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Image Processing of Multimedia and 5G Network Security Repair Technology in Arts and Crafts Design

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Abstract Arts and crafts design is a comprehensive discipline covering art, literature, history, philosophy and other fields. In modern society, it is more and more closely related to people's life, such as clothing design, environmental decoration, etc. The major of arts and crafts design is presented to people in the form of art, which brings people more visual enjoyment. The major of arts and crafts design requires people to cultivate solid basic skills of painting, and better grasp the knowledge and skills of combining traditional art and modern technology, so that they can engage in the creation of traditional art and handicraft production in arts and crafts enterprises and related units. In process design, image processing plays a key role. All process information is presented in the form of graphics. However, the current process system platform only provides the image part, which cannot meet the simultaneous processing of graphics and images by users. This paper selected the key links of ceramic industry in process design as the investigation background. The characteristics and new requirements of its process design were deeply researched and developed, and a graphics and image processing system based on process technology was realized, which realized the collaborative work of graphics and images. In the experiment and analysis of image processing, the results showed that the number 1 and number 3 had the highest and lowest accuracy difference, and their values were 0.543 and 0.448. Therefore, it is very necessary to use multimedia and 5G (5th-Generation Mobile Communication Technology) network security repair technology to conduct image processing research on arts and crafts design.

Index Terms Arts and Crafts, Image Processing, Multimedia Technology, Safe Restoration Technology

I. Introduction

In the field of ceramic processing, the design and manufacture of arts and crafts patterns are very necessary. The traditional drawing process is that the designer first draws a sketch, and then the technician draws the drawing to the actual processing size and process requirements. After that, the processing personnel would process on the working surface of the drawn pattern. At present, all kinds of text, pattern engraving machines and laser engraving machines on the market use automatic machines instead of manual operations, while pattern design mainly uses computer aided design (CAD), drawing retrieval access workstation (DRAW) and other drawing software. In order to overcome the operator's difficulties in design, all systems adopt different characters and patterns, but this also explains its limitations from another perspective: operators usually do not have the expertise of print designers, and many design patterns provided by customers are difficult and time-consuming to be re-entered by operators. According to the characteristics of process data management of Process Distribution System (PDS), a process data management system based on PDS technology was proposed to further improve the efficiency and quality of process design.

Image processing of arts and crafts design is one of the hot topics of research. The purpose of Inocian Reynaldo Bontuyan was to reveal the complexity of Bacat's weaving art and the main materials and principles used. He showed that the bakat weaving art represents the values of perseverance, adaptation to change, passion for craft, community awareness and family-centered [1]. Oguttu Wanyama established a variety of ways for arts and crafts courses to promote children's emotional, physical, cognitive and creative growth and development [2]. Meenakshi Sharma mainly discussed the application of language stylistics to the art and technique of leaping rhythm in Gerald Manley Hopkins's poetry [3]. However, due to the lack of data sources, the above research is only at the theoretical stage and has no practical significance.

It is innovative to study the image processing and analysis of arts and crafts design using multimedia and 5G security repair technology. Hair Ross expanded this perspective by investigating how the close relationship between the arts and crafts movement and Kozwald shaped Krayes's publishing practice and poetics [4]. Calvert Robyne introduced a brief biography of the Health and Art Clothing Alliance. This is a clothing reform association

established in 1890. Its purpose is to show the urgent needs of climate and environment, the requirements of clothing art arrangement, and the coordination of colors [5]. Wang Yongzhi proposed that the design process of arts and crafts products should be combined with design psychology, so as to bring people a “moderate intensity” positive emotional experience and make people feel relaxed and happy [6]. However, due to the traditional thinking and definition, the two cannot be highly integrated and give full play to their advantages.

Taking a large ceramic enterprise as an example, this paper deeply analyzed the new requirements and new features of its process design, and developd a process-oriented process image system aiming at some existing problems. After analyzing the characteristics of the process-oriented graphics and image system, the architecture based on “software bus-parts” was proposed. The bottom layer was divided into the bottom support library, the bottom graphics platform and the graphics and image module. The specific functions of each module were modularized.

II. Exploration on Image Processing System of Arts and Crafts Design Based on Multimedia Technology

II. A.Image Acquisition and Processing System

This paper proposed an automatic processing system based on machine vision and integrating image acquisition and processing. Image acquisition card is an integrated image acquisition system that uses image acquisition and processing technology to achieve the acquisition and processing of graphics and images. It is composed of optical lens, photoelectric conversion chip, signal amplification, clock and logic control, signal synthesis and other circuits. Its image acquisition card is a universal interpolation format, and has the image storage capacity of two frames. The pixel value of each frame is 512 * 512, which can realize fast digital-to-analog conversion and realize the design of real-time acquisition board [7], [8]. The system framework is shown in Figure 1.

