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Research Article

Digital Art Pattern Design Based on Visual Material Colouring Intelligent Programming System

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With the continuous enhancement of computer technology, digital technology brings more convenience to people with its powerful functions. After the digital technology is applied to the design field, it greatly expands the creative space of art design. In the digital age, fabric printing and dyeing design needs to be combined with digital technology under the guidance of art theory. Traditional flat patterns can no longer satisfy people's pursuit of visual illusion patterns with a sense of space and three-dimensionality. The use of computer representation can realize the innovative artistic design and can directly generate various highly creative visual images in the computer according to the theme and creative needs. We input the digital data related to the fabric, such as graphics, photographic photos, logos, fonts, and textures, into the computer and then use various application software to perform various special effects on them to produce creative, unique, and surprising picture effects. In the aspect of exploring the meaning of the theme, the application of spatial expression means is studied, and practical research is carried out to guide the design of works with spatial beauty and creativity. In view of the neglect of artistic design, on the basis of studying the space art expression of traditional printing and dyeing process patterns, the traditional space art expression is combined with computer image processing technology. And special techniques are used to create differences in various textile fabrics and garments. We use the software of digital art design to carry out the artistic creation practice of spatial expression. Through the application of computer software functions, combined with the guidance of spatial expression techniques, the design comparison of patterns is carried out, which provides design practice ideas for the integration and innovation of traditional printing and dyeing technology and modern design. The implementation of the visual material colouring programming system reduces the coupling between artists and programmers and reduces the coupling between art collections and producers. The colouring program in the process of art pattern development improves the efficiency of art design.

1. Introduction

The role of patterns in clothing design is huge. As the famous British pattern designer Olan Kelly said, patterns are a huge visual treasure in his design [1]. Patterns can not only decorate and beautify clothing but also entrust the designer's emotions and ideas in this "art of life," which contributes to the fashion design. People continue to create new patterns from changing surrounding things or life scenes, from simple geometric patterns to complex flower and bird patterns, from local patterns to world patterns, and from hand-dyed patterns to digital printing patterns [2]. With the continuous development of society and the textile and apparel industry, the content and style of clothing patterns are becoming more and more abundant, the subject matter is more and more extensive, and the application methods are becoming more and more diversified [3]. Although the emergence of the new pattern is a new design, it has not completely departed from the old pattern. As the Norwegian scholar Lars Schwenderson wrote in his book "The Philosophy of Fashion," "the cycle time of fashion has been in the past 50 years. It began to accelerate rapidly [4]. There is no doubt that, at such a high rate, no one has the ability to create a truly new style. It is more to organize the elements of

the past fashion in a different pattern and reappear. Many classic pattern elements are always brought back into people's field of vision by designers after a circle, and they are loved and pursued by people of this era with a new fashion look [5].

The richness of patterns has made the appearance of clothing more and more personalized and diversified, and it has also brought more inspiration to designers [6]. At the same time, the storage and management of a large number of patterns has also become a difficult point. As far as the existing patterns are concerned, they involve a wide range of types, with characteristics such as relevance, intersectionality, similarity, and ambiguity [7]. It is difficult for designers and clothing pattern-related staff to use a single channel for pattern reference and accurately find patterns that can be used for reference [8]. Even if the patterns are found, they only exist in image format. It is difficult to further understand other detailed pieces of information about the patterns. Most of the patterns are grasped by personal experience [9]. Especially for the grasp of colour, some designers' patterns and colour matching are too perceptual, and they ignore the limiting factors of clothing pattern colours, making it difficult to realize the pattern in actual production or the realization effect and the design effect be quite different [10]. This causes a waste of resources and personnel and also makes the production cycle of clothing products longer, which brings losses to the enterprise [11]. Therefore, it is particularly important to effectively manage the pattern information so that it can be better applied to clothing [12]. At the same time, the advancement of science and technology has brought more opportunities for the development of art, and computer technology has increasingly been integrated into various fields of clothing development, making it continue to develop informatization and digitization. In the field of clothing design, computer graphics have replaced traditional paper and pens. Drawing software has brought more convenient tools to designers, greatly enriched the design space, and enhanced the communication between designers and producers [13].

Use computer technology to digitally process some characteristic classic patterns in clothing and categorize them to establish a database, add information descriptions to the patterns, and establish a digital colour matching scheme, which can realize the integration of massive clothing pattern information, enabling designers and related pattern staff to have a better grasp of the pattern, be more targeted when designing, and be more convenient and quick to use, thereby improving the efficiency of resource use, improving the efficiency of production design, launching products with market potential, and bringing greater benefits to the enterprise. This subject is based on this in order to meet the actual needs of enterprises for the design and production of clothing patterns. Starting from the concept of database system platform design and construction, according to the overall structure and application requirements of the database system, it analyzes the characteristics of patterns from the perspective of clothing and combines patterns. The two characteristics of "shape" and "colour" systematically classify and digitally process patterns; considering that colours can make patterns more vivid and trigger designers' inspiration, we further carried out digital colour matching work on related patterns to form colour matching examples; editable files are provided at the same time so that designers can also adjust the colour matching of the pattern in combination with the colour of the clothing during specific colour matching and finally complete the preliminary establishment of a clothing pattern database platform that comprehensively manages pattern information and colour information.

