Application Methods of Interior Decoration Design in the Era of Artificial Intelligence

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Abstract: This article focuses on the development of interior decoration design in the era of artificial intelligence (AI), and discusses the application of AI in interior decoration design. By analyzing the related concepts of AI and interior decoration design, this article studies the impact of AI on this field, including positive aspects such as design efficiency improvement, personalized customization support, creative expansion, and human-machine cooperation problems such as technology application threshold and style convergence risk. The research follows the principles of people-oriented, integration and innovation, and sustainable development, and explores specific application paths from data collection and site analysis in the early stage of design, to intelligent algorithm application and scheme evaluation and optimization in the generation stage of design scheme, and then to virtual modeling visualization and construction guidance and supervision in the design deepening and construction stage. The purpose of this article is to provide theoretical basis and practical guidance for the interior decoration design industry to achieve efficient, innovative and sustainable development in the AI era.

1. Introduction

With the rapid development of science and technology, AI has gradually penetrated into all fields of social life and become the core force to promote industrial change and innovation [1]. Interior decoration design, as an industry closely related to people's lives, is also deeply influenced by the AI wave. In recent years, AI technology has made breakthroughs in image recognition, data analysis and machine learning [2]. These technologies not only bring brand-new development opportunities to many traditional industries, but also inject new vitality into the field of interior decoration design [3]. In the process of interior decoration design, AI technology has shown great application potential, from the accurate grasp of customer needs in the early stage, to the conception and presentation of the mid-term design scheme, and then to the supervision and management of the later construction process.

It is of great purpose and significance to explore the application methods of interior decoration design in the AI era. From the perspective of industry development, it is helpful to promote the digital transformation of interior decoration design industry and enhance the overall design level and competitiveness of the industry [4]. In terms of design concept, it can promote the integration of traditional design thinking and emerging technologies, and give birth to more innovative and forward-looking design concepts [5]. In addition, AI also plays a positive role in meeting the increasingly diversified and personalized needs of consumers. With the help of AI technology, designers can more accurately create a living and working space that suits their customers' wishes.

However, at present, the research on the application method of AI in interior decoration design is still in the stage of continuous exploration and improvement [6]. Although some research results have been obtained, there are still some shortcomings in comprehensiveness, systematicness and depth and breadth of practical application. Based on this reason, it is of great practical significance to explore the application methods of AI in interior decoration design for promoting the development of this field.

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2. AI and interior decoration design

AI is a comprehensive technology that combines computer science, mathematics, psychology and other multidisciplinary knowledge, aiming at making computer systems have the ability to simulate human intelligence. In the field of interior decoration design, the related AI technologies mainly include machine learning and computer vision [7]. Machine learning can predict design trends and analyze user preferences by learning a large amount of data. Computer vision can recognize and process images, and help designers to analyze space and build virtual scenes.

The purpose of interior decoration design is to create an indoor space environment that meets people's material and spiritual needs through space planning, color matching, material selection and furniture layout. Its basic elements include space, color, material, light and shadow [8]. Spatial planning determines the functional layout and use efficiency of space; Color collocation affects the spatial atmosphere and emotional expression; The choice of materials is related to texture and durability; Light and shadow design adds layering and 3D sense to the space. Interior decoration design process usually covers demand investigation and site analysis in the early stage of design, scheme conception and deepening design in the design stage, and project management and quality control in the construction stage.

3. The role of AI in interior decoration design

With powerful data processing capabilities, AI can quickly generate design schemes and automate drawing. For example, in the past, it may take several hours for a designer to manually draw a plan of a complex apartment, but using intelligent drawing software, a preliminary plan can be generated within a few minutes after inputting the apartment data, which greatly improves the efficiency. Through machine learning algorithm, it can also automatically match the design elements of similar cases, saving design time [9]. AI can accurately analyze user preferences based on multi-source data such as user browsing records and preference questionnaires. For example, an intelligent design platform customizes the exclusive design scheme for each user by analyzing a large number of users' selection data of different styles of furniture and colors. The preference analysis of different user groups shows that young office workers prefer modern minimalist style and light color; Middle-aged families, on the other hand, favor Chinese style, and their colors prefer calm tones. This makes the design more suitable for the personalized needs of users.

Figure 1 Residential Interior Decoration Design

AI provides designers with novel design ideas by analyzing massive design cases and works of art. For example, it can integrate design elements from different cultures and historical periods to

create a unique design style. The algorithm can also be used to generate non-traditional spatial form and layout, break through the limitations of traditional design and inspire designers' creative inspiration.

