Research on Portrait Matching Technology based on Feature Points

Ye Wang, Shanyou Yang, Long Cheng*
Development & Service Center for Science &Technology Talents, The Ministry of Science &Technology (MoST), Beijing, 100045, China

Abstract: Most of the traditional matching techniques are gray portrait matching. As a result, a new character portrait matching technique based on character attribute points is proposed. Using the SIFT algorithm, the character attribute information of the person's name, gender, place of origin, position, technical field, etc. is taken as the local feature point of the character, and the character feature data set is prepared. The feature search strategy with kd tree as the core is selected to establish the search space and search feature set. Within the feature point mapping, the similarity measure is used to judge the similarity between the feature points of the feature set through the cost function, and the character portrait matching is realized. Experimental research shows that compared with the traditional gray portrait matching method, the feature point based human portrait matching technology can improve the accuracy of human portrait matching in normal environment by 17%. In the interference environment, the matching accuracy can be improved by 25%.

Keywords: Character portrait; Matching degree; Feature points; Character attribute information

1. Introduction

With the continuous progress of science and technology, computer vision, as a new field, has attracted more and more attention. Its wide application prospect can bring great convenience to people's life[1]. For example, face recognition through human face and iris, traffic violation handling in the traffic field, automatic target detection in the military field, image retrieval in the information retrieval field, etc., all need to use the relevant technology of computer vision. As a key technology in computer vision, portrait matching plays an important role in promoting the whole field. Portrait matching technology refers to the use of relevant portrait matching algorithm to search for similarity between multiple different portraits, and establish corresponding relationships through image content, feature, structure, relationship, texture and gray level, etc. Through the analysis of similarity and consistency, the method of same portrait target is found. In the process of computer vision recognition, the core of portrait matching is to compare two or more images of the same scene obtained by different sensors or the same sensor under different visual and imaging conditions to find the same person information in this group of portraits. The matching technique is the key step of the processing and analysis of the figure portrait, and also the basis of computer vision. The accuracy and speed of the matching have a decisive influence on the subsequent processing. At present, there are mainly two kinds of matching techniques: one is based on gray scale and the other is based on feature. The application of gray image matching is simple, which is mainly used for registration of multi-band remote sensing image after geometric correction. With the maturity of computer vision technology, portrait matching based on feature points has been selected by more people. Nowadays, it has become an information processing field. Special characters are the key technologies in the field of portrait processing, and their application ranges in many fields, such as medical diagnosis field, military field, information security field, industrial field, remote sensing field, etc. The deepening of practice brings about great development of portrait matching technology research. In this regard, a personage portrait matching technology based on feature points is designed to provide a certain reference basis for the study of portrait matching technology[2].

2.Design of Matching Technology for Character Images based on Characteristic Points

Based on feature point portrait matching technology is to find similar images by using the attribute information of characters such as name, gender, place of origin, position, and technical field as the local feature points of the characters, using the analysis of the similarity and consistency of feature points. Methods. In the specific recognition process, the image matching is to compare two or more images obtained by different sensors or the same sensor to different fields in different data sets and different search conditions, and find the same or similar characters in the group of images. . The image matching is expressed mathematically, that is, the data mining method is used to find the relationship between the two por-

traits.The matching portrait and the template portrait are respectively set as I_1 and I_2, and the relationship is as follows:

$$I_2(x,y) = I_1\left[f(x,y)\right] \quad (1)$$

Image matching is a multi-step process, which is roughly divided into the following processes: input image, pre-processing image, feature extraction, similarity measurement, search strategy, output results, etc. There are big differences between the different image matching algorithms, but the basic process is similar. Figure 1 is the flowchart of image matching. In the whole matching process, the matching of the figure portrait based on local feature points can be roughly divided into the following three processes: First, the extraction of local character attribute features, the second is to choose the right search strategy, finally, the similarity analysis of the portrait is carried out by using the similarity measurement method. In practice, the extraction of local features is the core.

