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Computer-Aided Design AND APPLICATIONS

Optimization of Interior Engineering Design Process and Application Based on Enhancing Aesthetic Experience of Interactive Design

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Abstract. This article applies image recognition technology to the design of aesthetic experience in architectural interior design. A computer-aided enhanced image recognition algorithm for interactive optimization was constructed by simplifying the analysis of architectural image recognition using CAD technology. By designing an image recognition algorithm based on ResNet, the effectiveness of indoor space design has been optimized. This article uses a dataset-based image recognition training model to test the dataset partitioning of the design workflow rigorously. The study rigorously evaluated the user interior design experience. This article highlights the algorithm's reference for user development. In the design of architectural images, this article constructs an integrated intelligent expression for interior design for designers.

Keywords: Architectural Image Recognition; Interior Design; Interactive Design; Aesthetic Experience
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1 INTRODUCTION

With the swift progression of society and the elevation of people's living standards, interior design has emerged as a pivotal aspect of individuals' pursuit of a high-quality lifestyle. Interior design not only pertains to aesthetics and comfort but is also intimately linked to people's physical and mental well-being, work productivity, and overall quality of life [1]. Hence, conducting an in-depth examination of the interior design process, identifying prevalent issues, and proposing tailored optimization strategies carry immense practical and theoretical significance. Interior design, as a comprehensive art, not only involves spatial layout and planning, but also encompasses knowledge from multiple disciplines such as aesthetics, psychology, and ergonomics. Currently, interior design teaching is facing many challenges. Traditional teaching methods often focus on imparting theoretical knowledge while neglecting the cultivation of practical abilities [2]. This has brought unprecedented development opportunities to the interior design industry, while also placing higher demands on interior design education. With the continuous development of society and the improvement of people's living standards, the demand for indoor environments is becoming increasingly diverse and personalized. Through 3D simulation technology, students can intuitively experience the volume, material, proportion, colour and other elements of space, and preview the design effect in advance, which not only enhances their learning interest but also greatly improves teaching effectiveness [3]. 3D computer-aided simulation technology can accurately simulate the three-dimensional effects of indoor spaces through computer-related software, providing designers with a brand-new design platform. Meanwhile, by simulating real-life scenarios, students can also discover and solve problems during the design process, improving the feasibility of design solutions. The advancement of technology, especially the emergence of 3D computer-aided simulation technology, has brought revolutionary changes to interior design teaching. In interior design teaching, this technology can help students better understand the relationship between space and people, master the core elements of design, and improve their design practice ability [4]. In the field of interior design, designers need to use various visual methods to effectively convey their design concepts to project stakeholders, including clients, architects, contractors, etc. [5]. And explore how these visual methods adapt to changes with the development of technology, especially in the specific field of interior design. The study will pay special attention to the relationship between design thinking, conceptual design innovation, and visual methods used in professional design practice. The study used quantitative methods to analyze the communication protocols of 75 professional interior designers and evaluated the effectiveness of the visual methods they used in practice for design innovation [6]. This method combines the intuitiveness of hand-drawn sketches with the precision of CAD technology, making the communication of design concepts more accurate and effective.

Architectural image recognition technology primarily relies on computer vision, converting architectural visuals into digital data for algorithmic analysis and categorization. This technology encompasses several key steps: ⊖ Image preprocessing, involving noise reduction, contrast enhancement, and smoothing, aiming to bolster the precision of subsequent recognition processes. ⊜ Feature extraction, where crucial attributes such as colour, texture, and shape are distilled from the refined image for future identification and sorting. ⊛ Classification decision, utilizing machine learning techniques like support vector machines, random forests, and neural networks, to train and validate the extracted features, facilitating automated image recognition and classification. In the interior design domain, image recognition is increasingly becoming a catalyst for driving innovation and elevating design efficiency [7]. To this end, this paper introduces and refines an image recognition algorithm grounded in ResNet. The objective of this investigation is to scrutinize and streamline the interior design process through a comprehensive analysis of all its components, striving for enhanced efficiency and rationality [8]. By incorporating CAD technology, we aim to not only enhance design efficiency but also minimize design errors, ultimately delivering higher-quality design services to customers. Additionally, our examination of the interior engineering design process aims to offer valuable insights to related industries, fostering their growth and contributing to the healthy development of the entire sector [9]. The specific research questions guiding this study are: What are the challenges and limitations in the traditional interior engineering design process? How can we leverage CAD technology to improve and optimize these issues? Will the optimized design process, integrated with CAD, lead to improved design efficiency and quality? To address these questions, we will employ a range of research methods to conduct a thorough investigation into the interior engineering design process. Based on our findings, we will propose targeted optimization strategies and validate their effectiveness through empirical analysis [10].