This paper analyzes the structure of the graphical development system, emphatically discusses the design and implementation of programming tools, and gives the overall design scheme. The operating mechanism of the application program is studied, and the data structure to realize the general data link is designed. This paper expands creative thinking with the help of digital technology, analyzes the problems existing in fabric pattern design, and discusses how to use computer technology for artistic creation to realize the combination of localization and modern design.

2. Pattern Feature Analysis and Attribute Definition

The ornamental nature of clothing patterns comes from the decorative nature of the patterns themselves. Pang Xunqin, a famous painter and arts and crafts artist in my country, believes that "the purpose of patterns is to design the decoration of all utensils." As a common feature of all patterns, decoration determines the meaning of patterns and is the most important feature of patterns. In ancient my country, due to the rule of feudal emperors, the use of colours in civil life was restricted [14]. The types of colours that can be used on common people's clothing were few. People used printing and dyeing methods to turn a single colour into a pattern to decorate clothing to make up for it. There was a lack of aesthetics in clothing [15]. Among the clothing patterns, the "articles" to be decorated by the clothing patterns are the clothing itself, and the human body is beautified through the decoration of the clothing, which is the ornamental nature of the patterns. The decoration of clothing patterns requires patterns to be designed in conjunction with human body parts, body shape, characteristics of human activities, and so on to set off the beauty of the human body and conceal the defects of the human body. Fibrousness and craftsmanship originate from the main dependence of the pattern itself. At the beginning of the design, the clothing pattern is more like a painting, and its final value is reflected in the clothing itself. It can exist alone, but its greater significance lies in its decorative effect on clothing. Combining different fabric characteristics and craftsmanship, the pattern finally shows a unique appearance on the clothing, which is also the biggest difference between the clothing pattern and other patterns. At the same time, fiber and craftsmanship are also an important factor that restricts clothing patterns. Some patterns look beautiful, but they are not necessarily suitable for use in all clothing. The limitations of some craftsmanship on patterns will affect the formation of patterns. Therefore, clothing fabric fiber

characteristics were combined with pattern production process characteristics. Design and production of clothing patterns can ensure that the patterns can have more practical meaning in clothing. The modernity of patterns is closely related to the technical means of pattern formation. The development of production levels in each era promotes continuous changes in the creation of clothing patterns. Advances in science and technology have led to more and more technical means of pattern generation, and different technical means have formed.

The main content of the clothing pattern database is to manage patterns so that users can browse and quickly find the patterns they need [16]. To realize these functions, the patterns should be sorted first and stored in the database according to certain rules. According to the principle of database construction, this chapter analyzes the composition characteristics of patterns and considers the convenience of users to define pattern attributes. Under normal circumstances, when searching for a pattern, people will first use a more prominent feature in the pattern to describe the pattern. For example, the clothing pattern in Figure 1 has obvious subject characteristics. Set the search term as "flower pattern," but when the single feature of "flower pattern" cannot accurately describe the pattern, other descriptive features need to be added to further describe the pattern and narrow the search range, and the pattern can be further described. Described as a "flower embroidery pattern," the pattern is described from the content and pattern formation process, thereby narrowing the search scope. Therefore, the reasonable division of pattern categories can help users find patterns more clearly, quickly, and accurately. In addition, when people are browsing patterns and see the characteristics of various categories of a pattern, they can also use this as a design reference to avoid the unavailability of the pattern in actual production, thereby improving the design and production efficiency.

Colour expression is a presentation of different colours produced in the colour matching of patterns, and it is also an important element that constitutes a pattern. The colours of clothing patterns can generally be divided into main colours and auxiliary colours [17]. The main colour determines the overall colour appearance of the pattern and is an important influencing factor of the pattern style. It largely determines the first impression of the pattern and determines the pattern and availability of clothing of specific colours. The auxiliary colour is the starting point to embellish the role of decoration, making the clothing colour more layered and richer. The main and auxiliary colours affect the colour appearance of the pattern together. Whether it is from the "shape" aspect or the "colour" aspect, the pattern is described in order to make the pattern attribute expression more specific. Therefore, according to the constituent elements of the pattern, the attributes are specifically set, which involves the description of the characteristics of the pattern itself. Attributes include content subject matter, composition shape, composition method, organization form, expression form, source application, cultural attribution, colour registration, and colour expression. The attributes involved in the description of patterns and wearing characteristics include realization methods, decorative parts, fabric matching, and the relationship between the attributes of the pattern, as shown in Table 1. The patterns often present different ornamental appearances, such as hand-dyed patterns and digital printing patterns, which are the products of patterns in different eras, reflecting the characteristics of the patterns in different eras.

Colouring ability, also known as colouring strength, is caused by the absorption and scattering of light by dyes. The difference in colouring ability of fabrics will also affect the colour matching of clothing patterns. Fabrics with strong colouring ability can realize patterns with high chroma and high brightness through printing and dyeing, while some fabrics with weak colouring ability will reduce the original chroma and brightness of the pattern. For example, a pattern of the same colour, using the same dye, will be brighter and brighter when printed on silk fabric, while the colour will be relatively dimmer when printed on linen fabric. Therefore, the pattern should be adjusted according to the colouring ability of the fabric when the pattern is processed. For fabrics with weak colouring ability, try to avoid using bright colours when matching colours to prevent inconsistency between the actual object and the design draft due to the colouring ability of the fabric.