In addition, noise and threshold selection also have an impact on the matching accuracy of portraits. Due to the large number of people in the related field, the character cannot be accurately matched by a single character attribute data. In the process of storing and transmitting the character image, the conversion of the character attribute data storage format may occur. The noise interference caused by these processes brings great difficulty to the processing of the image, which makes it difficult to ensure the accuracy of subsequent image recognition and classification, and some even cannot be performed. Therefore, selecting an appropriate method can effectively reduce the noise matching of the character attribute data. Impact. According to the statistical theory, noise is generally divided into two categories[3]. In general, the statistical characteristics change with time, and those that do not change are called stationary noise. If the amplitude of the noise is the same, the location of the noise is arbitrary and it is called salt and pepper noise. According to the distribution form of noise amplitude, noise is also divided into two categories. If the amplitude distribution form is gaussian, it is called gaussian noise; similarly, the amplitude distribution form is Rayleigh noise[4]. In the process of measuring the similarity of the figure portraits, the selection of the threshold has a great influence on the experimental results, and the rationality of the threshold has a decisive influence on the accuracy and error rate of the matching results. The selection of threshold value is not unique in the same matching algorithm in different application environments. It should change with the application environment. The determination of threshold value needs a lot of experimental data to assist.

The local attribute feature refers to the attribute characteristics of a single or part of a character. For a portrait of a person, this part refers to some points that can appear stably and have good distinguish ability. Unlike global attribute features, local features can represent a person without the underlying information being incomplete. Design uses SIFT algorithm to extract character attribute features[5].

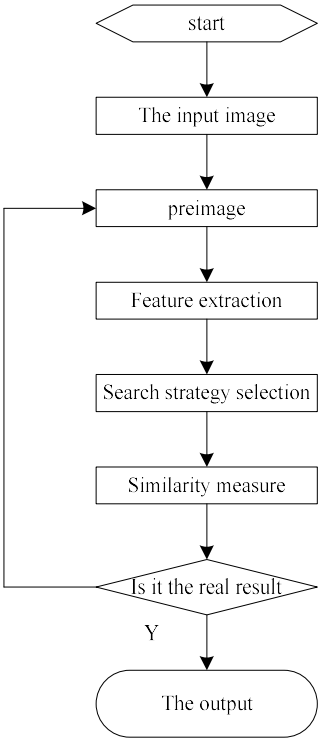

Figure 1. Image matching flowchart

2.1. Local feature extraction of character images

Firstly, scale space needs to be constructed. The purpose of scale space construction is to describe the multi-scale features of the figure portrait data. The object of the study was a two-dimensional portrait of a person. The generation of multi-scale space for two-dimensional portraits requires convolution operation with two-dimensional gaussian function. So here I'm defining portrait $T(x,y)$ to be matched. The scale space generated by the portrait is $L(x,y,\sigma)$. $*$ stands for convolution operation, then:

$$L(x,y,\sigma) = T(x,y) * G(x,y,\sigma) \quad (2)$$

In formula (2), $G(x,y,\sigma)$ is the two-dimensional gaussian function with variable scale, and the specific formula is:

$$G(x,y,\sigma) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}} \quad (3)$$

In formula (3), a is the portrait coordinate and b is the scale factor, which determines the smoothness of the processed portrait. Obviously, the bigger it gets, the more blurred it gets, the smaller it gets. Scale space is generally represented by gaussian pyramid when used. Figure 2 is the construction process of gaussian pyramid:

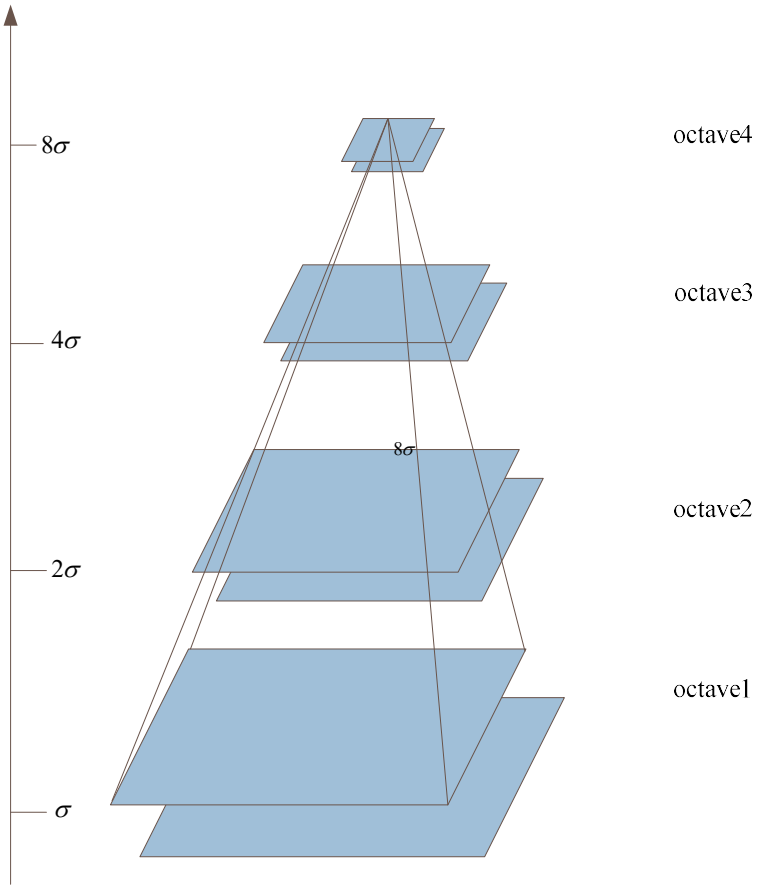

Figure 2. A schematic of the gauss pyramid

The construction of gaussian pyramid is generally divided into two steps: firstly, the portrait is smoothed with different degrees of gaussian. The portrait is then subject to down sampling. After the construction of the gaussian pyramid, the Dog pyramid, namely the gaussian difference scale space, needs to be generated according to the gaussian pyramid, and the Dog pyramid is needed for the detection of the extreme point later[6]. Here is the diagram and formula for the formation of Dog pyramid in gauss pyramid:

$$D(x,y,\sigma)=\left[G(x,y,k\sigma)-G(x,y,\sigma)\right]*T(x,y) \quad (4)$$

In the figure above, the gauss full character tower has S+3 layers, and the Dog remaining character tower has S+2 layers, where S denotes the number of portrait layers in each group, generally ranging from 3 to 5[7]. The figure above is only a group of portraits. Since the composition of the Dog pyramid is based on the two layers of the gaussian pyramid, it is one layer less than the gaussian pyramid[8].

After establishing the scale space, the image extreme point needs to be tested. Because the key points of the character portrait feature points are generated according to the extreme points of the portrait, the extreme points need to be compared with the pixels in the surrounding environment to find the maximum or minimum value[9]. The specific detection process is as follows。

As shown in Figure 4, first select the 8 adjacent character attribute points around it, plus the upper and lower corresponding co-layers of 9 points for a total of 26 points for comparison, so as to ensure search in the portrait and scale space. The accuracy of the extreme sites. However, there is a problem in this way. Two portraits at the beginning and end of a group of portraits cannot directly search for extreme attribute points. In order to solve this problem, at the highest level of each group of portraits, at the highest level of each group of portraits, another 3 is generated. The deputy portrait looks for dozens of points, so that in the end, only two portraits need to be lost.[11-12].

2.2. Search strategy selection

The search strategy refers to finding the optimal solution of the obtained feature points through translation, rotation and other transformation parameters in the search space by using a reasonable and effective search method. Through the search strategy, the image can be trans-

formed after the maximum similarity. The selection of search algorithm can greatly affect the computational efficiency of the whole algorithm. The more complex the search space, the larger the data volume, the more reasonable the search strategy should be selected. Because the feature space formed by the feature points of portrait matching technology will directly affect the selection and range of search strategies. Based on the feature point extraction technology completed in the above design process, the design uses the nearest neighbor search algorithm to conduct exhaustive search for any feature point set[13-14]. The nearest neighbor search algorithm needs the help of k-d structure.

