Intelligent Optimization Algorithm for Digital Media Art CAD Design Combining Media Big Data

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Abstract. This article aims to explore the design and implementation of an intelligent optimization CAD system combined with media big data (BD) and verify its effectiveness and practicability through experiments. In this article, the requirement analysis method of CAD design based on media BD and the integration strategy of the intelligent optimization algorithm is adopted to construct an integrated intelligent optimization CAD system. The system can automatically acquire and process media BD and use an intelligent optimization algorithm to optimize and iterate the CAD design scheme automatically. In the experimental part, typical cases are selected to show the design requirements and results, which verifies the remarkable advantages of intelligent optimization CAD systems in improving design efficiency and reducing material cost. The experimental results fully prove that the design using this method has been significantly improved in innovation, practicality and aesthetics. The system can effectively use media BD to guide design decisions, improve design quality, and reduce manual intervention and design iteration time. In addition, the design results are comprehensively assessed, which proves the feasibility and effectiveness of the system in practical application. It provides a useful reference for research and practice in related fields.

Keywords: Media BD; Digital Media Art; CAD Design; Intelligent Optimization Algorithm
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1 INTRODUCTION

As information technology swiftly advances, media BD has emerged as a novel data resource, finding extensive application in the realm of digital media art (DMA). As a typical representative of the combination of artistic creation and science and technology, the CAD design of DMA involves a lot of complicated data processing and decision optimization. In this era, digital media art plays an important role in various fields, among which CAD design, as one of its core technologies, is leading the trend of art and design [1]. In the construction of the metaverse, video streaming technology plays a crucial role. By capturing and transmitting high-definition videos in real-time, digital media art can achieve realistic presentation in the virtual world. With the help of CAD design, artists and designers can create rich and colourful visual effects, immersing the audience in vivid scenes. This combination enables digital media art to transform from traditional static display methods to dynamic and interactive display methods. In the virtual reality world, CAD design provides a broader creative space for digital media art. Artificial intelligence technology provides new tools and methods for spatial art design, enabling designers to handle complex design tasks more efficiently. He and Sun [2] utilize artificial intelligence technology to automate some tedious design tasks, such as rendering, typesetting, etc., thereby saving a lot of time and effort. In addition, AI can also provide automated design solutions for designers by learning their creative styles and habits. Media big data provides a wealth of user behaviour, market demand, and other information. AI technology can analyze this data, provide valuable reference opinions for designers, and help them make design decisions that are more in line with actual needs. Through technologies such as machine learning and deep learning, AI can intelligently optimize design solutions, improving the quality and efficiency of design. For example, AI can predict the market acceptance of design solutions based on historical data, thereby optimizing design solutions.

In the exploration of parameter space in ensemble simulation, visualization techniques can help researchers better understand and analyze data. By creating intuitive charts, images, or virtual environments, researchers can observe simulation processes, explore parameter spaces, and discover patterns and relationships hidden in the data. This provides powerful tools for scientific research and simulation, making complex data and parameter spaces easy to understand and operate. Art graphics is the intersection of digital art and computer graphics, emphasizing the importance of aesthetics and visual expression. In the exploration of parameter space in ensemble simulation, art graphics can provide researchers with more expressive and attractive visual results. By combining science and art, art graphics can help researchers better convey information and discoveries, making research results more influential and persuasive [3]. Hsu et al. [4] explored how computer graphic design software can be applied to computer-aided patterns in artistic makeup design. Computer graphic design software has powerful image processing, editing, and synthesis functions. In addition, these software also have the characteristics of easy operation and user-friendly interface, allowing designers to focus more on the design itself. By utilizing computer graphic design software, designers can easily select, match, and adjust colours. Through precise colour control, the theme and style of makeup can be better highlighted, improving the overall design effect. By utilizing the image processing function in the software, fine adjustments can be made to the makeup effect. For example, by blurring, sharpening, and other operations, the makeup effect of a certain area can be highlighted or weakened to achieve better visual effects. Computer graphic design software provides abundant materials and tools, allowing designers to create freely with these resources. Conventional CAD design approaches often falter when confronted with the vast and multi-faceted nature of media BD, thus failing to harness its full potential. Consequently, there is considerable theoretical importance and practical worth in investigating intelligent optimization algorithms that integrate media BD into the CAD design of DMA. This integration can lead to enhanced design efficiency, innovative design techniques, and a broader array of artistic expressions.