3. Digital Model of Art Pattern Colour

Digital colour is the product of the combination of chromatics and information technology. It uses computer technology as a carrier and traditional chromatics as a link to transform people's perception of colour into accurate and specific computer language [18]. Compared with the colour recognized by the human eye, it is more standardized and accurate.

$$L \approx \frac{1 - 1/L + d + N}{1 + 1/L + d + N}. \tag{1}$$

In traditional design, colours are mainly expressed by designers using pigments. The types of colour choices are very limited, and the accuracy is not very high. The emergence of digital colours has enriched the types of colours and made designers more flexible in the application of colours [19]. It improves the colour accuracy of patterns in the design and production process. At the same time, digital colour is used for expression in colour matching, which is also more conducive to the later information processing and conforms to the development trend of design digitization. Commonly used digital colour models include RGB, CMYK, Lab, and HSB. The RGB colour model is a colour model that is synchronized with monitors such as computers and cameras. R, G, and B are red, green, and blue. After mixing in different ways, more new colours will be produced. In the RGB colour model, the colour value range of the three colours is 0–255. The larger the value, the "brighter" the colour. When the three colour values are all "0," the brightness of the colour is the smallest and the colour is the darkest. At this time, there is "black" with no brightness. When the three colour values are all "255," the brightness of each colour reaches the highest. At this time, the colour

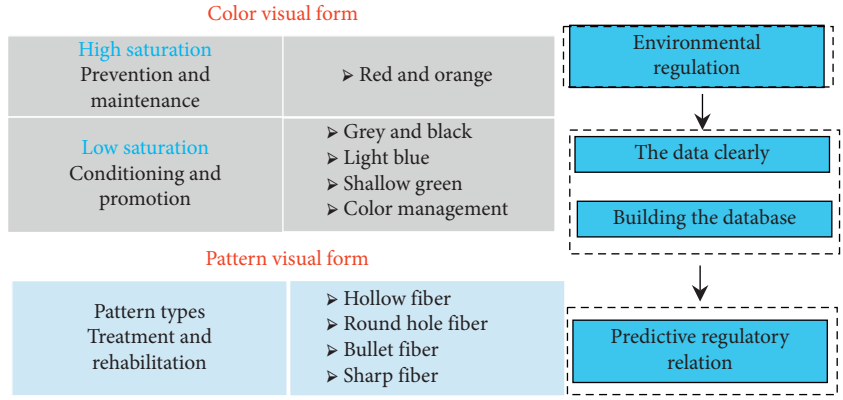

Figure 1: Construction of clothing pattern database.

Table 1: The relationship between the attributes of the pattern.

Feature description	Description	Value
Content theme	Overall colour	2
Make up the shape	Pattern style	4
Composition method	Availability on clothing	2
Organizational form	Embellishment	4
Manifestations	Layering	5
Source application	The colour aspect of the pattern	7
Cultural belonging	Realization method, decoration part, and fabric matching	6

intensity is the largest, and the "white" with the highest brightness appears. When the colour value is "255" and the other two are "0," the colour with the excellent value of 255 is the most saturated state. As the current clothing design is mostly carried out on the computer, designers also use the computer as the platform for pattern browsing and post-design. Therefore, the RGB colour model is first selected to represent the colour values involved in the pattern colour matching.

In the Lab model, the red-green bias of the colour is described by the a value, and the value range is [−120, +120]; the yellow-blue bias is described by the b value, and the value range is [−120, +120]; the black-white relationship is described by the L value, and the value range is [0, 100]. From these three component values, you can intuitively see the visual bias of the colour [20]. For example, when the Lab value is (30, −118, 4), the colour appearance presented can be described as dark green (blackish green). In addition, the colour value in Lab mode can also be used to evaluate the degree of colour difference:

$$\Delta E = \frac{\left[(a_2 - a_1)^2 + (b_2 - b_1)^2 + (c_2 - c_1)^2\right]^{1/2}}{\tilde{a} + \tilde{b} + \tilde{c}}. \quad (2)$$

Simulated colour matching can also be based on the colour matching of some existing classic patterns as a reference. The life cycle of classic patterns is usually very long, which shows that the public accepts them better, especially some traditional patterns. The combination of colours not only is popular with the public but also can reflect the cultural characteristics and profound connotation of the pattern. Therefore, the colour is also called the characteristic colour of the pattern. When simulating the colour matching of characteristic colours, because the combination of characteristic colours is not one way, the colour matching group can be generated by changing the colour position, adjusting the area of the colour area, and so on. The generation of the colour matching group changes the appearance of the pattern but will not change the colour. The conveyed cultural aspect still exists, so when the pattern colour is processed, its characteristic colours can be extracted for digital restoration and combined to form a new colour scheme population and provide designers with colour schemes that can reflect the cultural connotation of the pattern and also ensure the overall pattern. There will be no big deviations in the colour matching, which helps some inexperienced designers to better grasp the pattern colour matching. When performing primary colour peeling, there are two ways to obtain the digital colour of the pattern. One is to use a colour measuring instrument to measure the colour, and the other is to use the colour picking tool in the relevant drawing software to absorb the colour.

