Application Research of Color Design and Collocation in Image Processing

Feiying Xia[1] **and Shenghong Huang**[2]*

[1] *Art Academy of Shaoxing University, Shaoxing 312000, Zhejiang, China*
[2] *Applied Technical School, Jiaxing University, Jiaxing 314000, Zhejiang, China*

Color is one of the primary elements of artistic expression. Its design and collocation play a very important role in image processing. While the number of people using the Internet is increasing, more attention is being paid to the user's experience including the color design and matching of the Internet web interface, in order to reach the color design of the web interface with image processing as the core. This thesis firstly discusses the importance of web interface color design and matching in image processing from the image processing appeal of the web interface and the color characteristics of the web interface. Secondly, through a simulation experiment, the characteristics and emotional color of the web interface colors are analyzed. The function of interface color design and the application of the web interface color design, color matching and color emotion are summarized. This paper discusses the concept of the web interface color design with image processing as the core, provides theoretical guidance for implementing color design for web interface designers and related parties, and provides content for further exploring the color design of web interface in image processing.

Keywords: color design; WEB interface; color matching skills; image processing; color emotion

1. INTRODUCTION

Color is a clever thing, and the most amazing thing about it is that people have instinctive reactions to color without being taught anything about color theory. Color is used in all human activities. Especially in works of art, color comes from nature which is the source of colors.The properties of color result in a complex color system theory. At the same time, because color can be subjectively perceived and understood, color has emotional characteristics and perceptibility. When taking into account social and human factors, color also has regional and cultural significance. Therefore, how best to use color, plan and integrate all aspects of its attributes and features, and then apply it to the design according to local conditions is particularly important. A good color experience is a process in which the user perceives the essence of the color, and feels satisfied both physiologically and psychologically. A good color experience

requires a well-considered mix of applied theory and includes practice systems as a support. Color matching is the best way to achieve the ultimate goal of color design.

Based on the problems in image processing and the importance of in-depth discussions, many research teams have conducted research on image processing and formed a complete theoretical system. Deng (2019) designed an automatic coal unloading control system for impeller coal feeders based on image processing, this system can realize the self-setting of the operating range and operating frequency of the impeller coal feeder, and complete the automatic unloading of coal. Zheng and Zhan (2017) designed and developed the embedded image processing system for both hardware and software, and applied it to an intelligent identification system for security products. The security identification system of the security inspection machine can quickly and efficiently identify all kinds of contraband;this greatly improves the efficiency of security inspection and achieves the goals of reducing staff and increasing efficiency.

---

*Corresponding author (Email: 1359416089@qq.com)

Niu, et al. (2019) introduced machine vision technology into the magnetic particle crack detection of the spherical storage tank, and using MATLAB software applied the image processing of the image captured by the acquisition system to realize the detection and observation of spherical tank cracks despite a complex image background. The automation of realizing the magnetic particle crack detection of storage tanks has immense practical value. Qi and Wang, et al. (2019) designed a set of signal processing simulation systems based on the MATLAB GUI for students to learn abstract and difficult to understand concepts in the "Digital Image Processing" course. System parameter adjustment is flexible, the system is easily expandable, and the results can be converted into a stand-alone .exe executable file, which does not rely on the MATLAB environment and is therefore convenient for assisting in teaching. Guo and Chen (2019) selected the 4C video image as the object of subsequent development in order to realize the image recognition of the pillar number. The algorithm of HOG feature extraction and the SVM classifier was used to capture the position of the pole number card, and then the pillar accordingly. According to the characteristics of the pole number card, the method based on Opency pole number recognition is proposed, and the recognition software is designed by MFC. Through the visual interface, the fault time picture is retrieved for identification. Finally, the system automatically derives the fault time lever number to achieve the purpose of fault location. Li, et al (2019) adopt a pixel filtering method, based on OpenCV technology, which eliminates the shortcomings of traditional methods, and implements the dynamic addition of Chinese characters in video image time, title and various other logging parameters. The method is simple in algorithm, high in efficiency, small in data volume and good in effect. Wang, et al. (2019) show that SNN-P has a very low time complexity when compared with traditional clustering algorithms. Experimental results show that SNN-P has good recognition ability for facial images. Xu and Zhang (2019) proposed a rapid simulation method based on image processing to realize the realistic simulation of the appearance of plush fabrics, analyze the basic laws of the light and dark changes of the plush fabric, realize the simulation of colored plush fabrics and display its simulation. Ou, et al. (2019) and others studied a new ship operating state monitoring technology, and introduced video image processing technology, by first collecting the ship operating state information, and then processing the ship operating state information through the extracted video image features, before finally displaying the ship operating status information results. Liu (2019) designed a computer vision display system based on the ARM processor. The simulation results of the system are analyzed and obvious errors are corrected. The system device is small in size, low-cost, wide in angle of view, high in resolution and strong in human-computer interaction. Liu, et al (2019) found that when acquiring high-frequency details, by adjusting the weights to obtain details, or by adopting a simpler high-frequency detail cut-off processing method, the enhancement algorithm can be effectively improved. Xu, et al. (2019) realized a set of laboratory access control intelligent management systems by using LabVIEW face image detection and recognition technology combined with 51 single-chip control technology. The system can accurately realize face image collection, analysis and recognition, automatically