With the advent of the big data era, the application of media big data has penetrated into various fields, including environmental space art construction design. Jin and Yang [5] focused on exploring the application and impact of combining big media data in environmental space art construction design. Environmental spatial art construction design refers to the design of spaces such as architecture, landscape, and interior, emphasizing spatial sense, atmosphere creation, and aesthetic experience. Media big data provides rich data resources and scientific analysis methods for this design. By utilizing big data analysis, designers can optimize the layout and functional division of spaces to meet the needs of different users. For example, by analyzing the distribution data of pedestrian flow, the location of functional areas such as rest areas and display areas can be reasonably planned. A feasible approach to effectively process such large-scale data is to combine deep learning models to analyze the image saliency of video data. Li et al. [6] explored how to construct an image saliency depth model scheme that combines media big data with video data. Image saliency refers to the areas in an image that are prominent or significant, and these areas are usually more attractive to people's attention. In video data analysis, understanding image saliency helps identify keyframes, extract key information, and optimize data processing processes. Select a portion of the preprocessed data as the training dataset for training deep learning models. Select suitable deep learning model structures based on needs, such as VGG, ResNet, etc. These models can automatically learn and recognize features in images. It uses the selected deep model to train the training dataset and optimizes the model through methods such as backpropagation and gradient descent. Use independent test datasets to test and evaluate the trained model to ensure its generalization ability. Apply the trained model to practical video data analysis tasks and adjust and optimize it as needed. Hidden capacity refers to the maximum amount of information that can be hidden in CAD colour images. When designing a payload partitioning strategy, we need to allocate the location and space of information reasonably based on the size of the hidden capacity. In CAD colour images, there are significant differences in pixel values between different regions, so the image can be divided into different regions based on the differences in pixel values. In the payload partitioning strategy, we can allocate hidden information to different regions to achieve better information-hiding effects. The encoding method refers to the way in which information that needs to be hidden is encoded according to the requirements of information type and hidden capacity; different encoding methods can be selected, such as LSB encoding, differential encoding, etc. Based on the above steps, we can implement corresponding steganography algorithms to hide information in CAD colour images. During the implementation process, attention should be paid to maintaining the visual effect of the image and the integrity of the original data [7]. At present, many scholars and institutions have begun to explore the integration of media BD and CAD design of DMA. Moreover, some cutting-edge CAD design software has begun to integrate intelligent optimization functions to improve the automation and intelligence of design.

Nevertheless, current research endeavours harbour notable limitations. These include algorithmic intelligence that falls short of expectations, suboptimal utilization of BD resources, and a dearth of refined strategies tailored to the unique artistic attributes of digital media. The aim of this investigation is to delve deeply into the intelligent optimization algorithms for CAD design of DMA, leveraging media BD. Initially, the study examines the traits of media BD and how they align with the requirements of CAD design in DMA. Subsequently, it explores the fundamentals of intelligent optimization algorithms and their current usage in CAD design. Following this, an intelligent optimization CAD system, integrated with media BD, is devised and undergoes development and testing. Ultimately, the system's efficacy and real-world applicability are assessed through case studies and practical deployments.

The novelty of this work is highlighted in several aspects: Firstly, it introduces research concepts and methodologies for intelligent optimization algorithms tailored for CAD design of DMA, incorporating media BD. Secondly, it designs an intelligent optimization CAD system with proprietary intellectual property, facilitating efficient utilization of media BD and intelligent decision support. Thirdly, the system's effectiveness and practicality are substantiated through case studies and real-world applications, offering valuable insights for research and practice in related domains.

This article is structured into eight segments, progressively unfolding based on research content and methodologies. The introductory segment outlines the research background, importance, current landscape, and methodologies. Segments two through seven delve into media BD, CAD design of DMA, intelligent optimization algorithms, system design and implementation, case studies and practical applications, conclusions, and future outlooks, respectively. The eighth segment provides a comprehensive summary and synthesis of the entire work.

2 OVERVIEW AND ANALYSIS OF MEDIA BD

The combination of traditional art creation methods and CAD technology provides artists with more creative means and possibilities. Liu and Yang [8] focused on exploring contemporary art computer-aided design patterns and their applications with colour visual effects as the core. Colour, as an important element in artistic creation, plays a crucial role in the emotional expression and visual impact of works. In contemporary art, colour visual effects are endowed with more meaning and connotation. Artists can convey unique emotions and thoughts, attract the audience's attention, and evoke resonance through clever colour application. Using CAD software, artists can choose and match various colours according to their creative needs. The colour library in the software is powerful and can meet the needs of artists for colour diversity and accuracy. Meanwhile, CAD technology can also assist artists in creating effects such as colour mixing and gradients. In CAD software, artists can make subtle adjustments and optimizations to colours according to actual needs to achieve the best visual effects. For example, by adjusting parameters such as saturation, brightness, and contrast of colours, different styles of colour expression can be achieved.

However, designing an efficient and accurate DCNN model to address the diversity and complexity of art image classification remains a challenge [9]. Art image classification is a challenging task, mainly due to the diversity and complexity of art images. Unlike ordinary images, artistic images often have unique styles, forms of expression, and themes, which makes classification tasks more difficult. In addition, the semantic information of art images is also an important basis for classification, and how to effectively extract and utilize this information is the key to improving classification performance. In order to improve the quality of digital media art images and enhance their visual effects, using large-scale low-light simulation datasets for training and optimization has become an effective method. Lv et al. [10] explore how to use large-scale low light simulation datasets for digital media art, which are generated through computer simulation of large image datasets, including images under various lighting conditions, scenes, and angles. These datasets can provide a large number of training samples for digital media art image enhancement, helping algorithms better learn and recognize details and features in images. It adjusts the dynamic range of the image to better adapt to the visual characteristics of the human eye. It can be achieved through methods such as global histogram equalization and local histogram equalization. Training deep learning models using large-scale low-light simulation datasets can learn image features under various lighting conditions, thereby improving the effectiveness of image enhancement. Traditional physical museums are no longer the only display places for artworks, and digital technology provides new possibilities for the preservation, display, and dissemination of artworks. Especially with the application of media big data, museums can better leverage their educational and research value while providing the public with a richer and more in-depth artistic experience. In the digital age, database technology provides new solutions for the preservation of artworks. By establishing a digital art database, museums can achieve long-term and stable preservation of artworks, avoiding damage or loss of artworks caused by environmental and human factors. In addition, the database can also achieve functions such as high-definition image collection, metadata organization, and information retrieval for artworks. Big data can also help museums optimize exhibition layout, enhance audience experience, and achieve wider dissemination of artworks [11].