$$dE = \frac{\left[(a_2 - a_1)^2 + (b_2 - b_1)^2 + (c_2 - c_1)^2\right]^{1/2}}{d\tilde{a} + d\tilde{b} + d\tilde{c}}. \quad (3)$$

The former is aimed at physical patterns, such as patterns in fabrics and printed matter, and the latter is mainly aimed at electronic patterns in computers. Instrument colour picking refers to the use of related instruments to measure colour and obtain colour values. The colour value measured by the instrument is relatively accurate and can express

colours according to multiple colour systems. Its biggest limitation comes from the limitation of the measured colour area. The colour measurement of the instrument generally introduces the colour through the aperture for evaluation. Therefore, if the target colour area is smaller than the aperture area, other colours around the target colour will be mixed in, which will affect the final measurement result. In this study, the characteristic colour measurement instrument used KONICA MINOLTA's CM-2500d handheld portable spectrophotometer. The system uses a ring-shaped illumination method with uniform area illumination, which can reduce the measurement direction, sample location, measurement location, and other factors to measure the influence of the result, which can realize the measurement of irregular curved surfaces, including the colour measurement of different texture surfaces or directional distinguished surfaces. It can be used in the colour measurement of fabrics, coil coatings, printed products, solid-state spraying, and other fields.

$$\begin{aligned} P &= e^{-2\pi T^2} \\ &= e^{-2G}. \end{aligned} \tag{4}$$

The wavelength range is 360–740 nm, the resolution accuracy is 10 nm, and the observation conditions are 2°/10° field of view (CIE 1931/2°; CIE 1964/10°). In order to avoid fogging, the measurement temperature is controlled at about 20°C, and the instrument measures colour aperture diameter is 8 mm.

$$P\{X = m\} = A_N^m \left(\frac{2}{L+d}\right)^m \left(1 - \frac{2}{L+d}\right)^{N-m}. \tag{5}$$

In this pattern, there are three characteristic colours. Among them, there is one background colour, and the area is the largest, so it is the main colour of the pattern (the colour with the largest colour area in the pattern is set as the main colour of the pattern), and the area of the other two colours is smaller as the auxiliary colour. In the main colour measurement, in order to ensure the accuracy of the measurement, three different measurement points are selected for colour measurement, and the average value is taken as the final colour value of the measured colour. The colour value is entered into the computer in Lab mode, and the main colour is taken from the sample. It can be seen from the Lab value graph that the colour has a reddish, yellowish appearance, and low brightness (Figure 2).

For the characteristic colour of the pattern, by changing the colour position (area) when matching the colour, more colour matching schemes can be obtained to form a colour matching group:

$$Q_n^m = \frac{n!}{(n-m!)}. \tag{6}$$

The human body itself is a kind of symmetrical balance. The sense of balance can often make people feel stable and comfortable. Otherwise, it can be disturbing. The colour of the pattern should also be adapted to the sense of balance of the human body to bring a comfortable visual experience.

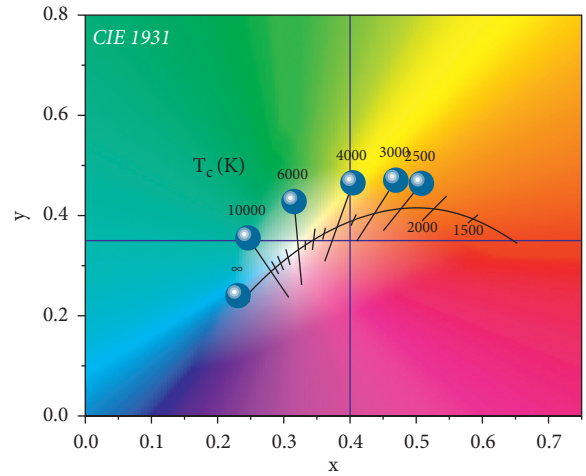

Figure 2: Lab colour value analysis of digital colour.

$$P(n) = \frac{(\lambda t)^{n+1} e^{\lambda t}}{n!}. \tag{7}$$

Colour balance requires correct handling of the relationship between the area of the pattern colour area and the colour when matching colours, achieving the variability, space, and layering of colour matching without violating the principle of balance and avoiding too messy and rigid colour matching. In its colour harmony theory, the component ratio of colour attributes is summarized as follows:

$$\frac{A \times \text{Pur}}{B \times \text{Pur}} = \frac{\text{Area}_B}{\text{Area}_A}. \tag{8}$$

4. Database Construction

Conceptual structure design refers to the information modeling of the real world through the description of the data, conceptualizing the characteristics and connections of the clothing patterns in the real world, constructing the clothing pattern information model, and finally storing it in computer language [21]. It is the link between the real world and the computer world (Figure 3). When designing the conceptual structure of the clothing pattern database, it is mainly carried out by establishing an ER (Entity-Relationship) data model.