open and close the door, and record the entry and exit of personnel; this meets the intelligent management requirements of the laboratory access control system. Wan (2019) and Tsai, et al. (2014) performed an in-depth study of GPU graphics processing algorithms to summarize the main algorithms of graphics processing in the GPU running process in order to fully exploit the characteristics of the GPU and the practical application in machine vision processing. Chen, et al. (2019) and others used image processing methods to study the on-line mixing uniformity of pesticides. They foundit is feasible and intuitive to analyze the influence of the structure and the performance parameters of the mixture on the mixing effect. Wang et al. (2019) used the idea of a level set to construct a C-V model to minimize the energy function used to perform image segmentation on a given road image. It is optimized by mathematical morphology to fill the void area inside the target to solve the problem of unclear road trajectory in the image.

Although research on image processing technology is not uncommon, domestic and foreign research teams have their own unique insights, and due to their limitations, the intensity and depth of research is limited. In this context, it has become important to study the application of color design and collocation in image processing.

Many research teams have analyzed and researched color design and matching from various aspects Liu (2019) applied color design to interior design, fully considering the functional principle, conforming to the composition principle, and combining the building materials to improve the sense of indoor space. The use and matching of indoor colors vary from person to person, and the matching methods that can be used include the monochrome matching method, similar color configuration method and the contrast color matching method. Yin (2018) applied color design to interior decoration design, and found that the indoor space can be effectively adjusted by color to highlight the characteristics and personality requirements of the owner. Liu and Zhao (2018) applied color design to the decoration of the elderly's old-age environment. This was done through analyzing the indoor color situation and color attributes, investigating the physiological and psychological feelings brought by color to the target audience, summarizing the principles of color application, and studying the space to be decorated from the perspective of color design. Feng (2018) studied color design matching in mechanical drawing, and adopted the shortest distance error correction algorithm (MSD algorithm) to design the color matching and color fusion; this improved the fusion ability of color matching and output the peak signal noise of mechanical color design pattern. Lei (2018) focused on the design principles and design steps of urban sculpture color, providing a reference for designers to grasp the harmonious relationship between colors in urban sculptures during their design. Shi (2018) conducted a study on color design matching in Chinese restaurants, and found that the Chinese dining space needs to grasp the design principles of color in line with its catering culture and philosophy, so that the Chinese dining space has its own cultural charm. Yang and Lu (2018) applied color design to the design of the online store system, and proposed an appealing store color system, which is an important feature for enticing consumers to like and then purchase from the online store. Therefore, to design an online

store, the first step is to determine the color system of the store to ensure that it is appealing to consumers. Ning (2018) proposed that designers can selectively use color matching to effectively improve the quality of industrial design. In industrial design, designers should adhere to the principles of simplicity, image and innovation. Fu (2018) proposed that, from the aesthetic elements, the color aesthetics law should be introduced into the color design of the interior space of subway cars, and the color design of the interior space of the modern subway was designed with color balance, color harmony and the symbolic meaning of color as the core starting points. Wang (2018) applied color design to the car manufacturing process, introduced the color design process of the car interior, and then introduced market research, color scheme verification and color in the car interior color design process in conjunction with the actual project.