Traditional physics learning mainly relies on laboratories and textbooks, which greatly limits the learning methods and effectiveness of students. Digital expansion provides unlimited possibilities for physics learning, allowing students to understand and master physics knowledge more intuitively. Through virtual laboratories, students can simulate various experiments on computers, avoiding various limitations and dangers in real experiments. At the same time, digital learning resources are also more abundant and diverse, allowing students to engage in personalized learning according to their interests and needs. Art, craftsmanship, and design, seemingly unrelated to physics, actually play an important role in physics learning. Art can help students better understand the aesthetic essence of physical phenomena, craftsmanship can help students transform theoretical knowledge into practical applications, and design can guide students to engage in innovative physics practices. Nortvig et al. [12] integrate art, craftsmanship, and design into physics learning through blended learning, which can help students understand and apply physics knowledge from multiple perspectives to enhance their learning interest and practical ability. For example, when studying mechanics, students can experience the practical application and charm of mechanics by designing and making artworks or handicrafts. With the advent of the big data era, data has become an indispensable element in modern art creation. Artists are beginning to explore how to utilize media big data for the production of artistic works. Toshiya and Sugimori [13] focused on exploring the practice and impact of art creation that combines media big data. Data visualization is a way of presenting data using visual elements such as graphics and images. Artists can use data visualization technology to transform massive amounts of data into images and animations with artistic beauty, creating unique visual effects. Artists can use big media data to analyze social phenomena, cultural trends, and human behaviour, extract inspiration from it, and integrate it into their artistic creations. For example, artists can create works of art that reflect modern society by analyzing user-generated content on social media and understanding people's preferences and emotions. Artists can utilize media big data to synthesize and process data from different sources, creating innovative and experimental works of art. For example, artists can integrate image, sound, and text data from different periods to create cross-temporal and spatial works of art.

Combining the two can achieve the intelligence, efficiency, and personalization of digital media art. By analyzing and mining media big data, we can discover patterns, trends, and related relationships, providing inspiration and a basis for the creation of digital media art images. Develop a creative plan for digital media art images based on needs and goals, including themes, styles, and forms of expression [14]. Utilize intelligent, creative tools such as machine learning, deep learning, and other technologies to automate or semi-automate the generation and processing of digital media art images. The Internet of Things technology enables the intelligence and interconnection of the physical world through various sensors, devices, and applications, while cloud computing technology provides powerful data processing, storage, and management capabilities. The combination of these two enables us to obtain valuable information from massive amounts of data, further promoting innovation and development in visual communication design. By collecting various data through IoT devices, such as geographic location, environmental temperature, and human flow distribution, combined with the processing capabilities of cloud computing, graffiti works with specific themes or styles can be generated. This data-driven creative approach makes graffiti art more targeted and practical. With the help of IoT devices, viewers can interact with graffiti works, such as changing the colour, and shape, or display the content of graffiti through gesture recognition, sound control, and other methods. This interactive experience enhances the fun and engagement of graffiti art. Combining cloud computing technology, graffiti works can be dynamically adjusted based on changes in time, weather, or other external conditions. For example, under sunlight or after rain, the colour or pattern of graffiti may change, bringing a different visual experience to the audience.

Zhang and Rui [15] focused on exploring the application and impact of image-assisted design combined with media big data in art colour composition design. By utilizing big data media, designers can extract various colours from massive images and match and select colours based on themes and needs. This colour extraction method based on big data can help designers obtain a wider and richer range of colour resources and improve the artistic expression of their works. By analyzing media big data, designers can understand the current trend of colour trends in society, providing reference and inspiration for their designs. This colour trend prediction based on big data helps designers better grasp the market and consumer needs and improve the commercial value of their works. In art design, the colour composition is a very important part. Using image-assisted design software, designers can perform colour adjustment, segmentation, fusion, and other operations on images to achieve the best colour composition effect. Zhang [16] explored the CAD design and application of digital media art in visual communication. With the popularization of dynamic media, the demand for dynamic visual communication design is increasing. CAD technology can assist designers in designing dynamic images, such as dynamic posters, dynamic logos, etc., making design works more dynamic and vibrant. In interactive media, CAD technology can help designers create interactive interfaces and animation effects. By interacting with users, we can increase their engagement and experience.

