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# Analysis of Visualization Teaching Strategies for Art Works Based on CAD and Computer Vision

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**Abstract.** With the rapid development of digital technology, its application in education and teaching is becoming increasingly widespread. As one of the core courses of digital technology, art courses have also begun to introduce digital technology for teaching reform. In traditional art courses, teachers mainly rely on analyzing and explaining student works. This model not only takes up a lot of students' spare time but also causes serious deficiencies in their aesthetic ability, artistic literacy, and other aspects. This study takes various artworks as examples, analyzes the problems existing in traditional teaching modes, and proposes an artwork analysis model based on a simulated annealing algorithm and CAD and computer vision. This model can not only improve students' understanding and aesthetic ability of artworks but also stimulate their interest in learning, improve classroom teaching efficiency, and have certain reference significance for other digital technology and art subject courses.

**Keywords:** Computer Vision; CAD Technology; Analysis of Art Works; Simulated Annealing Algorithm; Visual Teaching
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## 1 INTRODUCTION

Under the wave of digital CAD, the integration of art and technology is becoming a teaching strategy for computer vision analysis. Especially in art courses, the application of digital technology provides more innovative ideas, such as using image recognition technology to analyze student works and using VR technology to display student works virtually. However, in traditional art teaching, teachers often only focus on analyzing students' works and neglect their understanding of the works, resulting in serious deficiencies in their aesthetic ability, artistic literacy, and other aspects. Fan and Li [1] focused on researching images in the field of visual arts, using computer graphic visual communication methods to classify them. Many times, researchers also classify artworks based on artists, which can also be seen as a form of style classification. They are distinguishing artistic works based on the artist's personal style, such as da Vinci's works, Michelangelo's works, and so on. In addition to simple strokes, cartoons, and other relatively easy-to-understandable artworks, many visual artworks often make it difficult for non-art professionals to understand without written explanations. In the process of generating visual-spatial ability descriptions. The interweaving of visual senses between the real material world and the digital code virtual world leads to a gradual blurring of artistic experience. González et al. [2] conducted research on artistic visualization using the mapping graphic content of decoders. The article mainly focuses on the keyword "digital visual art" and presents emerging art categories that can be perceived and felt by the visual system. Art originates from life while changing it, and its understanding and experience of art begin with visual expression. The development of digital technology has brought humanity into a new era. It adopts the reconstruction of artistic essence, reshaping the understanding of the connotation and extended meaning of artistic expression. The way in which artistic style is presented has always been a problem in the exploration of visual art. From the visual centrism perspective of traditional art to the invention of photography and film technology, and then to the current era of digital imagery, the relationship between visual art viewing, the objects of viewing, and the results of viewing. It has made differential adaptations to the content between different datasets.

The boundaries of the "intangible" and "borderless" characteristics of contemporary visual art's digitization are gradually becoming blurred. Although the presentation of digital visual art is very rich in both quantity and representation. However, rich artistic practice lacks corresponding theoretical research integration, and the two need to complement each other. The virtuality of digital symbols generated by the development of computer Internet technology is not intended to express the nihility of negating the existence of matter. Therefore, Jiang and Zhang [3] used three-dimensional art images as their research object to explore the ability of existing technologies to understand art images. To explore the perception and understanding ability of virtual reality visualization technology on art images, and fill the gap in understanding visual art images, Jiao and Li [4] constructed a high-quality art image description dataset and focused on proposing an art image processing technology method based on virtual reality visualization. Firstly, by standardizing the target description style in the art field, the construction of the description dataset is completed. And manually filtered and annotated the descriptive data. Then, based on the annotation of the main sentences in the high-quality dataset, a text content filtering model is established through correlation analysis to determine the input information of the migrated dataset in the subsequent migration process. Finally, combined with transfer adaptation strategies, the design of an art image understanding tool was completed trained and implemented on the SemArt dataset. When designers present visual information, there are multiple outcomes. This includes the relative completeness of visual information, the relative accuracy of visual information (consistency between ideas and visual information), and the relative adaptation of visual information (consistency between design demands and visual information). Jin and Yang [5] make choices based on the user's needs. Taking the art painting of the proposition "Apple Seed" as an example, it is related to farmers, apple trees, and profiles of apples. In terms of visual information presentation, apple trees have the strongest visual impact on users, while farmers and apple profiles are relatively weak. In the presentation of visual information content, the content presented by apple planning is the most clear, followed by apple trees. Finally, the visual effects of farmers are presented.

