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Development model based on visual image big data applied to art management

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ABSTRACT

This paper aims to explore the application of visual image big data (BD) in art management, and proposes and develops a new art management model. First of all, this study conducted extensive research on the overview and application of big data, focusing on analyzing the characteristics of big data and its characteristics and application methods in art management. By introducing image processing (IP) technology, this paper expounds on the application of visual image technology in art management in detail and discusses the classification of computer vision images to determine its application direction. On this basis, this paper proposes the application of visual images and big data in art management from three aspects: the accurate acquisition of visual images, the development model of art management, and the development of visual image technology in art resource management and teaching, and strengthens the development model of art management based on IP algorithm. Experiments and surveys show that the art management model development system built by the newly introduced visual image technology, big data technology, and IP algorithm can increase user satisfaction by 24 %. This result shows that the new model has a significant effect in improving the efficiency and quality of art management, providing strong technical support for the field of art management, while also providing designers with a more accurate tool for assessing market trends, helping to adhere to and promote good design concepts.

1. Introduction

Art management is a multi-faceted field, which integrates urban planning, design aesthetics, environmental ecology, and the expression of human behavior, and covers the unified artistic design of the internal and external environment of the building. With the progress of computer image processing technology, the application of big data and image processing technology has significantly improved the ability of real-time processing in the field of art. For example, in environmental art design, the integration of internal and external environmental elements of the building can create a space that is both beautiful and practical. At the same time, the analytical ability of big data enables art managers to have a deeper understanding of market trends and audience needs, which enhances audience interaction and market adaptability of artworks. Image processing technology has also made the digitization, archiving, and presentation of works of art more efficient and diverse. IP-based art management system, with its efficient data processing capabilities and innovative management strategies, shows broad application potential, indicating that the field of art management will experience a technological innovation, which will further enhance the efficiency of the creation, display, and protection of artworks.

Although previous studies have deeply explored the application of big data and computer vision techniques in the field of art

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management, this study further promotes the evolution of art management models by introducing innovative image processing algorithms. This study is unique in that it not only focuses on the practical application of these technologies but also verifies how these technologies can significantly improve the efficiency and quality of arts management through a series of experiments. In recent years, the continuous development of computer technology has provided solid support for all fields of life. IP technology is an important part of computer technology. The mastery and reasonable use of computer IP technology can boost the design quality of the entire art management. In recent years, society has gradually entered the information age, and the information society will become more and more perfect in the future. In this process, computer image visualization would also have more space for development, and the technology would become more and more mature. As an application trend, computer technology is inevitable. Therefore, computer vision imaging technology must be constantly updated to create greater value for society. Relevant technical personnel must be committed to the development of computer vision art management and constantly improve the update of art management to meet the common requirements of users.

This research aims to explore the key challenge of art management in the era of big data: how to use computer vision technology to improve the efficiency of digital processing and management of artworks. The study begins by asking several core questions: How can computer vision and big data analysis optimize art management processes? How can these technologies help art managers better understand and anticipate market trends? And how can these technologies enhance the conservation and management of works of art? To solve these problems, the main contributions of this paper include: (1) a development model of innovative art management that integrates visual images and big data is proposed; (2) The effectiveness of this model in improving employee satisfaction and art resource management efficiency is verified through experiments; (3) The application potential of this model in art education and resource conservation is discussed. These achievements not only promote the progress of art management theory but also provide a new perspective and tool for practical application.

The structure of this paper is as follows: The second part will delve into the elements and characteristics of Big Data (BD), as well as their specific application and impact in art management. The third part will investigate and analyze the application of image processing (IP) technology in art management in detail, and discuss the classification of computer vision images and its development direction in art management. In the fourth part, we will discuss the application of visual images and big data in art management from three aspects: the accurate acquisition of visual images, the development model of art management, and the development of visual image technology in art resource management and teaching. The fifth part will introduce the construction process and method of strengthening the art management development model based on the IP algorithm. The sixth part will show the experimental results and evaluation of the IP-based algorithm. Finally, in the conclusion of Part 7, we will summarize the research findings and discuss the direction of future work.

2. Related work

Many scholars have analyzed and studied art management. Lu C evaluated the quality of the plant landscape in Dongpu National Wetland Park in Luyang, Anhui Province by using big data and an analytic hierarchy process, which provided the scientific basis for artistic management and promoted biodiversity and ecological balance [1]. Pidlisna O offers effective strategies for arts management in creating harmonious urban Spaces through the application of art and innovative design to urban environmental optimization [2]. By analyzing the network process assessment framework, Di Zhang W provides aesthetic guidance for the design of public space in western rural areas and promotes the protection of folk culture and tourism development [3]. Hamzavi H uses the Delphi method and expert advice to propose a green roof concept model that enhances the ecological aesthetics of urban landscapes and provides an innovative perspective for art management [4]. Through ecological analysis and regression method, Fu W proposed the campus landscape design model of Jiangsu Province, optimized ecological aesthetics, and provided a scientific basis for the application of art management in the campus environment [5]. Enright T critically analyses transport art projects, revealing their political and economic context and providing insights into the urbanization process for arts management [6]. All the above studies described art management, but there were still some deficiencies in visual image analysis.

