrieval of Wenchuang products to optimize the design process of Wenchuang products.

(2) This article proposes a new color feature extraction algorithm which takes the spatial average distance of pixels as the color feature.

⊗ In order to meet the characteristics of different image libraries and the needs of different users, the weighted distance is introduced in similarity measurement, and the image library containing 50 Wenchuang product images is searched by taking the Wenchuang product images with red as the detection object.

This article introduces the influence of interactive experience on Wenchuang product design, and constructs an image retrieval model of Wenchuang product based on color feature extraction. Then the feasibility of the model is verified. Finally, the application results and future research direction of this method are summarized.

2   RELATED WORK

Fuzzy Decision model is a tool in the field of mathematics and computer science. It can deal with fuzzy, uncertain or uncertain problems. In the field of product design, fuzzy Decision model can be used to solve some complex problems in design. Hsueh et al. [6] need to determine the positioning and theme of the product before the design begins. The fuzzy Decision model can be used to determine the importance and priority of the design theme. Assist designers in better selecting and positioning products based on different cultural backgrounds and consumer needs. In the design process, various factors need to be considered, such as practicality, aesthetics, cultural value, etc. The fuzzy Decision model can help designers weigh different factors, optimize design schemes and improve the comprehensive performance of products. In design, it is necessary to consider the impact of the product on the environment and the efficiency of resource utilization. The fuzzy Decision model can be used to assess the severity of the impact on the environment at different stages of the product life cycle, so as to optimize product design and improve the efficiency of resource utilization. Lorusso et al. [7] enable users to operate and experience in a virtual environment, thereby obtaining more authentic feedback and feedback. Virtual reality technology can quickly adjust and optimize product design to meet user needs and requirements. Virtual reality technology can reduce the cost of product design, avoid rework and modifications caused by design errors, and thus reduce the cost and risk of product development. In short, conceptual modeling in product design in a virtual reality environment can present the concepts and effects of product design more intuitively, interactively, and adjustable, enabling users to have a deeper understanding and evaluation of product design, thereby better meeting user needs and improving product quality. Users review data driven product optimization design methods, and the relationship between Computer-aided design and computer graphics is mainly manifested in data driven product optimization design. Lu et al. [8] collected and analyzed a large amount of user data to understand user needs and behaviors for design and optimization. Computer-aided design technology can help product designers complete design work more quickly and accurately, and provide various analysis tools for evaluating and optimizing product design. Computer graphics technology can provide a visual human-computer interface, so that users can more intuitively understand and evaluate the effect of product design. User reviews can optimize and improve product design by collecting user feedback and evaluations, thereby improving product quality and user experience. To sum up, it is closely related to Computer-aided design and computer graphics technology.

Hyperspectral reflectance spectroscopy can be used to identify important components of cultural relics, such as pigments and binders. Combining reflection spectra with images can also achieve surface distribution analysis of pigments and binders, which is very important for understanding the production process of cultural relics and identifying their authenticity. In addition, hyperspectral imaging technology can also be used for cultural relic protection. Picollo et al. [9] have a deep understanding of the degree of damage to other cultural relics, providing assistance for the study of painting techniques. More importantly, it can provide reference for the selection of materials for the protection and restoration of calligraphy and painting cultural relics