The primary contribution of this study lies in the integration of image recognition technology into interior design, coupled with a set of interactive design optimization strategies tailored to this technology [11]. This innovative approach not only broadens the scope of application for image recognition technology but also opens up new avenues for growth in the field of interior design. Furthermore, our empirical research and case analyses validate the efficacy of the proposed strategies, providing invaluable insights for related research and practical applications. The logical arrangement of the chapters in this paper is clear [12]. Firstly, the research background and research problems are put forward through the introduction, and then the strategies to enhance the aesthetic experience of interactive design are discussed in detail, including the concept definition, the importance of indoor environment interactive design, the optimization strategy of interactive design with the help of image recognition technology and specific practical cases. Then, through empirical research and case analysis, the proposed strategy is verified and interpreted, and practical conclusions and enlightenment are obtained. Finally, the research results are summarized, and the contributions and innovations of the research are pointed out, as well as the shortcomings of the research, and the future research direction is prospected [13]. The whole article is rigorous in structure and coherent in content, aiming at deeply discussing the promotion strategy of the aesthetic experience of interaction design and providing a valuable reference for research and practice in related fields.

2 RELATED WORK

Although traditional 3D indoor scene rendering can produce high-quality effects, the rendering time is often longer, especially when exploring different colour themes. Trivedi and Dubey [14] have launched an innovative interactive system specifically designed for interior designers and homeowners, which can quickly create and preview colour snapshots of indoor scenes. Compared to traditional 3D rendering, this system does not require a long computation time but can generate colour snapshots of moderately complex scenes in just a few seconds. From the perspective of architectural design, the parameterized design of prefabricated buildings based on BM achieves the linkage of information models in a three-dimensional form. At the same time, it also conforms to the development direction of BIM positive design and conforms to the trend of the integration of building informatization and industrialization. Not only does it solve the problems of low modelling efficiency caused by model duplication but also economic losses caused by design changes. Therefore, Tytarenko et al. [15] took prefabricated components of prefabricated shear wall structures as the research object, adopted the parametric design concept, and utilized the powerful scalability of Revit modelling software for secondary development. They proposed a parametric model and applied it. By designing geometric models of different types of prefabricated components, establish a logical relationship between the insertion point and positioning point of the model. The results indicate that parameterized modelling can achieve the modification of parameter linkage models, greatly improving efficiency. Write the main program for two modeling methods, driving system family and self-built family, to automatically create models with given parameters and propose a parameterized method for creating openings for multi-opening shear walls.

By using the modelling method, the carbon emissions of prefabricated components can be unified and informationized, improving accuracy while also providing designers with more choices based on corresponding emission reduction strategies. From the perspective of energy conservation and emission reduction, the current calculation of carbon emissions from prefabricated buildings mostly remains in the stage of calculation statistics and empirical calculation. In response to the problem that the reinforcement configuration cannot be automatically changed according to the model during the modelling process, Wang [16] proposed a modelling method based on prefabricated shear walls for area division and edge component division, replacing the component as a whole. A user interaction window was designed using WPF, and a visual parameter adjustment interface for modelling and reinforcement of prefabricated components was designed. Combined with parameter identification, a linkage control model was created and modified. By inputting data information into modelling software, a model-based carbon emission measurement system was constructed to calculate the carbon emissions of prefabricated components automatically. Manual modification of steel bars is required to adapt to the current situation of geometric models, achieving adaptive adjustment of parameterized steel bar models. By changing the parameters, the model can be shared among different projects. Based on existing parameterized models, write a program to extract the engineering quantities of concrete and steel reinforcement automatically. In interior design, AMoC can be used to create unique walls, furniture, decorative elements, etc. Indoor space is usually limited, thus requiring miniaturized and high-precision AMoC equipment. These devices may face limitations in printing accuracy, printing speed, and material processing capabilities. Wu et al. [17] analyzed the application of AMoC in interior design, including potential challenges and response strategies. Concrete Additive Manufacturing (AMoC) is a technology that constructs three-dimensional structures by adding materials layer by layer. Therefore, the control method of AMoC needs to be more precise and flexible to adapt to complex indoor environments. In addition, the colour, texture, and glossiness of concrete may be limited, making it difficult to meet diverse interior design needs. The factors that need to be considered in interior design far outweigh those of outdoor buildings, such as lighting, ventilation, furniture layout, etc. Concrete materials may appear too heavy or hard in interior design, making them unsuitable for all application scenarios. However, due to the characteristics of concrete, such as weight, hardness, curing time, etc., its application in interior design needs special consideration. As an important component of real-life 3D models, 3D building models have presented fine and complex data features and larger data volumes with the rapid development of data acquisition technology. The existing high-resolution 3D building model data processing, storage, and transmission pose new challenges. The current main solution in academia is to use Level Of Detail (LOD) models to represent 3D architectural models. The key to generating LOD is to simplify the model to reduce its complexity, thereby achieving the goal of reducing the amount of model data. Yang [18] conducted research on 3D architectural model simplification techniques that take into account texture features, with a focus on model simplification and data organization and management. In the process of simplifying 3D building models, texture features are introduced, and a model simplification method that takes into account texture features has been developed. While minimizing the amount of data and complexity of the model, important geometric and visual features of the model are preserved. Specifically, it includes a 3D building model mesh simplification algorithm based on "local vertex" texture features and a multi-resolution 3D building model data organization and management method based on global position grids. Thus, the hierarchical management of multi-resolution 3D building model data is achieved, thereby improving the query, retrieval, and computational efficiency of building models. Reuse data organization and management methods that conform to the structure of 3D building models for data management in order to solve the problem of low query indexing and computational efficiency of large-scale urban 3D building model data.

