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*Retraction*

# Retracted: Art Research Based on Machine Learning and Artificial Intelligence

**Security and Communication Networks**

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*Security and Communication Networks* has retracted the article titled "Art Research Based on Machine Learning and Artificial Intelligence" [1] due to concerns that the peer review process has been compromised.

Following an investigation conducted by the Hindawi Research Integrity team [2], significant concerns were identified with the peer reviewers assigned to this article; the investigation has concluded that the peer review process was compromised. We therefore can no longer trust the peer review process, and the article is being retracted with the agreement of the Chief Editor.

The authors do not agree to the retraction.

## References

[1] R. L. Qiang, L. F. Guang, S. Y. Hua, and D. Maia, "Art Research Based on Machine Learning and Artificial Intelligence," *Security and Communication Networks*, vol. 2022, Article ID 7853974, 9 pages, 2022.
[2] L. Ferguson, "Advancing Research Integrity Collaboratively and with Vigour," 2022, https://www.hindawi.com/post/advancing-research-integrity-collaboratively-and-vigour/.

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*Research Article*

# Art Research Based on Machine Learning and Artificial Intelligence

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In this paper, machine learning and artificial intelligence are applied to art research to improve the intelligence of art research. This study concludes that the Gaussian homomorphic filter has the best processing impact in the image homomorphic filtering stage by comparing the processing effects of Gaussian homomorphic filter, Butterworth homomorphic filter, and exponential filter. Moreover, this study uses median filtering to eliminate salt and pepper noise in images and designs and implements a rapid digitization system for art works based on three-dimensional reconstruction. In addition, in order to improve the time efficiency of the system and the digital quality of art works and optimize the SIFT feature matching speed, this study proposes a relative position-based SIFT feature fast matching algorithm. Finally, this study verifies the effectiveness of the method proposed in this study through experimental research. The results show that it has a certain effect on promoting the development of art research and the application of computer technology in the art industry.

## 1. Introduction

Today's world has entered the information age, with rapid technological development. Digital technology has been used in different sectors as a result of the popularisation of computer technology and the growth of the Internet, and science and art are continuously reuniting. Furthermore, in today's highly developed society, people's living conditions are continually rising, and the need for culture and art is increasing, and it is becoming increasingly essential. Digital technology has progressively infiltrated many parts of human existence, bringing with it a variety of advantages. People go to art galleries mostly to enjoy art feasts. How to meet people's cultural and artistic needs is an important topic in front of art galleries. Compared with the physical exhibitions of traditional art galleries, digital exhibitions obviously have the advantages of more liberalization, autonomy, and self-help. In addition, this also means that in the future, the art gallery will meet the growing cultural life needs of the people from the perspectives of "knowledge production" and "knowledge reproduction." Under the situation that the popularity of art galleries in my country is still seriously insufficient, digital technology is used to break through the limitations of time and space to enable the resources of national and local art galleries to exert greater social benefits and bring new opportunities for the development of fine arts. Moreover, it has brought new opportunities for the development of fine arts and has become an inevitable requirement for modern art galleries to adapt to the development of the times, and it is also an inevitable trend for the future construction and development of art galleries [1].

The use of digitization is a revolution in the management of works for art galleries in the sense of appreciation and research. This also requires that the majority of managers must keep up with the pace of updating the management of works, improve their own quality, quickly change their concepts, and master new management methods, management measures, and management tools as quickly as possible. Therefore, the research on the digital management of works and collections in art galleries in various places is extremely urgent and has important practical significance. Nowadays, various domestic art galleries are constantly emerging. There are different levels of good and bad, including national and local governments and many private exhibition halls and galleries. Moreover, the scale is also uneven and uneven. However, one thing is that most of them are mainly traditional physical works display spaces, but they are becoming more and more contemporary in terms of display effects, decoration styles, and display forms in the display space [2]. However, the digital process of these museums has almost no concept. Based on the current situation of local art galleries, in order to meet the urgent needs of people to browse and visit in an all-round and convenient way, freely call out the works they want to see, and understand the information of the author's works in the art life, it is necessary to establish a database for the digital collection of local characteristic art works and ordinary works and collections and display them to a wide audience through a digital network display platform. Moreover, it is necessary to conduct corresponding research on digital management such as work display, work management, academic research, interaction with the audience, and information collection. China has a vast territory, numerous ethnic groups, and local art forms, which are very rich and varied, with huge differences. Therefore, if we do not study and implement digital management and communication, it will bring great difficulties to the publicity, learning, and communication of local art [3].

This article utilises digital technology to process art works and applies machine learning and artificial intelligence technology to art research in order to overcome the limitations of conventional display platforms and increase the impact of art research.

