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Computer-Aided Design AND APPLICATIONS

Intelligent Decorative Pattern and Color Optimization Based on CAD and Big Data

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Abstract. This article seeks to investigate the utilization of CAD (computer-aided design) and big data within the realm of intelligent generation and colour refinement for decorative patterns, enhancing design efficiency, fulfilling personalized user demands, and fostering design innovation. Firstly, the research reviewed the basis of colour theory, then analyzed the user's colour preference and market colour trend based on big data, and developed a set of colour optimization algorithms. By introducing intelligent algorithms into the CAD system, the automatic generation of decorative patterns and intelligent colour matching is realized. In order to verify the effectiveness of the method, this article selects three different types of cases: residential interior design, commercial space decoration and public art installation design for empirical research. The implementation results show that the intelligent method significantly improves design efficiency, user satisfaction is over 90%, and remarkable achievements have been made in design innovation. Future research will focus on improving the generalization ability and adaptability of the algorithm, deeply studying the influence of user's emotions on colour preference, and optimizing the collaborative mechanism between the CAD system and big data platform.

Keywords: CAD System; Big Data Collaboration; Intelligent Decorative Patterns; Color Optimization; Design Efficiency
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1 INTRODUCTION

The rapid progress in information technology has established CAD as a crucial tool in decoration design [1], enhancing efficiency and precision through accurate drawing, 3D modelling, and material simulation. This enables designers to respond to market changes and individual customer swiftly needs [2]. However, current practices in decorative pattern design and colour matching heavily depend on designer experience and aesthetics, lacking systematic intelligent assistance. By analyzing a large amount of historical meteorological data, indoor usage data, and passenger behaviour data, big data platforms can identify the impact of sunlight on indoor environments at different time periods and locations, as well as passengers' preferences for lighting, temperature, privacy, and other needs [3]. Colour is an important component of traditional Chinese culture and has high research and utilization value. It was particularly prosperous during the Yuan, Ming, and Qing dynasties, and its most prominent feature was the brilliant and harmonious colours. The core of the colour-matching technique of Yunjin is mainly reflected in the Yunjin colour blending mnemonic. Using image processing technology in conjunction with cloud brocade colour yarn sample cards to digitally extract the colours of each halo, and then using image processing technology to assist in the colour restoration, a systematic cloud brocade colour halo mnemonic and colour halo colour sorting was carried out for the first time. The subjective colour-matching formula of Yunjin colour halo is similar to Western digital colour theory, following their respective colour-matching logic, using colour contrast and harmony to form a good colour-matching effect. However, most of the Yunjin color-blending mnemonics have been lost [4]. The empirical and subjective characteristics of the traditional cloud brocade colour scheme result in a lack of scientific and standardized data research, which greatly limits its application in automatic colour matching. Starting from the study of Yunjin colour halo, collect and sort out Yunjin colour halo mnemonics and colour halo usage, digitize colour reproduction, and then carry out automated colour matching design and application to achieve a new inheritance of traditional Chinese colour culture. Firstly, sample collection was conducted on the Yunjin collection and the physical Yunjin weaving factory to study the Yunjin colour halo. Based on historical materials and literature, an innovative method was used to extract the Yunjin colour halo mnemonic through mutual verification among the three parties. Secondly, the digital colour information of the Yunjin colour halo is placed in the HSB colour space for quantitative analysis, attempting to analyze the colour-matching characteristics of the Yunjin colour halo from the perspectives of colour system, hue, saturation, brightness, and colour-matching methods, and exploring the influencing factors of its colour matching characteristics [5].