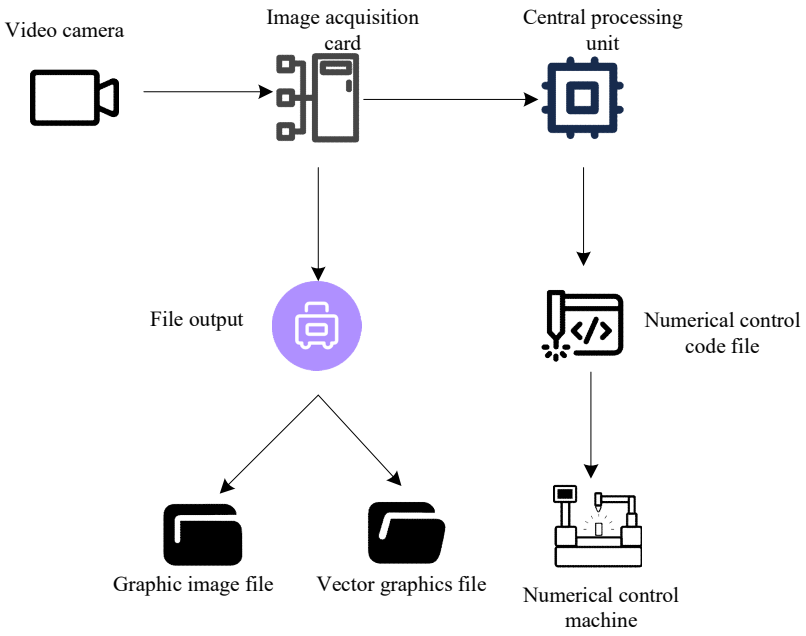


Figure 1: System block diagram

In Figure 1, by using the system application software, the computer can analyze, calculate and process the image signal in the frame memory, and complete the processing through human-computer interaction, thus generating the output of numerical control (NC) code file. The computer can also simulate and verify the processing results through external instruments, such as plotters. The CNC system needs continuous contour control, that is, the interpolation of more than two connecting rods and an arc. For the process graphics composed of arbitrary curves, because ordinary machine tools do not have the ability of higher-order interpolation, a set of shorter straight line segments is used to approach higher-order curves.

The software module is mainly composed of three parts: input and management module, graphics and image information processing module, and output module. It is managed by the main control module. Each menu item is classified according to its function and presents a tree structure.

(1) Input and management module

This module manages the image information collected from the camera and the call of image files. It includes two menu groups: file and input management and window management

The file and input management group includes the control of camera acquisition mode and the input, output and conversion of image files. The window management menu group includes the operations for the defined window, such as opening, modifying, moving, selecting, closing, clearing, restoring, etc.

(2) Graphics and image information processing module

The graphic information processing menu set provides the functions of editing, modifying and recreating images. The menu set of graphic information processing includes three submenus: decomposition extraction, geometric transformation and synthesis. The geometric transformation submenu set includes the composite submenus of the enlargement, reduction, rotation, flip, stretch, deformation of the geometric dimensions of the figure. Overlap and stitching are the reverse operations of interception and clipping, which can synthesize multiple image information.

(3) Output module

Since the system is output code, it is necessary to carry out further process analysis on the output of graphics processing module, including optimization of tool path, tool path sequence, tool interference check, tool radius compensation, tool path planning, and tool path adjustment [9]. The automatic program design realizes the translation of the above modified image data, and sets the corresponding process auxiliary command. In order to avoid the damage caused by the program error to the mechanical processing, the processing data is simulated and verified. In particular, the results of data simulation inspection using a plotter are much better than those of screen simulation test.

II. B.System Characteristics

(1) Graphic design

At present, the scanner is a main input device for two-dimensional images. Its scope of use is limited to a single paper, and its field of view is very small, which limits its use. The image information obtained through visualization has the following characteristics: in the case of no contact, it can be free from the interference of environmental factors; it can collect or obtain the information of the target scene changing with time from multiple angles, and has the characteristics of strong adaptability and wide application range; it has adjustable resolution and field of vision; by adjusting the zoom of the optical lens, different resolutions can be achieved. Using a variety of computer graphic design and editing tools, the original form of design is processed, that is, the graphics and picture materials collected and stored from the computer are used to create new works of art [10].