## 2. Related Work

Digital image splicing technology is a process of generating a natural, high-quality panorama of the scene through a series of images of the same scene that have a certain degree of overlap with each other using mathematical modeling. The core step of digital image stitching technology is to achieve precise registration, and it is hoped that the specific positions of all overlapping regions can be accurately obtained through registration calculation [4]. Literature [5] starts from the basic principles of image registration and summarizes them comprehensively and profoundly. The method of feature registration is often used in practical applications because this method can describe the local content of the image very well and has simple and easy-to-implement operation. Literature [6] proposed a method based on the SIFT feature to realize the automatic stitching of the same scene image to obtain a complete and seamless panorama. Literature [7] uses scale-invariant feature transform (SIFT) feature points to achieve a panorama from a bunch of chaotic images. Image fusion refers to the process of combining all registered images of the same scene through an efficient mathematical modeling method to synthesize a new complete seamless panorama [8]. On the overlapped region of the picture, the conventional average fusion technique just conducts a basic mathematical average assessment. The picture output achieved by the fusion is not optimal, despite the fact that the technique is reasonably easy to implement. The weighted average method introduces the concept of weight on the basis of the average method, and its effect is improved to a certain extent compared with the average method. However, the weighted average method is easy to cause ambiguity when dealing with large fusion intervals, and clear narrow-band problems appear when dealing with small fusion intervals [9]. The multiresolution spline method is to solve the images of different frequency domains to form an image pyramid, and then each layer of the pyramid image is weighted and fused. After many years of practical application summary, the fusion effect is the best among the three algorithms, but because the algorithm needs to construct a lot of frequency domain image pyramids, it has a huge amount of computation [10].

Art work splicing is a common method for the digital protection of traditional art works and cultural relics. Because the digitalization of fine art works requires high precision, the splicing of art works poses more challenges than ordinary image splicing applications [11]. The stitching of fine art works requires that the resolution of the stitched panoramic image can reach at least 300 dpi to meet the requirements of high fidelity. Second, in order to reduce the error between the digitized panorama and the real art work, more stringent requirements are put forward for the image registration and image fusion module in image stitching [12]. Literature [13] demonstrated the key technology of high-fidelity digital acquisition of large-format ancient paintings and proposed how to achieve high-fidelity digital acquisition technology through the links of shooting, correction, and stitching. Literature [14] proposed an SFM-based high-fidelity splicing technology for large-format artwork images and introduced the SFM three-dimensional reconstruction technology to obtain the three-dimensional information of the two-dimensional image feature points. Although the current art work splicing technology can obtain good-quality panoramic pictures of art works, there are still many problems. Image registration errors are unavoidable, leading to problems such as distortion of lines in the panorama obtained by image stitching [15]. Literature [16] suggested using three-dimensional information for picture registration; however, the three-dimensional information is really picked to suit a plane and then combined on the fitted plane in the final processing. Despite the fact that the fitting plane is derived from three-dimensional data, it must have inaccuracies when compared to the actual three-dimensional data. This also leads to errors in image registration, which causes problems such as line distortion in the final fused panoramic image. At present, the commonly used art work splicing technology is realized based on the image registration of feature points, but the traditional feature point matching method has high time complexity, resulting in expensive time cost [17]. At present, the multiresolution spline method is used in the image fusion stage of art work splicing. In addition to the large amount of calculation, this algorithm can also cause a certain degree of ghosting and blur, which makes the art work splicing result in distortion [18].

## 3. Binarization of Artwork Images

In the digital image processing of fine art, many images have to go through the step of binarization. This step can make the image have only two colors, black and white, thus distinguishing the background from the target area, and at the same time, it can show the outline of the target. Using binarization to process images has a very important position in image digital processing. To binarize the grayscale image is to set the pixel points of the image to 0 or 255, so that the welding surface defect image is only related to the point with the pixel value of 0 and the point with the pixel value of 255. In order to obtain a good segmentation effect, the threshold method is often used for binarization. As long as the appropriate threshold is set, the ideal binary image can be obtained. That is, all pixels in the gray value less than or equal to the threshold can be defined. The background area is denoted as 0, and the pixel with a gray value greater than the threshold is determined as the target area, denoted as 255. Areas operated in this way often use connected, closed boundaries to define nonoverlapping areas.

The Otsu algorithm, commonly known as the maximum between-class variance approach, is a method for establishing the picture segmentation threshold. This method is not only simple to calculate but also not affected by the brightness of the image itself and the contrast of the image itself, so it is regarded as the best algorithm to obtain the threshold value in image segmentation and has a wide range of applications in image processing. The Otsu algorithm divides the image into two parts, the foreground (target) and the background (nontarget) according to the gray level of the image, and the variance can be used to describe the uniformity of the gray distribution. The larger the value of the variance of the target and the nontarget is, the greater the difference between the two parts that make up the image.

For image $I(x, y)$, we set the threshold to distinguish between target and nontarget as $T$, the proportion of target pixels in image I is a, and the average gray value is $\mu_0$. The number of nontarget pixels in the entire image is set to $b$ and the average gray value to $\mu_1$. The average gray level of image $I$ is set to $\mu$, and the variance between classes is set to $s$.

If it is assumed that the size of the image $I$ is $M \times N$, the number of gray values of pixels smaller or equal to the value of $T$ in the image is $N_0$, and the number of gray values of the pixels greater than the value of $T$ is $N_1$, then [19]

$$
\begin{aligned}
a &= \frac{N_0}{M \times N}, \\
b &= \frac{N_1}{M \times N}, \\
N_0 + N_1 &= M \times N, \\
a + b &= 1, \\
\mu &= a \times \mu_0 + b \times \mu_1, \\
s &= a(\mu_0 - \mu)^2 + b(\mu_1 - \mu)^2, \\
s &= \mathrm{ab}(\mu_0 - \mu_1)^2.
\end{aligned}
\tag{1}
$$

In Matlab software, the function of graythresh function is to use the maximum between-class variance method to find the most suitable threshold for the image, and there is no need to artificially set the threshold. The effect diagram is shown in Figure 1.