The existing 3D building model simplification algorithms cannot effectively preserve the detailed features of the model and are prone to texture distortion. Yi [19] proposed a 3D building model mesh simplification algorithm based on "local vertex" texture features. On this basis, focus on the data organization and management requirements of 3D building models and further introduce global location grids to organize and manage multi-resolution 3D building models. The existing simplification methods for 3D building models often overlook texture factors, resulting in texture distortion and loss of detailed features in the simplified model. The research results indicate that despite the increasing application of digital tools in interior design, many professional designers still prefer the traditional method of manually sketching. Its study used quantitative methods to analyze the different visual methods used by 75 professional interior designers in communication and evaluated the effectiveness of these methods for design innovation. By combining hand-drawn sketches with digital tools, interior designers can find a balance between innovation and practicality. For example, they can use CAD software to create accurate floor plans, elevations, and sections to ensure that the construction team can accurately understand and execute the design plan. This hybrid approach not only helps designers maintain flexibility in the project but also ensures that they can meet the needs and expectations of customers. It can quickly express design concepts using hand-drawn sketches and validate and refine these concepts using digital tools.

By combing and analyzing the current research situation, it can provide a useful reference for the development of this study. Based on this, this study mainly analyzes the problems and challenges existing in the indoor engineering design process and puts forward targeted optimization strategies to improve design efficiency and quality.

3 ANALYSIS OF THE INTERIOR ENGINEERING DESIGN PROCESS

3.1 Traditional Interior Engineering Design Process

The traditional interior engineering design process usually includes project initiation, scheme design, construction drawing design, material selection and procurement, construction cooperation and supervision, and completion acceptance. In these links, designers need to communicate and coordinate with customers, construction teams, and material suppliers to ensure the smooth implementation of the design scheme.

3.2 Problems and Challenges in the Process

Although the traditional interior engineering design process has formed a relatively perfect system, there are still some problems and challenges in the practical application process. For example, at the start-up stage of the project, the designer may not understand the project requirements and customer expectations accurately enough, resulting in the deviation of the subsequent design direction. In the scheme design stage, due to insufficient communication between designers and customers or inaccurate information transmission, the design scheme may be frequently modified and adjusted. In the stage of construction drawing design, designers may lack a deep understanding of construction technology and material properties, which leads to the design scheme can not be successfully realized. In the stage of construction cooperation and supervision, designers may not be able to follow up the construction progress and quality problems in time, which may lead to problems such as project delay or substandard quality.

4 APPLICATION OF IMAGE RECOGNITION IN INTERIOR DESIGN

4.1 Application of Image Recognition Technology

Refer to Table 1 for the primary potential applications of image recognition technology in interior design:

Potential application	*Describe in detail*
Get design inspiration quickly.	Designers can quickly identify the design elements and styles in the images by uploading or shooting architectural images, so as to quickly gain design inspiration and improve design efficiency.
Material identification and matching	Image recognition technology can accurately identify information such as material texture and colour in the image, help designers quickly find materials that match the design scheme, and improve the accuracy of material selection in design.
Spatial layout analysis	By analyzing the spatial layout of architectural images, image recognition technology helps designers to understand the spatial structure more deeply and put forward a more reasonable and efficient spatial layout scheme.
Virtual reality and augmented reality applications	Combined with image recognition technology, more realistic virtual reality and augmented reality experiences can be constructed so that customers can intuitively understand the design scheme and improve their satisfaction and trust in the design.