(2) Output of process graphics

The system takes the CNC machine tool as the output, which can efficiently complete the production of artistic graphics on metal, glass, plastic, stone, wood and other materials, and can simulate and verify the processing data.

(3) Management of process resources

As the bottom support of CAD application, the graphic and image processing system for process design has rich process resources. These resources can come from the built-in system, the management supplement of users, and the subsequent customized development of programmers according to user needs. In order to make full use of resources and find them quickly, these rich process resources must be effectively and reasonably managed. In the system, process resources are uniformly managed by the process resource database [11], [12].

a) Structure of process resource library

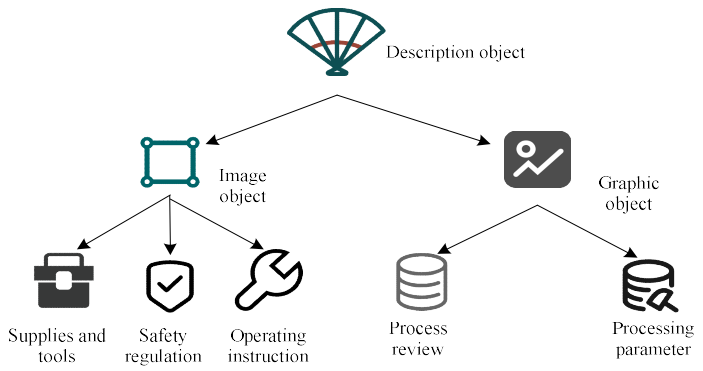


Figure 2: Process resource database structure tree

All resources related to the expression of process information in the system can be included in the process resource library. In combination with the specific application environment and place of the system, the resource structure tree of the process resource library is shown in Figure 2.

According to Figure 2, objects in the process resource library describe the outside world in a unified way. In a specific component, it is divided into image target and graphic target, both of which are expandable elements. However, the attributes and methods of the former have been determined, so users can directly add picture resources to the resource library; the latter is completed by specialized experts. In Figure 2, the process resource library mainly includes three resources:

Image recognition mainly represents the specifications and processes of process design in the form of graphics, and can also be divided into tools, safety regulations, operating procedures, quality risks, etc. They are generally used in the development of process specifications, such as process equipment operation manuals, process flow specifications, etc. [13].

Process audit mainly refers to the comments during process audit. It can be divided into arrow, line, review, seal, mark, note, etc.

Process parameters are the geometric information and production and assembly information given in the design process, including surface roughness, dimension marking, various tolerances, datum and process design data.

The process resources described above are general resources that can be directly embedded into the process resource database. At the same time, they can also be expanded to meet the needs of specific industries or companies.

b) Extension of process resource library

The process resource library mainly includes image resources and graphics resources. Because of the different data structures, the expansion methods of the two are also different. The process resource library expansion process is shown in Figure 3.

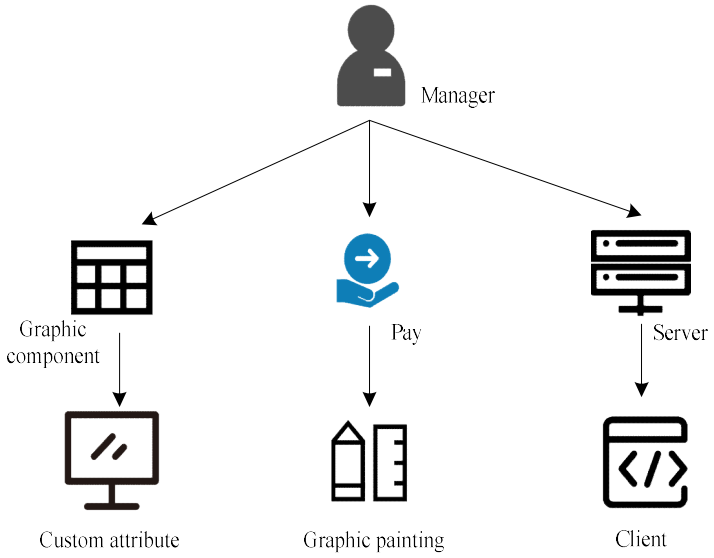


Figure 3: Process resource library extension flow chart

In Figure 3, because the attributes between images are the same, its extension is easier to implement than graphics, and can be managed by users themselves. In enterprise applications, the process system is generally managed by the user's authority to facilitate the management of process data, and also provides a simple and practical method for the management and expansion of image database. In the final application, a gallery would only appear in the environment where the server or administrator is located, and other users can access it by downloading it. There are a large number of joint ventures in the ceramic industry, which often adopt the industrial standards of other countries. The expression of process parameters has changed, and the process resource pool has also expanded [14], [15]. Due to the characteristics of graphics and the particularity of methods, it is difficult to have a good algorithm to realize it at present. The definition and description of attributes for new objects can only be done on the basis of an existing expandable element object mechanism. Finally, the updated parts are handed