For textile products, the first thing that catches the eye is colour, and the colour is also the most infectious. Therefore, colour spun yarn with a soft colour and unique layered style is deeply loved by consumers. A study was conducted on the BP neural network model for hemp grey yarn, and a three-layer colour-matching structure model was established [6]. Training the network with the three stimulus values of the standard sample as the input layer yields good results. On the other hand, in order to conform to the mainstream of today's era, the environmental friendliness of colour-spun yarn determines its promising development prospects. In response to these challenges, some scholars have developed a computerized colour-matching system for colour spinning based on three different color-matching models and the established of a colour-spinning database [7]. Based on the Friele model and the method of determining unknown parameters studied by previous researchers, 100 sets of standard samples with different colour mixing ratios were spun to determine the optimal fixed parameters [8]. Then, 14 sets of samples were randomly selected for validation, and the average fitting colour difference was greater than 1, indicating that the colour-matching results were not ideal. Therefore, based on the visual characteristics of the human eye, different weight coefficients were assigned to the reflectance at 31 different wavelengths, and 36 sets of samples (including the previous 14 sets of samples) were selected for colour-matching calculation. The average fitted colour difference is only 0.2626, and all fitted colour differences are within 1, indicating that the colour-matching results are very good. However, so far, the production of colour-spun yarn still faces the problem of difficult colour matching. The vast majority of enterprises still use manual experience colour matching. This method is not only influenced by the psychological factors of colour-matching personnel, but also has problems such as cumbersome colour-matching processes, low efficiency, and high costs [9]. Firstly, from the perspective of the stereo-matching disparity search strategy, colour segmentation is introduced into stereo-matching technology. A disparity constraint method based on colour segmentation is proposed, and a disparity search strategy of stepwise matching of disparities within a certain range is proposed. This colour segmentation-based step-by-step matching technique not only obtains high-precision disparity maps but also greatly improves the matching speed. Firstly, the mean shift algorithm is used to segment the image, and initial matching is performed using segmentation regions of any size and shape as support windows.

Then, starting from the perspective of stereo-matching similarity measurement functions, the shortcomings of traditional similarity measurement functions that are easily affected by noise and lighting changes were studied. Based on the traditional non-parametric transformation, an improved similarity measurement function under the fusion mechanism is proposed. Firstly, the colour segmentation results are used to calculate the matching cost function based on colour segmentation, then the traditional non-parametric transformation process is weighted, and finally, these two matching cost functions are fused to form a joint matching cost function. The joint matching cost function under this fusion mechanism not only improves the robustness of traditional non-parametric transformations to lighting changes but also enhances the accuracy of disparity matching.

This research focuses on harnessing the synergy between CAD and big data to achieve intelligent decorative pattern and colour optimization, aiming to boost design efficiency, foster innovation, and reduce design cycles and costs while enhancing competitiveness. Big data analytics provide designers with a scientific foundation, facilitating market trend understanding and user need fulfilment. Moreover, this integration promotes design innovation, unveiling novel styles and colour schemes that elevate artistic and practical design qualities.

Ultimately, this study aims to delve into the potential of CAD and big data collaboration in an intelligent decorative pattern and colour optimization. The following are the innovations of the article:

⊖ Combining the precise design of a CAD system with the analysis ability of big data brings a brand-new intelligent solution to the field of decoration design. Through the analysis of big data, users' preferences and market trends can be captured more accurately, providing strong data support for design.

⊜ An innovative intelligent algorithm is developed, which can automatically generate a variety of creative and aesthetic decorative patterns according to user input and style requirements. This algorithm enhances design efficiency while also offering increased inspiration to designers.

⊛ A new colour optimization algorithm is proposed, which can recommend a harmonious colour matching scheme for design works based on the results of big data analysis. This algorithm considers many factors, such as the attributes of the design object, the characteristics of the target user group and the colour trend in the market, thus realizing intelligent colour matching and adjustment.

This article begins by presenting the research background and objectives, followed by a review of colour theory in the second section. The third section outlines the research methods, encompassing CAD systems, big data analytics, and intelligent algorithms. Sections four to six illustrate the application process and outcomes through three case studies. The seventh section provides a comprehensive evaluation of the application's impact, while the eighth section summarizes the findings and discusses future research directions.