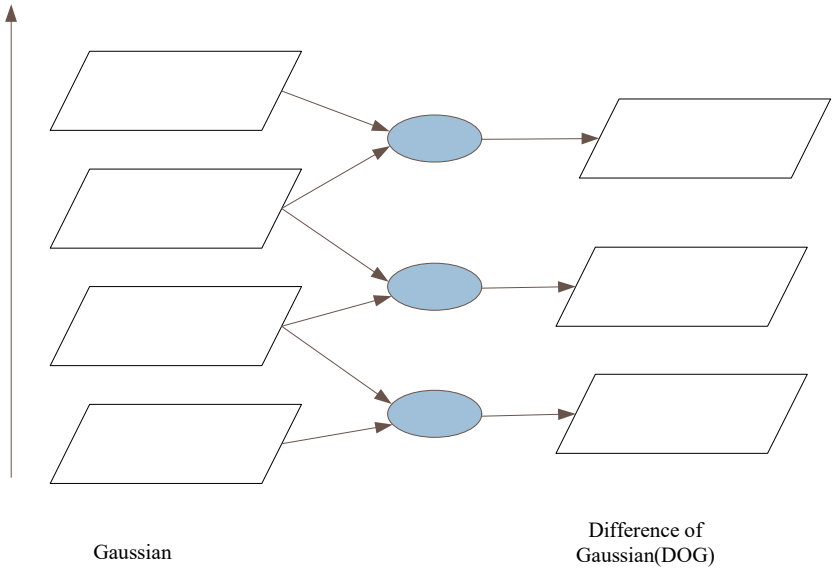

Figure 3. The DOG pyramid

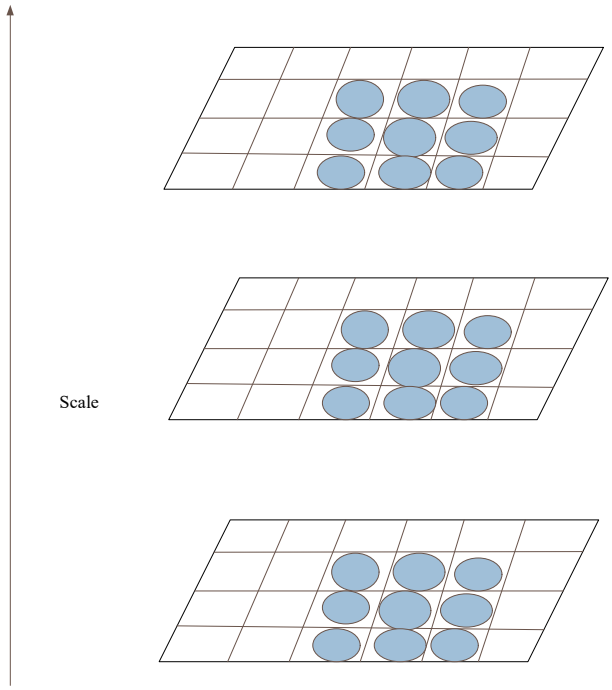

Figure 4. Extreme point selection

2.3. Achieve portrait matching

Similarity measure is to determine the similarity relation of feature set by selecting some cost function or bird function. The traditional similarity measures include: Euclidean distance, rural distance, Hausdorff distance, normalization correlation function, etc[15]. The selection of similarity measure and the selection of feature space are complementary to each other. To some extent, the selection of feature space determines the range of similarity measure selection.

3. Experimental Data Analysis

The above process completes the human portrait matching technology design based on specific points. In order to verify the overall design results, verify whether the design technology can effectively improve the matching accuracy. MATLAB programming was used in this experiment, and the computer configuration was Intel(R)Core(TM) i5-3230m, cpu2.6gz memory 12G. The database was established as sample 1(a number of faces photographed by mobile phones in reality) and sample 2 (Yale face database). Each image has a pixel size of 100*1000. First, the threshold value R is set for the number of successfully matched points between the two images, which affects the experimental accuracy and error rate (value is 0.52 and R value is 0.5). In order to objectively compare the matching accuracy rate of the matching technology, the experimental group and the contrast group were set, so that the comparison group chose the traditional gray level matching and the experimental group chose the feature point matching of the design. The images of the characters were compared under normal state and interference environment respectively, and the accuracy of the comparison was verified.