In digital media art graphic design, the rational use of media big data can enhance the effectiveness and expressiveness of the design. Content-aware generation modelling is a technology based on artificial intelligence and machine learning aimed at extracting useful features and patterns through deep analysis and learning of large amounts of data. Zheng et al. [17] identified the emotional tendencies and colours contained in text, images, and other data through analysis, thereby guiding designers to better convey emotions and atmosphere in layout. By analyzing a large amount of data from excellent design works, aesthetic features and design rules can be extracted, providing useful references and guidance for designers in layout. With the rapid development of digital media, the field of art and design is undergoing unprecedented changes. Digital media, with its unique interactivity and variability, provides more possibilities and freedom for art and design. Zhu [18] explored how digital media influences and drives the process of intervention and design iteration in art and design. Digital media, such as digital images, animation, interactive art, etc., have brought unprecedented innovation space to art and design. Designers can achieve more complex and detailed designs through digital technology while also adjusting and modifying designs in real-time to achieve the best design results. In traditional art design, designers usually need to go through a long period of conceptualization and creation to complete a work. In the era of digital media, designers can quickly implement design ideas through digital technology and adjust and optimize designs through real-time feedback. This intervention method not only improves the efficiency of design but also enables designers to control the design process and results better.

3 APPLICATION OF CAD IN DMA

Media BD refers to the massive, diversified, and high-speed data collection generated and accumulated in the media field. These data come from various media platforms, such as social media, news websites, video platforms, etc., and contain information in various formats, such as text, pictures, audio, and video. The characteristics of media BD are shown in Table 1:

Characteristic	*Describe*
A large amount of data	The media industry produces a huge amount of data every day, involving user behaviour, content creation, advertising, and many other aspects.
Variety	Data formats are diverse, including structured data (such as database records) and unstructured data (such as text, pictures, videos, etc.).
Real-time	The media industry requires high real-time data and needs to process and analyze data quickly to respond to market changes.
Low-value density	Although there is a large amount of data, valuable information is often scattered in numerous data and needs to be mined and refined.

Table 1: Characteristics of media BD.

The gathering of media BD primarily relies on techniques such as web crawling, API interfaces, and tracking of user interactions. When it comes to processing, techniques like data cleansing, storage, mining, and analytics come into play.

For data gathering, web crawlers are employed to extract data from a wide array of media platforms, while authorized data is sourced via API interfaces. Additionally, user interactions on these platforms are captured through meticulous tracking.

Data cleansing involves preprocessing the raw data collected and eliminating duplicates, invalid entries, and errors to enhance its overall quality.

For storage, a combination of distributed systems (e.g., Hadoop) and relational databases is utilized to cater to diverse query and analysis needs.

Lastly, data mining and analytics leverage machine learning, deep learning, and other advanced algorithms to unearth hidden patterns and insights within the data.

Media BD has a far-reaching impact on CAD design and brings new enlightenment and development opportunities for CAD design.

Enrichment of design materials: Media BD provides a large number of material resources, such as pictures and videos, as well as more diverse design elements and inspiration sources for CAD design.

Accurate grasp of user needs: Through the analysis of user behaviour data, CAD designers can more accurately grasp user needs and market trends so as to design products that are more in line with user expectations.

Intelligent design process: Combined with an intelligent optimization algorithm, media BD can assist CAD designers in making automatic design decisions and optimization, as well as improve design efficiency and quality.

Objectivity of design assessment: Using user feedback and assessment information in media BD, we can objectively and quantitatively assess CAD design results and provide the basis for design improvement.

To sum up, media BD has important application value and development prospects in the CAD design of DMA. By deeply studying the characteristics and processing technology of media BD and combining it with CAD design, innovation and development in the field of DMA can be promoted.

DMA is an art form based on digital technology and media platforms, which combine traditional art and modern technology and create artistic works with unique aesthetic value and expressive force through computer graphics, animation technology, and interactive design. DMA not only expands the space of artistic expression and creative means but also enables artistic works to be presented to the audience in a more dynamic, interactive, and diversified way.

CAD is a computer technology widely used in industrial design and architectural design, which helps designers design, model, and render accurately through professional software tools. In the field of DMA, CAD is also widely used in three-dimensional modelling, animation design, scene construction and so on. Through CAD, DMAists can create art more efficiently and realize complex design ideas and visual effects. The CAD design of DMA usually follows the flow in Table 2, and its design elements are shown in Table 3.

Step	*Content*
Conceptual design	According to the creative theme and demand, carry out preliminary conceptual design and conception.
Make a model	Three-dimensional modelling is carried out by using CAD software, and the basic form and structure of artistic works are constructed.
Materials and maps	Give the model appropriate materials and maps to enhance the realism and visual effect of the work.
Lighting and rendering	Set reasonable lighting effects and rendering parameters to make the work present the expected visual effect.
Animation and interaction	Add animation effects and interactive functions to the works as needed to enhance the interactivity and interest of the works.

Table 2: Design Process.