According to the analysis of the requirements and functions of the clothing pattern database, the design of Table 2 and the rules for the fields in it are set as follows.

Information display is divided into basic pattern information display and colour matching information display. The basic pattern information display includes pattern picture information and pattern text information [22]. The pattern picture information is used to display the shape and appearance of the pattern. The text information is used to describe the characteristics of the pattern, including the characteristics of the pattern itself (content theme, expression form, composition method, organization form, source application, composition shape, and cultural ownership), pattern taking characteristics (implementation method,

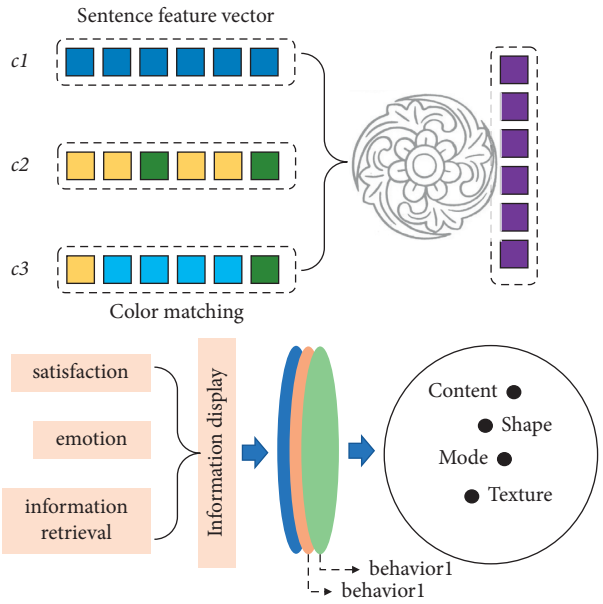

Figure 3: Conceptual structure design.

decorative parts, fabric matching, and remarks information), and pattern management personnel-related information (enter and entry date). The colour matching information is composed of colour matching picture information and colour matching text information.

When entering the basic information of the pattern, the system defaults to the date of the day for the "entry date" option; when entering the colour matching information, the colour matching number is automatically input by the system, adding "mc" to the corresponding pattern number. For example, when the pattern number is "0100001." The system default colour matching number is "mc0100001," which is to make the colour matching better match the pattern [23]. The number of auxiliary colours can be increased or decreased according to the specific situation of pattern colour matching, and the system can automatically calculate the colour register value according to the number of auxiliary colours. When there are n auxiliary colours, the system calculates the colour register value as $n+1$.

5. Results and Analysis

5.1. Analysis of Intelligent Distribution Results. This paper takes 50 test cases to test the functions of the visual material programming system for the above four different use cases and check the correctness of the results. The following is a test case and its test results in each type of use case set in the test results. The specific content of the test case is the node control on the right side of the software interface and the connection method. The detailed test result is shown in Figure 4. The implementation of the visual material colouring programming system reduces the coupling between artists and programmers and reduces the coupling between art collections and producers. The colouring program in the process of art pattern development improves the efficiency of art design.

Table 2: Basic pattern information table.

Field name	Field type	Allow null values	Remark
id	Int(11)	N	Numbering
Image_no	Input(32)	Y	Pattern number
Content	Input(32)	Y	Content theme
Shape	Input(32)	Y	Manifestations
Mode	Input(32)	Y	Composition form
Texture	Input(32)	Y	Organizational form
Culture	Input(32)	Y	Cultural belonging
Method	Input(32)	Y	Decorative part

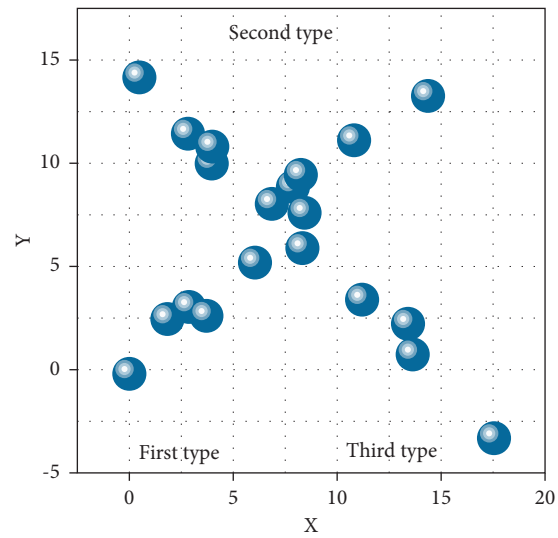

Figure 4: Test case data table.

In a use case of the first type of use case, each node is correctly connected. One of the use cases is that a two-dimensional texture node (Texture2D) and a three-dimensional floating point vector node (Float3) representing red are connected to an addition node (Add) and finally output to the diffuse reflection component of the root node. All subsequent descriptions are the same as the description of the first category. The result is shown in Figure 5.