2 RELATED WORK

With the rapid development of CAD (computer-aided design) technology and big data, this traditional field is undergoing unprecedented changes. The combination of colour and material plays a crucial role in interior design, which designers often refer to as the 'black box'. Wu [10] extended the design from two-dimensional images to three-dimensional space, achieving more intuitive and detailed design previews and optimizations. The introduction of big data enables us to delve into user preferences, market trends, and colour and material matching patterns in historical design cases. Based on this framework, not only has the principle of furniture pairing been successfully derived, but also the functions of intelligent decorative patterns and colour optimization have been further implemented. Its complexity and diversity make every partner feel like they have embarked on a creative adventure. This study not only focuses on exploring the principles of furniture matching but also further combines the framework of "intelligent decorative patterns and colour optimization based on CAD and big data", aiming to provide more scientific and intelligent solutions for colour and material matching in interior design. Wu et al. [11] developed a new research framework by integrating advanced technologies such as object detection, colour extraction, material recognition, and network analysis. This framework can not only analyze a large number of image datasets (N=24194) collected from online interior design platforms but also utilize the precise modelling capabilities of CAD software. Designers can quickly generate multiple design proposals based on the spatial layout and lighting conditions in CAD models, combined with colour and material matching suggestions obtained from big data analysis. Through data-driven methods, we can extract the unique colour, material, and furniture combination features of each of the eight mainstream interior styles, and calculate their authenticity values to quantitatively evaluate the fit between different matching schemes and expected styles.

In the fast-paced modern business environment, the high dependence of traditional pattern design on manual labour and the limitations of design efficiency are becoming increasingly prominent, making it difficult to meet the rapidly growing market demand. This framework can not only automatically generate image layouts for traditional patterns, but also finely evaluate the quality of the generated patterns through an integrated aesthetic evaluation system. The intelligent decoration pattern and colour optimization solution combining CAD (computer-aided design) and big data technology by Wu and Kyungsun [12] has emerged, opening up new avenues for solving this development bottleneck. On the basis of in-depth research on traditional pattern design, we further explored an intelligent design framework based on adversarial network generation and aesthetic evaluation and closely integrated it with CAD and big data technology. The structural similarity (SSIM) value of its generated patterns is superior to other methods and closer to the ideal value, indicating that the model performs well in terms of aesthetic quality. This rating mechanism not only considers the structural beauty and colour harmony of the patterns but also combines user preferences and market trend analysis to make the generated patterns more in line with actual needs. This achievement not only improves the efficiency and flexibility of traditional pattern design but also provides strong support for the application of intelligent technology in the inheritance and innovation of traditional culture. Meanwhile, the application of CAD technology makes the process of pattern design from concept to implementation more efficient and accurate. Xin and Daping [13] quickly adjust and optimize design solutions in virtual environments until satisfactory results are achieved. By mining and analyzing big data, common patterns and unique features in traditional pattern design can be captured, providing rich learning samples for adversarial networks. The experimental results show that the model has achieved significant results in automatically generating traditional pattern images.

Solid wood flooring holds an important position in high-end interior decoration due to its unique aesthetic value and natural texture. In the early stages of solid wood flooring production and design, CAD technology was widely used to simulate flooring effects, adjust colour schemes, and optimize pattern layouts. In this context, Zheng's [14] intelligent decoration pattern and colour optimization strategy combining CAD (computer-aided design) and big data technology not only improves the accuracy and efficiency of solid wood floor colour classification but also brings innovative solutions to the entire decoration industry. In order to further enhance the artistic effect of interior decoration and achieve the perfect integration of solid wood flooring colour and overall design style, precise colour classification and personalized customization have become key. Utilize big data platforms to collect and analyze colour trends, user preferences, and solid wood flooring sales data in the global interior decoration industry. Especially the excellent performance of the XGBoost model after feature filtering not only improves the classification accuracy to 97.22% but also significantly shortens the training and testing time, demonstrating efficient production capacity. Through CAD software, Zhuang et al. [15] intuitively observed the visual representation of different coloured flooring in different spaces, thereby predicting and adjusting design schemes in advance and reducing the cost of trial and error in the actual production process. Through CAD software, designers can intuitively see the visual representation of different coloured flooring in different spaces, thereby predicting and adjusting design schemes in advance and reducing trial-and-error costs in the actual production process. By using a colour CCD camera to capture high-resolution wood images and utilizing deep learning models to automatically extract colour features from the images, fast and accurate classification of solid wood flooring colours has been achieved.