Table 1: Potential application of image recognition technology in interior design.

4.2 Effect Evaluation and Optimization Suggestions for Technology Application

In practical applications, image recognition technology has shown outstanding achievements in interior design. Nevertheless, challenges such as limited accuracy and sluggish processing speed persist. Addressing these issues, this paper presents the following optimization proposals:

Algorithm Enhancement: Conduct continuous research to refine the image recognition algorithm, aiming to boost its precision and velocity, thus satisfying the demand for high accuracy and efficiency in interior design.

Data Collection and Expansion: Set up an interior design-specific image repository and compile an extensive collection of image data to enhance the algorithm's generalization capability and accuracy.

User Experience Improvement: Tailor the user interface and interaction mode of image recognition technology to the practical demands of interior design, aiming to elevate the overall user experience.

5 METHODS AND STRATEGIES FOR OPTIMIZATION OF INDOOR ENGINEERING DESIGN PROCESS

5.1 Theoretical Basis of Design Process Optimization

Design process optimization is a process based on design management, quality management, and project management, which improves design efficiency and quality by improving all links in the design process. Its theoretical basis includes process management theory, quality management theory, and project management theory.

5.2 Design Process Optimization Method Based on Image Recognition

In this section, we delve into the development and refinement of an image recognition algorithm rooted in ResNet. This advancement permits the construction of deeper models, enabling the capture of intricate image features.

Given the intricate nature of interior design imagery, enriched with intricate details and complex elements, this study opts for a deeper incarnation of ResNet-101 to encapsulate these intricate features (depicted in Figure 1). Concurrently, we tailor the network's architecture by adjusting the convolution layer count, kernel dimensions, and stride sizes to align with the specific dimensions and resolutions of interior design images. These customizations enhance the network's capacity to extract crucial image information, thereby augmenting the algorithm's recognition accuracy. Furthermore, we have attentively curated a dataset tailored to interior design tasks, encompassing data collection, labelling, enhancement, and preprocessing procedures.

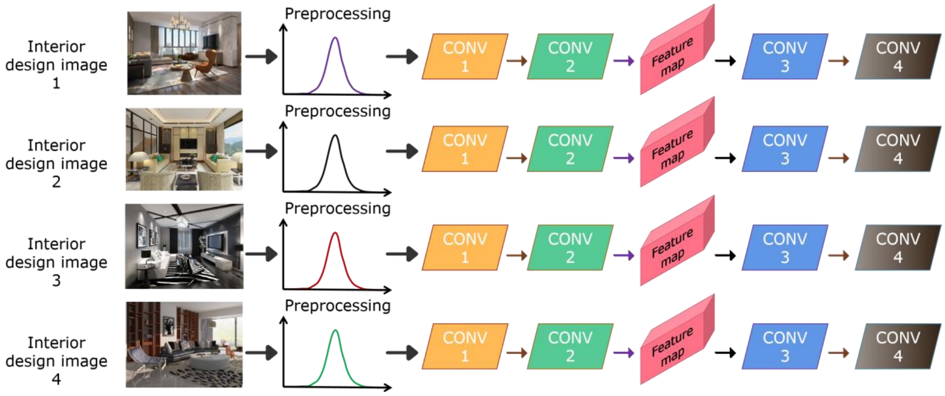

Figure 1: ResNet-101 structure.

In order to speed up the training process and improve the accuracy of the algorithm, this paper uses the ResNet weight pre-trained on a large data set (ImageNet) as the initial weight. These pre-training weights contain rich visual feature information, which can help the model learn the key features in interior design images more quickly. By using pre-training weights, we can obtain higher recognition accuracy in a short time and reduce the risk of over-fitting.