One of the test cases of the second type is used, and each node is correctly connected. However, the SpecularPower of the root node does not support Float3 data, so it cannot pass the validity connection test. The result is shown in Figure 6. When performing digital expression, based on RGB and Lab models (the former is used for display display, and the latter is used for conversion between different devices), digital colours are obtained through measuring instruments and drawing software, and simulations are provided by combining knowledge of colour science. Combining the above work, the establishment of a clothing pattern database platform was initially completed, and the management of clothing pattern information using a computer database system was realized. The establishment of the clothing pattern management system can complete the browsing, query, update, deletion, and modification of the basic information of clothing patterns and colour matching information and can download related editable files. It provides

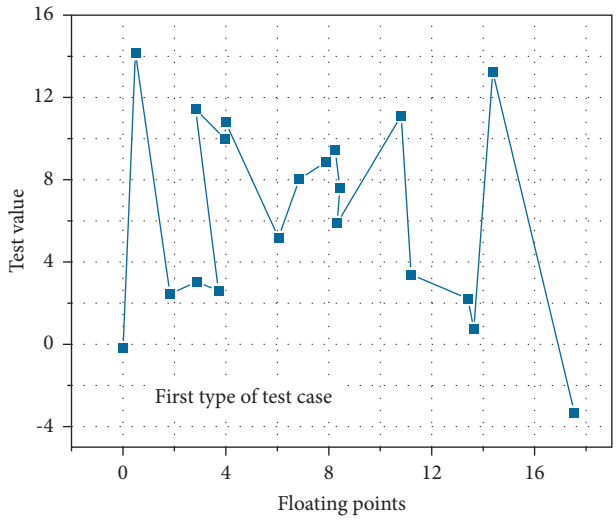

Figure 5: Results of the first type of test case.

users with a professional digital resource platform and also expands research on the knowledge of clothing pattern management.

Innovative colour matching mainly combines the characteristics of clothing patterns and provides new colour matching methods for patterns according to the law of digital colour. Throughout the ages, experts and scholars in the science and art circles have summed up many theoretical laws in the study of colour science, laying a solid foundation for colour research, and pattern colour matching according to relevant colour theory laws will make pattern colour matching easier to conform to the public's aesthetics. People can often distinguish the colours in daily life through observation, but when describing in detail, different observers will give different answers, which makes the expression of colours have certain perceptual factors and many similar colours. It is also difficult to be distinguished. Therefore, colourists have selected three unique physical quantities to describe different colours through research and analysis, namely, hue, lightness, and chroma (purity), which are called the three attributes of colour. The three attributes of colour decompose and describe colours from colour appearance, brightness, and vividness. These three factors are also the most basic elements of colour. Colour matching based on the three attributes of colours can make it easier to match patterns with clothing tones. As one of the three attributes of colour, hue is often the first element that people choose when describing colour, and it is no exception in clothing patterns. When the hue of a certain colour in a pattern plays a dominant role and unifies the overall colour matching, this is the colour matching method dominated by hue. In the colour matching method, where the hue is the dominant colour, the main colour and the auxiliary colour form a different relationship according to the colour law, as shown in Figure 7.

Uniform colour matching refers to colours with the same or similar pattern colours. Because its colour is relatively weak, it is easier to grasp in the pattern colour matching, and the colour matching effect is relatively stable, which conforms to the principle of similarity in colour harmony. Clothing patterns that use uniform hue and colour matching are also easier to produce a sense of harmony when matched with the colour of the clothing body. Hue uniform colour matching can be divided into the same colour matching, adjacent colour matching, and similar colour matching. The same colour matching is also called a single colour matching. The main colour and the auxiliary colour have the same hue, and the colour gradation is enriched by changes in brightness or purity. In the same colour matching, the overall colour of the pattern is stronger, and the sense of unity is stronger, but improper matching can easily produce a sense of monotony.

5.2. Analysis of Experimental Results. Colour contrast type colour matching tends to give people a greater visual impact, and the colour matching effect is more exaggerated. Because of the obvious contrast between the hues, the clothing patterns tend to appear more prominent, and the characteristics are more obvious. However, due to the greater visual impact of contrasting colour matching, when it is not well grasped, the colour matching will lose the sense of visual balance, which is repelling. Therefore, attention should be paid to the relationship between colour area and brightness and purity and the balance of colour. Colour contrast type colour matching can be divided into medium colour matching, contrast colour matching, and complementary colour matching. In the middifference colour matching, the difference between the main colour and the auxiliary colour is obvious, and there is a contrast relationship. Patterns use middifference colour matching, usually showing bright, lively, and full characteristics. This colour matching is at a weaker level in contrasting colour matching, which is easier to grasp and more commonly used. Figure 8 shows the position of the primary and secondary hue of the neutral colour. In the contrast colour matching, the main colour and the auxiliary colour have obvious hue difference. The colour is relatively strong, which makes the pattern more eye-catching and eye-catching. When using the overall pattern colour matching, the auxiliary colour area should generally not be too large; otherwise, it will easily appear gaudy or make people visual fatigue; when using the partial pattern colour matching, the control of the auxiliary colour area can be slightly relaxed.

Hue-led colour matching is a pattern colour matching formed by changes in the brightness and saturation of the colour. It is a general description of the pattern as a whole, often with a certain emotionality, so it can clearly express the style and emotional characteristics of the pattern and also make the pattern style. It can better integrate with clothing styles and reflect the beauty of harmony and rhythm. The determination of the hue is related to the brightness and saturation of the colour. In previous studies, the PCCS colour system published by the Japan Colour Research Institute combined the Munsell and Ostwald systems to divide the colours of the equal hue plane into a variety of tones so that people can use the colour tone style to match colours, as shown in Figure 9. In the computer, tonal division can also be performed.