Visual images are widely used in art management. Chen Y reveals trends in the application of social media imagery in social science research, and points out the potential of computer vision and machine learning in arts management, while emphasizing the importance of ethical and privacy issues [7]. Kar A K reviews the potential of artificial intelligence and large-scale language models in industrial applications to provide new perspectives on arts management, highlighting the importance of visual images in enhancing decision-making and customer experience [8]. Nathanson R analyzes the role of photographic practice in the representation of the Israeli occupation, revealing the institutionalized limitations of visual images in art management and their impact on collective memory and identity [9]. Kelishadrokhi M K proposed an image retrieval method combining color and texture features, which improves retrieval performance through local neighborhood difference mode and optimization of HSV color histogram, which is of great significance for visual image analysis in art management [10]. Beyan E VP reviews the application of AI image generators in architectural design, pointing out its potential to expand design imagination in art management while proposing technical challenges and future directions [11]. Garzon-Paredes R studies the effect of virtual reality on tourists' emotions through EEG, providing a scientific basis and A new perspective for the emotional role of visual images in art management [12]. Through structural equation modeling, Zhou Q revealed the impact of the cultural heritage revitalization experience on tourists' willingness to re-visit, emphasizing the importance of visual images in art management to enhance the tourism experience and destination image [13]. The above studies described the application of visual images, but there were still some deficiencies in the research of art management.

3. BD and application evaluation

3.1. BD elements and characteristics

BD is a form of information used to collect a large amount of information on the Internet [14]. BD technology has diversity and timeliness. When analyzing BD, it is necessary to filter and classify all kinds of information and obtain valuable data results. BD is highly time-sensitive, but the data is too old to meet users' needs for information processing. Intuitive BD almost has no relationship with art management. However, BD can promote the development of art management. By collecting art management information, information islands in the design process can be avoided and art managers can obtain high-quality professional information. The art management specialty itself has a strong interface. The use of BD to understand different areas of life helps guide design. Art managers can use BD to understand the information composition of art management. It is necessary to meet the needs of art management and provide information according to the actual situation, to establish a database to understand the changing needs of the art management market.

With the wide application of big data technology in art management, data security issues are increasingly concerned. Recent studies have shown that achieving lightweight security is critical to protecting sensitive data in art management [15]. Other studies have highlighted the limitations of algorithmic security and called for more in-depth research on implementation attacks, which is of great significance for protecting art management data in the post-quantum era [16].

3.2. Characteristics of BD in art management

With the continuous development of computer systems and the improvement of intelligence levels, the way manual design works is gradually replaced. In art management, the application of computer technology and BD can improve design accuracy and better meet the needs of image and aesthetics [17]. Due to the application of computer technology, some complex relations in art management can be solved by computer technology. For example, computer technology can provide high design efficiency for some models and repetitive models, which can simplify the design process and shorten the design cycle. The use of computer technology embodies many advantages, especially the significant improvement of artistic innovation. Creativity is the basis of artistic management value. Only by constantly integrating new ideas can artistic management have a better impact. Generally, designers should consider whether the design is feasible and whether it contains new content, as shown in Fig. 1.

3.3. Art management methods under BD and visual image technology

The application of computer technology has greatly improved the environment of traditional art management. By combining BD to create digital graphics, the past artistic activities are summarized, and there are clear objectives in digital IP to ensure the rationality of the design. Art management is closely related to IP. At present, art management and computer IP are closely linked to ensure the rigorous effect of art management. In the past, IP technology faced great challenges in many design works, especially some special effects, such as portrait matting. With the support of BD, artists can protect their legitimate interests from plagiarism and plagiarism. In the past, many design concepts were plagiarism. On the one hand, the efficiency of intellectual property is low; on the other hand, it is due to the lack of technology to detect plagiarism in time. BD technology can meet the requirements of intellectual property protection

