Research on the Aesthetic Features and Technology of Computer Graphics

Yanbin Song
Liaoning Communication University, Shenyang 110113, China
13709880633@lntjsz.edu.cn

Abstract. Computer graphics is a new science produced with the popularization of computers. The processing technology of graphics and images in computer graphics has attracted much attention. How to make reasonable use of them has become an important subject in the field of modern scientific applications. For this research background, this paper proposes an image recognition algorithm based on wavelet and DFB-PCA. After decomposing the recognition image with wavelet transform, DFB-PCA recognition is performed on the low frequency subband. The experimental results show that the method is beneficial to reduce the influence of factors such as illumination, posture and expression, reduce the dimensionality of noise and image recognition, and has better robustness. Compared with directly using PCA recognition on the original image, the calculation speed and recognition efficiency of the image can be improved.

Key words. Computer image, aesthetic characteristics, scientific image, wavelet algorithm.

1. Introduction
The development and application of computer science is one of the great achievements of human civilization. The computer has gradually evolved from the form of pure data and pure code to the present form of application with rich pictures and texts, which is a huge improvement and convenience for us. Graphics exist objectively in the real world, images are constructed subjectively, and computer graphics and image processing technology is to link the two, combining graphics and image processing technology in the computer disciplines, along with computer graphics and With the continuous development of graphics and image processing technology, the combination between the two is becoming closer and more harmonious, and its applications in various fields have become more and more extensive, gradually becoming the most active subject in computer science. In practical applications, image stitching is often the first step in the application of complex systems, so improving the speed of the image stitching system is an urgent problem [1]. Through research, this paper has designed an image stitching system with fast speed, stable operation and good stitching effect, which will be analysed and introduced below.

2. Image processing and recognition technology
We convert each two-dimensional image data into a one-dimensional vector. Each person selects a certain number of images to form the training set, and the rest form the test set. Suppose the size of the image is w×h (w and h are the width and height of the image respectively), the number of images in the
entire image library is \( n \), the number of images used for training is \( n_1 \), and the number of images tested is \( n_2 \); let \( m = w \times h \), the training set is an \( m \times n_1 \) matrix, and the test set is an \( m \times n_2 \) matrix. The \( i \)-th image can be expressed as (\( m \) is the one-dimensional vector dimension):

\[
x^i = [x_1^i, x_2^i, \ldots, x_m^i]^T
\]  

(1)

Calculate the generator matrix \( \Sigma \) of the KL transformation, and perform the KL transformation. The generating matrix of the KL transformation can be the overall dispersion matrix \( S_t \) of the training samples, or the inter-class walking matrix \( S_b \) of the pre-training samples. The walking matrix is generated after training, and the overall walking matrix can be expressed as (ignoring coefficients):

\[
S_t = \sum_{i=1}^{n_1} (x_i - \bar{x})(x_i - \bar{x})^T \in R^{m \times m}
\]  

(2)

Take the overall dispersion matrix \( S_t \) as the generator matrix \( \Sigma \) and record it as:

\[
X = [x_1 - \bar{x}, x_2 - \bar{x}, \ldots, x_{n_1} - \bar{x}] \in R^{m \times n_1}
\]  

(3)

Then \( \Sigma \) can be written as:

\[
\Sigma = XX^T \in R^{m \times m}
\]  

(4)

Calculate the eigenvalues and eigenvectors of the generator matrix \( \Sigma \) to construct the subspace. First, the eigenvalues are sorted from large to small, and the order of the corresponding eigenvalue vectors is adjusted accordingly; then, a part of them is selected to construct the feature subspace. Project the training image and the test image into the feature space. After each image is projected into the subspace, it corresponds to a point in the subspace. Similarly, any point in the subspace corresponds to an image [2]. The images formed by these subspace points after reconstruction are very similar to "images", also called "feature images"; and the method of image recognition through KL transformation is called the method of generating "feature images". With such a dimensionality reduction subspace composed of "feature images", any image can be projected to it and a set of coordinate coefficients can be obtained. Since this set of coefficients can indicate the position of the image in the subspace, the recognition problem of the original image can be transformed into a classification problem based on the training sample points in the subspace.