3.1. Comparison of normal state matching accuracy

10 groups of test samples were randomly selected from sample 1 and sample 2 to match the portraits in the test environment. The comparison result of its accuracy is shown in figure 5.

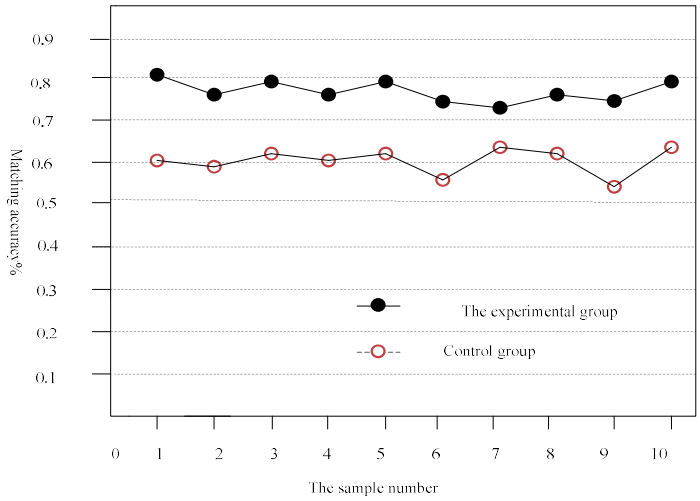

Figure 5. Normal contrast

According to the data in figure 5, it can be clearly seen that under the normal state, the accuracy rate of portrait matching between the experimental group and the comparison group is in a relatively stable state. As can be seen from the line chart, the accuracy rate of the people's portrait matching in the experimental group was basically maintained above 70%, and the maximum was about 81.5%. The control group was all under 70%. The error of the experimental group and the comparison group can reach about 25%, and the average error difference is 17%. It can be preliminarily judged the matching technology of the people portraits used in the experimental group, and the accuracy rate of portrait matching increased by about 17%.

3.2. Comparison of matching accuracy under interference environment

In order to further judge the accuracy of the above experimental process, it is determined whether the portrait matching technology based on feature points can improve the accuracy of portrait matching. Using the above experimental environment, and by setting the interference factors, it was judged again. From sample 1 and sample 2, 10 groups of test samples are randomly extracted, which are called original images. The original image was randomly processed by 5 degrees, 10 degrees, 20 degrees and 30 degrees. The processed image was taken as the experimental image and the feature point was matched again. The matching results are shown in table 1.

Table 1. Comparison Table of Matching Accuracy under Interference Environment

	The Experimental Group Matched Feature Points	Contrast Group Matching Feature Points	Accuracy Rate of Experimental Group	Contrast Group Accuracy
1	7514	7215	85.5%	77.3%
2	7352	5394	77.4%	65.5%
3	6527	5214	90.9%	75%
4	3299	2215	78.5%	70%
5	4875	3525	84.6%	72%
6	3568	3934	81.2%	69%
7	1576	898	95.7%	85%
8	6298	4215	85.3%	80%
9	1587	788	84.2%	65%
10	5216	4258	75%	49%

According to the information in table 1, the matching accuracy of the experimental group and the comparison group was significantly different under the interference environment. According to the numerical error, the overall matching accuracy of the experimental group in the interference environment was also higher than that of the control group. After actual quantization, the accuracy rate was increased by 25%. After two experiments, it can be determined that the matching technology based on feature points can improve the accuracy of matching.

4. Conclusions

Image matching technology, as a basic key technology in computer vision, has been a hot spot and difficulty in research since its inception, and has a broad application prospect. It has strong applicability in all fields. For example, the popularity of mobile devices such as video monitoring system and mobile phone makes the transmission of images between people convenient. However, this convenience also provided the conditions for the dissemination of personal portrait information. Therefore, the state needs to take relevant measures to monitor the portraits. The monitoring system will use the data analysis obtained from the base station to extract the features, and use the database to match each character image to find the target image. By feature point matching, strategy search and similarity measurement, the design can match the figure portraits. Experiments have proved that it has distinct advantages.

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