AI improves design efficiency through powerful data processing capabilities, and also supports personalized customization to meet the diverse needs of users. In the interior decoration design of residential buildings, AI can accurately analyze users' preferences and create a personal style and practical living space, as shown in Figure 1. In terms of commercial space design, AI uses virtual modeling and visualization technology to optimize design communication and improve customer satisfaction. The high-precision virtual model shown in Figure 2 makes customers intuitively feel the design details.

Figure 2 Commercial Space Decoration Design

There are also some restrictions on the reference of AI. AI technology is difficult for designers who lack technical background to learn, and the high learning cost limits its popularization. Over-reliance on AI may lead to homogenization of design and weaken the uniqueness of works. At the same time, AI's lack of emotional and humanistic care, as well as communication barriers with designers in understanding design intent and scheme adjustment, will also affect the efficiency of collaboration and the final design quality.

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4. Application principles of interior decoration design in AI era

(1) People-oriented principle

The core of interior decoration design is always people, and the design should focus on people's needs, feelings and experiences. Although AI can provide an efficient and novel design scheme, it can't be divorced from human's dominant position. For example, in the design of space layout, we should fully consider people's action routes and usage habits to ensure the convenience of space use; In terms of color selection, we should pay attention to the influence of color on people's psychology

and emotions and create a comfortable visual environment. Designers should use AI to help understand users' needs, but the final decision-making power should still be based on people's feelings, so as to create a space that truly meets people's life and work needs.

(2) The principle of integration and innovation

AI technology should be deeply integrated with traditional interior decoration design methods to create new design patterns and styles. Traditional design methods contain rich experience and humanistic connotation, and AI provides strong technical support. Through integration, we can break the limitations of traditional design and realize innovation. For example, the unique spatial form generated by AI is combined with traditional crafts to create design works with both modernity and rich cultural connotations. Futhermore, designers are encouraged to exert their subjective initiative when using AI tools, explore new design ideas and expression techniques, and promote the innovative development of interior decoration design industry.

(3) The principle of sustainable development

It is very important to realize the sustainable development of interior decoration design by using AI. In the selection of materials, the environmental performance, source and sustainability of materials are analyzed with the help of AI, and green materials are given priority to reduce the negative impact on the environment. In the aspect of energy utilization, by simulating the conditions of space lighting and ventilation, the design scheme is optimized and the energy utilization efficiency is improved. Table 1 shows the specific considerations of different design elements under the principle of sustainable development:

Table 1 Analysis of Sustainable Development Elements in Interior Decoration Design

Design Element	Considerations for Sustainable Development	Specific Measures	Long-term Benefits
Material Selection	Environmental friendliness, renewability	Use recyclable materials such as recycled metals; promote renewable materials like bamboo	Reduce landfill waste, decrease dependence on virgin resources
Energy Utilization	Energy saving, alternative energy sources	Optimize daylighting design to reduce artificial lighting energy consumption; consider the use of clean energy such as solar power	Lower energy costs, reduce carbon emissions
Space Planning	Efficient space utilization	Rational layout to avoid space wastage and improve space utilization	Enhance space value, reduce construction demand
Water Resource Utilization	Water conservation, water recycling	Install water-saving fixtures, set up rainwater collection systems for irrigation, etc.	Reduce water consumption, improve water utilization efficiency
Furniture Configuration	Durability, recyclability	Select high-quality, easily repairable, and recyclable furniture	Reduce furniture replacement frequency, minimize resource waste
Decoration Techniques	Low pollution, high efficiency	Use environmentally friendly paints, promote efficient and low-consumption techniques such as 3D printing	Reduce indoor pollution, improve process efficiency
Waste Management	Classification, recycling, reuse	Classify construction waste and reprocess reusable materials	Reduce waste emissions, achieve resource reuse

The principle of sustainable development not only contributes to environmental protection, but also reduces long-term operating costs, satisfies people's pursuit of green and healthy living space, and promotes the development of interior decoration and design industry in a more sustainable direction.