and the evaluation of restoration effects. Wang [10] needs to utilize modern design methods for innovation. This includes 3D printing, CAD design, artificial intelligence, and more. For example, we can use 3D printing technology to create complex product shapes, or use AI to design unique product patterns. Through this method, we can create products that not only have the cultural characteristics of the South Island indigenous people, but also have a sense of modernity and practicality. For example, we can design an ocean themed Coffee cup, whose pattern is inspired by the marine culture of the South Island natives, while its shape and materials take into account the actual needs of modern life. The design of Chinese painting elements in cultural and creative products should follow the following principles: first, it should reflect the characteristics and connotation of Chinese culture. Secondly, it should be combined with modern design concepts to meet the aesthetic needs of modern people. Finally, it is important to have practicality and aesthetics, and not just focus on form while neglecting practical value. In the design process, the following methods can be used to apply elements of Chinese painting: First, Chinese painting works can be transformed into cultural and creative products by copying or re-creating. Secondly, we can use the patterns, colors, composition and other elements of Chinese painting to design cultural and creative products with Chinese characteristics. Finally, modern design techniques such as abstraction, three-dimensional, and deconstruction can be used to design cultural and creative products with a sense of modernity. Yan [11] integrates modern design elements while applying Chinese painting elements to form a unique style. For example, Chinese painting elements can be combined with the layout, color, and graphic elements of modern graphic design. The design and promotion of these cultural and creative products can promote the inheritance and development of traditional Chinese culture. Chinese painting is an important part of Chinese traditional culture. Its elements are diverse and rich in connotation. By applying it to cultural and creative products, more people can understand and understand Chinese painting, and increase people's understanding and love of Chinese culture. Zhang and Romainoor [12] conducted binary image segmentation and coloring art processing. Pop art style images can be used to copy and reproduce classic works of art to reduce costs and time, while maintaining the appearance and feel of Prehistoric art. The generated Pop art style images can be used to create Digital art works, such as digital painting, digital sculpture, digital photography, etc., and can be created and displayed in a virtual environment. Pop art style images can be used in clothing design, such as pattern design, fabric design, accessory design, etc., which can bring unique design style and fashion sense.

The generated Pop art style images can be used for graphic design and visual design, such as poster design, packaging design, book cover design, etc., which can increase the visual attractiveness and uniqueness of the designed works. Pop art style images can be used in product design, such as furniture design, ceramic design, electronic product design, etc., which can bring unique design styles and visual effects. In a word, the generated Pop art style images have a wide range of applications in cultural and creative products, which can bring unique design styles and visual effects, and also increase the attractiveness and value of products. Zhang et al. [13] can reduce product development time and costs by searching for shareable functional components. It can search through the internet or obtain shareable functional components from existing open-source platforms. Integrating the searched functional components into the product at the same time requires consideration of compatibility and interface issues. Use Computer-aided design software to design and model products. Utilize computer-aided simulation technology to simulate the application of products to verify their performance and reliability. Based on the simulation results, optimize and improve the product to improve its performance and reliability. Finally, production and manufacturing are carried out to convert the product into actual products to meet market demand. The process of integrating the mode of pre development stage of local culture. Zhang and Wen [14] innovated and designed by integrating the cultural elements discovered with modern design concepts and techniques. Develop cultural and creative products with local cultural characteristics. When designing cultural and creative products, it is necessary to consider market demand and consumer demand in order to design and produce products that meet market demand, while also considering the practicality and aesthetics of the product. After developing cultural and creative products, marketing and promotion are needed to attract more consumers

and tourists. This can be achieved through exhibitions, activities, online promotion, and other means. In the sales and promotion process, it is necessary to collect customer feedback to understand the popularity and existing problems of the product. Based on feedback information, products can be improved and optimized to enhance market competitiveness. Intelligent computers can use artificial intelligence and machine learning techniques to learn and train a large number of agricultural product packaging designs, in order to identify and predict trends and patterns in artistic styles, thereby providing more creativity and optimization solutions for design. Zhao et al. [15] analyzed 3D modeling and rendering techniques. Intelligent computers can use 3D modeling and rendering techniques to create 3D models of agricultural product packaging, and present them through rendering techniques for design and evaluation. Intelligent computers can use automation and optimization techniques to optimize agricultural product packaging design, such as automatically adjusting design parameters to optimize the artistic effect and functional performance of packaging. In short, the art style appearance design of agricultural product packaging assisted by intelligent computers is a field full of potential and opportunities. By using advanced technologies and methods, agricultural product packaging with artistic style and functionality can be created, providing new advantages for the development of the agricultural industry and competition in the agricultural product market.