Visual art, as a ubiquitous form of visual art, has various forms of presentation. It can help them interpret artistic works from multiple dimensions and deeply explore the internal logic of artistic creation. Not only does it open a door to the world of art for non-art professionals, allowing them to better understand and appreciate the beauty of art, but it also effectively enhances their aesthetic ability, further cultivates their temperament, and cultivates their character. At the same time, it can also analyze the development context and laws of art history, and may even inspire new creative inspiration. This analysis is of great significance for art theory researchers, artists, and other creative workers. From solemn sculptures and architecture to everyday clothing and photos, all embody the charm of art [6]. The essence of interpersonal communication is the process of extracting, selecting, and optimizing information. In communication, both parties can express and receive information clearly through text and language. However, when converting text and language into visual graphics, the transmission of information can cause ambiguity. This is also true in design and creation. Due to the different cognition and experience of users, when previewing a designer's design work, users can only understand a part of the meaning of the work and even go against the designer's intended expression. Based on this situation, Liu and Yao [7] have developed a relatively complete visual design creation mode to enable users to obtain more complete visual information. How can designers transform their ideas into graphics and images to generate more elemental features? Based on these principles, select the most suitable content from the converted graphics and images as design elements. It analyzes how designers organize design elements and what kind of form they will present after the organization. Thus transforming and upgrading towards intelligent teaching in visual communication design. The analysis of visual art images has important and far-reaching research significance and commercial value. Firstly, classifying and analyzing visual art images can help non-art professionals understand the artworks they are interested in. Mahadevkar et al. [8] better understood and appreciated art through artist and style information, brief textual analysis, and similar art recommendations. Secondly, using computer technology to analyze artworks not only helps institutions such as museums and art galleries to quickly classify their collections. Moreover, it can assist art historians in analyzing the subtle changes in the artist's creative style throughout their lifetime and exploring the development laws of art history. In addition, understanding and analyzing visual art is the foundation of other more complex art studies. Previous studies have generated new works of art or transferred the artistic style of images based on existing art collections, and have achieved surprising results. This provides artists with creative inspiration to a certain extent.

Therefore, in order to improve the efficiency of classroom teaching and promote the comprehensive development of students, this study proposes a teaching strategy for art analysis and visualization based on CAD and computer vision to address the problems existing in traditional art curriculum teaching. This strategy utilizes CAD and computer vision technology to analyze and visualize multiple artworks. Firstly, generate a drawing containing multiple artworks using CAD software. Then, using computer vision technology to extract relevant information from the images and form data packets. Finally, mix the data package with the drawings generated by CAD software to complete the analysis and visualization of the artwork.

## 2 RELATED WORKS

Posada et al. [9] classified features based on the prominent granularity of images. This is very important for the presentation of some artistic images. It innovatively utilizes methods such as multi-level features of images, and through comprehensive analysis and utilization of these features, successfully improves the accuracy and reliability of visual art image classification. Simultaneously, deep learning was combined to efficiently process and classify multi-level features. It further demonstrates the performance and efficiency of digital image classification in the process of automated optimization feature extraction and classification of images. The study by Ruzova et al. [10] presents us with a novel computer art system. With the training of machine learning models, the system can automatically recognize and classify different artworks. By utilizing pre-trained deep neural network models on large image datasets, we can effectively extract features of art images and generate corresponding descriptions. This innovation not only enables works to be presented to audiences in a more realistic way, improving their viewing experience but also promotes the digital display and dissemination of artistic works. This not only provides a more accurate and rich way to describe artistic works but also provides artists with more creative inspiration and references. The application of transfer learning is particularly crucial in the generation of artistic image descriptions. The image database used for media transfer analysis is insufficient. Through digitization and analysis of media structure, the innovation of the art system has been successfully demonstrated. However, visual analysis in the current art field still faces a significant challenge. In the process of generating artistic image descriptions, Sajovic and Boh [11] used transfer learning to obtain feature extractors to extract features from artistic images. It combines natural language processing techniques to transform these features into descriptive text. This technology can fully utilize the knowledge of existing deep learning models, avoiding the tedious and time-consuming process of training models from scratch. Meanwhile, transfer learning can capture high-level semantic information about images. Therefore, the generated descriptions are more accurate and vivid, which can better reflect the connotation and value of artistic works. Wang [12] starts from the relevance of new media scenes to classify and analyze visual art images. Considering the connection between the evolution of art painting styles and the background of art history. It explores the characteristics of the dimension of art history and summarizes three factors that influence the formation and development of art painting styles. Including the place of origin, time of origin, and artistic movement. The study conducted rigorous experiments on multiple art painting datasets. The experimental results show that compared with traditional single-label classification methods, this method exhibits significant advantages and can more accurately capture and express the diverse features of artistic works. Through end-to-end training, the model can learn and fully utilize the rich texture information of visual art images. The art image enhancement algorithm based on DBN proposed by Wang and Wu [13] has demonstrated remarkable performance after rigorous experimental verification. Whether it is classical painting or modern art, it can be accurately classified, providing strong technical support for art researchers. Through this method, it is possible to delve deeper into the inherent characteristics of artistic works, and thus classify and identify art styles, genres, etc. more accurately. It not only preserves the local structural information in the image but also significantly improves the contrast and three-dimensional sense of the image, greatly enhancing the visual effect of the artwork. This method not only significantly improves the accuracy of classification, but also provides unprecedented new perspectives and tools for art history research and artistic creation. Its framework can deeply explore the texture information of images and deeply analyze artistic images from the visual dimension. It is not only a technological breakthrough, but also a model of deep integration of art and technology. The perfect combination of technology and art will undoubtedly open up broader space for future artistic creation and research. Xin et al. [14] have made breakthrough progress in the field of deformation and displacement monitoring of image data sequences, providing practical and feasible solutions to this long-standing challenge. The uniqueness of this method lies in its ability to monitor and accurately measure the deformation and displacement of artworks in real time through a continuous sequence of image data. In the experiment, Xin et al. used a camera to record time-series image data of model deformation. Through in-depth analysis of these data, they successfully captured the overall deformation of the model surface. They not only verified the practicality and effectiveness of the IR-CV monitoring method through carefully designed indoor model experiments but also through on-site drone simulation experiments. In carefully designed model experiments, the IR-CV method demonstrated strong capabilities and successfully captured the subtle displacements generated by the artistic image model during the deformation and failure processes.