The principle of the iterative optimal threshold method is to first set a threshold $T$ and then calculate the center value of the target area and the nontarget area under this value. When the average value of the center value of the target area and the nontarget area is the same as the set threshold, the iteration is stopped, and this value is used as the threshold for binarization processing. The algorithm steps are as follows:

(1) The algorithm first predefines the difference $d$ between the two thresholds.

(2) The algorithm determines the initial threshold $T_0$ and finds the maximum gray value and minimum gray value of the image, which are denoted as $g_1$ and $g_2$, respectively:

$$T_0 = \frac{g_1 + g_2}{2}. \tag{2}$$

(3) The algorithm uses the obtained initial threshold $T_0$ to divide the image into two parts, the foreground and the background, and obtain the average gray value $m_1, m_2$ of the foreground and the background, respectively.

(4) The algorithm calculates a new threshold:

$$T_1 = \frac{m_1 + m_2}{2}. \tag{3}$$

(5) The algorithm repeats Steps 3 and 4 until the threshold difference is less than the predefined threshold difference $d$.

(6) After the algorithm finds the optimal threshold T, it performs normalization; that is, it divides the maximum pixel value of the image, so that the optimal threshold k is in the range of 0–1.

This article regards program $d = \mathrm{ads}(T - T_n)$ as the termination program. When $d < 0.001$, the iterative program stops, and the value of $k$ is 0.6805 at this time. The iterative effect diagram is shown in Figure 2.

Kapuret developed the maximum entropy threshold as an image entropy segmentation technique, and it is still widely used. Entropy is a statistical assessment tool for determining how much information a random data source contains. The greater the image information, the greater the entropy. The formula is as follows:

$$H = -\int_{-\infty}^{+\infty} p(x)\log[p(x)]\mathrm{d}x. \tag{4}$$

Similar to the Otsu threshold algorithm and iterative optimal threshold algorithm, the maximum entropy threshold segmentation method also divides the picture into two parts, the foreground and the background, and then finds an optimal threshold to maximize the sum of the

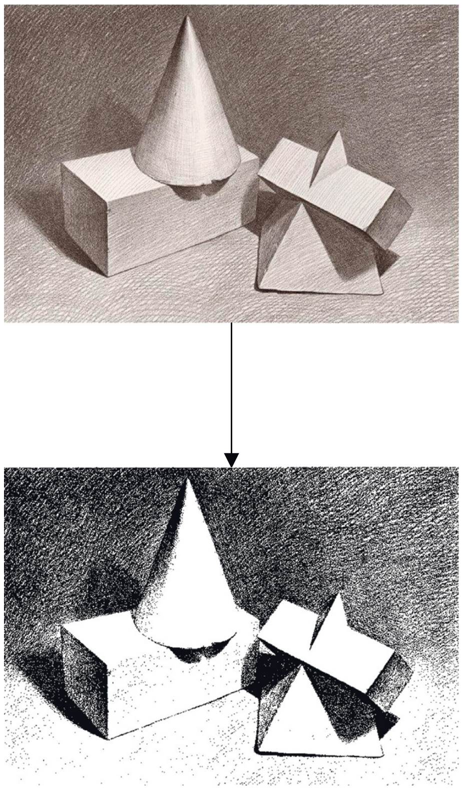

Figure 1: Effect diagram of Otsu algorithm.

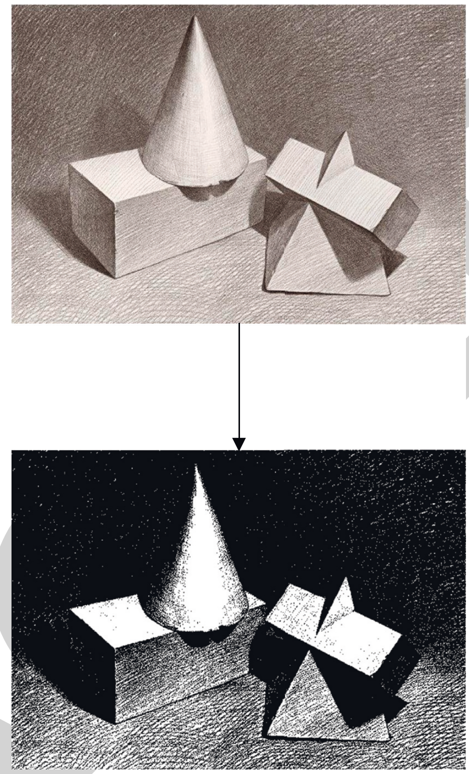

Figure 2: Iterative optimal threshold method.

entropy of the two parts of the background and the foreground. The specific implementation steps are as follows:

(1) The algorithm sets the initial segmentation threshold $T_0$ and calculates the maximum and minimum gray values of the image as $g_1$ and $g_2$ respectively, then

$$T_0 = \frac{g_1 + g_2}{2}. \tag{5}$$

(2) The algorithm calculates the histogram $h$ of the image and finds the pixel probability of the image:

$$p(i) = \frac{h}{XY}. \tag{6}$$

(i) Among them, $X$, $Y$ are the length and width of the image, respectively.