3   THE INFLUENCE OF INTERACTIVE EXPERIENCE ON WENCHUANG PRODUCT DESIGN

The extraction of image features is the basis of image classification. The selected features should be able to fully represent the semantic content of the image and have certain robustness and stability to the change of environment. If the feature selection is wrong, the classification will not be accurate or even classified. Enhancing the interactive experience of Wenchuang product design can realize more personalized design. Consumer demand will determine the function of the product, make the product more targeted, thus attracting consumers to pay the bill. The information environment brings a new form of user experience, and the design of Wenchuang products also needs to serve the user experience, and the user experience is based on the interaction between customers and products. Therefore, the design of Wenchuang products should establish the concept of interactive design. Wenchuang products focus on culture and creativity, and enhance the added value of products through creation, creation and innovation, mainly including hardware carriers and Wenchuang content. In the new media environment, in order to meet users' complex and rich needs for Wenchuang products, designers should follow users' psychological and behavioral characteristics and adopt interactive experience design methods to strengthen the service and experience functions of Wenchuang products.

Using scientific and technological means to develop Wenchuang industry is the only way under the information environment. In the information environment, industrial design is being reconstructed, and Wenchuang industry is playing an increasingly important role in the adjustment and upgrading of industrial structure. Under the HCI concept, Wenchuang's product design must determine the user's demand according to the demand analysis, and define the function and characteristics of the product based on the demand. After creating a conceptual design scheme, it is necessary for HCI experts or actual users to evaluate the scheme, and at the same time, effective feedback should be put forward to facilitate the improvement of the design. Emotional interactive experience design involves many levels of human spirit, emotion and psychology, and belongs to one kind of interactive experience design. Compared with ordinary design, Wenchuang products emphasize the connection with the audience's emotions, thus giving the products profound spiritual connotation and emotional support.

With the application of scientific and technological means, the design of Wenchuang products will lead to the service mode of adding experience and value in the future. Service adds experience and value, so design should integrate plane, interaction, product and space, and design should be transformed from consumption perspective to service perspective. From the analysis of interactive experience, people begin to have interactive behavior at the first sight of a product, and produce experience, that is, visual experience. A good visual experience means that the product looks good

or novel, which will guide customers to know him, and then further produce a deep experience. Scientific and technological means can improve the effect of experience to a certain extent. In the context of information technology, designing products and implementing product-based services will rely on user experience and analyze users' interactive experience by scientific and technological means, so as to design products that meet consumers' needs and improve consumers' satisfaction. Emotional factors are indispensable in Wenchuang's product design. Different regional cultures contain many different emotional expressions, or admire historical celebrities and legends, or miss hometown and homesickness, or reflect unique lifestyles and interests.

4   METHODOLOGY

4.1   Product Color Feature Recognition Model

Extracting color features from digital images depends on the understanding of color representation and color theory in digital images. In this article, the space is roughly divided into different intervals by extracting the main color and sub-main color of the image, and then the middle of each interval is used as the quantization result of the interval, that is, the image is quantized in the form of global histogram first, and then only the colors with the highest and second highest color frequencies in the image are concerned. Based on these two, the image is filtered once, and then the red, yellow and blue in road traffic signs are taken as the main colors of the three tones. By grasping the color with the most prominent tone as the feature extraction, the image is extracted quickly and effectively, and finally the purpose of the second screening is achieved. See Figure 1 for the color feature recognition and classification model of Wenchuang products.
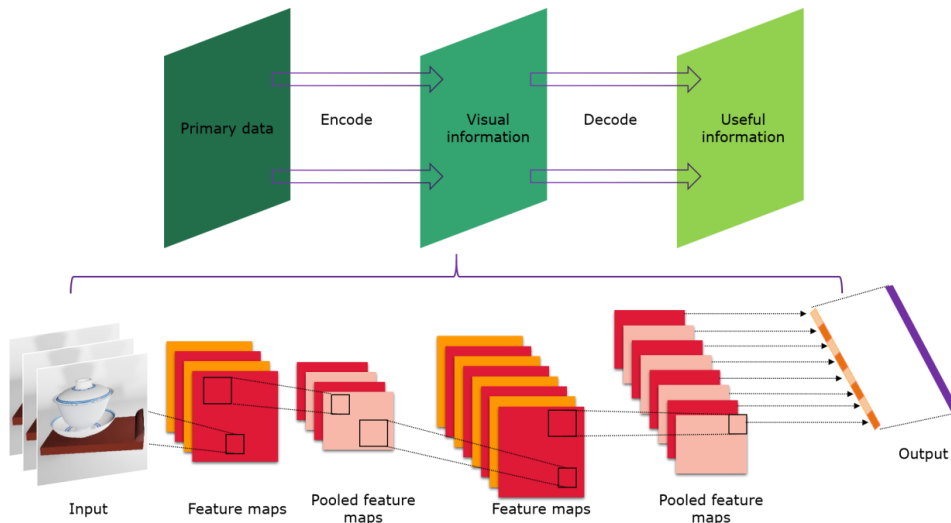
Figure 1: Wenchuang product color feature recognition and classification model.