In the field of decoration design, CAD technology has become an important tool for designers to carry out space planning, material selection and effect preview. The purpose of this study is to explore new methods and technologies of collaborative application of CAD and big data in intelligent decorative patterns and colour optimization, so as to fill the gaps in current research.

3 THEORETICAL BASIS OF COLLABORATION BETWEEN CAD AND BIG DATA

CAD system is a software tool that uses computer technology to assist designers in product design, drawing, and simulation. The core functions of a CAD system include geometric modelling, material and texture simulation, lighting and rendering, parametric design, automation, and intelligent functions. In decoration design, CAD system is widely used in indoor layout, furniture placement, wall decoration, floor paving, and other aspects, helping designers to quickly realize design ideas, optimize space utilization, and improve design quality.

Big data analysis refers to the mining, processing, and analysis of massive and complex data to reveal the laws, trends, and associations behind the data. In decoration design, big data analysis can be applied to market trend prediction, user preference analysis, design effect evaluation, and other aspects, providing designers with a scientific design basis and decision support.

The collaborative working mechanism between CAD and big data is shown in Table 1:

Collaborative Work Stage	*Role of CAD*	*Role of Big Data*
Data Collection	Provides basic data during the design process (e.g., geometric dimensions, material properties, etc.)	Integrates multi-source big data such as market trends, user behaviour, historical project data, etc.
Data Analysis	Uses built-in algorithms for initial design verification and optimization	Applies machine learning, deep learning, and other algorithms for deep data analysis to uncover hidden patterns and trends
Pattern Generation	Generates initial design patterns based on design specifications and user input	Combines big data analysis results to intelligently recommend and optimize pattern designs, enhancing innovation and richness
Colour Optimization	Offers basic tools for colour matching, such as colour selection, gradient effects, etc.	Analyzes user colour preferences, and market colour trends, and intelligently recommends and optimizes colour schemes
Material Selection	Recommends suitable materials based on design requirements	Analyzes material performance data, supplier information, cost factors, etc., to assist designers in making optimal choices
Cost Control	Estimates the initial cost of the design scheme	Based on historical project data, market price fluctuations, and other information, performs cost forecasting and control analysis.

Table 1: Overview of collaborative working mechanism between CAD and big data.

Table 1 summarizes the main links of collaborative work between CAD and big data in the field of decoration design and their respective roles. Integrating CAD's precise modelling with big data's extensive analysis capabilities enables the intelligent enhancement of decoration design, thereby improving design efficiency and quality, and addressing the growing diversity of market demands.

4 RESEARCH ON INTELLIGENT GENERATION METHOD OF DECORATIVE PATTERNS

4.1 Pattern Database Construction

Constructing a decorative pattern database is the basis of realizing intelligent pattern generation. The database should contain rich pattern resources covering different styles, themes, and colour combinations. The construction process includes:

Data collection: collect decorative patterns from various channels, including design works, art albums, network resources, etc.

Data collation: collate, classify and mark the collected patterns to ensure the accuracy and availability of the data.

Database design: design a reasonable database structure, including the storage format and index mode of patterns, so as to efficiently retrieve and manage pattern data.

4.2 Design of Intelligent Generation Algorithm

The automatic generation algorithm of decorative patterns based on big data analysis is the key to realising the intelligent generation of patterns. The algorithm design includes the following steps:

Feature extraction: feature extraction is the basic link of the algorithm, which involves systematically collecting and analyzing the basic elements of patterns from a huge pattern database. This process is not limited to traditional image processing methods but also incorporates CNN (Convolutional Neural Network) to learn and extract deeper feature representations automatically. There are many types of features, including but not limited to the shape outline, colour distribution, texture details, style attributes (such as classical, modern, abstract, etc.), and spatial layout of patterns.

Define D as the pattern database, F as the feature extraction function, and X as the pattern's feature representation. Consequently, the feature extraction formula is articulated as follows:

$$X = F(D) \tag{1}$$

Among them, F can be a composite function composed of CNN, which is expressed as:

$$F = f_{CNN}(f_{\text{traditional}}) \tag{2}$$

Here, $f_{\text{traditional}}$ stands for traditional image processing method and f_{CNN} stands for convolutional neural network.