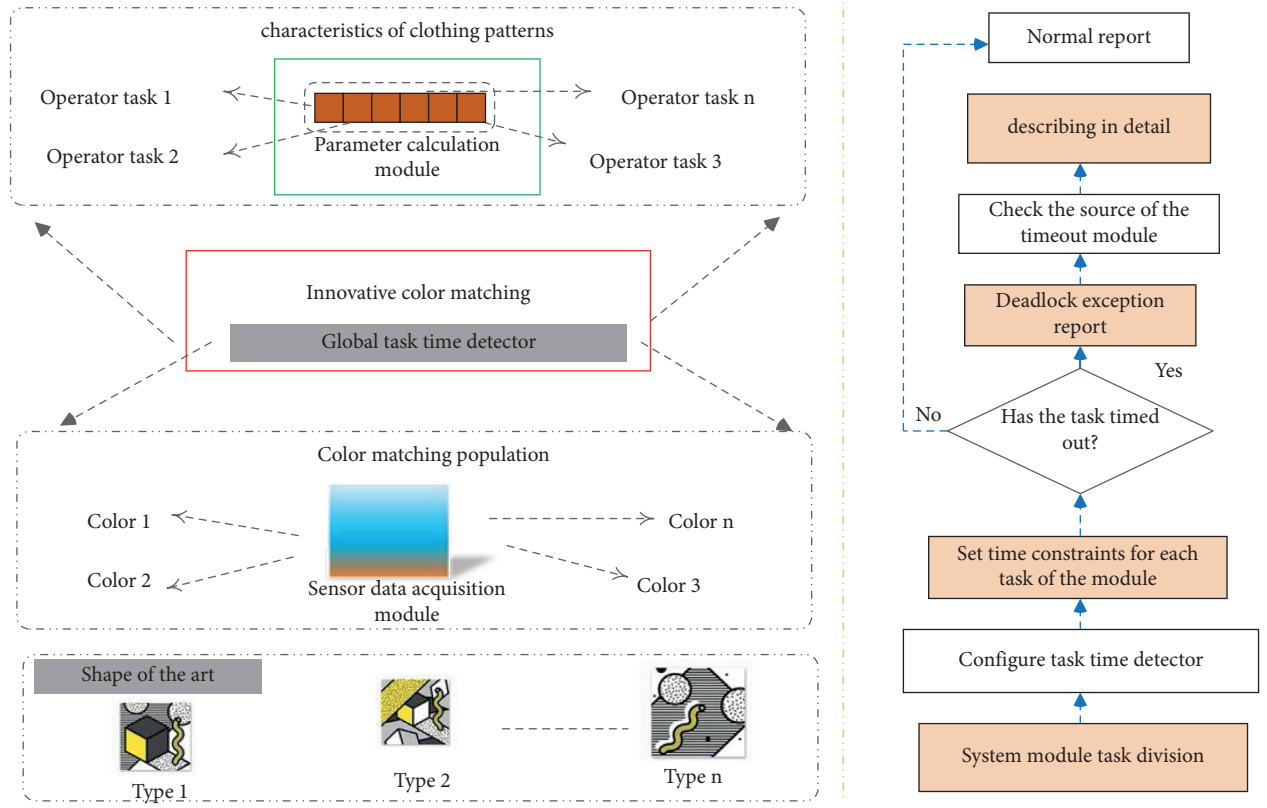

Figure 6: Colour matching population data construction.

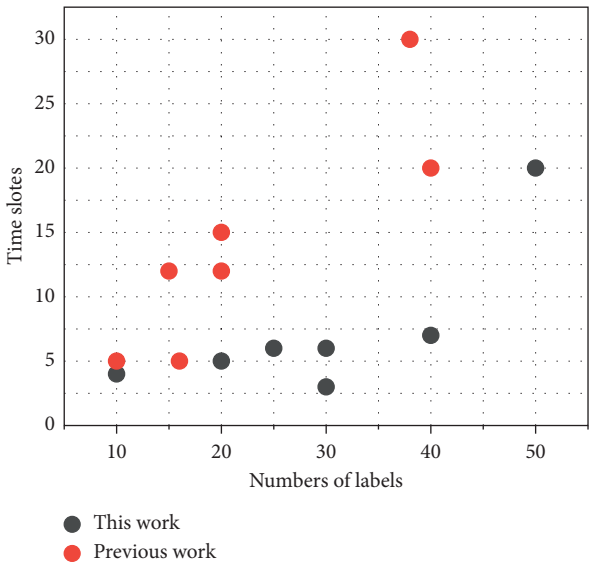

Figure 7: Throughput rate comparison.