The quantity of feature maps and the size of convolution kernel jointly determine the convolution layer structure. All related neurons on the same feature mapping plane use the same filter. As shown in formula (1), it is a convolution kernel:

$$h_{ij}^k = \tanh\left(\left(W^k * x_{ij}\right) + b_k\right) \qquad (1)$$

Where W^k represents the weight and b_k represents the offset.

Usually, the convolution layer will have multiple convolution kernels of the same size. Each convolution kernel will output the corresponding feature map after convolution, so the output of the whole convolution layer is a three-dimensional tensor. The activation function receives input signal processing to produce output signal, which is different from linear behavior. When the input of neuron exceeds a certain threshold, the nerve will be activated. The activation function is introduced to increase the nonlinear description ability of convolution network.

$$f(x) = \frac{1}{1 + \exp(-x)} \tag{2}$$

When the input is compressed to [0,1] after the function is activated, but when the input value falls at both ends of the function, the output is 1 or 0 regardless of the value, which is called "gradient disappearance phenomenon". This will cause the gradient to be close to 0 during back propagation, which will cause the error of this neuron to be unable to be transmitted, thus affecting the whole training process.

Most of the color models used now are hardware-oriented or application-oriented. There have been hundreds of color spaces since they were put forward, and most of the improved space models are only partially changed or dedicated to a certain field.

For small networks, when the quantity of input nodes is greater than the quantity of output nodes, the optimal quantity of hidden layer nodes h:

$$h = \sqrt{M \times N} \tag{3}$$

Where N is the quantity of input nodes and M is the quantity of output layer nodes.

Almost all neuron learning algorithms can be regarded as variants of Hebb learning rules. Specific to the aforementioned neuron model, the Hebb rule can be expressed as the following algorithm:

$$\Delta w_{ij} = \lambda x_i y_j \tag{4}$$

Δw_{ij} is the correction of the i th weight, and λ is the coefficient that controls the learning speed.

In practical application, the distribution of errors in the weight space of the network is very complicated, and there are many peaks and valleys, that is, local minima, while the BP algorithm uses error gradients to modify the weights step by step. One of the improved methods is to add the previous gradients as momentum terms in the weight modifiers:

$$\Delta w_{ji}(n) = -\eta \sum_{t=0}^{n} \alpha^{\eta-t} \frac{\partial \varepsilon(t)}{\partial w_{ji}(t)} = -\eta \frac{\partial \varepsilon(n)}{\partial w_{ji}(n)} - \eta \sum_{t=1}^{n} \alpha^{\eta-t} \frac{\partial \varepsilon(t)}{\partial w_{ji}(t)}, \ 0 < \alpha < 1 \tag{5}$$

The current gradient is the most influential component in $\Delta w_{ji}(n)$, and its coefficient is always one. The influence of the previous gradient on $\Delta w_{ji}(n)$ decreases exponentially with $\alpha^{\eta-t}$.