Pattern recognition: On the basis of feature extraction, the advanced machine learning algorithm -GAN (Generative Adversarial Networks) is used in the pattern recognition stage to carry out deep learning and pattern recognition on the extracted features (as shown in Figure 1). The goal is to build a model that can understand and simulate the pattern design rules, and the model can learn the internal structure, style changes, and creative combinations of patterns.

Let G be the GAN model, Y be the result of pattern recognition and X be the extracted feature, then the formula of pattern recognition is:

$$Y = G(X) \tag{3}$$

Among them, the GAN model consists of a generator G and discriminator D, and its training process can be expressed as:

$$\min_G \max_D V(D,G) = E_{x\sim pdata(x)}\left[\log D(x)\right] + E_{z\sim pz(x)}\left[\log(1 - D(G(z)))\right] \tag{4}$$

Here, $V(D,G)$ is the objective function of GAN, $pdata(x)$ is the distribution of real pattern data and $pz(z)$ is the noise distribution.

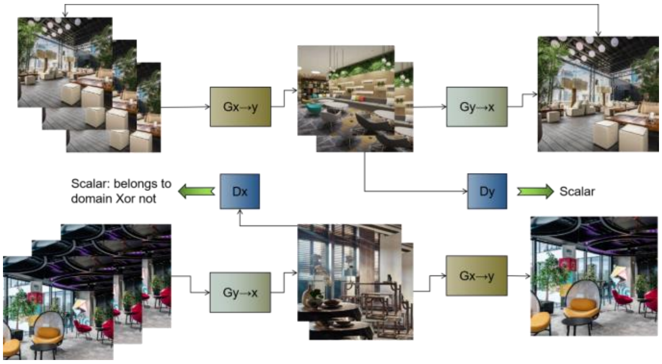

Figure 1: GAN model.

Pattern generation: Based on the specific needs of users (such as theme, colour preference and size requirements) and design constraints (such as cultural sensitivity and copyright restrictions), the pattern generation model constructed in the previous step is used to generate new decorative patterns creatively. This process involves a variety of technical means, such as condition generation, style transfer, creative integration, etc., to ensure that the generated patterns not only meet individual needs but also meet aesthetic standards. The formula for pattern generation is:

$$P = M \;\; C,Y \tag{5}$$

Where P is the generated pattern and C is the user's demand and design constraint? M Is a pattern generation model, which can include technical means such as conditional generation M_{cond}, style transfer M_{style} and creative fusion M_{fuse}, and is expressed as:

$$M = M_{\text{cond}} \circ M_{\text{style}} \circ M_{\text{fuse}} \tag{6}$$

Evaluation and feedback: evaluate the generated pattern and feedback and adjust the algorithm according to the evaluation results, so as to continuously improve the quality and innovation of the generated pattern. The iterative optimization process of the algorithm is shown in Figure 2.

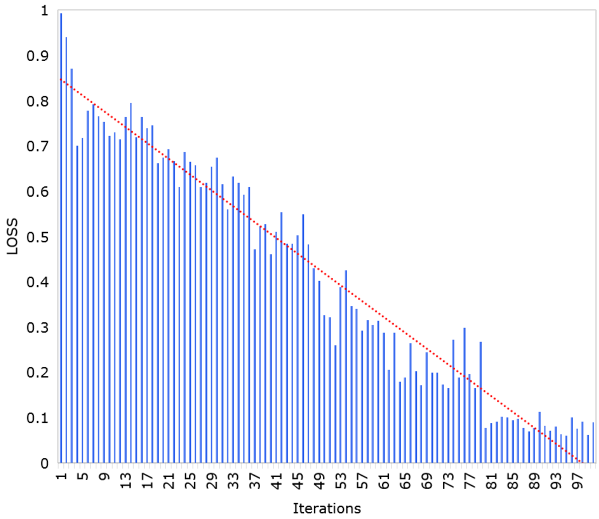

Figure 2: Iterative optimization of algorithm.