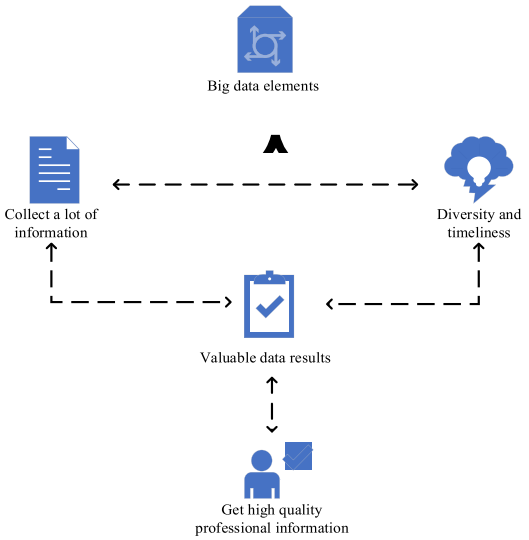

Fig. 1. Characteristics of BD in art management.

in technology. It is necessary to fully understand the creative ideas of relevant writers, and promote BD technology, to better protect the intellectual property rights and artistic ability of art managers and advance production development [18].

4. Application investigation of IP technology in art management

4.1. Classification of computer visualization images

Image denoising technology is one of the most widely used functions in computer visualization images. When recording some image data, due to objective factors such as material and environment, the captured image would generate noise, which usually appears in the form of firmware noise and photon noise during the operation of the computer IP system. This has a corresponding impact on the IP work and damages the initial efficiency and quality of IP. Therefore, image-denoising technology is the basis of visual image calculation. Image enhancement technology is one of the most widely used functions in computer vision images. In some cases, it is necessary to capture part of the information contained in the image. Image enhancement technology can retrieve useful information and update or delete unnecessary information. Computer visualization image technology is one of the most widely used image compression technologies in computer vision and is often used to quickly retrieve image information. Generally, TV images can produce comparable image data transmission speeds. Therefore, in the process of IP, image compression technology for image distribution can effectively prevent image distortion in the transmission process, and can maximize the image resolution.

4.2. Application of computer visualization image

Computer image visualization can be applied to all aspects of art management. For example, in the process of urban planning, computer image visualization can be reasonably used to create a simulated urban planning map. The advantage of this simulated map is that it can restore all urban planning projects, so every detail is reflected. This is very useful for urban planners to learn design more intuitively and eliminate the gap, which can significantly improve the rationality and artistry of urban planning. Staff participating in the final form of urban planning can preview through visual images, which greatly reduces mistakes in urban planning and construction. Art comes from daily life. Whether at home or in other shopping centers, people can always see a variety of products. For more consumers to consume these products, the practicality of the products must be guaranteed, and the packaging design must be rigorous, such as food packaging, clothing packaging, and commodity packaging. Commodity packaging is inseparable from computer image visualization and visual communication design. As a means to identify the value and use of commodities, packaging is not only the book cover that people read, but also the poster and color advertising page. What people see on the street is the basis of computer image visualization and the spread of art design. Human needs can inspire design and deepen people's thoughts, culture, and knowledge. Various colors and opacity settings can bring different visual effects, as shown in Fig. 2.

4.3. Development prospect of computer visual image in art management

With the continuous development of science and technology, more and more people have begun to put forward requirements for image quality. This requirement has become increasingly strict, which has promoted the significant development of computer graphics and related hardware facilities, as well as the need to create an art management system. In the process of creating the art management system, the person in charge is required to build the system, which takes time to produce. With the help of computer image visualization, it has become an ideal substitute for artificial code. The management level of the art management system has been greatly

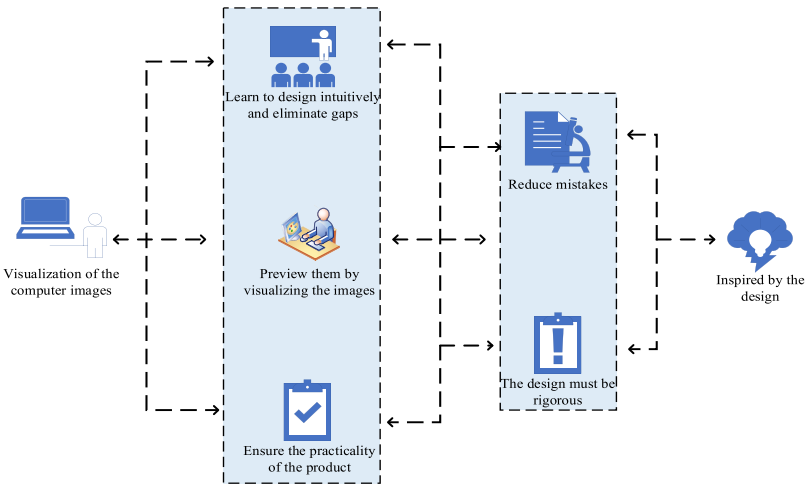

Fig. 2. Application of computer visualization images.

improved. The Internet is one of the indispensable tools for people in modern society. Whether the website design is beautiful or not is one of the conditions for improving website visualization. When designing websites, computer vision images can be used correctly. Through different artistic styles, visitors are attracted, which makes the website more beautiful. In web page design, the main purpose of computer image visualization technology is to enable it to process format, content, size, shape, color, etc., which can improve the visual appearance of the website and enhance the design level of the web page through IP technology.