Key element	*Content*
Morphology and structure	The basic form and structural features of a work of art reflect the overall shape and internal structure of the work.
Colour and material	The colour matching and material expression of the works affect the visual style and texture experience of the works.
Light and shadow	Through the visual atmosphere and effect created by lighting and rendering technology, the three-dimensional sense and layering of the works are

and rendering	enhanced.
Animation and interaction	Animation and interactive design can enhance the expressive force and interactivity of works and make works more vivid and interesting.

Table 3: Design elements.

4 THEORY AND APPLICATION OF INTELLIGENT OPTIMIZATION ALGORITHM

4.1 Principle of Intelligent Algorithm

Intelligent optimization algorithms are rooted in natural laws, biological behaviours, or principles of human intelligence. Their main objective is to tackle intricate optimization challenges, often finding near-optimal or global solutions within reasonable timeframes. These algorithms excel in global search capabilities, adaptability, and robustness, making them highly versatile across various domains.

Genetic algorithms mimic the biological evolution process, iteratively exploring solution spaces via selection, crossover, and mutation operations. They leverage fitness information from individual population members to steer the search, favouring the preservation and reproduction of fitter individuals.

Meanwhile, neural networks are computational models inspired by the interconnectedness of human brain neurons. They process input data through a web of neuronal connections and weight adjustments, facilitating feature extraction and classification recognition. Typically, neural networks learn via the backpropagation algorithm, gradually refining their output by adjusting the weights between neurons to align with target values.

4.2 Selection and Design Principles of Intelligent Optimization Algorithm

When selecting and designing intelligent optimization algorithms, the following principles should be followed:

Problem adaptability demands the selection of an intelligent optimization algorithm tailored to the unique traits and demands of CAD design challenges. Distinct algorithms excel in different problem domains, emphasizing their varied strengths and applicability.

Assessing algorithm performance necessitates the assessment of key metrics such as convergence speed, solution quality, and stability. These indices offer insights into the efficiency and reliability of the chosen algorithm in addressing CAD design complexities.

Parameter setting plays a pivotal role in algorithm performance and outcomes. Careful consideration must be given to setting parameters like population size, iteration counts, and crossover probabilities, as they significantly impact the algorithm's behaviour and results.

The scalability and customization potential of the algorithm are also crucial aspects to consider. Ensuring these qualities allows for algorithm enhancement and expansion to align with evolving CAD design requirements, ultimately enhancing its adaptability and flexibility.

Adhering to these guidelines enables the selection and design of an intelligent optimization algorithm well-suited for CAD design challenges, ultimately elevating the efficiency and quality of the design process. In this article, after careful consideration, the neural network method is adopted as the main algorithm, and the genetic algorithm is used for optimization. In this article, a complex nonlinear function is used to represent neurons:

$$z\ x\ = f\left(\sum_{i=1}^{D} w_i x_i + w_0\right) \tag{1}$$

Where $\{x_i\}_{i=1}^{D}$ is the input, $\{w_i\}_{i=0}^{D}$ is the weight coefficient of neurons to be trained, and z is the output?

$$h_t = \varphi\ Ux_t + Wh_{t-1} + b \tag{2}$$

$$o_t = Vh_t + c \tag{3}$$

This expression h_t represents the term bias. The ultimate output generated by the model can be formulated as follows:

$$\hat{y}_t = \sigma\ o_t \tag{4}$$

Within the given context, σ it represents the activation function, typically chosen as the softmax function.

Genetic algorithm is especially suitable for the optimization of neural networks, such as network structure, weight, and learning rules. The optimization process includes coding the parameters of a neural network as genes or chromosomes, creating the initial population, defining fitness function to assess performance, and generating a new population through selection, crossover, and mutation operations until the termination conditions are met. Finally, the best individual is decoded, and its performance is verified on the test set. The adaptive adjustment crossover probability of the genetic algorithm is shown in Figure 1.

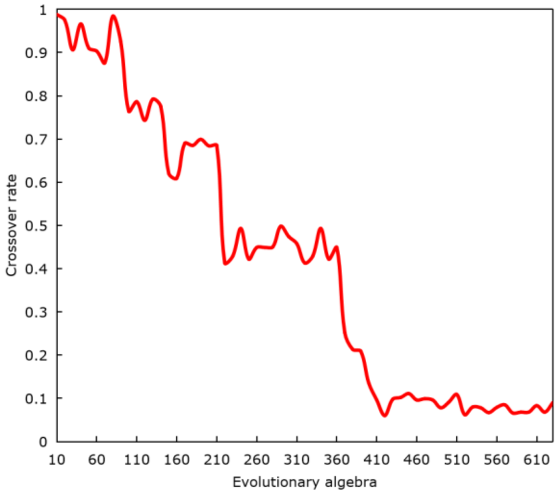

Figure 1: Crossover rate adaptation.