Once the image is projected into the subband space, the remaining task is how to solve the problem of judging the similarity of these images. There are usually two methods for judging the similarity between images: one is to calculate the distance between images in N-dimensional space, and the other is to measure the similarity between images. When measuring the distance, the distance should be as small as possible. Generally, the training image closest to the test image is selected as its category. When measuring similarity, the images should be as similar as possible, that is to say, the training image class with the greatest similarity is regarded as the class to which the test image belongs. This article uses the nearest neighbour method for similarity comparison. The nearest neighbour method, also known as Euclidean distance or the square root of Euclidean distance, is to add the square differences of pixels. The distance formula can be expressed as:

\[
L(x, y) = \sum_{i=1}^{4} (x_i - y_i)^2
\]  

(5)

3. Implementation of recognition algorithm based on wavelet and DFB-PCA

The implementation steps of the image recognition algorithm based on wavelet and DFB-PCA are shown in Figure 1: (1) read in the image and reprocess the image; (2) perform wavelet transform on the processed image and extract low-frequency coefficients; (3) Use DFB-PCA algorithm to process the low frequency coefficients; (4) Select a certain distance function for identification.
4. Simulation experiment and result analysis
The simulation experiment takes the ORL image database as an example, 40 people each have 10 images, a total of 400 images. In each person, select the first 2 images as the training set, and the last 8 images as the test set; a training set of 80 images and a test set of 320 images are formed. In order to choose a suitable best wavelet, experiments were carried out using different wavelets. From the recognition rate and time used in the experimental results of Table 1, it can be seen that Db2 is the best and Db3 is the second, but there is no greater difference [3]. Therefore, Db2 is chosen to realize the simulation test of the given algorithm.

| Wavelet | Training time (s) | Test time (s) | Recognition rate (%) | Subband image size |
|---------|------------------|---------------|----------------------|-------------------|
| Db2     | 3.88             | 0.10          | 83.9                 | 30×25             |
| Db3     | 5.42             | 0.13          | 80.1                 |                   |
| Db4     | 6.37             | 0.17          | 78.2                 |                   |
| bior4.4 | 6.06             | 0.16          | 76.4                 |                   |

If the information content of the image is 90%, the first 28 maximum feature values can be selected, and their corresponding feature vectors form the feature subspace. The first 28 images are shown in Figure 2. If the PCA algorithm is used to process the image directly, the first 37 maximum feature values can be selected according to the image information of the same size. Obviously, the algorithm proposed in this paper is superior to the PCA algorithm in terms of recognition rate and calculation speed.
5. Computer image processing system design

5.1. System Architecture
In order to find a general image mosaic technology, this paper proposes an image mosaic prototype system based on FAST feature matching. The system first detects the FAST features in the images to be stitched and matches each other, and then eliminates the wrong matching points through the improved RANSAC algorithm [4]. Through the calculated transformation matrix after eliminating the wrong matching, the images in different coordinate systems are mapped to the same coordinate system for stitching.

5.2. FAST feature detection matching
First, the FAST features of the two images are detected separately, and then the feature matching is performed. In order to facilitate observation, the corresponding feature points are connected with red lines.