5. Application of visual image and BD in art management

5.1. Visual image accurate acquisition and BD application features

Visual image technology uses stereo real scenes to record and intelligent multi-dimensional control technology to accurately control the rotation and walking direction, to accurately capture the visual image and innovate in the 3D capture of 3D and multi-dimensional data. With the rapid development of information technology, the amount of data generated by people using various digital devices is increasing every day. BD can store large amounts of data. Continuity, compatibility, integrity, and reliability make the whole system intelligently and quickly store various data and transmit large amounts of data. In addition to matching with texture and spatial location, internal infrared and ultraviolet image maps are made, which can quickly process and retrieve data from various art resources quickly access data resources, and create databases. The storage and collection of information is the basic processing method of art resources. There is no advantage in the value of single data. However, when this information is embedded into different data streams, the advantages of BD would emerge. Each image is captured, analyzed, evaluated, sorted, and combined. The value of massive data is mined and the dynamic evolution of data is recorded, as shown in Fig. 3.

With the wide application of big data technology in the field of art management, its potential security threats, especially data poisoning attacks, cannot be ignored. In the medical field, existing studies have revealed the vulnerability of machine learning models to systematic data poisoning attacks [19]. At the same time, with the increasing attention to energy efficiency, long-term continuous personal health monitoring systems are facing similar security challenges [20]. These studies highlight security issues that must be considered and guarded against when designing and implementing big data applications to ensure data integrity and system reliability for art management.

5.2. Development model of visual image on art management

The key technology of visualization image refinement is to capture implicit data links from data collection, automatic collection, sorting, operation, and analysis of two-dimensional, three-dimensional, and multidimensional data, scientific calculation, anatomy, classification and sorting, and BD induction and aggregation. Art resources are complex and scattered. Management methods and priorities vary by type. By using the concept and technology of BD, the digital art resource management platform is created from a new perspective to provide professional information services for art resources in various fields. BD gets rid of the non-renewable nature of art resources. BD accurately collected by visual images would provide a convenient, fast, and complete digital retrieval system and interactive data resource platform for academic research [21,22].

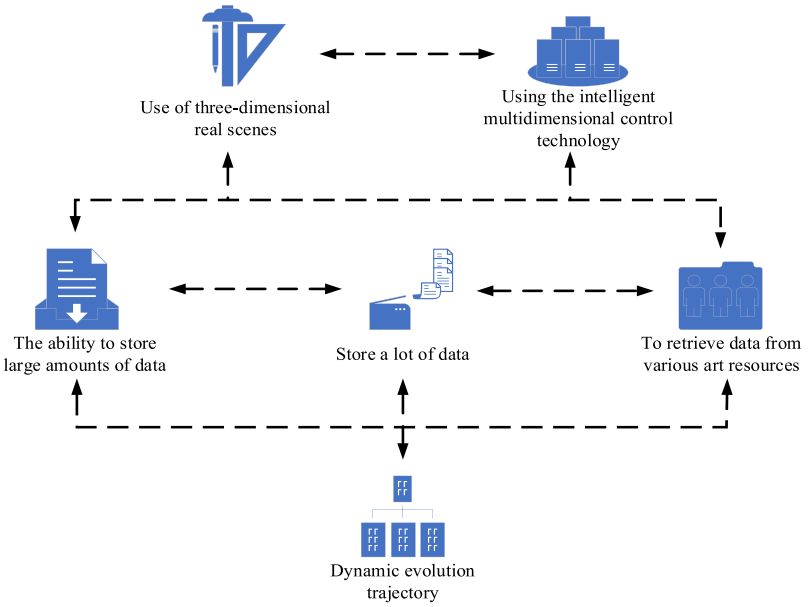

Fig. 3. Features of accurate visual image acquisition and application of BD.

5.3. Development of visual image technology in art resource management and teaching

At present, the promotion of Internet intelligent art resource management platforms has become an important goal in the field of art management. With the rapid increase of data resources, art management can no longer maintain horizontal operations. Visual image technology should strengthen the management of a large number of disorderly and dangerous art resource data, which is the requirement of the era of art management. Based on the development of intelligent platforms for these art resources, the Internet provides opportunities for digitization and globalization of art resources. Through the BD development of art resources, visual images attract the attention of economists and investors on modern information technology and cultural forms, especially the more interactive art creation industry based on new media. At present, in the teaching of art management, theories have been instilled into modern art management as the most important form of learning, but more cases and laboratory studies as well as scientific and technological assistance are needed. Visual images would help art management teaching, and provide technical support based on science and data, to form a teaching team of teachers and students and help teachers and students integrate and apply the advantages of teaching research projects of target resources. By starting from technical exchange and art resource management, it provides data for different types of art and establishes research directions, to meet the needs of students' development and training of applied talents, as shown in Fig. 4.