This paper firstly expounds the outline of web image processing color design and web image processing color element analysis. It is used as the basis for the analysis of the pre-design theory of visual color design of the web interface. It aims to explore the essence of the user's visual experience. In this essence, according to the design principle, the new interactive exploration of web image processing color design is carried out, and the past plane is extended to the interactive web image processing color design thinking. Then through the simulation experiment, the explanation of color psychology, the user's perception of color psychology and the application of visual color in the interface design, the principle of application of visual color psychology and user psychological perception and visual color in interface design is integrated into the web interface. Through the application analysis of visual color design in web image processing, a new method and new idea is provided for the difficult problem of web image processing color design research.

2. METHOD

2.1 Digital Color Mode

(1) RGB color mode

RGB color mode is a lighting mode and is also the color mode used by most electronic devices, such as scanners and televisions. When browsing the Internet using the web interface, color must pass through the display to the user. The color of the display belongs to the light source color, and it is derived from the superposition of different brightness ratios of three basic colors: red, green, and blue.

(2) Bitmap mode

This is also called monochrome mode. It is the simplest mode among digital color modes. The image in this mode consists of black and white areas. The number of colors is 1, that is, each pixel can only be black or white.

(3) Gray mode

Gray mode uses 256 variants of gray, from the color value 0, which means pure white, to the color value 255, pure black. Each number in between is used to represent a shade of gray. Gray mode and color mode can be directly converted.

(4) CMYK color mode

CMYK is a color mode that relies on reflection. It is the impression of color generated by sunlight or light shining onto an object, and some of the spectrum is absorbed and the rest reflected to the human eye, subtracting the absorbed colors from white light. This color mode is usually used in the field of color printing. The CMYK color mode simulates color experienced in real life and is characterized by its true appearance. Compared with the RGB color mode, its color gamut is relatively small, the displayed color brightness is not as high and the saturation is low.

(5) HSB mode

HSB represents Hue, Saturation and Brightness. The HSB mode is based on the colors that human vision can see. It is much easier to use RGB or CMYK modes than to use HSB for color grading. Only some color drawing software use this color mode.

(6) Lab mode

The Lab mode is a digital color model published by the International Lighting Commission (CFFI) in 1931. Rather than converting directly from RGB to CMYK, Lab color mode is used as a middle step. The reason it is used is that Lab's color spectrum includes both the color spectrums of RGB and CMYK. At the same time, the Lab color is independent of the color of the device and is not affected by the performance and features of any particular hardware.

2.2 Angular JS Framework

Angular JS uses the traditional MVC pattern (Model-View-Controller), which makes it easy to layer the application development. In other words, it is an MDV (Model Drive View) framework, a single-page application (SPA) that drives data view changes. As shown in Figure 1, a model represents an object that stores data, and its state. The change is notified by the controller; the view represents the data visualization; the controller acts on the view and the model, can control the data state of the model, and can update the view according to the change of the data stream. Model view decoupling has been reduced, which has also reduced much of the tedious logic processing for the application development.