over to the administrator and updated by the system administrator. The system would dynamically upgrade each customer according to user needs.

II. C.Multi-view Three Dimensional Reconstruction

Three dimensional reconstruction has been widely used in many fields. At the same time, there are some technical problems in ceramic art reconstruction, such as reflection and no texture. To solve this problem, the ceramic art reconstruction algorithm has changed from the traditional method to the learning method, and then the traditional method and the learning method are crossed and integrated, with complementary advantages. The traditional algorithm reconstruction process is shown in Figure 4.

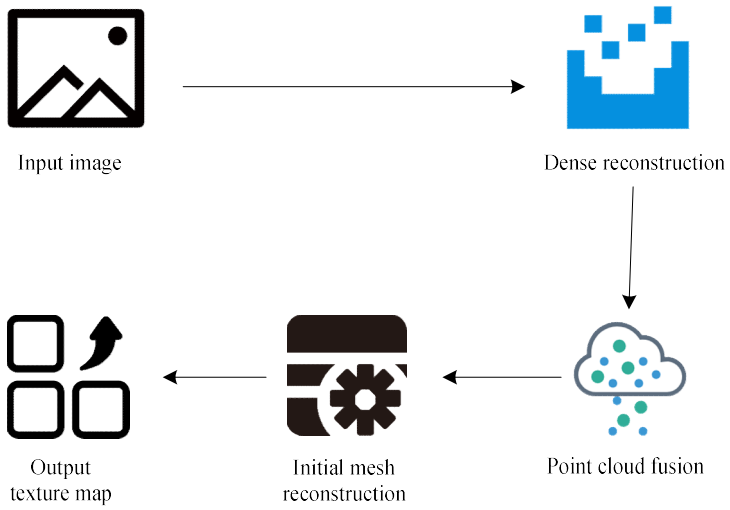


Figure 4: Multi-frame image reconstruction flow chart

The traditional repair methods include Red Green Blue Distance (RGBD) and Murata Vortex Spinning (MVS). MVS reconstruction is a method with high accuracy, low hardware requirements and large measurement range, but it can not fundamentally solve the problems of non-texture, reflection, repeated texture and so on. The contour reconstruction technology has the advantages of simple and fast implementation, and its accuracy depends on the resolution and contour of the voxel. The reconstructed model is not smooth enough, and it is difficult to realize the contour that needs a splitter, thus resulting in common defects. In the era of big data, the rapid development of computer hardware and deep learning technology has made 3D based on deep learning technology become a hotspot in the research field. The main learning methods are mesh model reconstruction from a single frame and depth reconstruction from a single frame or multiple frames.

II. D.Multi-label Feature Extraction Based on 5G Security Repair Technology

This paper presented an algorithm for semantic information extraction from multi-tag data. The algorithm first uses the self-coder to obtain the robust data set attribute space, and then uses the hypergraph principle to construct the geometric relationship between samples in multiple views. Secondly, it uses Laplace characteristic mapping technology to construct multiple data views under multiple labels, and then uses Laplace matrix to construct corresponding manifold space. Finally, it uses multiple manifold spaces to construct a complete Laplacian matrix, and uses the eigenvalue decomposition of the matrix to obtain a low-dimensional semantic space.