6. Development model for strengthening art management based on IP algorithm

The brightness equalization restoration process of the image is performed using the Jacobian iterative algorithm, and the coefficient matrix $\alpha_{n\cdot m}$ of the Jacobian transformation of the image is input; the adjacent element vector is $\beta_{m\cdot n}$; the edge fusion error is g; the initial solution vector is $x_{n\cdot 1}$; the edge pixel at the center of the art-managed image region localization is $\delta = \varphi$. It is assumed that $\eta = A/BK = \sqrt{H^2 + T^2}$ and. The conductivity formula of the optimal matching block region is Formula (1):

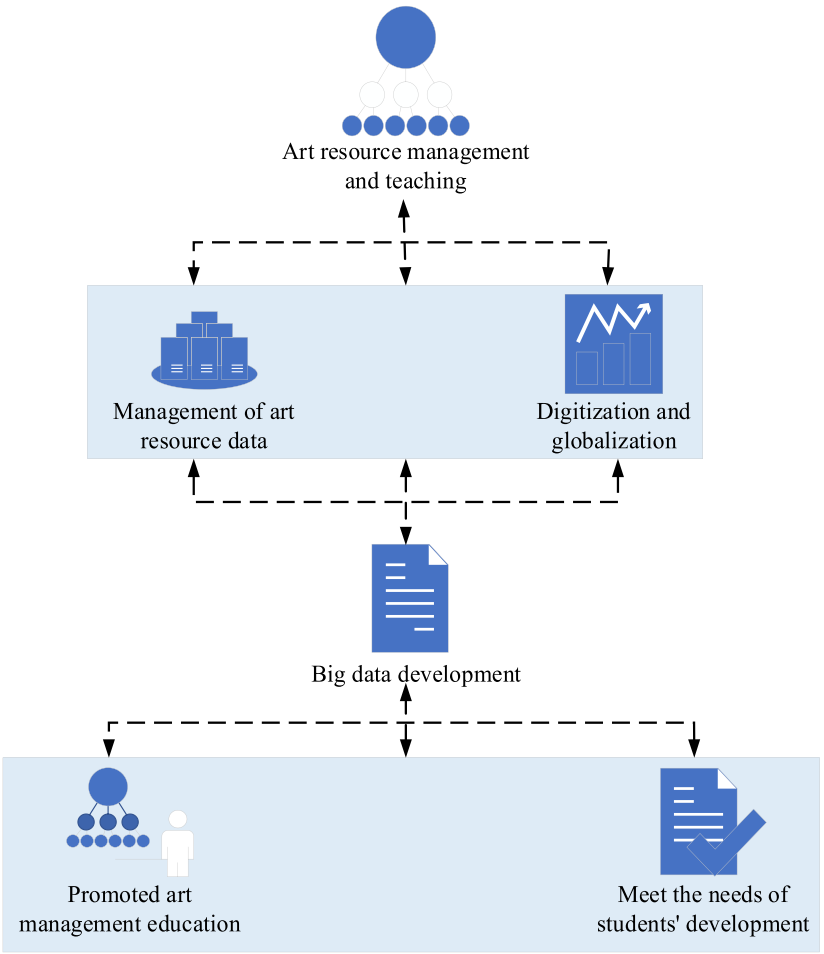

Fig. 4. Development of visual image technology in art resource management and teaching.

$$h(x,y)=\frac{k}{2\pi A^2}\exp\left[-\frac{1}{2}\left(\frac{x'^2}{A^2}+\frac{\eta^2 y'^2}{A^2}\right)\cdot\exp[2\pi jPx']\right] \tag{1}$$

The interclass bit rate is calculated. The center frequency P is the moment of rotational invariant, and the first block to be repaired δ_P is the diffraction center quantity. Through $A=\frac{\pi}{P}$, $P=\frac{\pi}{A}$ is obtained. The broken edge $\alpha\eta$ and all edge pixels are extracted, and Formula (2) is the distribution sequence of new edge pixels:

$$\delta_n=\frac{\pi P}{N}, P=1,2,\ldots,N-1 \tag{2}$$

The best matching block window function $W_i=\sqrt{2A}=\sqrt{2}\ \frac{\pi}{P}$ of image distribution is obtained by using the confidence optimization method of pixel point y. Formula (3) is priority coefficient adjustment of the block to be fixed:

$$\begin{bmatrix}x'\\y'\\1\end{bmatrix}=\begin{bmatrix}\cos(-\varphi),-\sin(-\varphi),0\\\sin(-\varphi),\cos(-\varphi),0\\0\quad 0\quad 1\end{bmatrix}\begin{bmatrix}x\\y\\1\end{bmatrix} \tag{3}$$

In the formula, x,y are the two-dimensional distributed coordinates of the primal ambient art design image.