Experiments show that after 80 iterations, the model gradually converges. This means that with the training, the model has made remarkable progress in learning how to generate higher quality and more innovative patterns, and this progress tends to be stable after 80 iterations.

5 STRATEGY AND REALIZATION OF COLOR OPTIMIZATION

5.1 Colour Trend Analysis Based on Big Data

As an important element in design, colour not only affects the visual aesthetic feeling but also carries rich emotional and cultural connotations. With the rise of digital channels such as social media and e-commerce platforms, users' colour preferences and market colour trends have been recorded and analyzed in large quantities. This section uses big data technology to mine these data deeply. By analyzing users' purchase records, browsing behaviours, comments and feedback, we can understand the changes in colour preferences of different user groups. At the same time, combined with industry reports, fashion magazines and other information sources, we can capture a wider range of market colour dynamics. These analysis results will provide strong data support for subsequent colour optimization.

5.2 Design of Color Optimization Algorithm

Based on the colour trend of big data analysis, this section will develop a set of colour optimization algorithms to realize automatic colour matching and adjustment. This colour optimization algorithm first collects and preprocesses the design object attributes, user characteristics and excellent design case data through big data, and then uses the SVM (Support Vector Machine) algorithm to build a colour-matching learning model and a user preference prediction model.

Let $\mathrm{SVM}_{\mathrm{color}}$ be the colour matching learning model, $\mathrm{SVM}_{\mathrm{pref}}$ be the user preference prediction model, θ_{color} and θ_{pref} be the model parameters respectively, and T_{color} T_{pref} be the training data sets of colour matching and user preference respectively, then the formula of model training is:

$$\theta_{\mathrm{color}} = \mathrm{Train}\ \ \mathrm{SVM}_{\mathrm{color}}, T_{\mathrm{color}} \tag{7}$$

$$\theta_{\mathrm{pref}} = \mathrm{Train}\ \ \mathrm{SVM}_{\mathrm{pref}}, T_{\mathrm{pref}} \tag{8}$$

Once model training is finished, the algorithm autonomously produces an initial colour scheme tailored to the design project's specific needs and the target user group's characteristics. It then determines the best colour combination using algorithm optimization techniques. The colour generation formula is as follows:

$$C = \mathrm{G}\ \ R, U, \theta_{\mathrm{color}}, \theta_{\mathrm{pref}} \tag{9}$$

Among them, G are the colour generation function, R the specific requirements of the design project, U the characteristics of the target user group, and C the generated preliminary colour scheme. Subsequently, the algorithm entered the stage of real-time adjustment and optimization. The formula of colour optimization is:

$$C' = O\ \ C \tag{10}$$

Among them, O is the optimization function and C' the optimal colour matching.

6 APPLICATION CASE AND EFFECT ANALYSIS

6.1 Case Selection

In order to fully verify the practicability and universality of the intelligent generation and colour optimization method of decorative patterns proposed in this study, three different types of decorative design projects are carefully selected as application cases in this section. These cases cover residential interior design, commercial space decoration and public art installation design, aiming to show the application potential of this research method in different design scenarios.

6.2 Implementation Process and Results

Case 1: Residential Interior Design

In the case of residential interior design, this article first uses a CAD system to carry out the preliminary design of spatial layout and furniture placement. Subsequently, through the pattern intelligent generation module, according to the user's preferences and style requirements, a variety of wall decoration patterns and curtain textures are automatically generated. According to the results of big data analysis, the colour optimization module recommends a harmonious colour-matching scheme for indoor space. Finally, the designer combined these intelligently generated suggestions to complete the detailed work of the whole interior design, as shown in Figure 3:

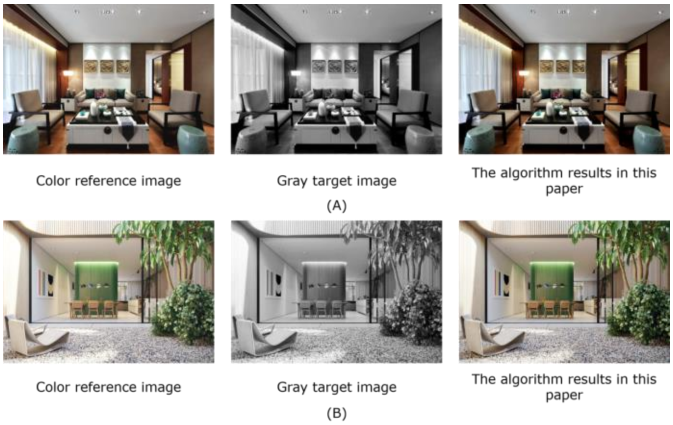

Figure 3: Residential interior design.