Self-coder is an unsupervised feature learning algorithm based on the principle of depth learning. Its inner layer can extract the image features robustly. The learning object of self-coder can be abstracted as a convex optimization problem to minimize the reconstruction error:

$$\sum_{i=1}^{n} \left\| x_i - \hat{x}_i \right\|^2 \tag{1}$$

For the de-noising self-encoder, data input $x_1,...,x_n$ are randomly replaced and composed, thus adding artificial noise to the original data. $\hat{x}_i$ represents the result of adding noise to x_i, and $W : R^d \to R^d$ represents a mapping

used to reconstruct input data with noise. Therefore, the objective function of reconstruction error can be defined as:

$$\frac{1}{2n}\sum_{i=1}^{n}\left\|x_i - W\hat{x}_i\right\|^2 \tag{2}$$

In order to reduce the difficulty of reconstruction, the multiple view stereonet (MVSNet) algorithm is used to process the training data multiple times, and different random noises are added in each step. The loss function of the least squares can be redefined as:

$$\frac{1}{2mn}\sum_{j=1}^{m}\sum_{i=1}^{n}\left\|x_i - W\hat{x}_{i,j}\right\|^2 \tag{3}$$

Among them, $\hat{x}_{i,j}$ represents the value after adding random noise for the *j*-th time after input data *x*; *m* is the number of times the same input is processed, that is, the number of layers of MVSNet. In order to improve the processing efficiency of the algorithm, the input data is matrixed.

$X=[x_1,...,x_n]$ is the input data matrix; *m* is a constant and has no effect on the minimum loss function. Therefore, the loss function can be simplified to Formula (4), and $tr(\bullet)$ represents the trace operation of the matrix.

$$loss(W)=\sum_{j=1}^{m}\sum_{i=1}^{n}\left\|x_i - W\hat{x}_{i,j}\right\|^2 = tr\left[\left(\bar{X}-W\hat{X}\right)^T\left(\bar{X}-W\hat{X}\right)\right] \tag{4}$$

Minimization is a least squares problem with a global optimal solution. Its solution is:

$$W = PQ^{-1} \tag{5}$$

Among them, $Q=\hat{X}\hat{X}^T$, and $P=\bar{X}\hat{X}^T$. Since Formula (5) is a convex function of *W*, it is only necessary to satisfy the extreme necessary condition of the objective function, that is, by setting all components of its directional derivative to zero, the global optimal solution of the problem can be obtained. Moreover, since $\hat{X}\hat{X}^T$ is an invertible matrix, the optimal solution $W*$ can be obtained from $\frac{\partial loss(W)}{\partial W}=0$ as Formula (6):

$$W* = \bar{X}\hat{X}T(\hat{X}\hat{X}^T)^{-1} \tag{6}$$

This method has good anti-jamming performance, but it does not take the relationship between tags and feature space into account, and would not reduce the dimension of feature space. Therefore, the constructed multi-tag classification algorithm would be limited in learning accuracy and timeliness.

III. Experimental Results and Evaluation of Image Processing of Arts and Crafts

III. A. Experimental Environment and Preparation

The basic configuration used in this experiment is shown in Table 1. At the same time, the research team server was used for remote training, and common libraries such as Python, Torchvision, Opencv-Python, Numpy, Plyfile, Pillow, Tensorboard were used. In addition, GeForce RTX 2080ti was stored in 12G.

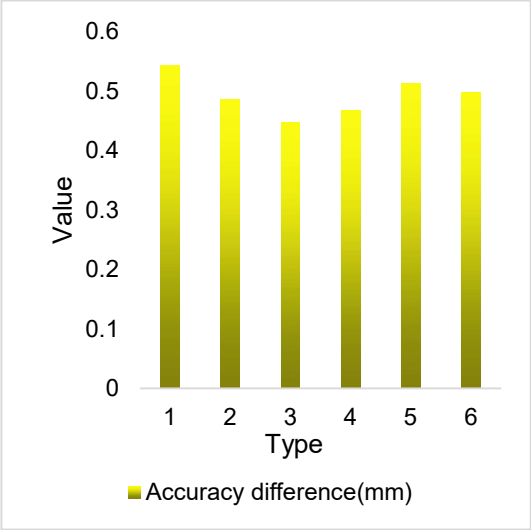
Table 1: Experimental environment and network parameter setting table

Experimental Environment	Parameter	Setting parameters	Value
Operating System	Ubuntu 16.04	N	34
Mainboard	Hp 8603(Hm370 Chipset)	Learning Rate	0.003
Display Card	Nvida Geforcegtx 2080ti*2	Batch Size	4
Internal Storage	16gb	Epochs	4

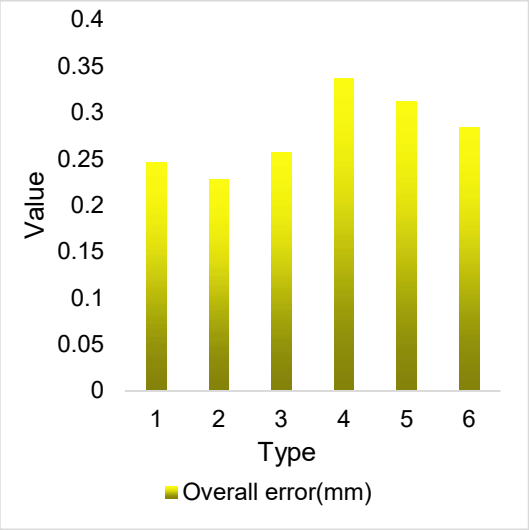
Learning rate is the learning rate; Batch size represents the number of parameters passed to the algorithm for training at one time; Epochs represents the iteration period.

