

# Research on Reasonable Color Matching Method of Interior Decoration Materials Based on Image Segmentation

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**Abstract—** In recent years, with the continuous growth of social and economic level, people's living standard has also been constantly improved. Under this background, contemporary people highly respect a good living environment, and the importance of building interior decoration engineering has been fully reflected. As one of the important design contents of interior decoration, the use level and effect of color will directly affect the overall visual effect of interior decoration and the comfort of interior space. Through the rational collocation of colors, the artistic characteristics of interior decoration can be displayed, which can also show the important role of color in interior decoration. In modern interior decoration, the use of colors is gradually enriched, and the use of multiple colors leads to the problem of actual color matching. Image segmentation, which is the premise of image recognition and tracking, divides an image into regions with different characteristics and extracts interesting objects. This technology has been widely used in military affairs, medicine, intelligent transportation, pedestrian detection, product inspection, sports, remote sensing, machine vision and other fields. Therefore, good color matching is very important in the actual interior decoration practice.

**Keywords—** Image segmentation, Interior design, Color matching, Decorative materials

## I. INTRODUCTION

With the development and progress of the economy and society, people's aesthetic consciousness is constantly improved, and their requirements for quality of life are gradually improved. As an important part of interior space decoration, color has an important influence on people's mood, work efficiency and lifestyle [1]. The same room area, using different color combinations, the final results may vary widely. If the color collocation is not good, it will make the room appear depressed and messy, negatively impacting people's lives. Therefore, reasonable collocation of colors can not only beautify the indoor environment, but also bring different visual feelings to people. In the digital information age, people have to accept a huge amount of information every day, most of which are image information obtained by human beings through vision, so images are important

information carriers for human beings to perceive the world [2]. In the study and use of computer vision, picture segmentation is frequently the initial stage. This phase plays a very crucial part in the overall processing process, hence it is essential to get it right. The accuracy of picture segmentation has a significant impact on the outcomes of future image processing tasks such as target detection, target recognition, image recognition, and scene analysis. Because of this, the study of image segmentation algorithms is extremely important to both image analysis and image processing [3]. Image segmentation is the process of splitting an image into many sub-regions that do not overlap with one another in such a way that the characteristics found within the same sub-region share certain commonalities while the features found within other sub-regions display clear differences [4].

The use of color is an important part of interior design, which not only impacts people's vision, but also has a certain regulating effect on people's mood and spirit. In architectural design, the use of color has become the most basic ability of a designer [5]. The application of indoor color elements has a great relationship with the function and use of buildings, which is greatly reflected in traditional buildings. However, in modern architecture, the structure and decorative elements of houses are in various forms. Apart from living, houses have more functions, and many styles are derived. With the continuous improvement of chemical technology, chemical products have also replaced the traditional wood and metal, become an important element in interior decoration, and become more abundant in color application [6]. In the interior decoration of modern buildings, rational use of color elements can effectively improve the layering of indoor space and bring psychological and spiritual changes to residents.

While the existing system may make use of human color selection or fundamental color matching techniques, the proposed system will utilize picture segmentation for the purpose of color matching. The suggested method is a more sophisticated and data-driven technique that is capable of analyzing the color properties of interior photos and picking

optimal color combinations based on those analyses. The suggested system is able to extract color information from interior photos by applying image segmentation. This enables the proposed system to do more exact color matching based on genuine visual cues. Homeowners, interior decorators, and interior designers can all benefit from the suggested method since it provides a more advanced and effective instrument for choosing color schemes that will result in aesthetically beautiful and well-coordinated interior spaces.

## II. METHODOLOGY

### A. Research on image segmentation method

Image segmentation is a fundamental work in computer vision and serves as a preprocessing step for a variety of computer vision-related activities, including image identification, scene analysis, and object detection [7]. It is common practise to refer to the difficulty of segmenting images as the "vertex segmentation problem" of a graph. The standard procedure involves mapping the image to be divided into multiple segments into a weighted undirected graph.  $G=(V,E)$ , where  $V=\{v_1,\dots,v_n\}$  is the set of vertices and E is the set of edges, as shown in Fig. 1.