(3) The algorithm calculates the initial entropy of the image:

$$H_0 = -p(i) \times \log p(i). \tag{7}$$

(4) The algorithm divides the foreground $G_1$ and background $G_2$ through $T_0$, calculates the average gray value $m_1, m_2$ of each, and updates the threshold:

$$T_1 = \frac{m_1 + m_2}{2}. \tag{8}$$

(5) The algorithm calculates the probability $P_{G_1}$ of the foreground $G_1$ and the probability $P_{G_2}$ of the background $G_2$:

$$\begin{aligned} P_{G_1} &= \sum_{i=1}^{T_0} p(i), \\ P_{G_2} &= 1 - P_{G_1}. \end{aligned} \tag{9}$$

(6) The algorithm calculates the information entropy of the foreground $G_1$ and the information entropy of the background $G_2$:

$$\begin{aligned} H_{G_1} &= -\frac{p(i)}{P_{G_1}} \log \frac{p(i)}{P_{G_1}}, \\ H_{G_2} &= -\frac{p(i)}{P_{G_2}} \log \frac{p(i)}{P_{G_2}}. \end{aligned} \tag{10}$$

(7) The algorithm calculates the total information entropy:

$$H = H_{G_1} + H_{G_2}. \tag{11}$$

The termination condition is ads$(H_0 - H_1) < 0.001$ and the number of iterations is set to 100. The actual effect is shown in Figure 3.

From Figures 1–3, it can be seen that although the defect position image in the undercut image in the maximum entropy threshold method is complete, there are too many black areas, and the gap between them is too large to be connected, which will increase the difficulty of processing. The number of defective images in the image increases. In

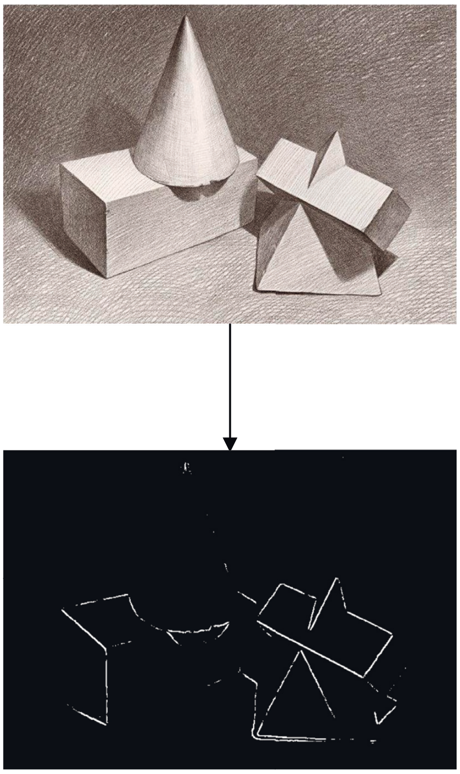

Figure 3: The effect diagram of the maximum entropy threshold method.

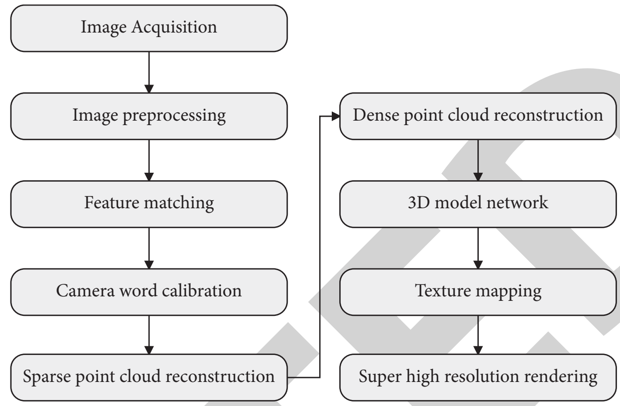


Figure 4: Flow chart of rapid digitization of art works based on 3D reconstruction.

the middle of the undercut image, the processing effect of the iterative optimal threshold method is not as clear and obvious as the maximum between-class variance method, but the difference between the two is not large, and the gap between the two can be made up by subsequent processing. In addition, the main reason is that Matlab comes with the maximum between-class variance method, and there is no need to write another algorithm program, which makes the processing speed of the image faster than the iterative optimal threshold method, so this article uses the method of maximum between-class variance to binarize the image.

## 4. Art Research System Based on Machine Learning and Artificial Intelligence

Traditional image stitching technology only considers the two-dimensional information contained in the two-dimensional image, and traditional digital image stitching technology generally uses multiresolution spline algorithm fusion. Not only does this kind of fusion technique have a significant time cost, but also the splicing output is not optimal. This study, on the other hand, for the first time, uses 3D reconstruction technology for the digitization of art works and presents a set of quick digitization framework for art works based on 3D reconstruction. Figure 4 shows the basic flow chart of the rapid digitization technology of art works based on 3D reconstruction.

The rapid digitization system of art works based on 3D reconstruction is the first innovative application of 3D reconstruction technology to the digitization of art works. The main concept behind the fast digitization method for art works based on 3D reconstruction is to use multi-image 3D reconstruction technology to create high-precision 3D models of art works and then use accurate 3D model texture mapping techniques to extract texture information from the models. Finally, it uses the ultrahigh-resolution texture 3D model rapid rendering technology to obtain the orthographic panorama of the 3D model of the artwork. As shown in Figure 5, the rapid digitization system for art works based on 3D reconstruction consists of four modules.