III. B. Experimental Results

On this basis, the self-coder based on noise reduction was further optimized. The PatchMatch iteration was improved while maintaining the original structure. The focus was on the fusion of depth maps, and improvements was made in terms of greatly reducing the utilization rate and computation amount of video memory. In many learning-based methods, view selection scores are used to define two optimal source views. However, there is a strong correlation between the selected source view and the reference view, which would have a negative impact on the training of the sub-pixel layer view weight network. Therefore, this paper selected 6 of the 10 best source views as training. This method can improve the diversity of training time to a certain extent, and dynamically enhance the data, so as to improve the generalization performance of the algorithm. At the same time, it can also improve its visibility by training unrelated random sources. This part tested and analyzed the selection of views. In order to reduce the blocking problem, increase the number of views and improve the reconstruction accuracy, N=1, 2, 3, 4, 5, 6. The accuracy difference and overall error of different sheets are shown in Figure 5.

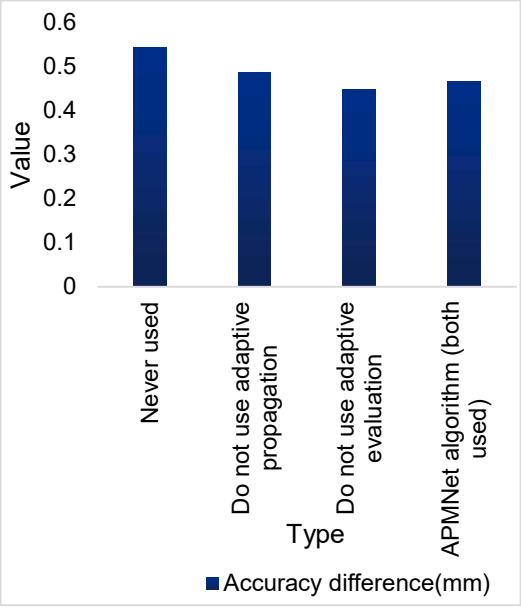


(a) Poor accuracy

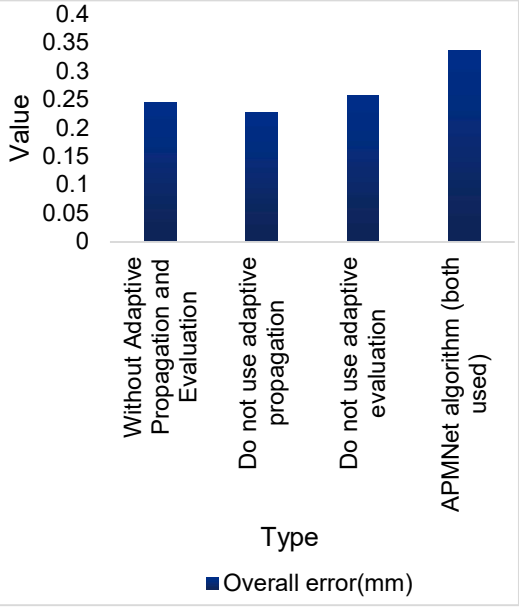


(b) Overall error

Figure 5: Accuracy difference and overall error of different sheets



(a) Poor adaptive accuracy



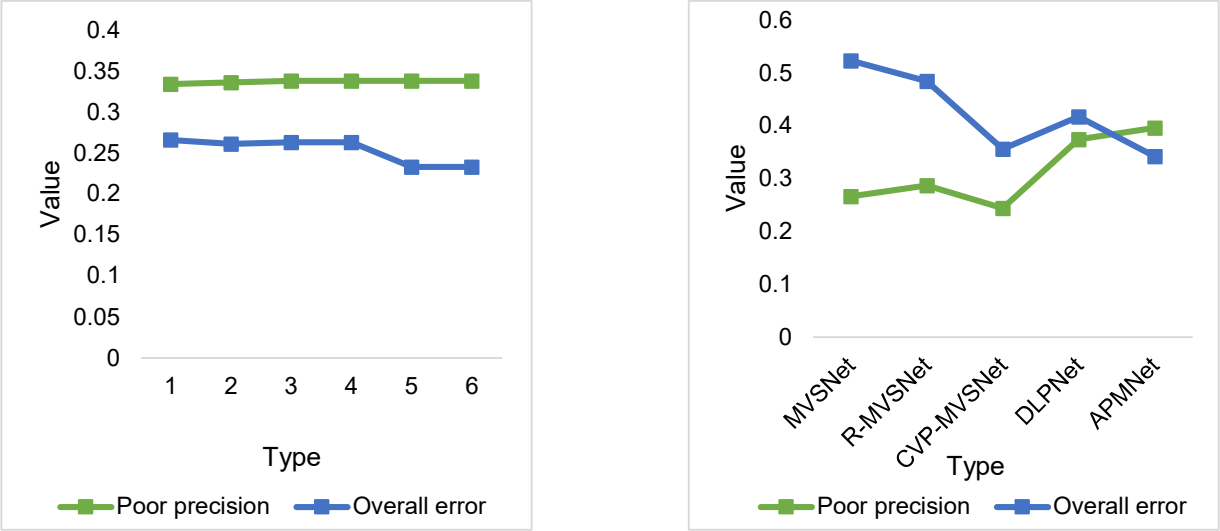
(b) Overall adaptive error

Figure 6: Adaptive accuracy difference and overall error

In Figure 5 (a), the highest accuracy difference was No. 1, which was 0.543. The lowest accuracy difference was No. 3, and its value was 0.448. In Figure 5 (b), the number 4 with the highest overall error was 0.337. The lowest overall error was No. 2, which was 0.228. To some extent, the more views, the higher the reconstruction accuracy and the overall error rate. However, when N=5, the comprehensive performance was better, so 5 views were used for input in this algorithm. In order to verify the effectiveness of adaptation, this paper compared the basic model of the algorithm with the fixed 2D (Two Dimensional) offset in propagation and evaluation. The data is shown in Figure 6.