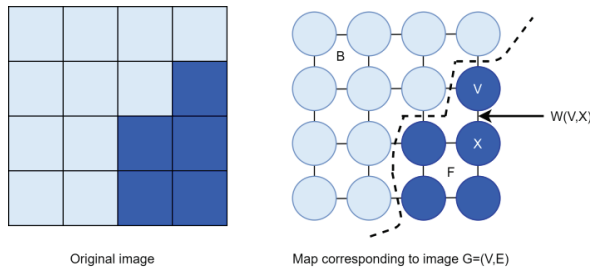


Fig.1 Image to graph conversion

Conventional picture segmentation algorithms include threshold, border detection, and region [8]. Depending on the classification method, image segmentation involves classifying a single pixel. First, support vector machine, logistic regression, and neural network classifiers are trained on the labelled image. After the trained classifier classifies the input image pixel by pixel, the image segmentation result is obtained [9]. Threshold segmentation segments images by region. It is central to many picture segmentation algorithms because to its intuitive theory and straightforward implementation [10]. Threshold segmentation is ideal for photos with large grayscale changes between target and background. Using threshold segmentation can decrease the image's data by converting it to a binary image of 0 and 1, making image processing easier and clearer. Assuming that the grayscale histogram shown in Fig.2 corresponds to an image,  $f(x,y)$  can easily see from the figure that the image is mainly composed of two types of pixels, one of which has a relatively large grayscale and the other has a relatively small grayscale.

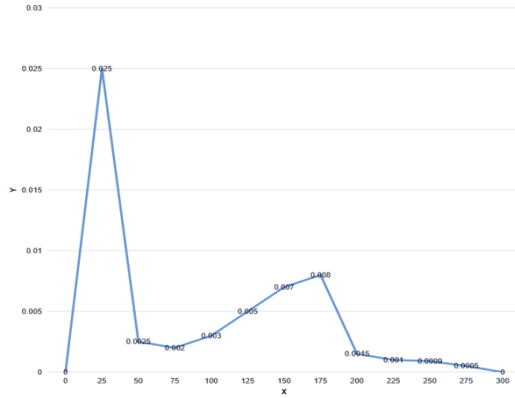


Fig.2 Gray level histogram

Assuming that the gray scale range of an image is  $[1,2,\dots,L]$ , remember  $n_i$  is the number of pixels with gray scale I, and n is the total number of all pixels in the whole image, then  $N=n_1+n_2+\dots+n_L$ . The probability distribution of the image is expressed by the normalized gray level histogram formula:

$$p_i = \frac{n_i}{N}, p_i \geq 0, \sum_{i=1}^L p_i = 1 \quad (1)$$

Suppose there is a threshold K that can divide all pixels in an image into  $C_0$  and  $C_1$ , where the gray scale range of  $C_0$  is  $[1,K]$  and that of  $C_1$  is  $[K+1,L]$ .  $\omega_i$  is the probability of class I,  $\mu_i$  is the average gray level of class I, and there are:

$$\begin{aligned} \omega_0 &= \Pr(C_0) = \sum_{i=1}^K P_i = \omega(k) \\ \omega_1 &= \Pr(C_1) = \sum_{i=k+1}^L P_i = 1 - \omega(k) \end{aligned} \quad (2)$$

For the given values of  $X_n$  and  $\mu_k$ , J is a linear function of  $r_{nk}$ , and the sample points  $X_n$  are independent of each other, so it is only necessary to divide all the sample points into the nearest cluster center, namely:

$$r_{nk} = \begin{cases} 1 & \text{if } k = \arg \min_j x_n - \mu_j^2 \\ 0 & \text{otherwise} \end{cases} \quad (3)$$

Thus, the two-stage optimization problem is iterated until it converges. Therefore, the realization process of K-means is the process of the following two steps: (1) data allocation. According to Euclidean distance, each data point is assigned to the nearest cluster center; (2) Update the cluster center. Recalculate the mean of all new data points in the cluster to get a new cluster center [11].