In the grid points of the image area distribution, the new image feature equation is assumed as Formula (4):

$$P^{ij}(x,y)=\frac{U^{ij}(x,y)}{\sum_{i=1}^{m}\sum_{j=1}^{n}U^{ij}(x,y)+\delta} \tag{4}$$

In the formula, $U^{ij}(x,y)$ the template distribution center moment of the rectangular block with (x,y) as the fusion region. Through pixel marking, the edge outlines of the forward-looking art design image are marked, and the extracted edge contour is labeled as Formula (5):

$$U^{ij}(x,y)=\exp\left(-\frac{(x-x^{ij})^2+(y-y^{ij})^2}{2A^2}\right) \tag{5}$$

For image noise reduction under the intensity of an equal illumination line, the parent wave of wavelet noise reduction is Formula (6):

$$W_q(\alpha,\beta,k)=\sum_{x=w}c(p)\left(\lambda(p)w_0(\alpha,k/p)+(1+\lambda(p)w_0(\beta,k/p))\right) \tag{6}$$

Formulas (7) and Formulas(8) are as follows:

$$W_0(x,y)=\frac{A_{xy}}{A_xA_y}\cdot\frac{2xy}{x^2+y^2}\cdot\frac{2A_xA_y}{A_x^2+A_y^2} \tag{7}$$

$$\lambda(p)=\frac{H(\alpha/p)}{K(\alpha/p)+K(\beta/p)} \tag{8}$$

In addition to traditional IP algorithms, lightweight cryptography techniques are also considered in the construction of the enhanced model of art management to enhance data security and integrity. Because of its high computational efficiency and low resource consumption, lightweight cryptography is particularly critical in the field of art management when processing large amounts of visual image data. This paper draws on error detection schemes in other studies to ensure the accuracy and reliability of data in the digitization process of art resources [23]. At the same time, the composite domain technology improves the error detection performance and adds additional security to the system [24]. Applying these lightweight cryptography techniques, the method of this study not only improves the efficiency of art management but also strengthens the protection of art resources, making them more suitable for the current rapidly developing digital environment.

7. Evaluation of results based on IP algorithms and experiments

With the development of computer networks, BD technology was applied in a wide range of areas of life. With the development of society, people's requirements for art also increased. Art management covers many aspects of art design, including environmental design, visual communication design, etc. The application of BD technology and IP technology in art management could boost the AI and real-time processing ability in art design. For this reason, this paper carried out a relevant investigation on the current methods and measures in art management to understand the current development status of art management. To investigate the application status of art management in detail, this paper uses a publicly available art management data set to evaluate the effects of the new art management model development system through simulation analysis. To verify the validity of the proposed arts management development model, the experimental steps were as follows: First, a dataset containing 150 employees from three arts centers was collected, which

covered issues such as image management distortion, insufficient intellectual property protection, creative plagiarism, and inadequate management level. Secondly, the performance of the new art management model development system is evaluated through simulation analysis using publicly available art management data sets. In the course of the experiment, the data collection method was adopted to ensure the representativeness and universality of the data and to comprehensively evaluate the performance of the model. In addition, statistical analysis techniques such as regression analysis and variance analysis are used to process and interpret the data to ensure the accuracy and reliability of the results. Through these methods, we can deeply understand the specific application effects of visual image technology, big data technology, and IP algorithms in art management, and provide a scientific basis for further optimization of the model.

The data of 150 employees in three art centers were analyzed through simulation, including the proportion of image management distortion, imperfect intellectual property rights, creative plagiarism, and low management level. The three art centers are set to A, B, and C, as shown in Fig. 5.

Fig. 5 shows the shortcomings of three arts center employees in various aspects of arts management in the simulation data. According to the analysis results, when it comes to image management distortion and imperfect intellectual property rights, 43 % and 63 % of the employees of Art Center A, 53 % and 72 % of the employees of Art Center B, and 41 % and 58 % of the employees of Art Center C. At the same time, in terms of creative plagiarism and inadequate management level, the staff of Art Center A accounted for 74 % and 45 %, the staff of Art Center B accounted for 68 % and 34 %, and the staff of Art Center C accounted for 32 % and 41 %, respectively.