The application of digital media art in graphics and aesthetics is a perfect combination of science and technology and modern art. To gain a deeper understanding of the essence of digital media art, it is necessary to find a logical starting point and theoretical structure that closely combines the two in research methods. Yang and Ren [15] cleverly integrated visual art methods to comprehensively and accurately analyze the practical application effects and potential of digital media art in stage design. Through this comprehensive research method, it is expected to provide strong theoretical support and practical guidance for the further development of digital media art in the field of stage design. And combining the development and reference of theoretical resources for research topics. Conduct targeted analysis of successful cases both domestically and internationally. Not only is engineering drawing used for research and investigation of artistic practice, but also graphics and sketching are used to comprehensively interpret the visual application of digital media art in art design from multiple perspectives. Nowadays, art designers around the world are using digital media art to create and complete visual works of art images. The combination of the infinite, extensive, and creative characteristics of digital media art concepts with stage design. This has brought digital image art, digital lighting art, digital interactive installation art, etc. to the works, gradually changing the visual expression of stage design in this process. Zhang and Rui's [16] research topic is the visual application of digital media art in design. Art design encompasses visual elements, but the application of digital media art showcases a diverse world and rich visual forms to us. It has changed the way we express our visual language and view the world, extending people's perception of the visual world on stage. This article aims to combine various temporal digital media arts, such as digital imaging, digital lighting, digital audio, etc., with spatial stage design. Exploring the visual expression process and influence of digital media art in art design, in order to enrich and develop visual image art and enhance the visual expression of art design.

Although some teachers have attempted to use digital technology for teaching reform in practice, most teachers have not yet formed a systematic digital teaching model. For example, some teachers, although using digital tools for teaching, simply digitize the content of the textbooks without utilizing digital technology to better integrate and restructure the content. Therefore, how to effectively integrate computer vision technology, CAD technology, multimedia technology and other related digital technologies with art education and apply them to art classrooms is an urgent problem that needs to be solved.

## 3 CONSTRUCTION AND OPTIMIZATION OF AN ART ANALYSIS MODEL

### 3.1 Strategy and Steps for Building an Art Analysis Model Based on CAD and Computer Vision

The art analysis models of CAD and computer vision mainly include three parts: CAD-based art analysis models, computer vision-based art analysis models, and work visualization teaching models.

The first aspect is that the CAD-based analysis model for artworks mainly involves the digital processing of artworks, laying the foundation for subsequent visual analysis. Firstly, digitizing the artwork and converting it into a digital form suitable for computer processing is necessary. Then, computer vision technology extracts and processes digital images and presents the processed image information to students. Finally, the processed image information is combined with text, graphics, and other content to achieve visual analysis of artworks. Digital transformation is not just about simple image scanning or photography; it involves the extraction of in-depth and detailed information from artworks. Pre-processing of digital image information is also an essential step before digital processing. At the same time, the extraction of color information is also crucial, as it can reflect the visual characteristics of artworks, such as color matching and tone changes. In addition to image and colour information, digital processing also requires combining this numerical information with text, graphics, and other related content. When performing digital image preprocessing, it is necessary to ensure that the basic features of the digital image, such as colour, brightness, contrast, etc., can be recognized and processed by the computer. The corresponding formulas in this process are as follows:

$$Q(c) = \int \frac{ec_i + \ e + m \ \ c_{i+1}}{e^2 + m^2} \tag{1}$$

$$W(c) = \sum_{i=1} \frac{ec_i + \ e + m \ \ c_{i+1}}{\sqrt{e^2 + m^2}} \tag{2}$$