In the graph cutting method, in order to obtain better segmentation effect, it is usually necessary to construct a complex cost function, and the time complexity of the algorithm is high, which is difficult to meet the requirements of real-time application. In view of this situation, people put

forward the SEEDS algorithm [12]. SEEDS algorithm first generates an initial segmentation in advance; Then, by moving the boundary between adjacent image blocks or exchanging pixels in adjacent image blocks, the segmentation boundary is constantly modified to obtain the best effect. Its cost function includes two items, which represent the color density distribution item of image block and the penalty item of local irregularity of segmentation boundary. The cost function is optimized by hill climbing method, and the solution is updated by finding the minimum local change in an iterative way. The experimental results show that the algorithm runs fast and has excellent performance. The image segmentation module sends the input image to the trained network model for image segmentation, and outputs pixel level [13]. Classify the label map, then post-process the image and optimize the label. In graphics, using open operation can remove smaller discrete pixel blocks, so in our system. The segmentation accuracy is basically not affected or only very low when the segmentation result of the network model is processed by open operation. Under the condition of small influence, better segmentation results can be obtained in visual effect. Fig.3 is the flow of image segmentation.

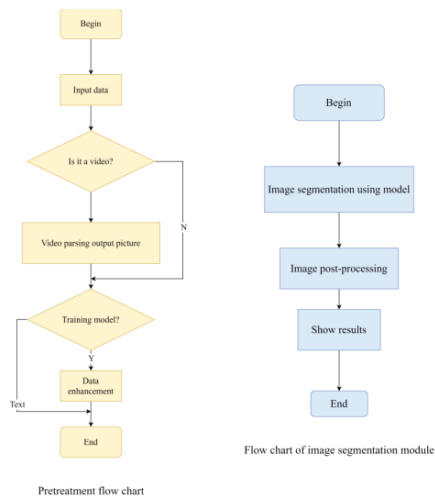


Fig.3 Image segmentation process

For images with complex scenes, SLIC segmentation does not fit well with the boundary. To solve this problem, people have improved SLIC, which is called SLIC0. The improved algorithm can adaptively select the optimal compactness parameters, and the segmented superpixel blocks are compact and effective. The essence of SLIC algorithm is to apply K-means algorithm to superpixel clustering. As we all know, the time complexity of K-means algorithm is  $O(NKI)$ , where  $N$  is the number of pixels in the image,  $K$  is the number of clusters, and  $I$  is the number of iterations. In SLIC, each point only needs to operate with up to eight points around it, and the number of iterations is constant, so the time complexity of SLIC algorithm is  $O(N)$ , and SLIC algorithm can generate compact and nearly uniform superpixels.

A compilation of photographs of interior spaces, such as living rooms, bedrooms, kitchens, or workplaces, all of which are of a very good quality and reflect a variety of different design styles and color schemes.

Information about the color palettes that were utilized for the interior photographs, including the RGB or HEX values associated with each color that was displayed in the image. Masks or annotations that identify and segment different sections in the interior photos, such as the walls, furniture, floors, and various objects of decor, are called segmentation tools. Annotations or labels that indicate how the color palettes used in the interior photographs are compatible with one another or how harmonious they appear to be. Metadata identifying the interior design style or subject of each image, such as modern, classic, or minimalist, amongst a variety of other possible descriptors. For the purpose of comparison and evaluation, background knowledge or recommendations relating to color theory and the principles of color harmony may be useful.