Multivariate analysis of variance was applied to the above results, and null hypothesis H0 was set: the mean values of the three art centers in the proportion of image management distortion, the proportion of imperfect intellectual property rights, the proportion of creative plagiarism and the proportion of inadequate management level were equal. Alternative hypothesis H1: At least one arts center has a different mean on at least one metric. Import the data into Pandas DataFrame and perform multivariate analysis of variance using the "MANOVA" function. The resulting value is 0.00264 and the P value is 0.0010, indicating that the overall model is significant. The results of multivariate analysis of variance showed that the three art centers had statistically significant differences in the proportion of image management distortion, the proportion of imperfect intellectual property rights, the proportion of creative plagiarism, and the proportion of inadequate management level ($P < 0.05$). This means that at least one arts center performed significantly differently on at least one metric.

To investigate the current application status in art management, the experiment simulated 300 employees of three art centers A, B, and C to investigate the application degree in the protection of artistic resources, data collection, art information exchange, resource database construction, and other aspects of art management. The survey results are shown in Table 1.

It can be seen from Table 1 that the employees of Art Center A accounted for 76 % of the art resources protection in the current art management, 85 % of the data collection, 68 % of the art information exchange, and 75 % of the resource database construction. The employees of the B Art Center accounted for 81 % of the art resources protection in the current art management, 78 % of the data collection, 70 % of the art information exchange, and 80 % of the resource library construction. The employees of the C Art Center accounted for 74 % of the art resources protection in the current art management, 81 % of the data collection, 71 % of the art information exchange, and 84 % of the resource database construction.

To enhance the current model development of art management, visual image technology, BD technology, and IP algorithm were introduced into the model development system construction of art management, and a new art management model development system was constructed. To investigate the application effect of the new art management mode development system, the data after the application of the new system are counted, and the shortcomings of the new art management mode development system are found, mainly including the proportion of image management distortion, imperfect intellectual property, creative plagiarism, and low

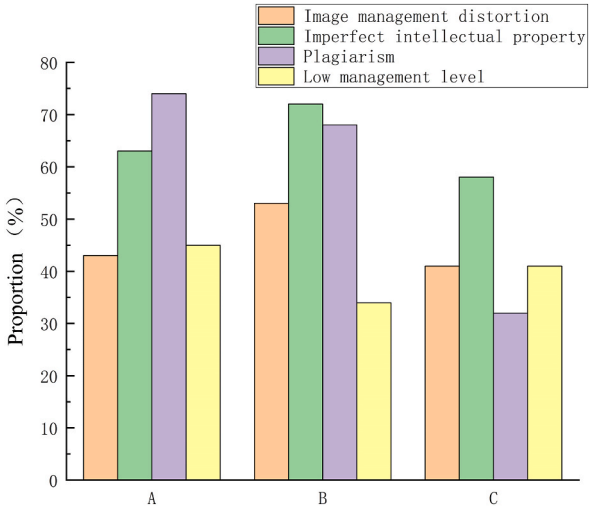

Fig. 5. The shortcomings of employees in the current art management.

Table 1
Current application status in art management.

	Protection of artistic resources	Data collection	Art information exchange	Resource database construction
A	76 %	85 %	68 %	75 %
B	81 %	78 %	70 %	80 %
C	74 %	81 %	71 %	84 %

management level. The three different regions were set as A, B, and C, and the specific effect is shown in Fig. 6.

Fig. 6 shows different aspects of the shortcomings of the staff simulating data in the Art Nouveau management model development system. The results of simulation analysis show that in terms of image management distortion and imperfect intellectual property rights, the employees of Art Center A account for 19 % and 31 % respectively, the employees of Art Center B account for 26 % and 36 % respectively, and the employees of Art Center C account for 15 % and 24 % respectively. At the same time, in terms of creative plagiarism and inadequate management level, the staff of Art Center A accounted for 28 % and 17 % respectively, the staff of Art Center B accounted for 24 % and 10 % respectively, and the staff of Art Center C accounted for 13 % and 21 % respectively.

To investigate the different effects of the traditional art management system and the new art management model development system, this paper compared the satisfaction of the employees of the art center with the traditional and new art management model development system and surveyed 200 employees of the art center in a certain area. The degree of satisfaction was satisfactory, average, and unsatisfactory, and the specific effect was shown in Fig. 7.

Fig. 7 shows a comparison of the satisfaction of Arts Center employees with the two arts management model development systems. According to the results of simulation analysis, the new Art management model development system, through the introduction of visual image technology, BD technology, and IP algorithm, has obtained a high degree of satisfaction. In this simulation, employee satisfaction was set at 85 %, commonly at 11 %, and discontent at 4 %. In contrast, the traditional arts management model development system was set at 61 % satisfaction, 24 % commonly, and 15 % discontent. Through this simulation comparison, we can see a 24 % improvement in employee satisfaction with the new system.