Suppose V_i represents the topological matching vector of the i region, and its expression form is:

$$V_i = N_i, R_i, \omega_L L_i, \omega_S S_i \tag{1}$$

Among them:

$$N_i = n_i / n_t \tag{2}$$

$$R_i = a_i / I_w \times I_h \tag{3}$$

$$L_i = \bar{L}_i / L_D / 2 \tag{4}$$

$$S_i = \sum_{j \in \Psi}^{m} R_j D\ c_i, c_j\ / 256 \tag{5}$$

Where n_i represents the number of adjacent areas in the i area, and n_t represents the total number of image areas;

a_i represents the area of the i area, I_w represents the image width, and I_h represents the image height;

$\bar{L}_i$ signifies the mean distance between colour points in the i region and the image's centroid, whereas L_D denotes the image's diagonal length. $D\ c_i, c_j$ Quantifies the variance in colour averages between the i and j regions in the LAB color space. Additionally, j the region is a subset of its contiguous region Ψ and ω_L, ω_S represents corrective factors. Specifically:

$$\omega_L = 0.2, \omega_S = 0.1 \tag{6}$$

In order to obtain the matching relationship F, is obtained by optimizing the energy function, and the formula is as follows:

$$F = \min_F \sum \left(\left\| V_i^s - V_j^t \right\|^2 \right) \tag{7}$$

In this study, the Euclidean distance metric is employed to quantify the dissimilarity between two weight-based matching vectors. Specifically, the vector V_i^s denotes the matching characteristics of the i area in the original image, whereas the vector V_j^t signifies the corresponding characteristics of the j area in the targeted color image.

$$S_r = D\ x, h\ \ TI, TT \tag{8}$$

$$S_w = D\ x, \bar{h}\ \ TI, FT \tag{9}$$

$$S_f = D\ \bar{x}, h\ \ FI, TT \tag{10}$$

$$L = \log\ S_r\ + \log\ 1 - S_w\ + \log\ 1 - S_f\ / 2 \tag{11}$$

Figure 2 shows the region segmentation results. Some building models have a large number of complex structures and independent components, and adjacent structures can affect and correlate with each other. After model simplification, the 3D mesh model may result in stretching or compression, leading to texture distortion in the building model after texture mapping. Due to the complex texture patterns in some structures of 3D building models.

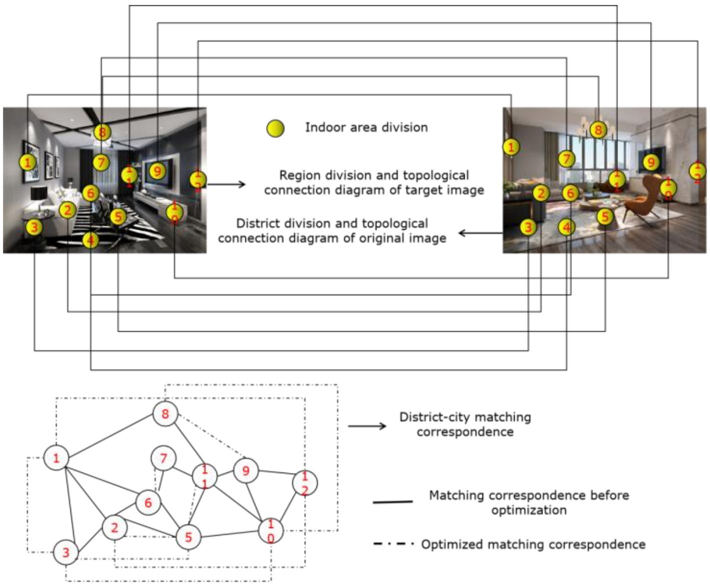

Figure 2: Region segmentation result.

There is an increasing amount of research on the simplification of 3D building models, with relatively less consideration given to textures. Additionally, the texture mapping of 3D models involves embedding the 2D texture space into the 3D mesh. Directly applying the general 3D model simplification algorithm to the simplification operation of 3D building models often cannot achieve good application results, so it is necessary to conduct separate research on the simplification of 3D building models. So as to achieve better visual effects when using the model. It is of great significance for the construction of realistic 3D scenes. Using a unified spatiotemporal reference framework to organize and manage multi-source heterogeneous 3D building model data in 3D scenes to support various industry applications is of great significance for improving the query, retrieval, and computational efficiency of model data. At the same time, in order to improve the efficiency of organizing and scheduling massive 3D building models in 3D scenes, it is necessary to design reasonable and efficient data organization and management methods based on the structural and attribute characteristics of the 3D building models themselves. In the simplification of 3D building models, texture is considered as a factor while minimizing the amount of data and complexity of the model while still retaining important geometric and visual features of the model.