In the pure hue area, the high-purity hue chroma is the largest, generally 90% to 100%. The patterns using this hue are colourful and have a bright style. They are extremely eye-catching in clothing and are easy to attract people's attention. However, it is not suitable to be used as a whole during regular use, and the choice of hue should be paid attention to when matching colours; otherwise, it is easy to make people feel vulgar and repulsive. The chroma of the medium pure tones is slightly lower than that of the high pure tones, and the chroma is around 75%, so the visual effect is higher. The pure tones are slightly weaker. The colour matching of the medium pure tones is bright and suitable for youthful and dynamic clothing patterns, especially some patterns in women's clothing. Low-purity tones are medium-purity tones in the area, with chroma of about 50%. Higher-purity and medium-purity tones have a lower vividness and softer colours. The patterns that use tones are generally simple, elegant, and gentle. The light tone is the smallest hue in the area, and the saturation is generally about 25%. The colour matching of this hue is suitable for a light, fresh, and soft style, with a hazy feeling. But it should be noted that the colour matching of light tones is often prone to "pink" due to poor control of the hazy feeling, so pay attention to controlling the clarity of the pattern to avoid bringing a sense of chaos.

The chroma and lightness of dark gray tones are both around 50%. The pattern colour matching effect of this hue is easy to give people a sense of dullness and depression, so it should be used with caution in pattern colour matching. The chroma of midgray tones is around 60%, and the lightness is around 75%. The brightness and chroma are moderate, it is easier to make the colour of the pattern visually comfortable when matching colours, making the picture more harmonious, and it is mostly used in the overall pattern. The colour saturation of light gray tones is about 30%, and the lightness is about 25%. Because of its low brightness, the colour effect is the most hazy in this area. The lightness of dark and dark tones is about 25%. At this time, the change of chroma has a

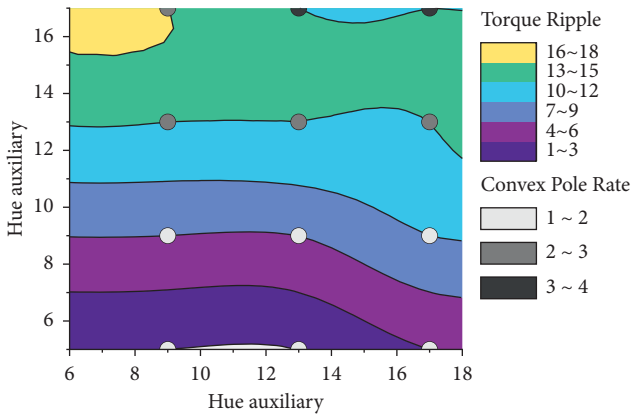

Figure 8: Hue auxiliary pattern composition design.

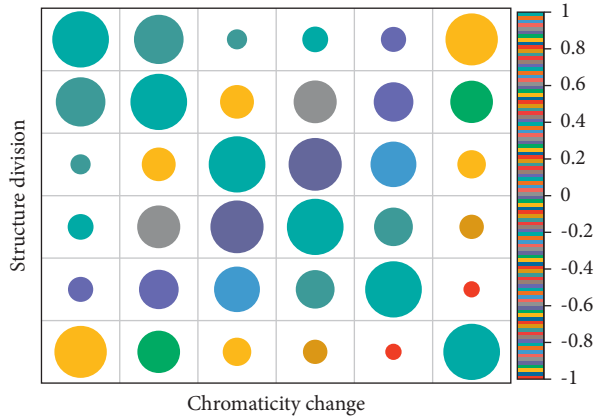

Figure 9: Chromaticity change and structure division.

weak effect on the overall hue, and the chroma can be any value. This hue is the deepest in the dark tone area. When this hue is used, the human eye has low recognizability of the pattern colour division, so it should be used with caution. The lightness of medium and dark tones is around 50%, and the saturation is around 80%. The colour matching gives people a sense of calm and solemnity and is relatively easy to grasp in terms of colour coordination, which is more suitable for the overall pattern colour matching. The lightness of the dim tones is around 75%, and the saturation is between 90% and 100%. The colour matching pattern dominated by dark tones can be used in calm, mature, and low-key styles of clothing. Generally, it is more commonly used in autumn and winter clothing and elderly clothing.

6. Conclusion

This paper is proposed under the background of the current digital development trend in the textile and clothing field, combined with the relevant pattern design knowledge theory to analyze and sort out the clothing patterns, starting from the practical application, discuss the limiting factors of the colour processing of the clothing patterns, and use this as a basis for the analysis. The pattern colour is digitally expressed, and the colour scheme is designed. Finally, relying on the MySQL database technology and the Java EE technology system, the preliminary construction of a clothing pattern database platform with colour matching information is completed. On the basis of the related theories of pattern composition and design, the related characteristic attributes of patterns are studied from the two angles of pattern "shape" and "colour." Among them, the "shape" aspect includes 7 attributes describing the characteristics of the pattern itself, including content subject matter, composition method, expression form, composition shape, organizational form, source application, and cultural attribution, as well as 3 representations such as realization method, decorative part, and fabric matching. The "colour" aspect includes two characteristic attributes that describe the colour of clothing patterns, including colour registration and colour expression. Through the division of these attributes, the pattern information has been further refined. Through the analysis and research of digital colour related theories, the digital expression of pattern colours and the analysis of colour matching ideas are carried out.

Data Availability

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

Conflicts of Interest

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

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