The SIFT feature point matching can be converted into a problem of searching for a solution from a large solution space, so the main time cost of the algorithm is generated by the search algorithm. It can be seen from the basic flowchart that the search strategy of the traditional algorithm shown in Figure 6 is to build a Kd tree for all the feature points of each image to be matched, and then each feature of the other images searches for matching points in this Kd tree, in turn. This algorithm must search all the images for each image to be matched, so that although it can find as many matching point pairs as possible, it also leads to a lot of invalid calculations.

According to the above analysis results, it can be seen that the main problems faced by SIFT matching of traditional images are as follows: (1) when the number of image sets increases, the invalid calculation of SIFT feature point matching also increases proportionally and accounts for about 90% of the calculation; (2) invalid matching calculation not only wastes calculation time but also increases the probability of matching errors.

In order to solve the problems faced by the traditional SIFT feature point matching algorithm, this study proposes a fast feature point matching algorithm based on relative position. Figure 7 shows the basic flow chart of the algorithm.

For feature matching in relative positions, the transformation model parameters of any two overlapping images need to be solved first. In order to reduce the time cost of the algorithm, it is necessary to downsample the input image

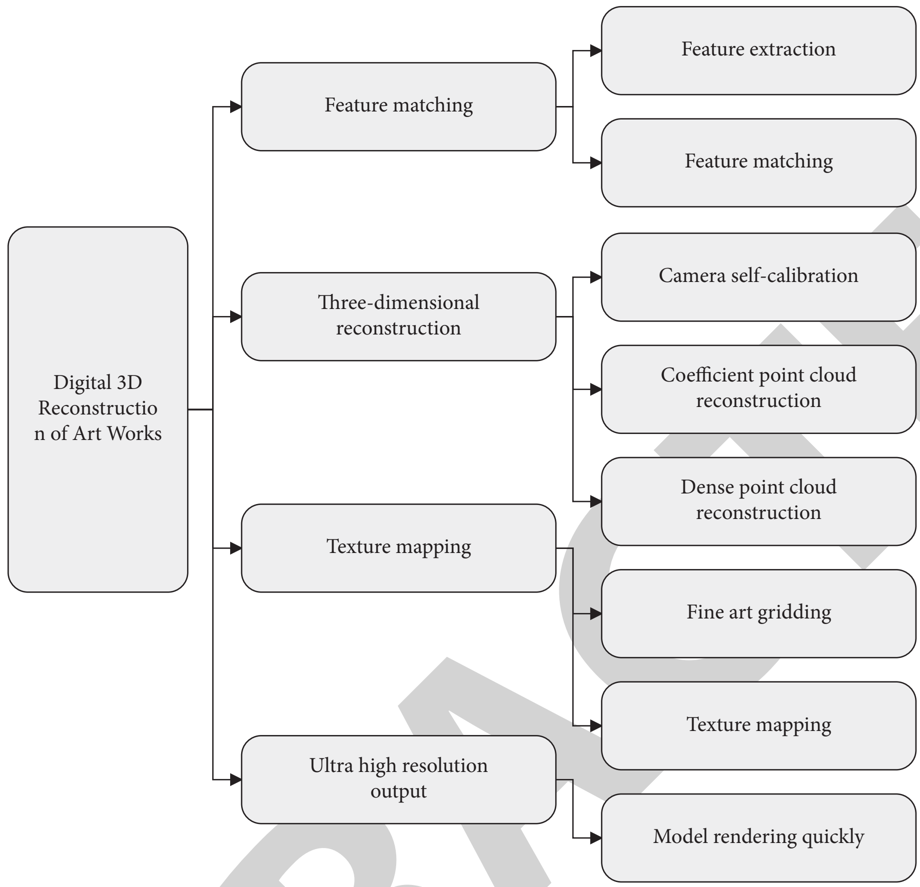


Figure 5: Modules of a rapid digitization system of art works based on 3D reconstruction.



when estimating the relative position relationship. The relative positional connection between any two overlapping pictures will be utilised to look for matching feature points in the Quadtree produced by the original image's feature points after getting the relative positional relationship between the images. The following will elaborate on the relative position solving between any two images and the Quadtree-based SIFT matching point search strategy.

When using traditional OpenGL-based rendering technology to render large-scale 3D models, there are mainly two serious problems: (1) due to the limitation of GPU storage capacity, when texture mapping is performed on large-scale 3D models with complex textures, all texture images cannot be loaded to the GPU. As a result, the texture information of the 3D model obtained by the final rendering is incomplete. (2) When rendering the texture of a superhigh resolution 3D model, if the rendering is performed directly, a 2D image with the same resolution as the actual 3D model will not be obtained, resulting in serious damage to the quality of the rendered image. The fast rendering technology of ultrahigh-resolution texture 3D models proposed in this section will focus on solving the two bottlenecks that traditional OpenGL-based rendering technologies are facing as pointed out above.