2.3 Access Database

Software developers and data architects can use Microsoft Access to develop applications that "advanced users" can use to build software applications. Like other Microsoft Office applications, Access supports the Visual Basic macro language, an object-oriented programming language that can reference a variety of objects, including DAO (data access objects), ActiveX data objects, and many other ActiveX components. Visual objects are used to display tables and reports. Their methods and properties are in the VBA programming environment. VBA code modules can also declare and call Windows operating system functions.
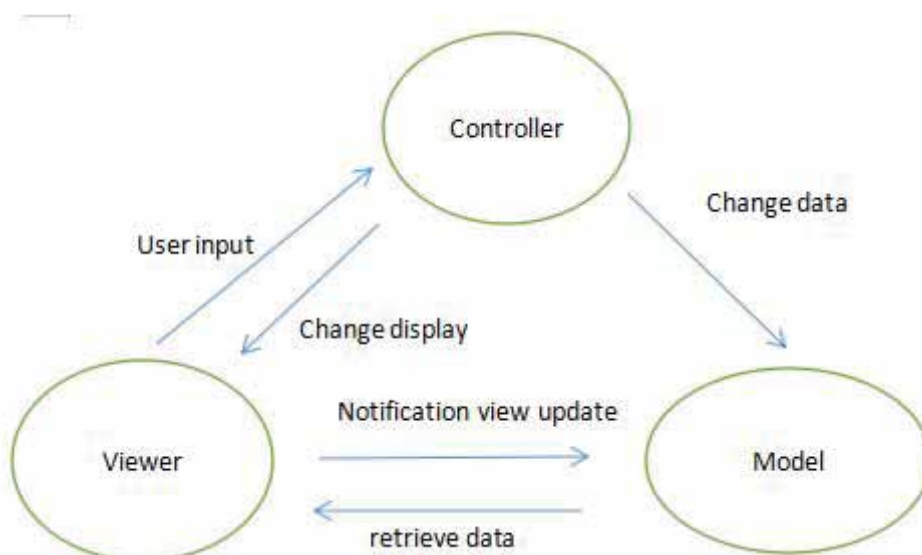
Figure 1 Angular JS MVC Model.

When used for data analysis Access has powerful data processing and statistical analysis capabilities, and it can easily perform various summary and average statistics by using the Access query function. For example, in the statistical analysis of hundreds of thousands of records and above, Access is much faster and easier to operate than other applications in the Microsoft Office suite such as Microsoft Excel. This is reflected in the fact that Access will be used to improve work efficiency and work ability.

2.4 YUV Joint Correlation and Image Autoregressive Model

The algorithm utilizes the YUV joint correlation of the image, that is, the local geometric feature structure similar to the luminance and chrominance image. It is considered that the luminance image pixel can be represented by the linear weighted combination of its neighboring pixels, and the same pixel of the chrominance image can also use the same neighbor. The domain combination relationship is represented and the linear weighting coefficients employed are similar to the luminance image.

A model that linearly weights neighborhood pixels to represent a central pixel is called an autoregressive model. Suppose that in the luminance image Y, the luminance value of the current pixel point r is Yr, it then satisfies the autoregressive model:

$$Y_r = \sum_{i=1}^{m} w_{ri} Y_{ri}$$

Where Yri is the neighborhood luminance value of the current pixel r. Similarly, for the pixel point r in the chroma image, the autoregressive model is also satisfied:

$$U_r = \sum_{i=1}^{m} w'_{ri} U_{ni}$$

Where Uri is the neighborhood chrominance value of the current pixel r. According to the YUV joint correlation, the autoregressive model of the pixel of the same position of the luminance image and the chrominance image is similar, that is, the weighting coefficient wri and wri' of the autoregressive model are similar for the luminance value and the chrominance value of the same pixel. Therefore, a known algorithm can be used to obtain the luminance weighting coefficients of all pixels by using a known luminance image, the chrominance image is then obtained, and the pixel weighting coefficient of the chrominance image is known and combined with some known chrominance values. The chrominance values of all pixels are therefore obtained by color diffusion.

3. EXPERIMENT

3.1 Angular JS Builds the Framework

TO begin the HTML code first in the <html> tag, an ng-app identifier is used to indicate that this is an AngularJS application. This ng-app identifier will cause AngularJS to auto initialize the application. The <script> tag is then used to load the AngularJS script: <script src="angular-1.1.0.min.js"></script>. By setting the ng-model attribute in the <input> tag, AngularJS will automatically double-tune the data. This new ng-model feature of the input box makes it easier for developers to implement the field validation features common in CRUD applications. The data comparison is relative to the chart.In the chart, this feature can help users find the different attribute value comparisons of the several genes they wish to see. Finding a fixed point using a search function is a feature that can be used in a large number of gene data tables and charts. Similar to the lookup in EXCEL, a gene or attribute value is known, found in a large range of data, and tagged. The next function calls an external procedure, specifying a null value for each parameter.