Error function:

$$E_p = \frac{\sum_{t}(t_{pi} - o_{pi})^2}{2} \tag{6}$$

t_{pi}, o_{pi} is the expected output and the actual calculated output of the network.

4.2   Principle of Product Image Classification and Retrieval

The content of the image may be completely different, so the spatial distribution information of the color should also be added, so people put forward the block histogram, that is, artificially divide the image into fixed blocks, and then extract the corresponding local color characteristics for each block. The difference between the generated image and the original image is not very big after the color density of an image changes, but the color values of each pixel in the image have changed, so the color histograms of the two images will be very different. It is difficult to locate two images with different color values by traditional color histogram retrieval method. Figure 2 is a schematic diagram of corrosion and swelling in Wenchuang product image classification.

Corrosion diagram
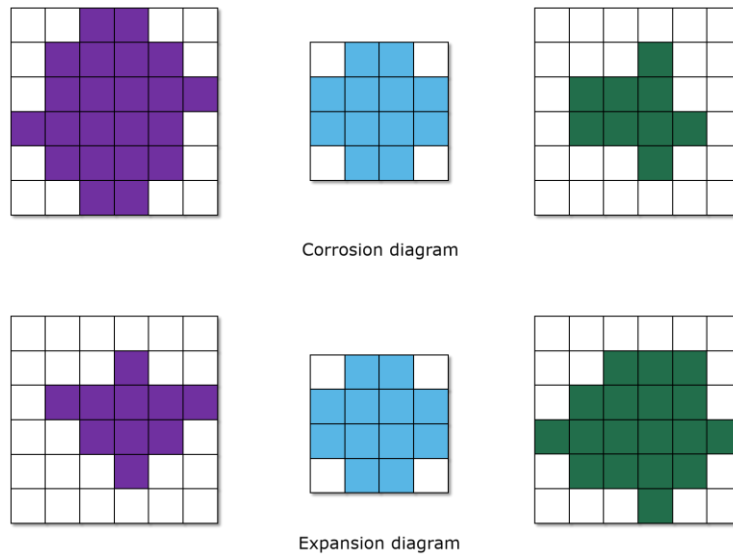
Expansion diagram

Figure 2: Schematic diagram of corrosion and expansion in Wenchuang product image classification.

Assuming that there are M samples of target image feature data, the weight of the newly arrived sample is recorded as $q_j(t), j = 1,2,\cdots,N$; The clustering weight is recorded as $p_i(t-1), i = 1,2,\cdots,C$. N_t data samples are divided into C clustering centers, and each clustering center is represented as:

$$p_i(1) = \sum_{j=1}^{N_i} u_{ij}q_j(1) + \sum_{i=1}^{C} u_{ij}q_j(0) \tag{7}$$

Where u_{ij} is the fuzzy membership degree of the sample belonging to the cluster center, $1 \le i \le C, 1 \le j \le N_i$.

Assuming that T represents the threshold of weighted gray density, it can be used as a measurement benchmark to distinguish noisy pixels from noiseless pixels, thus obtaining:

$$T(u(g),u(h)) = \log_2\left(\frac{u(g)^2 + u(h)^2}{2}\right) \tag{8}$$

After the above-mentioned gray scale etching operation, when the gray scale etching value is positive, the gray scale value of the pixel (x_g, y_g) used to describe the surrounding neighborhood of the pixel without the noise point g is larger than the gray scale value of the surrounding pixel (x_h, y_h) containing the noise area h.