5.3. Eliminate incorrect matching points
It is not difficult to find in Fig. 3 that some of the lines between the feature points are not parallel to other lines, indicating that there is an incorrect matching point. Figure 3 shows the feature points and their corresponding lines after the improved RANSAC algorithm eliminates the mismatch. The mismatch points have been eliminated.
5.4. System performance analysis

In order to further verify the performance of the system, such as the stability of rotation and affine transformation, a group of images taken by the same camera and simultaneously existing rotation transformation and affine transformation are selected for stitching. Because the system uses the "FAST Improved RANSAC" algorithm, it has a greater advantage in speed [5]. The author takes the "SUFT+RANSAC" system often used in other documents as an example for comparison. In order to obtain a reliable comparison result, the author conducted a splicing time test on different systems and different resolution pictures on the same machine (Intel I5-3120M processor, 2.5GHz) and tried to ensure that the same implementation mechanism is used. The results are as follows Table 2 shows.

| Algorithm          | Resolution | 421×237 | 737×415 | 1025×592 | 2104×1184 |
|--------------------|------------|---------|---------|----------|-----------|
| FAST (this text)/s | 0.4492     | 0.7468  | 0.9204  | 3.0732   |
| SURF (other)/s     | 0.4501     | 1.1276  | 1.3248  | 5.1056   |

It can be seen that the larger the picture to be stitched, the more obvious the speed advantage of the system proposed in this paper.

6. Application of computer graphics and image processing technology

In the context of the continuous development and innovation of technology, coupled with the summary of technical application experience, computer graphics and image processing technology has been applied in many fields and plays an important role.

6.1. Application in auxiliary design and manufacturing

With the development of technological innovation, various graphics and image processing technologies appear and are widely used in auxiliary design and manufacturing. Through the application of these technologies, the shape, size and texture of graphic images can be visually displayed through three-dimensional images, animations and other forms, allowing designers to clarify goals, grasp key points, adjust design ideas, reduce the time spent on product development, and let Products are put on the market as soon as possible to meet people's needs. In product design and production, with the support of graphics and image processing technology, it is possible to design parameter indicators reasonably, strengthen product development guidance, supervise product design, improve product design quality, and ensure qualified component performance [6]. And reduce errors, realize design innovation, and help improve product design level and product production efficiency.

6.2. Application in animation production and art design

The development and application of processing technology, in addition to facilitating the processing of static graphics and images, has also been applied in the fields of animation production and art design, facilitating people's daily life, work and study. Animation is a piece of graphic images stitched together, with the support and assistance of processing technology, can enhance the authenticity and vividness of graphic images. And reduce the labour intensity of the staff, and create more vivid and real graphics images for people. In addition, computer graphics and image processing technology has also been promoted and applied in the field of art design, and promoted the improvement of the level of art design. Through the application of processing technology, it is possible to effectively carry out artistic design, creation and processing, close the connection with daily life, and meet people's appreciation needs [7]. At the same time, with the support of Photoshop, 3DMAX and other auxiliary software, art designers can effectively carry out the design and production of 2D and 3D graphics and images, and perform operations such as cutting and adding text. Not only the operation is simple, convenient and efficient, but also the accuracy of graphics and image processing can be improved. It has broad application prospects in graphic design, interior decoration and other fields.
6.3. Application in visualization concept
Visualization refers to the purpose of improving the accuracy of graphics and image processing through modelling and rendering in the process of graphics and image processing. With the development of technological innovation, the visualization concept has made breakthroughs and gradually becomes a reality. At the same time, it has gradually been widely used in the fields of medical treatment and meteorological analysis. For example, in the medical field, through the application of graphics and image processing technology, image information can be transformed into a three-dimensional view, and medical staff can present clear and clear image information. In turn, it is conducive to accurate diagnosis of the patient's condition, which plays an important role in improving the quality of medical services. In addition, with the development and progress of society, visualization technology is bound to be applied in more fields, and its advantages and salient features will also be further utilized.

7. Conclusion
Computer graphics and computer graphics image processing technology is an important part of modern computer application technology, and play a very important role in the conversion, display and processing of computer graphics images. The demand for social development continues to increase, and universities are also required to strengthen the teaching of computer graphics and graphics and image processing technology, continuously improve the level of teaching, so that students can have a solid grasp of the application technology of computer graphics and image processing software, and cultivate more for the society Many professionals.

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