The next step is creating an XMLHttpRequest object that implements a refresh-free commit of color design collocations via AJAX technology. AJAX is an acronym for Asynchronous JavaScript and XML. AJAX consists of HTML, JavaScript,
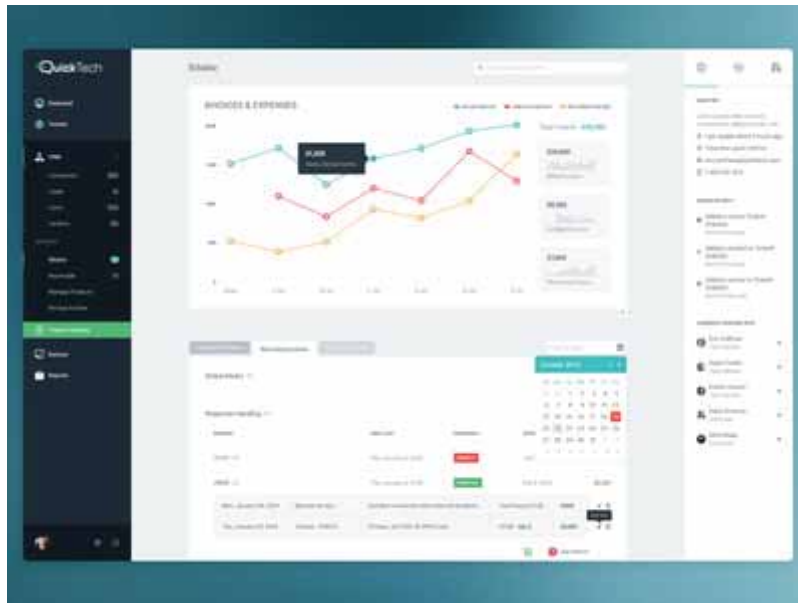
Figure 2 Web user interface.

DHTML, and DOM, which allows the browser to provide a more natural browsing experience for users.

3.2 Access Database Passes Null Pointers to Dynamic Libraries

An empty 32-bit pointer is either a valid value or requires some parameters for some dynamic link libraries. To specify a null value, a 0 is used. When a function calls a procedure and passes an expression with the value of 0, "&" specifies a 32-bit null pointer. In the function declaration, an ASANY parameter instructs AccessBasic not to perform type checking on that argument and pass the value to the called function. An AccessBasic function must be declared that passes a null pointer parameter to a procedure in a dynamic link library. The data bar of the system menu option is mainly used for data operations. Adding data means that the import of source data is directly imported from an external source, and no manual input is required. If there is missing data, it can be added directly and the filter can be run again. Data analysis mainly gives the reason for screening results. It is based on what is used to screen the representative genes. At this time, it is necessary to display the main numerical values in the screening process, such as classification accuracy and correlation.

3.3 Web Interface Design

(1) Web user interface design

The web user interface design consists of three parts, namely structural, interaction, and visual design.

1. Structural design is also called conceptual design and it is the skeleton in the web interface design. An overall architecture developed after research and specific task analysis is required. Paper-based low-fidelity prototypes provide user testing and refinement. User operation and understanding are important prerequisites for text definitions and logical classifications in the directory system.

2. Interaction design has the main purpose of web interfaces that can be used easily by users.

3. Visual design is based on the structure of the planning case provided by the interaction designer or planner, from the perspective of creativity and aesthetics, including color, layout, font, content and so on. The ultimate goal of visual design is to achieve a pleasant user experience.

3.4 Web Interface Color Matching

(1) Two-color matching

Color matching starts with the recognition of two colors, rather than with a single hue. Business cards can be used as an example to analyze the conclusions applied to the web interface color design as they are very simple flat carriers regardless of the occupation or the industry of the business card holder.

(2) Adjacent color matching

Each pair of colors has a unique visual experience. In the process of color matching, matching a higher purity color with a low purity or low brightness color can lead to unexpected results in the final image. When the power of color interaction is adjusted, there is a primary and secondary relationship between the colors and the effect is naturally harmonious.