Global histogram is to count the color distribution information on the whole image, so it loses the spatial distribution information of color. Two images with completely different color spatial distribution, such as the sky and the ocean, can have the same histogram, which will inevitably lead to classification errors, so color spatial distribution information should also be added. After quantization, considering the temporal complexity and spatial complexity of color histogram will affect the performance of image classification, and there is some information redundancy for resolution. The representative color reflects the general picture of the image and greatly reduces the storage space of the features. Therefore, this article uses global representative color and block representative color to extract features from images respectively. Figure 3 illustrates the ray tracing process of a scene composed of three translucent glass balls.
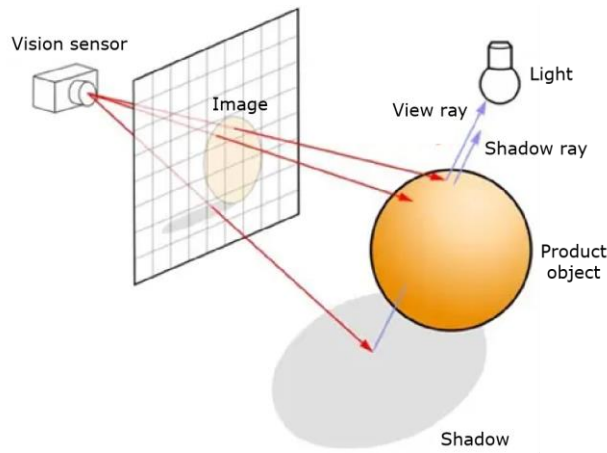
Figure 3: Ray tracing process.

Different from the global features, different blocking strategies can be selected to give the histogram features of blocks. The high-level energy distribution statistical information of the image is used to describe the binary product image.

$$B(i, j) = \frac{1}{h \times w} \sum_{x=i \cdot h}^{(i+1) \cdot h - 1} \sum_{y=i \cdot w}^{(j+1) \cdot w - 1} I(x, y) \tag{9}$$

Based on experience, choose the radial basis kernel function:

$$f(x) = <w, x> + b \tag{10}$$

$$\min_{w, b, \xi_i^+, \xi_i^-} \frac{1}{2} \|w\|^2 + C \sum_{i=1}^{l} \left(\xi_i^+ + \xi_i^- \right)$$

$$s.t. -\left(\varepsilon + \xi_i^- \right) \le y_i - <w, x_i> -b \le \varepsilon + \xi_i^+ \tag{11}$$

$$\xi_i^+, \xi_i^- \ge 0, i = 1, 2, \cdots, l$$

5 RESULT ANALYSIS AND DISCUSSION

The coordinate system of computer simulation calculation is generally based on the inertia principal axis of human multi-rigid-body model. Therefore, before operation, it is necessary to transform the original data, make statistics on parameters, remove singular points in error processing and smooth the whole data. The time synchronization processing is to match the spatial feature data and time feature of plane images, or to synchronously correct two mutually perpendicular plane image data in three-dimensional photography. The preprocessing of these data will affect the accuracy of the calculation results of the whole system. In order to meet the characteristics of different image libraries and the needs of different users, the weighted distance is introduced in similarity measurement, and the image library containing 50 Wenchuang product images is searched by taking Wenchuang product images with red as the detection object. The convergence index is used to compare the effects of HSV model and the proposed image retrieval method, as shown in Figure 4.
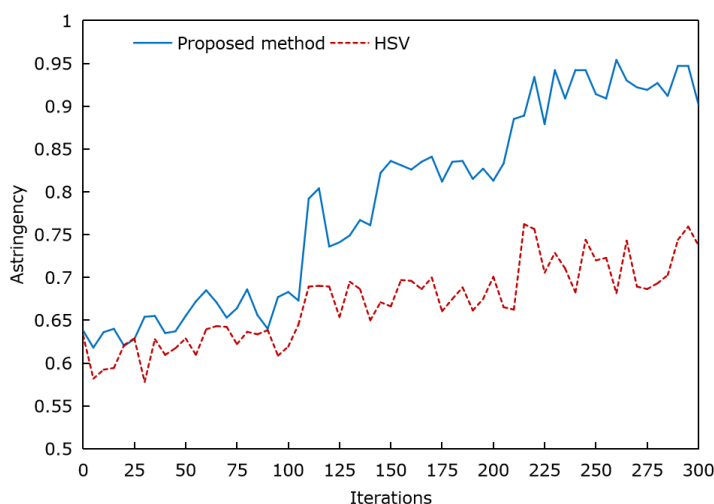

Figure 4: Comparison results of convergence.