Suppose there is a feature vector:

$$h_i\ \ i = 1,2,\cdots,m \tag{5}$$

$$h^* = \sum_{i=1}^{k} a_i h_i \tag{6}$$

Among them a_i is the weight, and the attention mechanism is to get a reasonable a_i. For a certain sample:

$$E=\frac{1}{2}\ y-p\ ^{2} \tag{7}$$

In the evolution of genetic algorithms, this article innovatively introduces an information exchange mechanism that enables information to flow freely between two different populations. This mechanism helps individuals avoid making decisions based on false information, thus avoiding falling into local optimal solutions. Moreover, this article also adopts a nonlinear dynamic adaptive inertia weight strategy to improve the algorithm's overall performance further. The specific update status of this policy is described as follows:

$$w\ t\ =w_{end}+\ w_{start}-w_{end}\ \times\exp\left(-k\times\left(\frac{t}{t_{\max}}\right)^{2}\right) \tag{8}$$

Within the group, k it serves as the controlling factor that regulates the smoothness of both w and t curves. The overall path index is then computed as follows:

$$S_{k}=\frac{1}{F}\left(\frac{n+1}{h_{y}\cdot j}\right) \tag{9}$$

In this context, S_k it denotes the distance separating the k distribution points while $1/\mathrm{F}$ signifies the distance traversed upon delivery completion. $h_y \cdot j$ Serves as the adjustment coefficient for the entire path and n represents the cumulative path index value.

5 INTELLIGENT OPTIMIZATION CAD SYSTEM DESIGN COMBINED WITH MEDIA BD

5.1 System Design Objectives and Requirements Analysis

The design of an intelligent optimization CAD system combined with media BD aims to achieve the following main goals: ⊖ improve design efficiency: automatically optimize design process through intelligent algorithm, reduce manual intervention and speed up design iteration. In the field of CAD design, the demand analysis of media BD mainly focuses on the following aspects: ⊖ Design trend analysis: through BD analysis, we can understand the current and future design trends and provide inspiration and direction for designers. ⊜ User preference identification: analyze user behaviour and feedback data and identify user preferences and needs to guide design decisions. ⊛ Design material mining: Mining useful design materials and elements from massive media data to enrich the design resource database. ④ Performance optimization prediction: Based on historical data, predict the performance of different design schemes to help designers make better choices.

5.2 System Architecture Design and Functional Module Division

Intelligent optimization CAD system combined with media BD should adopt a hierarchical architecture design, which mainly includes the following levels:

Data layer: responsible for storing and managing media BD and providing data access and query interfaces.

Algorithm layer: integrating various intelligent optimization algorithms, providing algorithm calling and parameter configuration functions.

Application layer: realize the related functions of CAD design, such as modelling, rendering, animation, etc., and integrate intelligent optimization functions.

Presentation layer: provides user interface and interactive functions and displays design results and optimization suggestions.

In the division of functional modules, the system should include the following main modules:

Data management module: responsible for data import, export, cleaning and conversion.

Intelligent optimization module: provides functions such as algorithm selection, parameter configuration and result display.

CAD design module: realize basic CAD design functions, such as drawing, editing and viewing.

User interaction module: provides interactive functions such as user registration, login and feedback.

Through reasonable architecture design and module division, the stability, expansibility and ease of use of the system can be ensured.

6 REALIZATION AND TEST OF INTELLIGENT OPTIMIZATION CAD SYSTEM

6.1 System Development Environment and Tool Selection

When developing intelligent optimized CAD systems, choose the powerful integrated development environment Visual Studio, which provides one-stop development support for code editing, debugging, and testing. In addition, in order to realize the graphic interface and interactive function of the CAD system, it is necessary to use related graphic libraries and interface design tools. In this article, Qt and TKInterframe are used to construct user interfaces, and OpenGL, DirectX or Vulkan are used to realize 3D graphics rendering and animation effects.

6.2 System Interface Design and User Experience Optimization

The system interface serves as the main hub for users to engage with the intelligent optimization CAD system, making its design quality crucial for ensuring a positive user experience [15]. When crafting the system interface, we prioritize simplicity, ease of use, colour harmony, logical layout, and visual appeal.

To enhance user engagement, we incorporate interactive design elements such as intuitive visual cues, drag-and-drop functionality, and shortcut key support. Furthermore, we continually refine and enhance the interface based on user behaviour patterns and feedback, aiming to adapt to evolving user needs and preferences.

6.3 System Testing and Performance Assessment

After the system is developed, it is necessary to conduct a comprehensive test and performance assessment to ensure the stability of the system. Testing can start from performance testing, safety testing and other aspects, covering all modules and function points of the system. In the aspect of performance testing, it is necessary to test the response time, processing capacity, and resource consumption of the system to assess the system's operating efficiency bottleneck. The response time of the system is shown in Figure 2, and the operating efficiency of the system is shown in Figure 3.

The response time of the system can be kept within 3 seconds, which is ideal for most user interaction scenarios. Fast response time means that users don't have to wait for a long time, thus improving the user experience.

Figure 3 reflects the operating efficiency of the system, which has reached more than 90%. This means that only a few resources are wasted when the system is dealing with tasks. This is because the system fully considers resource utilization and task scheduling when designing to ensure that each component can work in the best state.

In terms of security testing, it is necessary to check the data security, access control, and anti-virus ability of the system to ensure its security and stability. The safety test results are shown in Table 4.