(3) Interval two-color matching

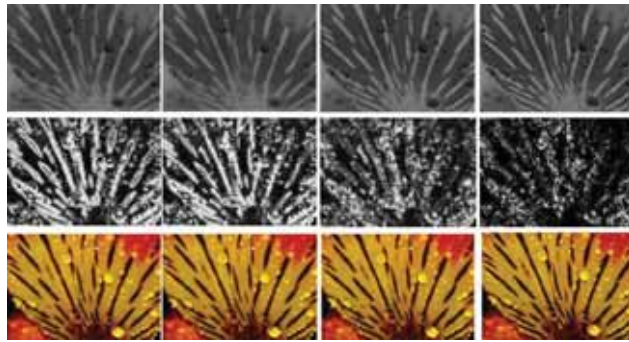The spacer color is also called the analog color. These names are judged by the position of the color within the

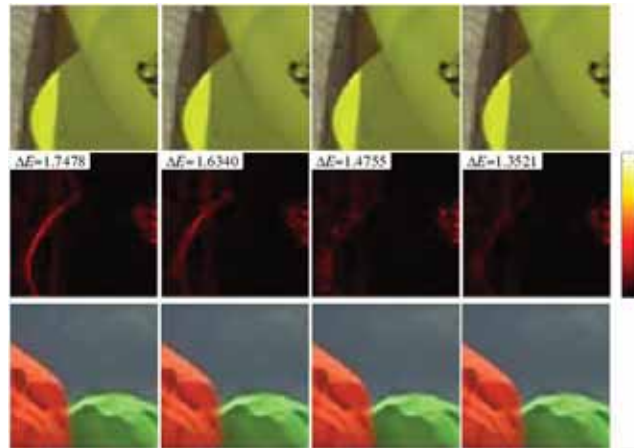**Figure 3** Partial Experimental Diagram.

Figure 4 Partial Experimental Image.

color circle. Color combinations are referred to as two-color matching unless they are an adjacent or contrasting color. In the case of red, orange, yellow, green, blue, purple, and magenta, red with yellow, orange with green, yellow with blue, green with purple, blue with red, purple with red are all a match of two colors.

Figure 3 is a partial experimental diagram.

4. RESULTS

4.1 Color Design With Image Output

A super-resolution reconstruction algorithm based on sparse representation obtains a high-resolution luminance image YH that is magnified 4 times. The low-resolution image to be reconstructed is obtained from the high-resolution color image known in the experiment by blurring and down-sampling. The blur filter is a Gaussian low-pass filter with a window size of 5×5 and a variance of 2. The GFCSR algorithm proposed in this section will be compared with the results of the bi-cubic interpolation algorithm, the Liu algorithm and the Huang algorithm. The CIEDE2000 metric will be introduced to obtain the color difference map of the reconstructed color image and the original high-resolution color image, display it with the "hot" color bar (colorbar), calculate the average value of the color difference map under the standard, and record it as E. Figure 4 shows some of the images used in the experiment (color matching color image).

4.2 User Color Preference Analysis

Despite color being described as objective, each user experiences color differently due to the slight differences in their vision. Figure 5, a survey report provided by KISSraetrics, clearly shows that both men and women are more interested in blue and green, possibly because it is the most common color in nature; both men and women find orange and brown the least favourable. The difference is that more men prefer black when compared to women, more women prefer white when compared to men.Considering the results of the survey males and females have very different color preferences . Therefore, when choosing a color scheme, the designer should consider the primary users of the site to make the correct choice.

The characteristics of the target user group will have a major impactin the color choices made by the designer. Users have different aesthetic preferences and understanding of color. Color psychology can be used to determine the aesthetic understanding and preferences of the target group.