The fast rendering algorithm for ultrahigh-resolution texture 3D models is proposed to solve the problem that large-scale 3D models cannot be rendered normally due to the

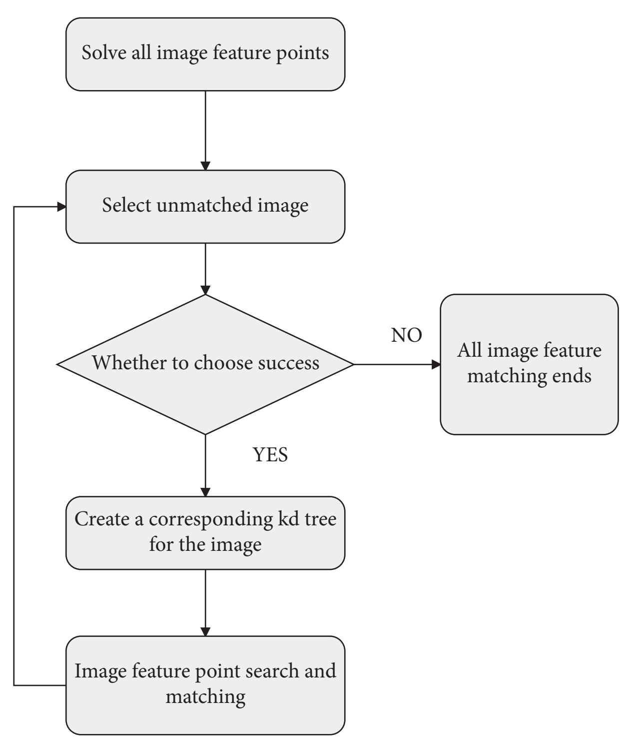


Figure 6: Traditional feature matching process.

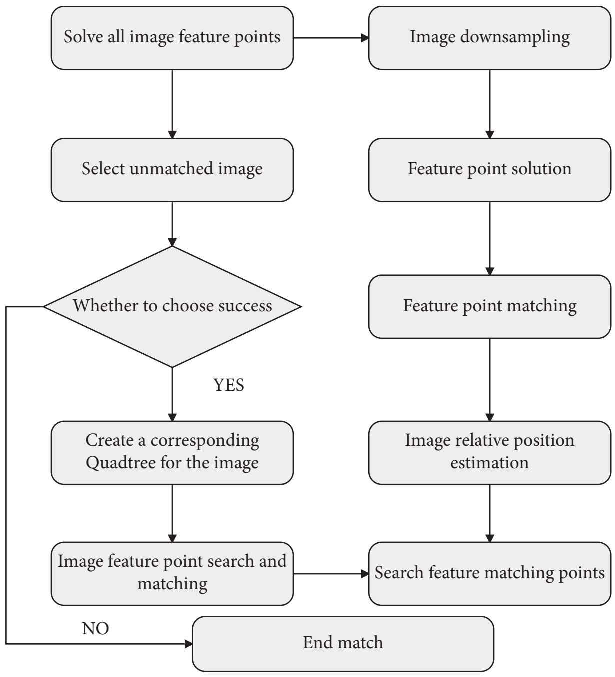


Figure 7: Flow chart of matching based on relative position.

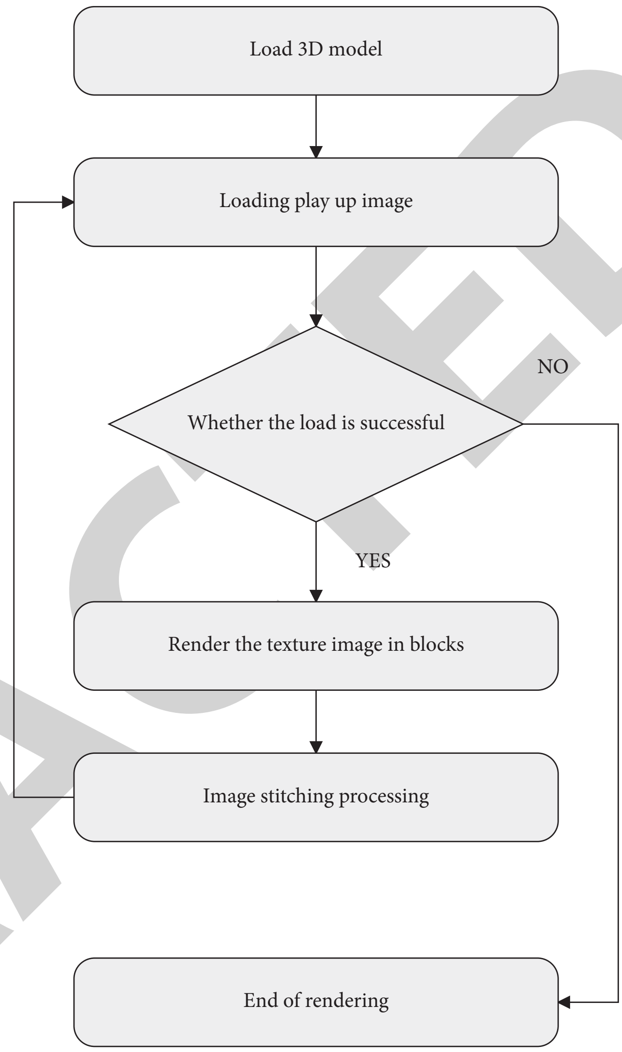


Figure 8: Flow chart of fast rendering technology of 3D model.

limitation of GPU memory capacity. The core of the algorithm is to use block technology to render large-scale 3D models. The fast rendering algorithm for ultrahigh-resolution 3D models is mainly composed of four modules: 3D model loading, texture image loading, block texture mapping, and block rendering result splicing. The basic flow of the algorithm is shown in Figure 8.