Test item	*Test content*	*Test result*
Data security	Strength and compliance of encryption algorithm	Pass
	Storage and transmission security of sensitive data	Pass
	Data backup and recovery mechanism	Pass

Access control	User authentication and authorization	Pass
	Assignment and management of access rights	Pass
	Prevent unauthorized access attempts.	Pass
Anti-virus ability	Detection and removal of viruses and malware	Pass
	Real-time protection and regular scanning	Pass
	Update and maintenance of anti-virus software	Pass

Table 4: Safety test results.

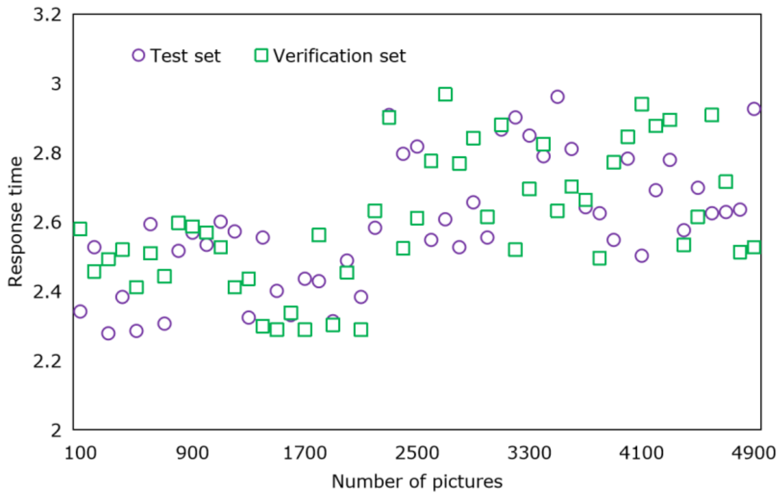

Figure 2: Response time of the system.

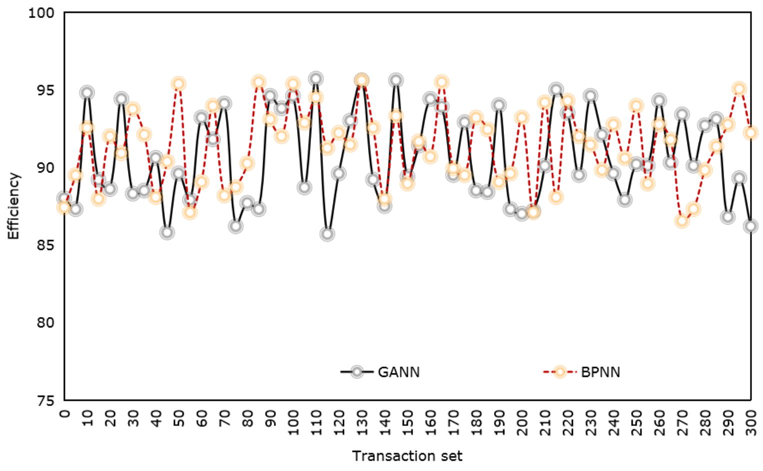

Figure 3: Operating efficiency of the system.

By conducting thorough testing and rigorous performance evaluations, potential issues and vulnerabilities within the system can be promptly identified and addressed. This not only enhances the overall quality and dependability of the system but also lays a solid foundation for future system upgrades and maintenance, providing robust support and assurance.

7 CASE ANALYSIS AND PRACTICAL APPLICATION

7.1 Typical Case Selection and Design Requirements and Process

The typical case selected in this article has the following characteristics: first, it is representative and universal, which can reflect the commonness and difficulty of a certain kind of design problems; Second, it is complex and challenging and can fully demonstrate the advantages and effects of intelligent optimization algorithm; Third, it has certain practical application value and can provide a useful reference for related industries or fields.

In terms of design requirements, the design objectives, constraints and assessment criteria of the case should be clarified. Design objectives should be specific and quantifiable, such as improving design efficiency and reducing material costs. Constraints should take into account the limitations in actual production and use, such as process requirements and safety standards. The assessment criteria should be objective and fair, which can fully reflect the advantages, disadvantages and feasibility of the design scheme. The design case is shown in Figure 4 and Figure 5.

Figure 4: Design case (A).

During the design of exemplary cases, this article leverages the full capabilities and strengths of the intelligent optimization CAD system. Initially, the system's data analysis and mining capabilities are employed to gain a profound understanding of the design challenges' traits and prerequisites, laying the groundwork for the subsequent algorithm choices and parameter configurations. Subsequently, the system's intelligent optimization algorithms are harnessed to iteratively refine the design solutions, continually elevating the design quality. Furthermore, the system's visual aids and interactive interface functionalities enable real-time display of the design process and outcomes, facilitating designers' real-time monitoring and adjustments.

Figure 5: Design case (B).

7.2 Display and Assessment of Design Results

After the design is completed, the design results should be fully displayed and assessed. The assessment can combine quantitative and qualitative methods to assess the innovation, practicality and aesthetics of the design results. The user scores of different methods are shown in Figure 6 and Figure 7.