5. DISCUSSIONS

According to the statistics, in addition to black, white, red and yellow, other colors will be applied to the webpage during the design process, and these other colors play different roles. For example, green is a neutral color, containing yellow and blue components. In the context of the Internet era, the choice and matching of web interface design colors is of great significance,
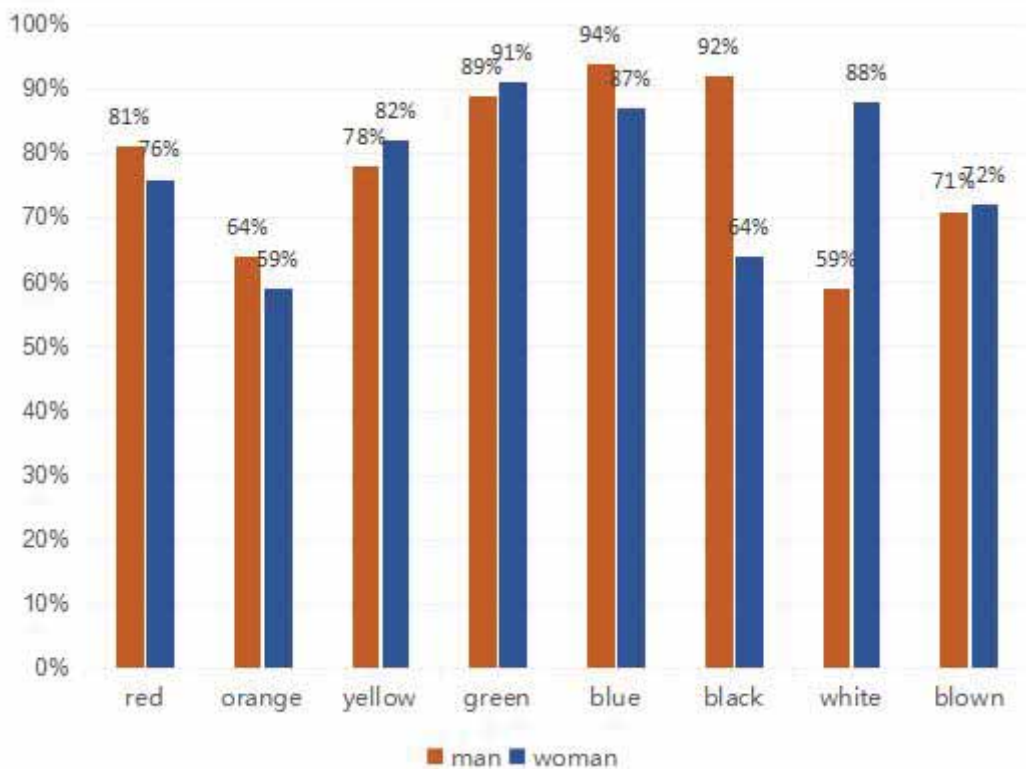
Figure 5 Data Chart.

as they can effectively enhance the user experience and promote web design. Therefore, at this stage of the web interface design, the color should be reasonably selected, in order to effectively improve the appeal of the web interface and promote the healthy development of the website.

6.   CONCLUSION

With the rapid spread and development of Internet network technology, online media has transformed from an exciting new thing to an ordinary information communication tool. Most of the web sites with strong technical support, rich visual effects and versatility are currently available. More and more web interface designers, industry insiders and participants have begun to pay attention to image processing effects and psychological feelings for users. At the same time, there is a higher level of demand for the color design of web interface designers and related industry designers, that is, image processing is mainly used for web interface color design.

IN the color design of a web interface, color choice needs to be based on color theory, and designers need to have keen observation and rigorous analytical powers, rather than designing using their own feelings. Color design is the key to the success of the web product interface.

REFERENCES

1. Chen, J., Zhang, M., & Xu, Y. (2019) Analysis of Pesticide In-line-mixing Uniformity Based on Image Processing Technology. *Journal of Agricultural Science and Technology (Beijing)*, 21(3), 85–93.

2. Deng, Z. P. (2019) Image Control Based Impeller Coal Feeder Control System. *Electronic Technology and Software Engineering*, 06, 85–86.

3. Feng, D. H. (2019) Study on the Optimization of Color Parameters in Mechanical Product Design. *Machinery Design & Manufacturing Engineering*, 47(06), 87–90.

4. Fu, L. (2019) Study on Color Design of Interior Space of Subway Car Based on Aesthetic Elements. *Journal of Suzhou University*, 33(03), 88–91.

5. Guo, R., Chen, T. L. (2019). Recognition of Contact Network Pillar Number Based on Image Processing. *Journal of Hunan Institute of Engineering (Natural Science Edition)*, 29(01), 18–21.

6. Lei, Y. L. (2018) Analysis of the Principles and Steps of Urban Sculpture Color Design. *Drama House*, 1–2.

7. Li. G. H.,Wang, L.,Li, X. H. (2019) Optimization of Downhole Video Image Processing and Chinese Character Addition. *Journal of Xi'an Shiyou University:Natural Science Edition*, 34(02), 123–126.