6 SIMULATION EXPERIMENT AND CASE ANALYSIS

6.1 Simulation Experiment

In this section, we conduct a simulation experiment to assess the image recognition algorithm. We divide the dataset into distinct sets for training, validation, and testing, allowing for a thorough evaluation of the model's performance. Based on the validation set's outcomes, we refine the model's hyperparameters. Figure 3 illustrates the comparison of accuracy before and after optimization.

After delving deeper into the information revealed in Figures 3 and 4, we can find that the optimized model significantly improves design efficiency. By optimizing the number of layers, nodes, and connection methods of the neural network, the model can better capture the complex features of interior design images, thereby more accurately identifying key elements. Improving accuracy can also provide designers with more choices based on corresponding emission reduction strategies.

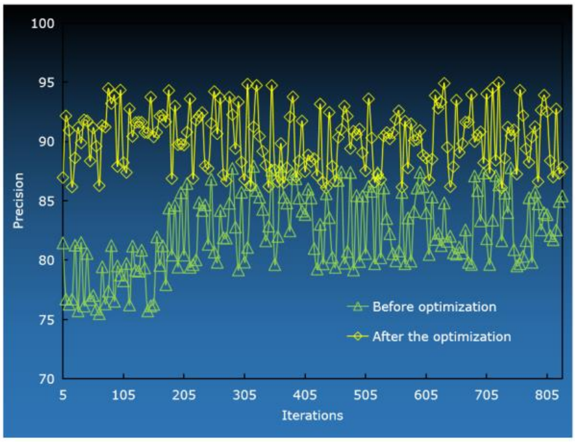

Figure 3: Accuracy comparison before and after optimization.

Write the main program for two modelling methods, driving system family and self-built family, to automatically create models with given parameters, and propose a parameterized method for creating openings for multi-opening shear walls. Utilizing the powerful scalability of Revit modelling software for secondary development, proposing parameterized models and applying them. The prefabricated components of prefabricated shear wall structures are taken as the research object, and the parametric design concept is adopted. By designing geometric models of different types of prefabricated components, establish a logical relationship between the insertion point and positioning point of the model. The problem of the inability to automatically change the steel reinforcement configuration in interior design based on the model is addressed in this paper. A modelling method based on prefabricated shear wall area division and edge training component division is proposed. The results indicate that parameterized modelling can achieve the modification of parameter linkage models, greatly improving efficiency. Implemented adaptive adjustment of parameterized steel bar models, allowing for model sharing across different projects by changing parameters.

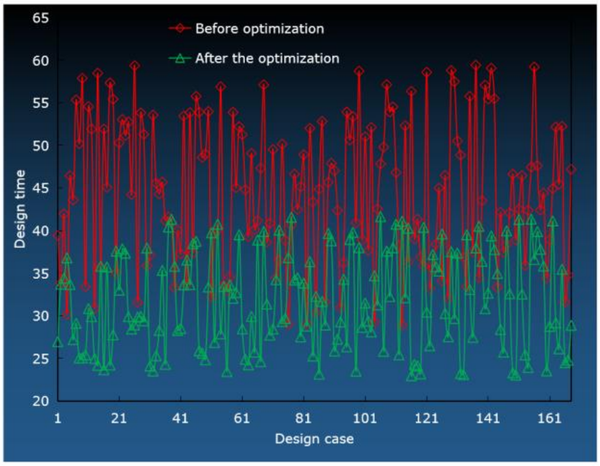

Figure 4: Design efficiency before and after optimization.

The content presented in Figure 4 reveals the outstanding performance of the optimization model in the field of interior design. This transformation not only improves the work efficiency of designers but also creates more creative space and time for them. Although efficiency is one of the goals pursued by designers, high-quality design output is the ultimate measure. The optimized model can complete tasks at an unprecedented speed when processing interior design images, which means that designers can obtain processed image data faster, thereby accelerating the entire design process. In the past, designers may have spent a lot of time waiting for image processing to be completed, but now, this time can be more efficiently utilized in creative thinking and solution optimization. It is not only a numerical improvement but also a great help to the efficiency of designers. This improvement in efficiency is undoubtedly a huge blessing for designers. Fortunately, the optimized model has made significant progress in both aspects. Optimizing models must not only improve efficiency but also ensure that design quality is not affected. Figure 5 visually illustrates the comparison of design quality before and after optimization. It can not only process images quickly but also meet the dual needs of designers for efficiency and quality while maintaining or even improving design quality. This comprehensive improvement makes the application prospects of optimization models in the field of interior design broader.