When digitizing artworks, it is necessary to ensure that digital images can be recognized and processed by computers and to ensure the quality of digital images. Therefore, based on the relevant judgment conditions of the initialized digital processing model, it can be obtained that:

$$E(c) = \sum_{i=1} \frac{\sqrt{ec_i + \ e + m \ \ c_{i+1}}}{em + m + 2} \tag{3}$$

$$R(c) = \sum_{i=1} \ ec_i + \ e + m \ \ c_{i+1} \ + \sum_{i=1} \ mc_{2i} + \ e - m \ \ c_{2i+1} \tag{4}$$

$$T(c) = \frac{\sqrt{\sum_{i=1} \ ec_i + \ e + m \ \ c_{i+1} \ + \sum_{i=1} \ mc_{2i} + \ e - m \ \ c_{2i+1}}}{e + m} \tag{5}$$

The formula, $E(c)$、$W(c)$、$E(c)$、$R(c)$、$T(c)$ represents the data conversion function, CAD visualization function, iterative judgment function, disturbance interference function, and image information channel function in the intelligent matching model. $c_i$ represents the interior design data element, $e$ represents the quality standard value, and $m$ represents the contrast factor.

The second aspect is that the analysis model of artworks based on computer vision is mainly based on computer vision technology, which realizes the extraction and processing of digital image information. The analysis model of artworks based on computer vision can better present digital image information and provide better conditions for subsequent visual teaching. This analysis model mainly combines digital images with text, graphics and other content to achieve visual analysis of artworks. When constructing an art analysis model based on CAD and computer vision, it is not only necessary to preprocess digital images to enable them to be processed by computers but also to extract and process the processed digital image information and present the processed information to students. Then, the processed information is combined with text, graphics, and other content to achieve a visual analysis of the artwork. The overall architecture is shown in Figure 1.

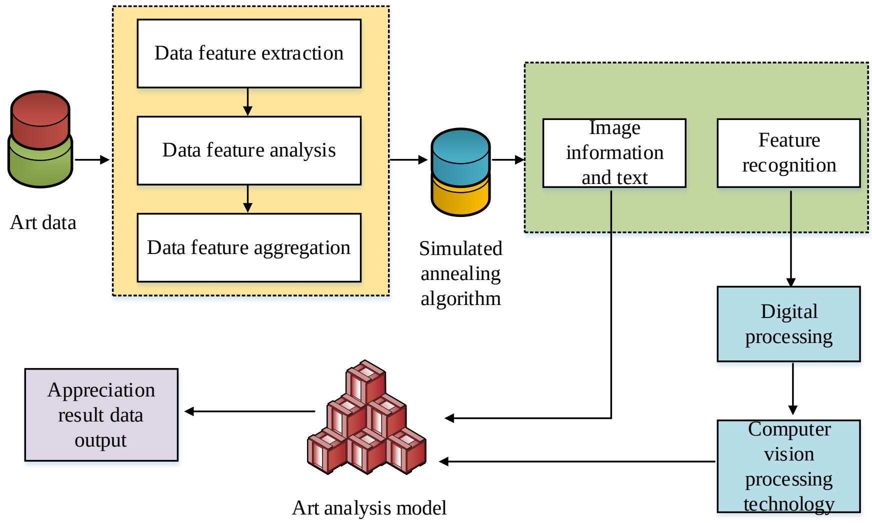


**Figure 1**: Strategy for building an art analysis model based on CAD and computer vision.

In the third aspect, the visual teaching model of works is mainly based on the visual teaching framework of the artworks created by students to achieve the rapid dissemination of works on the Internet, case teaching, art judgment, and other functions. In the specific operation process, teachers can apply virtual reality technology to CAD-based art analysis models to better present digital image information. When students process digital image information, teachers can record their operating behaviours and display them to students through multimedia playback devices, enabling students to have a more intuitive understanding of digital image information. In the specific operation process, teachers can use virtual reality technology to display artwork, allowing students to see various details in the artwork more clearly.

### 3.2 Application of Simulated Annealing Algorithm in the Construction Process of Art Analysis Model Based on CAD and Computer Vision

In order to ensure the accuracy of the output results of the art analysis model based on CAD and computer vision, this study introduces the simulated annealing algorithm and its related ideas into this analysis model.