Experiments show that compared with the standard HSV model, the convergence index of this model is more advantageous. In order to obtain an image color descriptor independent of the observation point, a color feature is needed, which can still be independent of the shape of the object surface and the observation angle under the influence of factors such as shadow, shading and brightness change. It has been found that the human eye is particularly sensitive to the hue of color, and the hue of color is a color feature independent of the observation point.

The decision-making module tests the test samples, obtains the experimental results, and evaluates and optimizes the decision-making model. Before classifying the feature model, the subsystem will test and evaluate the classifier trained by the training samples to improve the feature selection and calculation in feature extraction, and at the same time constantly correct the parameter selection in training to make the classification error of the classifier meet the requirements. The error comparison of the algorithm is shown in Figure 5.

Users can choose the corresponding color feature classifier to classify, and the system will return the results to users after classifying the test library. If users are slightly satisfied with the results, they can re-classify them through relevant feedback until they are satisfied.

Color quantization is to quantize very rich colors into fewer colors, so there is inevitable deviation and it is a lossy process. Whether color quantization can achieve ideal results depends on whether the contradiction between the overall level and local details of the input image can be

solved. Compare the accuracy and recall of HSV model for Wenchuang product image classification, as shown in Figure 6 and Figure 7.
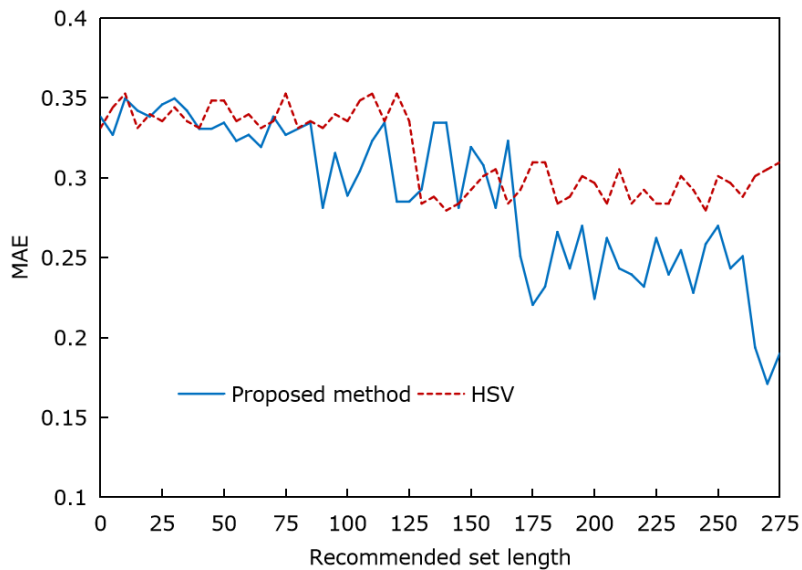
Figure 5: Test of image classification error of algorithm.
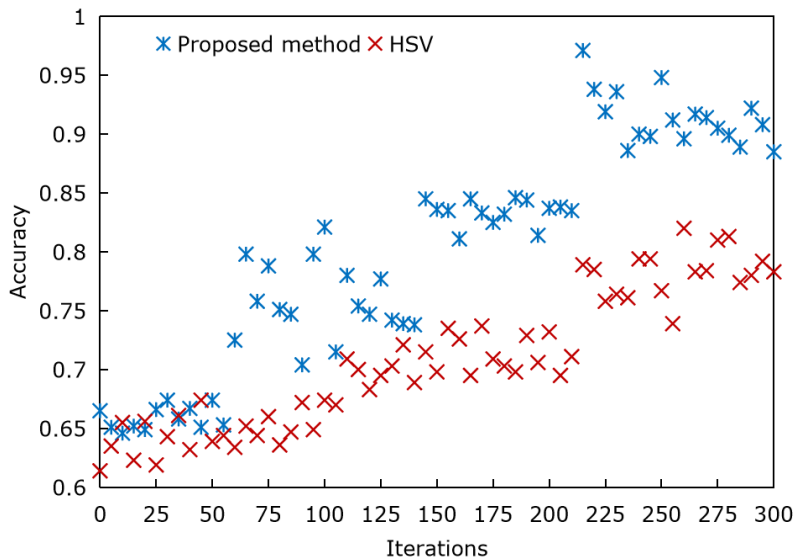
Figure 6: Accuracy of image classification of Wenchuang products.