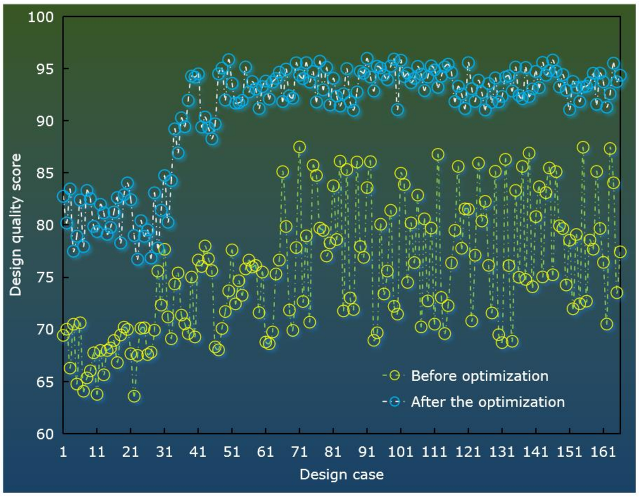

Figure 5: Design quality before and after optimization.

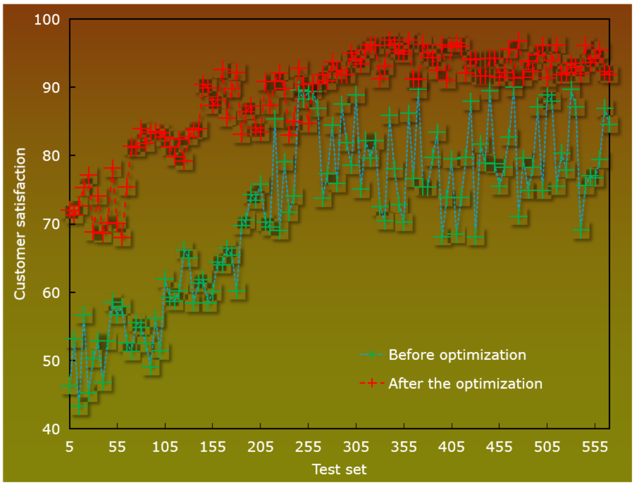

Figure 6: Customer satisfaction before and after optimization.

When delving deeper into the information revealed in Figure 5, it is not difficult to see significant progress in providing design recommendations through the optimization model. The improvement of design quality is crucial for enhancing user satisfaction and acceptance. In the field of interior design, customers often expect to receive design solutions that meet their own needs and expectations. Mainly a detailed description of the architectural image deduplication system and a detailed explanation of each functional module, as well as the process of the system. Through the functional modules and system processes of the system, this article provides a detailed design of the system and displays some of its interfaces. The system is mainly divided into three parts, namely user information management, image information management, and image deduplication operation. Due to the fact that the experiment in this article mainly focuses on image matching, and image deduplication happens to fit perfectly, the system is designed with image deduplication as the core while expanding user information and album information.

Figure 6 shows customer satisfaction before and after optimization. Enhanced design scheme evaluation and optimization: This technology aids in evaluating and refining design proposals, boosting their feasibility and practicality.

6.2 Case Analysis

This section uses empirical research methods to verify and enhance the strategies of aesthetic experience of interactive design by collecting and analyzing actual case data. In the design of research methods, this paper collects data by questionnaire, interview, and field observation and processes and analyzes the data by statistical analysis and case comparison. In the case of selection, this paper chooses representative and comparable indoor environment design cases as the research object. These cases will cover different design styles, functional requirements, and user groups to ensure the universality and applicability of the research results (Figure 7). In the research process, we will conduct an in-depth investigation and analysis of each case, including the design process, interaction design strategy, user feedback, etc.