In Figure 6 (a), among the poor adaptive accuracy, the values of not using adaptive propagation and not using adaptive propagation were 0.543 and 0.487 respectively. The values of algorithms (both used) without adaptive evaluation and asynchronous programming model net (APMNet) were 0.448 and 0.467 respectively. In Figure 6 (b), in the total adaptive error, the values that have not used and do not use adaptive propagation were 0.246 and 0.228, respectively. The values without adaptive evaluation and APMNet algorithm (both used) were 0.257 and 0.337 respectively.

In order to solve the problem of large difference when the depth is discontinuous in the sum algorithm of adaptive spatial cost aggregation, this paper used the absolute difference of the inverse depth between each sampling point and pixel, and normalized the inverse difference using sigmoid function to obtain the weight. Comparative experiments have been carried out through MVSNet, R-MVSNet, Cost Volume Pyramid Based Depth Inference for Multi-View Stereo (CVP-MVSNet), Digital Light Processing Net (DLPNet) and APMNet algorithms. The results are shown in Figure 7.



(a) Stage iteration times

(b) reconstruction results of each model

Figure 7: Stage iteration times and reconstruction results of each model

It can be seen from Figure 7 (a) that the difference between the results obtained by two and three iterations was very small. In order to save time and space, the algorithm selected 2 iterations. At the same time, combining local disturbance, adaptive propagation and cost aggregation can improve the accuracy of the algorithm and accelerate the convergence speed.

In Figure 7 (b), APMNet algorithm is significantly more dense and concentrated than other model point clouds. This is because the prominent adaptive algorithm has a better effect in texture and boundary reconstruction, which is due to the fact that adaptive propagation can correct the boundary error by using the neighborhood information within the boundary and extract the structure from coarse to fine multi-scale features.

To sum up, this paper analyzed the general problems of 3D reconstruction algorithm based on depth learning, and proposed an APMNet model based on depth map. Secondly, this paper proposed the overall architecture of APMNet algorithm. On the basis of maintaining the PatchMatch method, its normal vector was deleted to reduce the amount of computation. Thirdly, the improved model was described in detail. Finally, the robustness of APMNet was tested. In many model tests, APMNet algorithm was superior to other models in terms of accuracy and overall error. The overall quality had also been significantly improved, and had obvious advantages in memory occupation, running time and other aspects.