The first step of the fast rendering algorithm for ultra-high-resolution texture 3D models is to load the 3D model. The 3D model file that the algorithm can handle is OBJ file. The OBJ file format is a three-dimensional model file recorded in ASCII format that supports a wide range of fundamental primitive forms, such as widely used lines, triangles, and polygons. For simple straight lines and triangles, the OBJ file uses the vertices of the primitives to represent them and also stores the normal directions and texture coordinates corresponding to these points. For complex curves and surfaces, key points and other additional information are recorded. At the same time, the OBJ file will also store information such as the texture and surface material properties of the 3D model, while the texture image data saved by the 3D model are stored separately in an image format.

## 5. Performance Verification of Art Research System Based on Machine Learning and Artificial Intelligence

This study constructs an art research system based on machine learning and artificial intelligence. It uses three-dimensional digital technology to intelligently process art works, making them digitally decomposed works. On this premise, research on art works may increase the impact of art research while also promoting the use of machine learning and artificial intelligence technologies in art research. Based on this, in the system performance research, this study first analyses the digital processing effect of the art works of the system proposed in this study and then evaluates the art research effect. This study collects a large number of images of art works as sample data through the Internet and performs digital processing on these sample data to evaluate the effect of digital processing. The results are shown in Table 1 and Figure 9.

The above research verifies that the digital method proposed in this article can effectively decompose the art works and facilitate the development of subsequent experiments. Based on this, the effect of art research is evaluated. The results are shown in Table 2 and Figure 10.

From the above research, we can see that the art research system based on machine learning and artificial intelligence constructed in this study can effectively improve the effect of art research and has a certain effect on promoting the development of art research and the application of computer technology in the art industry.

Table 1: Statistical table of the evaluation of the effect of digital processing of art works.

| No | Digital effect | No. | Digital effect | No. | Digital effect |
|---|---|---|---|---|---|
| 1 | 95.12 | 26 | 94.05 | 51 | 95.73 |
| 2 | 95.93 | 27 | 94.83 | 52 | 94.61 |
| 3 | 95.52 | 28 | 95.79 | 53 | 96.45 |
| 4 | 95.34 | 29 | 94.44 | 54 | 96.64 |
| 5 | 94.41 | 30 | 97.72 | 55 | 95.43 |
| 6 | 95.39 | 31 | 96.50 | 56 | 96.72 |
| 7 | 96.92 | 32 | 94.44 | 57 | 95.81 |
| 8 | 96.06 | 33 | 97.30 | 58 | 96.13 |
| 9 | 96.87 | 34 | 94.96 | 59 | 97.83 |
| 10 | 94.31 | 35 | 94.12 | 60 | 97.72 |
| 11 | 94.60 | 36 | 97.36 | 61 | 94.31 |
| 12 | 96.49 | 37 | 95.92 | 62 | 96.20 |
| 13 | 96.00 | 38 | 96.66 | 63 | 97.92 |
| 14 | 96.00 | 39 | 97.74 | 64 | 97.49 |
| 15 | 96.07 | 40 | 97.77 | 65 | 97.41 |
| 16 | 94.01 | 41 | 97.89 | 66 | 96.85 |
| 17 | 94.58 | 42 | 94.95 | 67 | 94.90 |
| 18 | 94.20 | 43 | 96.58 | 68 | 95.02 |
| 19 | 97.89 | 44 | 96.57 | 69 | 96.28 |
| 20 | 95.62 | 45 | 94.63 | 70 | 95.83 |
| 21 | 95.79 | 46 | 95.08 | 71 | 97.32 |
| 22 | 96.62 | 47 | 95.66 | 72 | 95.64 |
| 23 | 95.41 | 48 | 97.20 | 73 | 96.79 |
| 24 | 94.13 | 49 | 96.32 | 74 | 97.12 |
| 25 | 94.70 | 50 | 94.89 | 75 | 96.00 |

Table 2: Statistical table of the evaluation of the effects of art research.