8. Discussion

This research has made remarkable progress in the application of big data and computer vision technology in the field of art management, but there are still some limitations. First, although the model shows positive results in improving employee satisfaction, in practice it may require more customized adjustments to adapt to the diverse arts management environment. Second, data security and privacy protection are ongoing concerns, especially when dealing with sensitive works of art and user information. In addition, while many aspects of technology implementation have been considered, there may be unforeseen implementation challenges, such as technology acceptance, user training, and system maintenance. Future research is needed to further explore these areas to ensure the sustainability and effectiveness of the technology.

9. Conclusions

Through empirical analysis, this study reveals the integrated application of visual image technology, BD technology, and

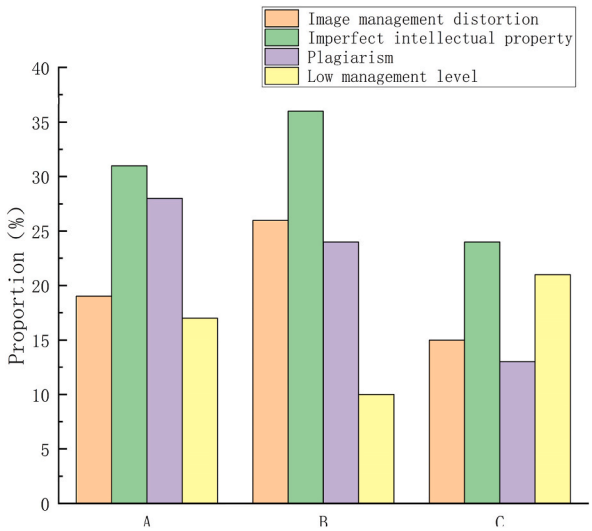

Fig. 6. Application effect of the new art management model development system.

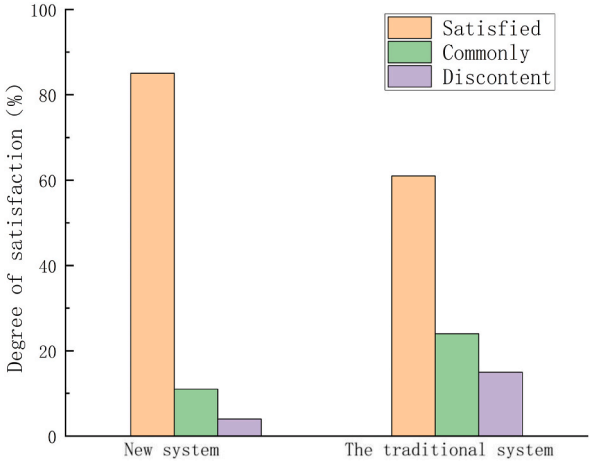

Fig. 7. Comparison of the satisfaction of the art center staff with the traditional and new art management model development system.

intellectual property algorithm in art management, which significantly improves management efficiency and user satisfaction. Compared with previous studies, this study not only provides new insights into theory but also verifies the practical application value and effect of these techniques through practical experiments. This finding shows that integrating modern technological approaches into arts management can not only lead to innovative solutions but also help push the field to a deeper level. The combination of visual imagery and big data technology has significantly improved the efficiency and precision of art resource management and education, opening up new directions. Research shows that the integration of computer vision and big data analysis technology improves the efficiency and quality of art management. This progress is not only reflected at the technical level but also helps designers accurately grasp the market dynamics and adhere to the design concept of innovation and practicality. To promote the development of art management, academia, and related institutions are expanding research fields such as big data protection, digital management of art resources, and optimization of the market environment. These studies need to be closely integrated with the industry to form an integrated academic chain. The application of big data in different cultures and environments provides a scientific framework for arts management and promotes the diversification and deepening of practice. The application of modern technology strengthens the technical support of art management and improves operability. These technologies help to mine the deep value of art data and promote the development of many aspects of art management. Therefore, art management should make full use of big data technology to improve design quality, enrich art expression forms, optimize the art education process, and promote industry innovation and development.

Future research will focus on the following key areas: First, further optimization of image processing algorithms to improve the accuracy and efficiency of the digitalization process of artworks. Secondly, explore the application of big data technology in art market trend analysis to more effectively predict and manage the demand for art resources. Finally, a more secure data processing framework is developed to deal with the increasing cyber security threats and ensure the integrity and privacy of data in art management. These research directions are not only expected to promote technological innovation in the field of art management but also to provide new perspectives and tools for art education and resource conservation.

CRediT authorship contribution statement

Jiehui Ju: Writing – original draft. **Yanghui Ma:** Writing – review & editing. **Ting Gong:** Visualization. **Er Zhuang:** Validation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e37478.

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