### B. The Importance of Reasonable Color Matching of Interior Decoration Materials

The color matching of decoration in interior design is of great significance. In interior design, the color matching of decoration is a very critical part, which has an important impact on the promotion of ieq. Usually, the cost is low, which can effectively improve the indoor environment and make the whole space rich in layers [14][21]. The influence of color on people's physiological function is mainly related to people's visual and psychological association. The stimulation of different colors to people is different in speed, strong or weak, and the psychological reflection of people caused by vision is also different because of individual differences [15]. It should also be noted that when the colors are matched, if they do not conform to the overall indoor structure, the indoor environment will become disorderly and have a certain negative impact. Scientific decorative color matching can not only bring people a sense of visual beauty, but also create a warm and comfortable space environment for the occupants, so that the occupants can always keep a good psychological state [16].

People's psychological feelings are mainly through receiving external information, perception of people, and feelings after processing information [17]. Color plays a very good role in people's sensory transmission. It can be said that color can represent people's emotional and psychological changes, and the same color will have different psychological effects on different people. Different colors bring people different visual experiences and natural psychological feelings. In interior design, people are good at using different colors, thus creating a unique mood of life. People can design and adjust according to their own preferences. Usually, the cool color makes people feel cold and calm, while the warm color makes people feel warm and full of vitality, and it also has a strong visual impact, as shown in Fig.4.

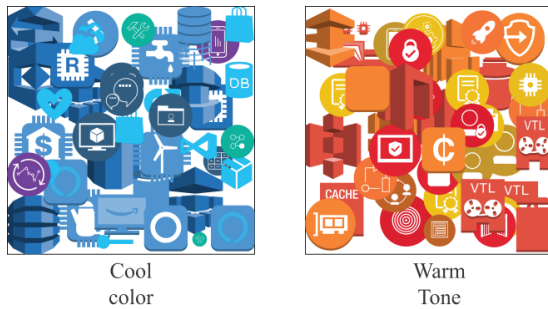


Fig.4 Comparison of cold and warm colors

People's psychological effects on color mainly come from the direct impact of human physiology due to the light stimulation of color. Each color has its own unique performance value, which will affect people's psychological function by stimulating their visual senses [18][22]. Thus, color can reflect a kind of psychological state and spiritual civilization, and this psychological reaction will be influenced by people's different life experiences, associations, habits, nationality, literacy, age and personality. The rational collocation of colors in interior design can also have psychological effects on people. The cultural connotation and theme of interior decoration can be realized through the rational collocation of colors, thus changing people's psychological feelings about the decorated interior space [23].

People's perceptual cognition is based on the material environment, and the use of color in the material environment will also affect people's perceptual cognition[30]. Such as a bright red room, people will have a feeling of excitement and happiness; On the contrary, the room is full of black and earthy tones, which makes people feel depressed and depressed[29]. Because of the influence of this color collocation on indoor residents. When choosing color collocation, we should carefully choose according to the color function, so as to create a good atmosphere. Different from the distribution of architectural space, different building area and different room uses, the use of architectural color will have a certain impact. Color can regulate indoor space, so when choosing color matching, the function and orientation of the room should be fully considered [24]. The interior color collocation mainly emphasizes the characteristics of different colors and many colors that are consistent with colors. Only in this way can we find a reasonable color collocation and complete design[28]. The psychological adjustment of color can be brought into play in interior decoration design, and the physiological adjustment of color can be brought into play in interior decoration design[26]. According to different personal preferences, different color matching can be selected in the process of interior decoration. According to the functions of different rooms, there are also differences in color matching skills. A simple analysis of the classic collocation scheme: The color collocation of the living room should ensure comfort, pleasure and entertainment, and attention should also be paid to the orientation of the room. If the room is facing west, the temperature is relatively high, so it is not suitable to use warm colors indoors. For example, red, yellow, red and yellow will give people oppressive feeling such as sweltering heat. But if you use

water blue and green, you can feel comfortable. Restaurant. Considering the appetite of residents, it is necessary to use warm colors, such as orange, pink, warm brown, etc. Bedroom color matching can be decorated according to one's hobby of color [19]. The rest environment is dominated by warm and warm colors, mainly by softness and calmness, with warm and bright colors to present a soft atmosphere[27].