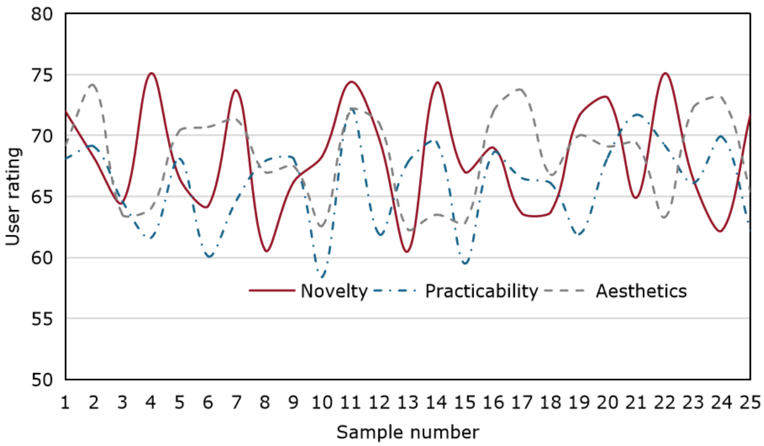

Figure 6: User rating of a traditional method.

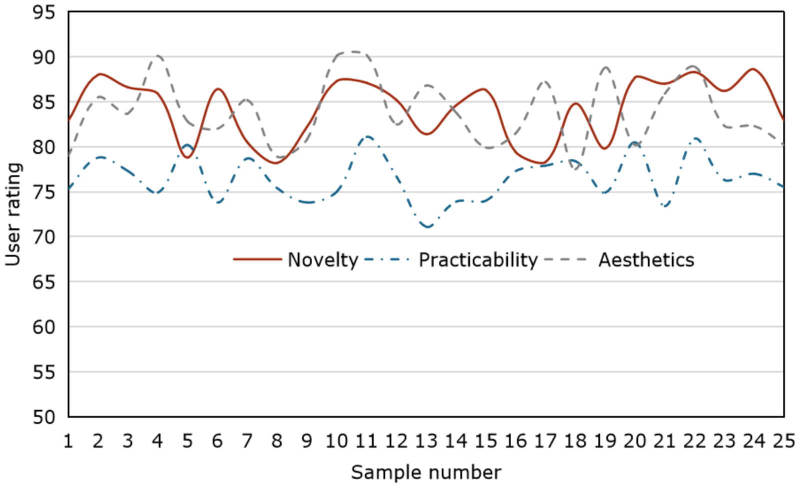

Figure 7: User rating of the method in this article.

Figures 6 and 7 show that the design using the method in this article has scored significantly higher than the traditional method in terms of innovation. This shows that the design method proposed in this article can stimulate the creativity of designers and produce more innovative design results. Moreover, in terms of practicality, this method has also obtained a high user rating. Practicality is an important index to assess whether the design results can meet the actual use requirements. The reason why the method in this article is excellent in practicality is that the intelligent optimization algorithm fully considers the actual use scenarios and user needs in the design process and accurately optimizes the design scheme through data-driven mode, thus improving the practicality and user satisfaction of the design. In addition, the aesthetic score of this method is also considerable. Aesthetics is the embodiment of the visual appeal of design results, which is very important for improving user experience and enhancing product market competitiveness. The application of intelligent optimization algorithms in design includes automatically adjusting the layout, colour matching and proportion of design elements to achieve more harmonious and beautiful visual effects.

7.3 Problems in Practical Application and Suggestions for Improvement

In practical application, intelligent optimization CAD systems may encounter some problems and challenges. For example, the efficiency and stability of the algorithm may need to be further improved; The interface interaction and user experience of the system may need to be further optimized; The design requirements in some specific areas may not be fully met.

To address these issues, the following recommendations are proposed: Firstly, intensify the research and refinement of the algorithm to enhance its stability. Secondly, prioritize user experience and feedback to iteratively refine the system's interface design and interaction methods. Thirdly, foster collaboration and dialogue with relevant industries and domains to gain a deeper understanding of evolving needs and trends, thereby broadening the system's application fields and functional capabilities.

8 CONCLUSION AND PROSPECT

This article aims to explore the design and implementation of an intelligent optimization CAD system combined with media BD and verify its effectiveness and practicability through case analysis and practical application. After a series of research and practice, the main achievements are as follows: The framework of intelligent optimization CAD system combined with media BD has been successfully constructed, and the integrated design process from data acquisition and processing to intelligent optimization has been realized. The requirement analysis method of CAD design based on media BD and the integration strategy of the intelligent optimization algorithm, which provides designers with more accurate design tools, are put forward. Through the selection of typical cases and the analysis of design requirements, the advantages and application value of intelligent optimization CAD systems in improving design efficiency and reducing material cost are verified. The design results are displayed and assessed comprehensively, which proves the feasibility and effectiveness of intelligent optimization CAD systems in practical application.

The findings presented in this article carry substantial academic and applied significance. Primarily, in terms of academic contributions, the article introduces an innovative design approach for intelligent optimization CAD systems incorporating media BD. This offers fresh perspectives and methodologies for CAD research. Furthermore, by analyzing case studies and real-world applications, the article expands the understanding of how intelligent optimization algorithms can be utilized in CAD design. Looking ahead, there is potential to further refine and enhance the system, enhancing its stability and scalability to accommodate more extensive and demanding design requirements.

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