The application results show that the design efficiency has been significantly improved, and the design works have been highly praised by customers in terms of innovation.

Case 2: Commercial Space Decoration

In the case of commercial space decoration, we are faced with greater design challenges, including the diversity of space functions and the specific requirements of customers for brand image. Through the 3D modelling function of the CAD system, this article constructs a virtual model of commercial space. Then, using the intelligent pattern generation algorithm, decorative patterns in line with brand tonality are generated for each area in the space. The colour optimization module formulates a unified colour strategy for the whole space according to the market colour trend and user survey data. The final design scheme is shown in Figure 4.

This design scheme not only meets all the needs of customers but also achieves remarkable advantages in design efficiency and innovation.

Case 3: Design of Public Art Installation

In the case of public art installation design, this article makes full use of the intelligent methods and technologies proposed above. Utilizing CAD's parametric design function, we rapidly built the geometric model for artistic installations. The intelligent pattern generator creates distinctive decorative patterns based on artistic vision and public space attributes. The colour optimization module ensures harmonious integration of the artwork with its surroundings. The culminating design is depicted in Figure 5.

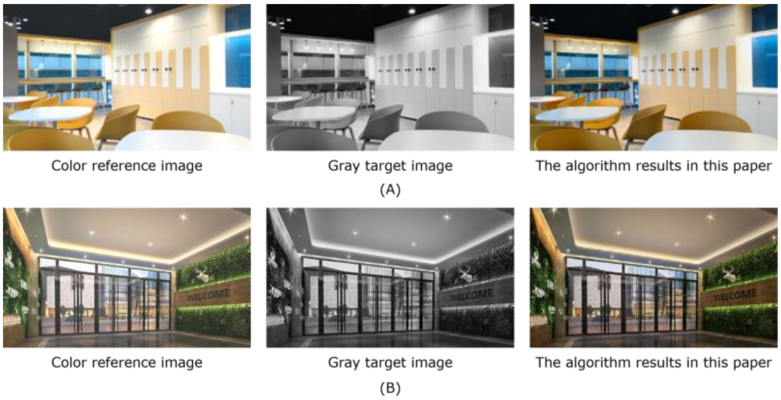

Figure 4: Commercial space decoration and design.

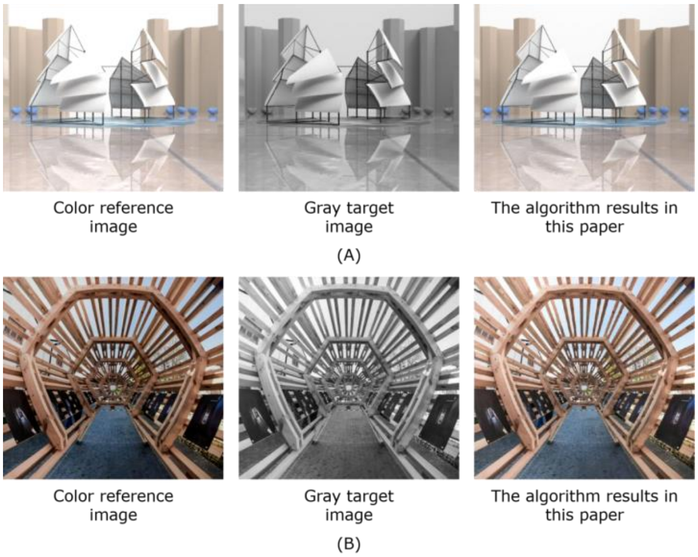

Figure 5: Public art installation design.