| No | Art research | No. | Art research | No. | Art research |
|---|---|---|---|---|---|
| 1 | 92.74 | 26 | 86.88 | 51 | 94.32 |
| 2 | 86.31 | 27 | 90.05 | 52 | 90.87 |
| 3 | 91.80 | 28 | 92.63 | 53 | 93.98 |
| 4 | 87.67 | 29 | 87.11 | 54 | 87.60 |
| 5 | 92.84 | 30 | 94.41 | 55 | 93.83 |
| 6 | 91.59 | 31 | 93.55 | 56 | 91.80 |
| 7 | 92.88 | 32 | 90.42 | 57 | 91.40 |
| 8 | 89.59 | 33 | 87.12 | 58 | 92.12 |
| 9 | 94.07 | 34 | 86.58 | 59 | 86.01 |
| 10 | 88.92 | 35 | 87.67 | 60 | 91.59 |
| 11 | 92.41 | 36 | 86.52 | 61 | 91.25 |
| 12 | 90.23 | 37 | 88.23 | 62 | 90.36 |
| 13 | 92.43 | 38 | 92.76 | 63 | 91.65 |
| 14 | 94.84 | 39 | 92.26 | 64 | 93.78 |
| 15 | 91.70 | 40 | 94.47 | 65 | 88.80 |
| 16 | 89.43 | 41 | 89.42 | 66 | 93.26 |
| 17 | 92.05 | 42 | 93.20 | 67 | 87.21 |
| 18 | 86.45 | 43 | 87.53 | 68 | 92.49 |
| 19 | 89.50 | 44 | 93.05 | 69 | 89.60 |
| 20 | 94.61 | 45 | 94.02 | 70 | 94.04 |
| 21 | 91.04 | 46 | 87.03 | 71 | 86.36 |
| 22 | 86.95 | 47 | 91.79 | 72 | 89.63 |
| 23 | 88.64 | 48 | 94.13 | 73 | 90.01 |
| 24 | 94.22 | 49 | 89.58 | 74 | 87.80 |
| 25 | 89.62 | 50 | 94.90 | 75 | 87.28 |

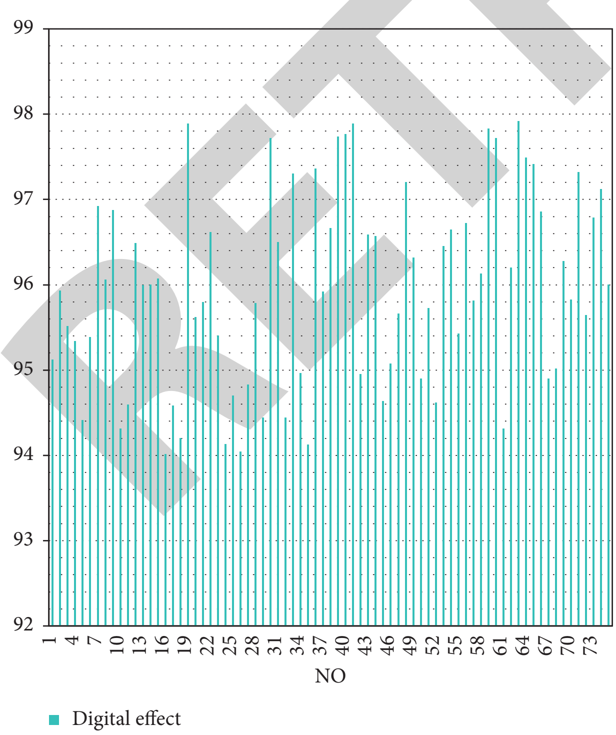


Figure 9: Statistical diagram of the evaluation of the effect of digital processing of art works.

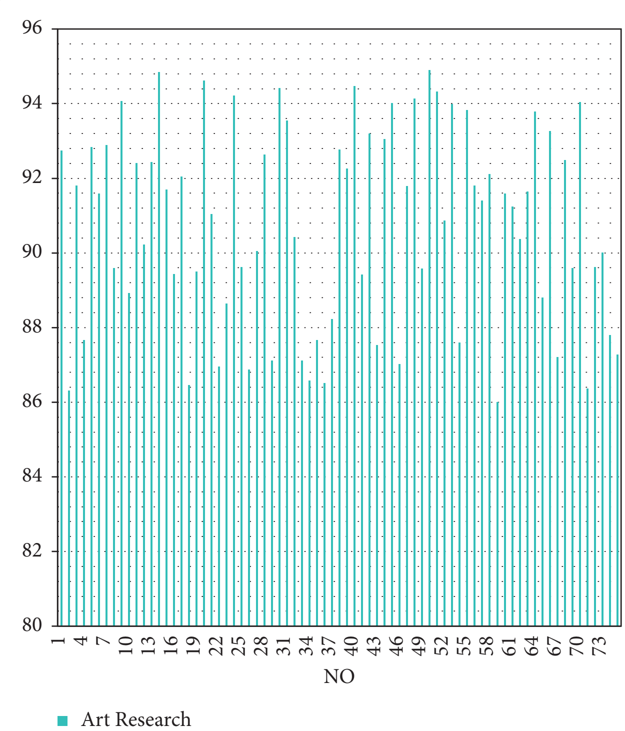


Figure 10: Statistical diagram of the evaluation of the effects of art research.

## 6. Conclusion

This study innovatively applies machine learning 3D reconstruction technology and artificial intelligence technology to the digitization of art research and designs and implements a rapid digitization system for art works based on 3D reconstruction. This research offers a fast SIFT feature matching technique based on relative location in order to increase the system's time efficiency and the digital quality of art works, as well as to improve SIFT feature matching speed. Furthermore, downsampling the input picture and then performing value-based SWT feature matching on the downsampled image are required to increase the algorithm's time efficiency. Then, the relative position estimation algorithm of global consistency is used to solve the relative position between the images to be matched. By using the relative position parameters of overlapping images, the search space for feature matching solutions is reduced, and the accuracy of SWT feature matching is also improved. Finally, after constructing the corresponding system, this article evaluates the effects of the method proposed in this article through experiments. Judging from the evaluation results, it can be seen that the system constructed in this study has a better effect.

## Data Availability

The data used to support the findings of this study are included within the article.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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