Firstly, when constructing a model for analyzing artworks, selecting one objective function from a set of objective functions as the final objective, makes it better than the original objective function.

When constructing an art analysis model, after setting an optimal solution, a new optimal solution can be set, and the new optimal solution can be used as the ultimate goal. Due to the inherent randomness of the simulated annealing algorithm, random attempts can be made during the construction process of art analysis models to continuously improve the efficiency of the simulated annealing algorithm. The simulation analysis results are shown in Figures 2 and 3.

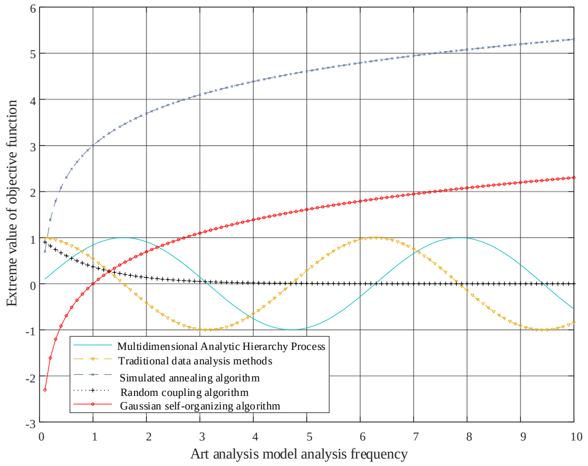


**Figure 2**: The extreme values of objective functions in art analysis models using different algorithms.

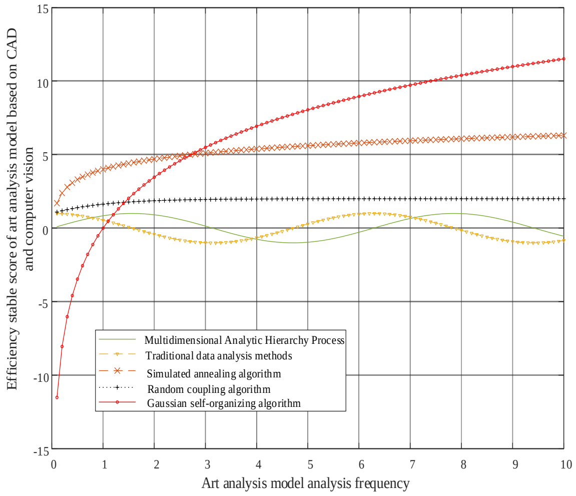


**Figure 3**: Stable efficiency scores of different algorithms in art analysis models.

From the results in Figures 2 and 3, it can be seen that introducing an algorithm into the art analysis model based on CAD and computer vision can improve the efficiency and quality of model construction. This is because, in the process of constructing an art analysis model, it is not only necessary to clarify the objective function to be studied, which is a crucial step in the entire analysis process but also to use the simulated annealing algorithm, an efficient optimization tool, to explore the possible objective function space. Through this method, the optimal solution for model performance can be gradually approached, thereby determining a new objective function that is more suitable for art analysis. After completing the above steps, we will use this new objective function as our ultimate goal and use it as the final objective function of the model. When the new objective function appears, we can use a simulated annealing algorithm to repeatedly iterate. The corresponding formulas in this process are as follows:

$$Q'(c) = \int \frac{\sqrt{emc_i c_{i+1} + e^2 c_i + (e+m)^2 c_{i+1}}}{e^2 + m^2} \tag{6}$$

$$W'(c) = \sum_{i=1} \frac{ec_i + (e+m)c_{i+1}}{\sqrt{e^2 + m^2}} \tag{7}$$

$$E'(c) = \sqrt{em + \sum_{i=1} \frac{\sqrt{ec_i + (e+m)c_{i+1}}}{em + m + 2}} \tag{8}$$

$$R'(c) = \sqrt{\sum_{i=1} (ec_i + (e+m)c_{i+1}) + \sum_{i=1} (mc_{2i} + (e-m)c_{2i+1})} \tag{9}$$

$$T'(c) = \frac{\sqrt[3]{\sum_{i=1} (ec_i + (e+m)c_{i+1}) + \sum_{i=1} (mc_{2i} + (e-m)c_{2i+1})}}{2e + \sqrt{e^3 + m^3}} \tag{10}$$

The formula, $E(c)$、$W(c)$、$E(c)$、$R(c)$、$T(c)$ represents the data conversion function, CAD visualization function, iterative judgment function, disturbance interference function, and image information channel function in the intelligent matching model. $c_i$ represents the interior design data element, $e$ represents the quality standard value, and $m$ represents the contrast factor.