8. Liu, C., Zhao, W. (2018) Color Analysis of the Living Environment of the Elderly Living at Home. *The House of Drama*, 12, 1–5.

9. Liu, H. L. (2019) Image Processing Technology Based on Computer Vision Algorithm. *Computer and Digital Engineering*, 47(03), 672–677.

10. Liu, L. S. (2019) Research on the Application of Color in Interior Design. *Computer Age*, 05, 94+164.

11. Liu, Y.,Yu, J. H., Gu, Z. Q.,Chen, X. F. (2019) Research and Application of an Improved Enhanced Image Processing Algorithm. *Laser & Infrared*, 49(03), 381–384.

12. Ning, Y. Y. (2018) The Use of Color Composition and Visual Psychology in Industrial Design. *Art Science and Technology*, 31(03), 142.

13. Niu, Z. (2019) Chen Jize, Huo Ping. Study on Magnetic Particles Detection of Surface Cracks in Spherical Tank Based on Image Processing. *Mechanical Engineering & Automation*, 02, 150–152.

14. Ou, L. Q.,Wang, H. Y.,Luo, X. D.,Li, P.,Liu, W. (2019) A Ship Surveillance Monitoring Technology Based on Video Image Processing. *Ship Science and Technology*, 41(06), 169–171.

15. Qi, Y, Q, Wang, Y. J. (2019) Design of Image and Video Processing Simulation System Based on MATLAB GUI. *Experimental Technology and Management*, 36(03), 146–149.

16. Shi, J. (2018) Study on the Application of Color Design in Chinese Restaurant Space. *Journal of Qiqihar University (Philosophy and Social Sciences)*, 04, 142–144.

17. Tsai, S. B., Lee, Y. C., Guo, J. J. (2014) Using Modified Grey Forecasting Models to Forecast the Growth Trends of Green Materials. Proceedings of the Institution of Mechanical Engineers, *Part B: Journal of Engineering Manufacture*, 228(6), 931–940.

18. Wan, B. (2019) Research on GPU-based Image Processing Calculation Method. *Thoughts of the Think Tank*, 11, 239–240.

19. Wang, L. (2018) Color Design Flow and Application of Automotive Interiors. *Machinery*, 45(01), 76–80.

20. Wang, X. W., Zhang, X. Y., Shi, H. B., Song, D. C., Li, B. L. (2019) A Road Image Processing Method Based on C-V Model and Morphology. *Computer Age*, 03, 49–52.

21. Wang, X., Liu, X. Y., Gu, F. (2019) Shared Nearest Neighbor Clustering Algorithm Based on P System and Its Application in Facial Image Processing. *Laser Journal*, 40(03), 74–78.

22. Xu, Q., Zhang, C. Q. (2019) Simulation of Plain Plush Fabric Based on Image Processing. *Light Industry & Technology*, 48(03), 61–64.

23. Xu, W.,Zhang, C.,Ai, W. Q. (2019) Design of Laboratory Intelligent Access Control Management System Based on Image Processing Technology. *Journal of Changshu Institute of Technology*, 02, 48–51.

24. Yang, Y., Lu, Y. D. (2018) Color System Design of Online Shops. *Modern Communication*, 06, 128–129.

25. Yin, J. (2018) The Use of Color Hard and Soft Clothing in Interior Decoration Design. *Home*, 12, 70–71.

26. Zheng, D. D., Zhan, Y. (2017) Research and Application of Intelligent Identification System for Security Products Based on Embedded Image Processing System. *Intelligent Computer and Application*, 1–4.

Feiying Xia was born in Ningbo, Zhejiang, P.R. China in 1978. She received her Bachelor's degree from the Zhengzhou University of Light Industry, P.R. China. She currently works at Shaoxing University. Her research interests include printing art design and package design. E-mail pingzest@163.com

Shenghong Huang was born in Shuangyashan, Heilongjiang, P.R. China in 1975. He received his Masters Degree from the Harbin Institute of Technology. He currently works at the Applied Technical School, Jiaxing University. His research interests include new media advertisement design and graphic design. E-mail 303325473@qq.com