5. Application method of interior decoration design in AI era

(1) Pre-design stage

The key of this stage lies in data collection and site analysis. AI can be used to collect a wide range of data, such as users' preference data for different styles, colors and spatial layout, as well as market trends, material price fluctuations and other information through online platforms. By analyzing the site with the help of computer vision technology, accurate data such as the size, shape, lighting and ventilation conditions of the site can be obtained quickly. For example, the intelligent scanning equipment can scan the site in all directions to generate a detailed site model, which provides a basis for the subsequent design. By analyzing these data, designers can have a deeper understanding of the project background and requirements, as shown in Table 2:

Table 2 Types of Data Collection in the Preliminary Design Phase and Their Uses

Data Collection Type	Data Source	Purpose	Collection Method	Key Indicators
User Preference Data	Online questionnaires, browsing history, social media	Clarify user requirements regarding design style, color, functionality, etc., and prepare for personalized design	Build online survey platforms, use data analysis tools	Style preference, color preference, functional priority
Market Trend Data	Industry reports, exhibition information, competitor analysis	Understand current industry trends to ensure designs are contemporary and forward-looking	Subscribe to professional reports, attend exhibitions, analyze competitor materials	Popular style elements, trends in new materials, emerging design concepts
Site Environment Data	On-site measurements, satellite imagery, Geographic Information System (GIS)	Understand actual site conditions for rational space planning and design	Use laser distance meters, satellite image acquisition software, GIS systems	Site dimensions, topography, daylighting and ventilation coefficients
Material Data	Supplier catalogs, industry databases, material exhibitions	Understand material properties, pricing, and supply availability for rational material selection	Review supplier documentation, access industry databases, attend material exhibitions	Material characteristics, price range, supply lead time
Budget Data	Client communication, reference from similar projects	Clarify project funding constraints and control design costs	Discuss with client, analyze cost data from previous similar projects	Total budget amount, budget allocation by category

(2) Design scheme generation stage

Based on the data collected in the early stage, the intelligent algorithm is used to generate the design scheme. AI can extract similar elements from a large number of design cases according to user needs and site conditions, and quickly generate multiple design schemes for designers to choose. If the user's functional demand, style preference and site type data are input, the algorithm can generate a variety of plane layout and space design schemes in a short time. Then, AI is used to evaluate and optimize the generation scheme. From the multi-dimensional analysis of space rationality, visual effect and material cost, the advantages and disadvantages of the scheme are

evaluated for designers, and optimization suggestions are given. Designers can adjust and improve the scheme according to these suggestions and their own professional knowledge to improve the design quality and efficiency.

(3) Design deepening and construction stage

AI can be used to realize virtual modeling and visualization. By creating a high-precision virtual model, designers can show the design effect from a 3D perspective, so that customers can feel the details of space atmosphere, material texture and so on more intuitively. Customers can roam in the virtual environment and put forward suggestions for modification, which is convenient for designers to adjust in time. Futhermore, in the process of construction, AI can play the role of construction guidance and supervision. By monitoring the construction progress and quality in real time and comparing with the preset construction standards, the deviation can be found in time and an early warning can be issued. For example, sensor technology is used to monitor key construction links such as wall smoothness and laying of water and electricity lines to ensure that the construction quality meets the design requirements and ensure the smooth progress of the project.

6. Conclusions

This article focuses on the application methods of interior decoration design in the AI era. Research shows that AI has had a far-reaching impact on interior decoration design. On the positive side, it greatly improves the design efficiency. With the help of data processing and algorithm, the design scheme and automatic drawing can be generated quickly, and the design cycle can be shortened. Futhermore, it strongly supports personalized customization, accurately analyzes user preferences, and meets diverse needs. It also provides assistance for the expansion of design creativity, breaks through the limitations of traditional design and brings new ideas. However, it also faces many challenges, such as the high threshold of technology application and the difficulty for designers to master it; There is a risk of convergence of design styles, which affects the uniqueness of design; There are communication and coordination problems in man-machine cooperation, which hinder the project progress.

Based on this, interior decoration design should follow the principles of people-oriented, integration and innovation, and sustainable development. In the specific application path, AI is fully used to collect and analyze multi-source data in the early stage of design to understand the site conditions; In the design scheme generation stage, intelligent algorithm is used to generate the scheme and evaluate the optimization; In the design deepening and construction stage, virtual modeling visualization and construction guidance and supervision are realized.

In the future, the interior decoration design industry needs to constantly explore the depth and breadth of AI applications. Designers should actively improve their technical literacy and better cooperate with AI. Futhermore, we should pay attention to balancing the humanistic connotation of technology application and design to avoid the simplification of design style. Through continuous innovation and practice, AI has become a powerful driving force to promote the interior decoration and design industry to a higher level, creating a better, personalized and sustainable indoor space environment for people.

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