Secondly, when constructing a model for analyzing artworks, simulated annealing algorithms can be used to remove some less influential data, thereby improving the efficiency of analyzing artworks. In the process of constructing an analysis model for artworks, it is first necessary to clarify the specific analysis goals we are pursuing. This goal should be specific and clear, which may involve identifying specific elements in the work or exploring the artist's creative techniques. Once these goals are established, they can be set as a new starting point, initiate a new analysis cycle, and perform continuous iterative calculations. The corresponding formulas in this process are as follows:

$$Q''(c) = \frac{e + 3m}{2m} + \int \frac{\sqrt{emc_i c_{i+1} + e^2 c_i + (e+m)^2 c_{i+1}}}{e^2 + m^2} \tag{11}$$

$$W''(c) = \sum_{i=1} \frac{\frac{e + 3m}{2m} + \sqrt{ec_i + (e+m)c_{i+1}}}{\sqrt{e^2 + m^2}} \tag{12}$$

$$E''(c) = \sqrt{\frac{e^2 + 3m}{2m^2} + \sum_{i=1} \frac{\sqrt{ec_i + (e+m)c_{i+1}}}{em + m + 2}} \tag{13}$$

$$R''(c) = \frac{e^2 + 3m^3}{2em} \sqrt{\sum_{i=1} (ec_i + (e+m)c_{i+1}) + \sum_{i=1} (mc_{2i} + (e-m)c_{2i+1})} \tag{14}$$

$$T''(c) = \frac{em}{e^2 + m^2} + \frac{\sum_{i=1} (ec_i + (e+m)c_{i+1}) + \sum_{i=1} (mc_{2i} + (e-m)c_{2i+1})}{2em + \sqrt{e^3 + m^3}} \tag{15}$$

The formula, $E(c)$、$W(c)$、$E(c)$、$R(c)$、$T(c)$ represents the data conversion function, CAD visualization function, iterative judgment function, disturbance interference function, and image information channel function in the intelligent matching model. $c_i$ represents the interior design data element, $e$ represents the quality standard value, and $m$ represents the contrast factor.

Finally, when constructing a model for analyzing artworks, it is necessary to use a simulated annealing algorithm to find the correlation between different data and analyze the artistic synergy between different artworks. In the process of constructing a model for analyzing artworks, due to the differences in artistic characteristics among different types of works, when studying the artistic synergy of different types of works, it is necessary to distinguish them reasonably, classify them, and then determine the correlation between each type.

In the process of constructing an art analysis model, it is important to avoid incorporating irrelevant data information into the model as much as possible. Secondly, the simulated annealing algorithm can transform non-smooth optimization problems into smooth problems, thereby achieving optimization of the objective function. Moreover, the simulated annealing algorithm can also handle uncertain factors, making the art analysis model more stable and accurate. Therefore, the simulated annealing algorithm plays an important role in constructing art analysis models based on CAD and computer vision.

### 3.3 Optimization of Simulated Annealing Algorithm in Art Analysis Models Based on CAD and Computer Vision

After building a perfect artwork analysis model in this study, it was found that there are still some problems in the actual experimental process, so it is necessary to optimize the model.

Firstly, in order to enable students to better understand and accept art analysis models based on CAD and computer vision, a reasonable selection of CAD images and text content can be made during the optimization process of the model. Usually, when selecting images, it is necessary to combine actual needs with the learning situation of students. If students are familiar with the teaching content, they can ask the art analysis model to choose some simpler images; If students are not familiar with the teaching content, they can ask the art analysis model to choose some representative images; If students are not familiar with the teaching content, they can choose some more intuitive images for the art analysis model, and the experimental simulation analysis results are shown in Figure 4.

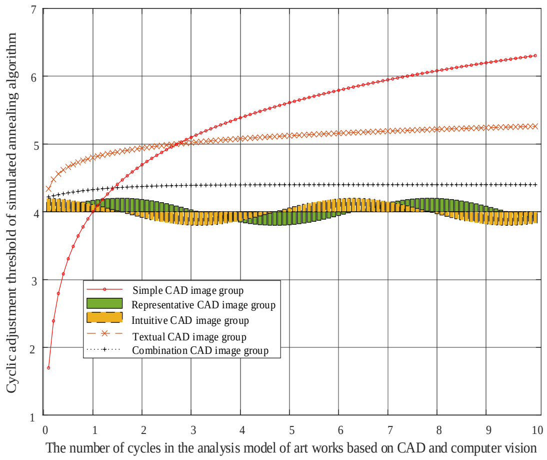


**Figure 4**: Circular adjustment threshold relationship diagram of different types of CAD image groups in art analysis models.