Usually, people's love for color is not determined by the hue of color, but by the adjacent colors and the area contrast between them[26]. We live in a world of colors, and colors have both positive and negative effects. Usually, people will have a special psychological reaction to a particular color, and the color symbol, color hobby, color association and color memory will have various effects on people's lives. These effects are usually the accumulation of people's life experience or the ideas and impressions formed by colors, etc. These accumulations, ideas and impressions have a very significant impact on people's body and mind [20].

### III. RESULT ANALYSIS

In view of this phenomenon, our analysis may be caused by the following reasons: when distinguishing the background similar to the target object, the model needs more data samples to learn the difference between the two. If the background change does not appear or rarely appears in the training set, it will be difficult to distinguish the background from the similar target, resulting in missing points or wrong points, which also exposes the problem of insufficient generalization ability of the model.

In the comparative experiment, we chose as the comparison the published Seg Net model and the Unet network model, both of which had a good influence on the Cam Vid data set. The results of the comparison are presented in Fig.5 of the accompanying figure. Six of the eleven types of DC-Unet models are superior to Seg Net, whereas nine of the eleven types of DC-Unet models are superior to Unet. Among these, the categorization of bicycles, traffic signs, and poles has seen tremendous development and improvement. It should come as no surprise that these three categories have a single trait: a focus on specific, granular goals. The incorporation of void convolution and leaping connection into the DC-Unet model is largely responsible for the significant progress that has been made by the model with regard to the aforementioned classification. These two operations are designed to extract rich and multi-level information in order to make the model more sensitive to the specifics of the targets. As a result, it is suitable for use against more manageable targets. [25].

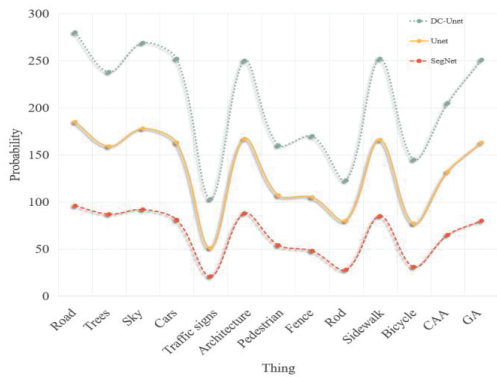


Fig.5 Comparison results of network models

As can be seen from the figure, the DC-Unet model performs better in detail segmentation and has a better segmentation effect on the small part of the target, including more target edges. In the segmentation result of Unet model, the smaller part of the segmented target will be identified as the background. It shows that the void convolution increases the receptive field, and the extraction and fusion of more scale features can improve the effect of image segmentation, especially in the tiny details segmentation.

#### IV. CONCLUSIONS

Color plays a very important role in interior decoration, and modern people's interior decoration needs are constantly changing. As designers, we should constantly study and explore modern people's interior decoration needs, and then make scientific and reasonable collocation. Reasonable interior space design is not only beautiful and practical, but also can give people a sense of physical and mental pleasure, calm and relax their mind and body after proper color decoration. Looking at the development of image segmentation in recent years, in actual segmentation tasks, it is necessary to flexibly select segmentation methods according to different application scenarios, and some even need to combine various segmentation methods to obtain the best segmentation results. With the continuous development of segmentation technology, the application of image segmentation in computer vision tasks is more and more extensive, and the accuracy and speed of segmentation have also been significantly improved. Follow certain color design principles, reasonably introduce color elements, and determine specific color design styles according to architectural space functions and users' preferences. Moreover, designers should follow artistic principles, reasonably apply artistic elements in the process of architectural interior decoration, scientifically match various colors, improve the aesthetics of indoor space, and realize the effective combination of artistic elements and architectural interior decoration design. Through the scientific application of color elements, we can build high-quality architectural interior decoration projects, further play the important role of color elements, cater to users' aesthetics, meet the design standards of users' needs, and provide continuous power for the overall development of the architectural field..

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