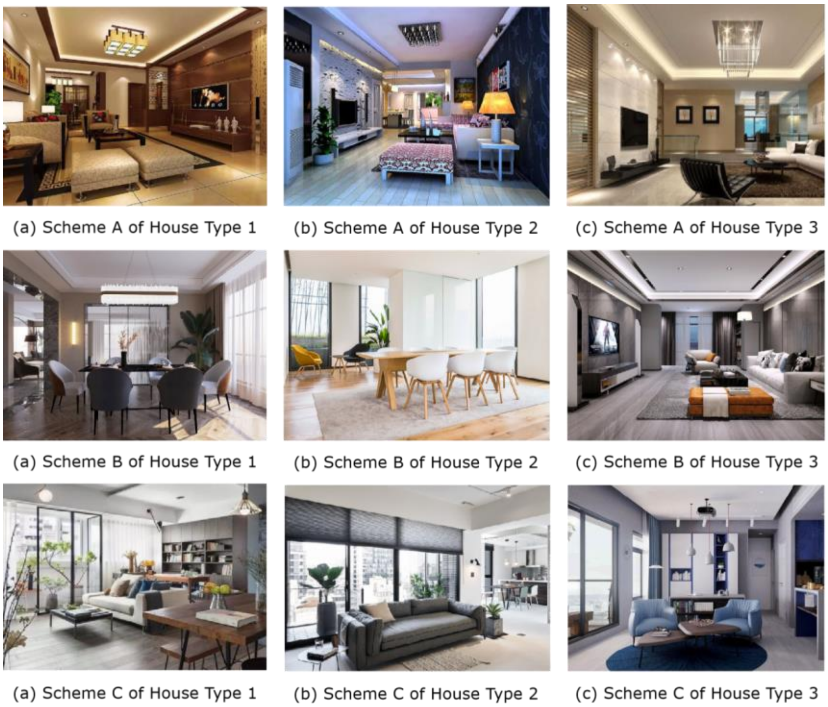

Figure 7: A case study of indoor environment design.

In data analysis, this section uses statistical software and professional analysis tools to process and analyze the collected data. Through the in-depth mining and interpretation of the data, we will reveal the influence degree and mechanism of different interaction design strategies on aesthetic experience. At the same time, we will also compare the design effect and user experience differences between different cases to find out the key factors of success and failure. See Table 2 and Table 3 for details.

Interactive design strategy	*Satisfaction score (1-5)*	*Average score*	*Sample size*
Strategy A (Concise)	4	4.2	100
Strategy B (Dynamic interaction)	3.5	3.8	120
Strategy C (Emotional design)	4.5	4.3	90
Strategy D (Personalized customization)	4.2	4.1	110

Table 2: Statistical table of a questionnaire survey on aesthetic experience strategy of interactive design.

Case number	*Design style*	*Function needs/requirement*	*User groups*	*Interactive design strategy*	*Aesthetic experience score (1-10)*
Case 1	Modern simplicity	Office space	Young white-collar workers	Strategy A, Strategy C	8.5
Case 2	Pastoral	Home environment	Home users	Strategy B, Strategy D	7.8
Case 3	European classicism	Hotel lobby	High-end business	Strategy A, Strategy C, Strategy D	9.2
Case 4	Industrial style	Coffee shop	Young people	Strategy B, Strategy D	7.3

Table 3: Comparative analysis table of indoor environment design cases,

On the basis of case analysis, this paper draws universal and instructive conclusions and enlightenment. These conclusions and inspirations will provide a useful reference for us to further optimize the aesthetic experience strategy of interactive design. Concurrently, we will delve into strategies for translating these research findings into practical design applications, thereby fostering innovation and growth in the indoor environment design sector.

7 CONCLUSIONS

The objective of this research is to explore the utilization of architectural image recognition technology in interior design and determine how interactive design techniques can elevate visual appeal and user satisfaction within indoor spaces. By deeply analyzing the potential uses of image recognition technology in interior design, coupled with CAD simulation analysis, this research introduces a ResNet-based image recognition algorithm and a suite of optimization strategies. The field of interior design images is constantly developing, and there will also be many specific applications, with image matching as the foundation. Design a prototype system with image deduplication as the core to verify the feasibility of the idea. Simultaneously fusing the key points extracted by two methods together results in a greater number of key points extracted by a single method, greatly improving matching accuracy. Therefore, it is proposed to fuse the features extracted from both methods and combine their advantages for interior design matching. In this field, there are both traditional SIFT algorithms and ORB algorithms, as well as convolutional neural network-based methods, both of which have their own advantages and disadvantages. Finally, comparative experiments were conducted between traditional algorithms on two datasets, and the results showed that the matching accuracy was superior to other algorithms. By combining the advantages of both, the calculation speed is fast and the information contained in the feature vectors can be enriched, improving the final matching accuracy. Secondly, using the same method to describe the features of key points, corresponding feature vectors and rich key point information are obtained. This algorithm uses two different methods in the key point extraction stage of interior design matching, namely Gaussian difference pyramid detection of extreme points and the FAST algorithm. Proposed RCS model and RCO model. Combine traditional algorithms with convolutional neural networks. Finally, comparative experiments were conducted on two datasets, and the results showed that the combined model had higher matching accuracy compared to a single algorithm and model.

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