Due to the use of the simulated annealing algorithm in this study, in order to ensure the accuracy of the art analysis model during the optimization process, it is necessary to make reasonable adjustments to the simulated annealing algorithm. Specifically, when analyzing artwork, mouse clicks can be used to extract graphic information; Then, extract the textual information from the artwork by clicking with the mouse; Finally, use mouse clicks to extract image information from artwork. In order to make the optimized model more acceptable to students, a simulated annealing algorithm can be used to combine the above two methods during the optimization process. Usually, students can first extract graphic information, then extract textual information, and finally combine the two. The purpose of doing so is to make the optimized art analysis model more realistic.

Secondly, due to the inclusion of various forms of image and textual information in the analysis model of artworks, it is necessary to process them reasonably during the optimization process. The optimization operations in this section are as follows: Firstly, when analyzing artworks, it is necessary to use a simulated annealing algorithm to appropriately screen them and classify information such as images and text reasonably; Then, when processing images, attention should be paid to the interrelationships between the images. Usually, text content can be extracted using mouse clicks; In addition, when processing textual content, the art analysis model should also focus on the interrelationships between images and textual content. This is because in the art analysis model if you want to analyze and classify artworks, you need to process the digital content in the artworks. In addition, when processing the content of artworks, relevant tools such as image processing software can be used. When analyzing artworks, it is necessary to first process the digital information of the artworks, and then process the image information. But in practical applications, if we want to make the information of images more comprehensive and accurate, we need to classify the digital content and image information in artworks reasonably. Therefore, when analyzing artworks, relevant tools can be used to complete this process, and in this study, Photoshop is mainly used to complete this work.

Thirdly, due to the strong stability of the simulated annealing algorithm, it can effectively improve the computational efficiency of the algorithm. Therefore, when analyzing artworks, the reasonable application of the simulated annealing algorithm can be used to analyze and optimize the classification of artworks. Usually, when optimizing the analysis model of artworks based on CAD and computer vision, this method can be used to process mathematical images, text, graphics, etc., thereby effectively displaying the information in the artworks. In this study, a simulated annealing algorithm was mainly used to normalize art images and digital information. The experimental simulation analysis results are shown in Figure 5.

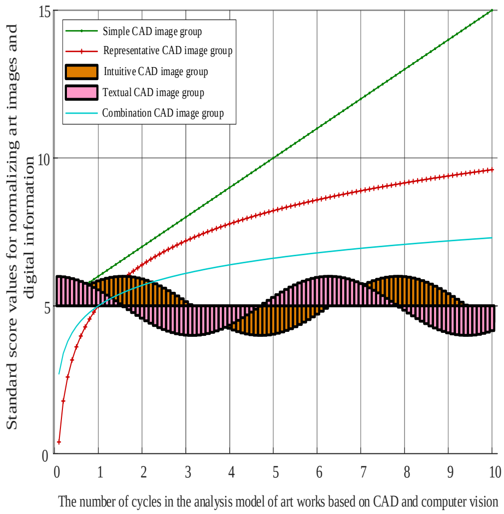


**Figure 5**: Standard score values for normalizing art images and digital information using simulated annealing algorithm.

From Figures 4 and 5, it can be seen that applying a simulated annealing algorithm to process art images can make the display of art images clearer, more accurate, and more intuitive, and can focus students' attention on art images. This is because when optimizing art analysis models based on CAD and computer vision, the digital information in the art analysis model can be uniformly processed through the reasonable application of a simulated annealing algorithm, thereby making the art analysis model more accurate. For example, when students see a digitized art image, they first need to convert it into a digital form suitable for computer processing - they can convert an image into three pixels, and then use formula content to convert the digital information into the content of the image.

## 4 VISUALIZATION TEACHING EXPERIMENT AND ANALYSIS OF ART ANALYSIS MODEL BASED ON CAD AND COMPUTER VISION

### 4.1 Visual Teaching Experiment Design Process

This study conducted an experiment on art analysis and visualization teaching based on CAD and computer vision. In this experiment, students were randomly divided into an experimental group (30 people) and a control group (30 people), and the teaching objectives were transformed into the following three levels: first level: understanding the work; Level 2: Analyzing the work; Level 3: Expressing works. Students at each level have different tasks. During the experiment, students are first assigned to the corresponding experimental and control groups according to their grouping requirements, and each student is asked to preview before class; Secondly, teachers provide course explanations and demonstrations based on the student's preview situation, and analyze the student's work; Finally, the teacher provides comments and summaries on the works of each group. The entire teaching process is jointly completed by the teacher and students. The teacher analyzes and explains the work through a computer, and displays the analysis results of the work through a computer screen. The results are shown in Figure 6.