From the detection results, it can be seen that the algorithm has higher accuracy in the classification and retrieval of Wenchuang product images, which is 22.44% higher than that of HSV model, and the recall is increased by 19.33%, which can accurately locate the edge contour of product images. The proposed image classification and retrieval model has a good guiding role and significance for the innovation of image retrieval technology and the improvement of HCI experience in Wenchuang product design.
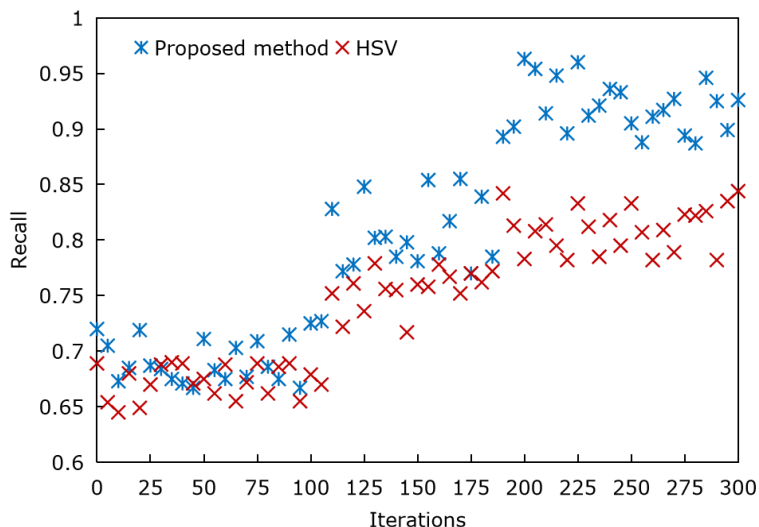
Figure 7: Recall of Wen Chuang product image classification.

Compared with the traditional product display mode, Wenchuang product intelligent display system is more flexible, has diversified display characteristics, and is more stable and faster for data processing and information collection. In Wenchuang product intelligent display system, products with the same shape can be displayed to customers anytime and anywhere by using three-dimensional models, which not only saves costs, but also improves the overall work efficiency and quality, and promotes the gradual transformation of product display from static mode to dynamic mode. On the basis of the initial system, the interaction between users and products is strengthened, the users' understanding of products is improved, and the related systems are pushed into a new development stage.

6   CONCLUSIONS

With the increasing amount of image information and the expansion of image database, how to effectively store, manage and access image information quickly and efficiently has become an urgent problem for people. In the case of manual design, because information search is through brain knowledge retrieval, manual retrieval of books and materials, design standards and norms, etc., its processing efficiency is low and the design cycle is long. Therefore, it is an urgent requirement for the growth of product design to realize some degree of design automation, shorten the design cycle, reduce the design cost and improve the design quality. Color is an intuitive visual feature, which has the advantages of insensitivity to rotation and translation changes and strong robustness, and can be easily used for content-based image classification. In this article, the technical concepts of CAD and HCI are applied to Wenchuang product image retrieval to optimize Wenchuang product design process. In order to meet the characteristics of different image databases and the needs of different users, weighted distance is introduced in similarity measurement. The system test results show that the application of this algorithm in the color feature extraction of Wenchuang product images can improve the HCI experience of image retrieval and has practical application value. In the future research process, a unified and standardized large database should be established to facilitate researchers to experiment and compare experimental results.

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