IV. Discussion

IV. A. Discussion on the Relationship Between Arts and Crafts and Image Processing

Through the analysis of different process design platforms, the technical characteristics of process design were expounded, and a process design method based on CAD technology was proposed. In the process-oriented image processing system, this paper mainly studies the following issues:

System framework: in view of the specific functional requirements of the system, this paper proposed a general platform that can not only support the editing operation of general engineering drawings, but also support the editing operation of mainstream images, image mixing operation, and has good portability in CAD as a foundation.

The description of image objects is unified: the data structure and operation methods between images and images are very different. Therefore, this paper mainly discussed how to construct a unified object to provide a unified description interface and support the fusion of vector operation and image operation. Technical data warehouse: through the analysis of the process information of ceramic industrial process design, it provided enterprises with a large number of scalable and customized technical resources. Through the analysis of the relationship between operations and the characteristics of related objects, a reasonable Undo/Redo mechanism was discussed to ensure the accuracy of data return and restore in operation.

IV. B. Historical Inheritance of Arts and Crafts

In the process of social development from industrialization to post-industrialization, knowledge, information and services are more powerful than machinery and material resources. Therefore, arts and crafts are receiving more and more attention in the development of cultural heritage and creative industries. According to historical records, the British handicraft industry has undergone five adjustments in the past half century. It changes from a production mode and creation form beneficial to industry and commerce to a culture and art education mode. It is composed of traditional national cultural heritage, cultural tourism products with unique functions, and cultural and creative industries that are valued today. The position of handicraft industry in modern society has changed.

From the perspective of cultural heritage, in 2003, UNESCO promulgated the Convention on the Protection of Intangible Cultural Heritage. From the perspective of “intangible cultural heritage”, traditional arts and crafts are a continuously generated and living form of cultural expression. Its inheritance subject, form of expression, cultural space, cultural identity, etc. need to be paid attention to, and practical measures should be taken to protect and implement them.

From the perspective of industrial development, the development of creative economy has brought new development space to handicraft industrialization. At this time, many issues such as ecology, culture, production and life have answers and directions. Especially, in the post-industrialization period, knowledge, information and culture have become the main driving force. The traditional mode of production and cultural form is not replaced by the impact of machine production and mechanical aesthetics, but ushered in a new construction in creativity and industrial mechanism, which integrates different cultural information such as tradition and fashion. In the new industrial mechanism and communication mode, in the daily aesthetics and application, it realizes the sense of identity and belonging of culture. At present, handicrafts and folk arts have become an important resource that cannot be ignored in the fashion industry, design industry, tourism and cultural industry. Not only luxury goods with a long history, such as clothing, clocks and watches, are of good quality and rich connotation in this era of mechanization and assembly line, but also have created the value of luxury goods, such as ceramics and communication equipment. It is also the combination of advanced technology and handwork to create a unique luxury, thus increasing the economic added value and cultural recognition of products. By tapping the intellectual and technological resources of traditional culture, handicrafts would be closely combined with industrial development and urban development to form a new development theme.

V. Conclusions

After analyzing the characteristics of the process-oriented graphics and image system, the architecture based on “software bus component” was proposed. The underlying system was divided into the underlying support library, the underlying graphics platform and the graphics and image module, and the specific functions of each module were modularized. The whole system architecture is clear, ensuring the integration and openness of the system. Each functional module can be developed independently, which greatly improves the development efficiency and work efficiency of the system. On this basis, this paper retained the multi-scale main frame from coarse to fine and the PatchMatch propagation mode, and removed the normal vector operation in the PatchMatch with large amount of computation. The initialization of the low resolution layer was triangulated, and PatchMatch was improved by using local disturbance, adaptive propagation, adaptive spatial cost aggregation and loss function, thus establishing a 3D reconstruction method of dynamic APMNet. However, there are still some defects in this paper.

For example, the process design-oriented Geographic Information System (GIS) is based on graphics and stores the processing data in the form of graphics to the disk, which leads to the inquiry and modification of process data. On this basis, the was is used to manage the process data, which improved the processing efficiency of the process data. At present, the development and customization of process objects can only be quickly customized by professional developers according to the requirements of customers, rather than by users themselves. This paper also proposed a vectorization method based on vector graph, that is, the content of the image was converted into vector image, and the corresponding features and methods were given. In this way, users can quickly create a processing target by using similar images or drawing a rough outline.

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