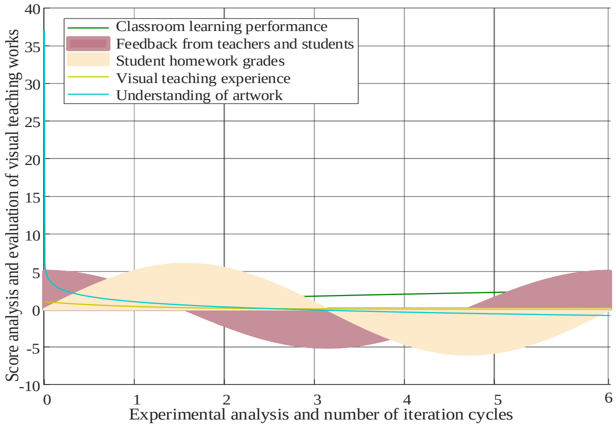


Figure 6: Experimental results of visual teaching of art analysis models based on CAD and computer vision for artwork analysis.

From the results in Figure 6, it can be seen that using visual teaching software to analyze the works of different groups, the results shows that there is no significant difference in the analysis results of the works of the first three groups; The analysis results of the last two groups show significant differences. At the same time, the author found that this teaching model can effectively improve students' understanding and aesthetic ability of artworks. This is because the art analysis model adopts multiple data adaptive analysis strategies, and when analyzing and processing large amounts of data, the model will use certain information in these data to make analytical judgments.

### 4.2 Analysis of Visualization Teaching Experiment Results

In order to make the results of this study more objective, a common multidimensional evaluation system was adopted, and a survey and analysis were conducted on students' classroom learning performance, teacher-student feedback, and homework performance. The results are shown in Figure 7.

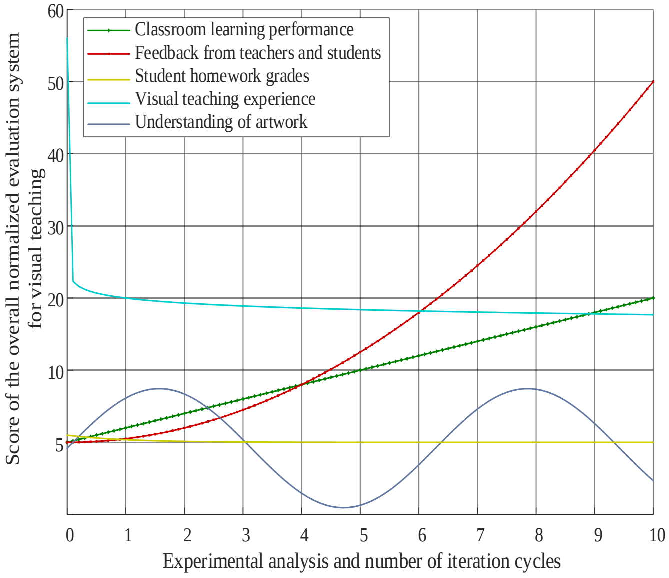


**Figure 7**: Visual teaching evaluation analysis of art analysis model based on CAD and computer vision.

Through the analysis of the results in Figure 7 and the works of the experimental group, it can be found that the experimental group has a good understanding and expression of the work "Color Still Life", while there are significant differences in the analysis results of the works of other groups. The reason for this is that under this teaching model, a large amount of data adaptability analysis strategies are used. Therefore, teachers can use the analysis results of students as evaluation criteria to encourage them to think more deeply. On the other hand, in this teaching model, teachers combine CAD and computer vision, which can enable students to exercise their aesthetic abilities while understanding works, thereby improving their understanding of artworks. In summary, the art analysis model based on CAD and computer vision has a good teaching effect.

## 5 CONCLUSIONS

With the continuous deepening of educational informatization and the continuous enrichment of digital educational resources, digital technology will play an increasingly important role in the field of education. In the context of the new curriculum reform, how to better leverage the role of digital technology in teaching, and enhance students' learning interest and self-learning ability, is a concern for educational researchers and frontline teachers. This study proposes a model for analyzing artworks based on a simulated annealing algorithm and CAD and computer vision and proposes various visualization teaching strategies. The model recognizes and processes images through computer vision technology, and converts the processing results into visualized graphics, allowing students to intuitively analyze and understand the works. At the same time, this study visualized artworks through CAD software and extracted details from images through image processing techniques, enabling students to quickly understand image information. In the future development process, this study will continuously attempt to combine CAD and computer vision technology for art analysis and visualization teaching, in order to provide reference for other digital technology and art subject courses.

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