The art installation not only attracted a large number of audiences but also became a new landmark of urban culture.

6.3 Effect Evaluation

In the last section, the actual design projects are selected for empirical research, and the new methods and technologies put forward in this study are deeply explored and applied. Through this practical process, this article not only verifies the feasibility of the new method but also preliminarily observes its potential to improve design efficiency. This section's primary objective is to thoroughly assess the efficacy of the novel method and substantiate its advantages using scientific data and objective evidence. To gain a comprehensive understanding, we focus not only on enhancing design efficiency but also on user feedback. We actively gathered user satisfaction and acceptance of the optimized colour scheme through meticulously crafted questionnaires and in-depth interviews. This step is crucial, as user approval is the ultimate measure of design success. Figure 6 provides a clear comparison of design efficiency.

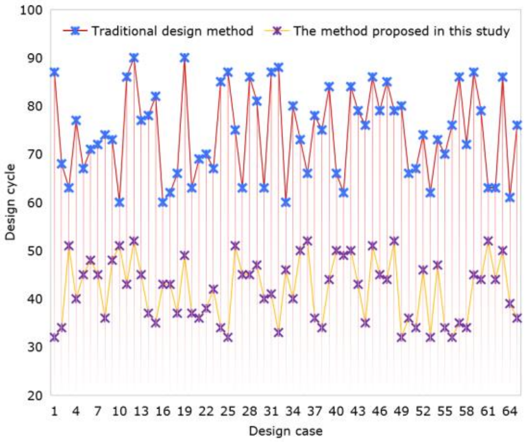

Figure 6: Comparison of design efficiency.

The traditional design method requires a 10-week cycle, whereas our proposed method reduces this to approximately 6 weeks—a 40% decrease. This substantial improvement not only accelerates product launches but also cuts design costs and boosts corporate competitiveness by enhancing designer efficiency. Figure 7 shows the user satisfaction.

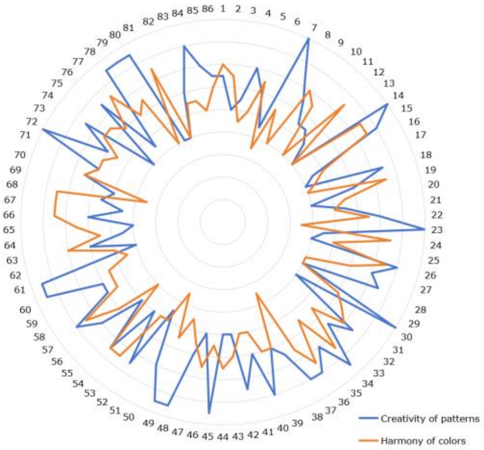

Figure 7: User satisfaction.

In terms of user satisfaction, through questionnaires and interviews, this article found that users showed a high degree of satisfaction with the intellectually generated design scheme, with a satisfaction rate as high as 95%, especially in terms of creativity of patterns and harmony of colours. In addition, from the perspective of innovation, the method of this study has brought new inspiration and ideas to the field of decorative design and promoted the innovative development of the design industry.

7 CONCLUSIONS

Our study explores the use of CAD and big data collaboration in decorative pattern intelligence and colour optimization. By examining CAD principles, big data analysis, and collaborative mechanisms, we propose a comprehensive method for intelligent pattern generation and colour optimization. Real-world case studies confirm the practicality and efficacy of our approach. Key findings highlight that intelligent methods enhance design efficiency, satisfy personalized user demands, and foster innovation. Big data technology is crucial for analyzing user preferences and market trends. The CAD-big data collaboration presents new avenues for development in decoration design.

Looking forward to the future, the collaborative research of CAD and big data in the field of decorative pattern intelligence and colour optimization will develop in the following directions: first, improve the generalization ability and adaptability of intelligent algorithms, so that they can better cope with complex and changeable design requirements; The second is to study the influence of user's emotion and cultural background on colour preference in order to develop more accurate colour optimization algorithm. Through the in-depth exploration of these research directions, we are expected to bring more intelligent, efficient and innovative solutions to the decoration design industry.

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