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Develop a New Method for People Identification Using Hand Appearance

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Abstract

In this paper a new method for people identification using hand appearance is presented. In this method, the contour information is used for matching. For this purpose, after applying pre-processing algorithms and edge detection, contour extraction, and to help the offices of concentric, hand's information including the number of pixels is limited to offices, will be extracted. By using extracted information, Matching will be done in the database identity and person will be identified. Benefits of the proposed method can be its lack of sensitivity to rotating and zooming the image pointed out. Practical results will show the accuracy of this method for identification. The proposed method can be used in other fields such as curve matching in addition to hand geometry identification.

Key Words

Identification, contour extraction, Matching, Hand appearance.

I. INTRODUCTION

Nowadays identifying the people is the most important world security issues. Different methods are using for identification, such as passport, but there are some problems on using it. Also identifying using computer technology is the main objectives of governments. By these reason, scientists are searching for features in the human body that could be use to identify individuals.

Examples of these features include iris [1], finger [2], face appearance [3], signature [4] and the appearance. In fact, the features of body can help in this way.

One feature of the human body that can identify its utilization is a hand's human appearance. A variety of methods available in matching appearance are presented. Some of these methods in matching use hand geometry features such as fingers and fingertips [5]. In these Methods, fingertips and toes and also the junction of the hand fingers have been used as points of review in determining the characteristics. There are also other methods that use existing lines and patterns on hand to compare and extract the features required [6]. These lines include lines of finger and palm lines. In addition, some methods use combination of these two methods. In such ways the geometric characteristics of hands and lines in the palms and fingers are used.

Innovative approach in this article are provided with matching curves obtained from the edge detection images using drawing concentric series of offices and counting the number of points in between these offices as a characteristic image to match its looks. Please note that the former method to compare with this method was implemented [7] and doing some tests. It was found that this algorithm has better and more acceptable results that in practical results section I will show it. In addition, this method is not sensitive to zoom and rotation.

II. PROVIDING IMAGES DATABASE

To collect images of people, two methods have been used. First with the help of a scanner, hands placed on the scanner and it scans. In this way the background will be black, like Figure 1. In the second method, images are used from a digital camera. At first, the hand is placed in front of a white paper and then photos will be taken. In this way, the background image is white. Another important issue related to data collection should be noted is that in all images the distances between each finger must be equal. The fingers distance will set by eye in this paper.

Images obtained by cameras or scanning devices for edge detection are used in the preprocessing stage. Edge detection algorithm can be algorithms such as sable edge detection method [8].

Edge detected Image may have extra edges. For removing these extra edges, greater threshold amount in edge detection is used. However, it should be noted that the high threshold might not be remove extra edges completely. In edge detected image that is shown in figure 2, the thinning methods have been used.

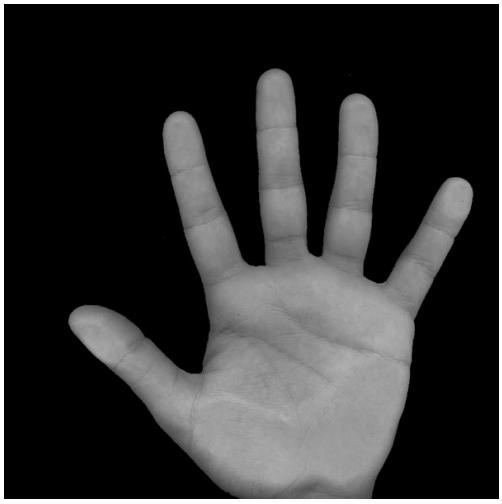

FIGURE 1: SCANNED HAND

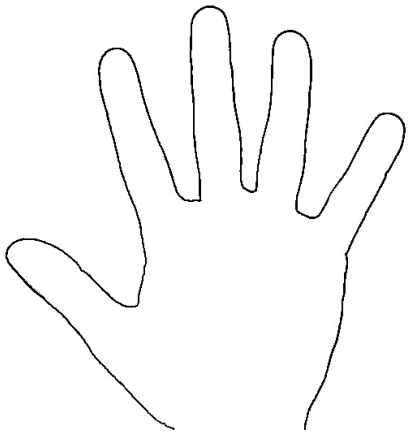

FIGURE 2: EDGED IMAGE

Thinning results can be seen in Figure 4. In thinning phase, morphological methods have been used based on the review of each pixel's neighbors without rupturing in the thin curve [9]. In this method, a considered for each pixel of the edge is concerned. Then this pixel's connectivity coefficient is calculated. If the connectivity coefficient obtained is equal to 1 and isn't end point, it will be removed. Otherwise, without any changes could go to next pixel. This work should be done for all black pixels in the image.

As you can see in Figure 3, there is no tear in the picture. One advantage of this method is that the end points of curve can be detected and removing end points can prevent.

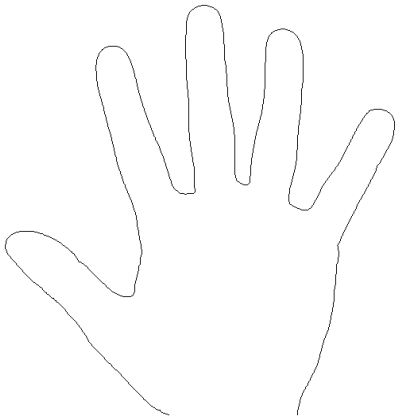

FIGURE 3: THINNED IMAGE

III. EXTRACTING HANDS FEATURES

Here, the hands features are extracted. These features should have enough information, In addition they should be stable in image rotation, zooming and moving. To eliminate rotation and zooming image, the suitable axis in the hand image is required that images rotation and zooming could be tolerated. For finding this axis, two appropriate points in hands image are selected. The first point that has been used for this purpose is the center of edges mass that its position is Unchanged in zooming and rotation. The purpose of the mass center is the point that X and Y coordinates is equal to average total black pixel in image. The center of mass can be calculated through the average of X and Y components of black pixels in the image with the help of equation (1).

$$xcenter = \frac{\sum x_i}{N} \quad (1)$$

$$ycenter = \frac{\sum y_i}{N}$$

Here, another point for the axis is needed. Farthest point to the center of mass as the second axis point is chosen. Whereas point choosing is very important in the matching algorithm, all probabilities are considered for the farthest point. In other words, many points choose as possible for the farthest point. Selection algorithm for the farthest possible points is as follows:

Farthest point on the contour to the center of mass is calculated named the distance between that and the center of mass as'd'. All points that the distance to the center is larger than 0.9d kept and the rest points are removed.

The continuous component extraction algorithm is applied to the remaining parts and continuous components have been extracted. In each continuous component the point that has the greatest distance is selected to the center of mass as possible point.

After finding the farthest possible points, for each of these points, the features extracted and stored. Now features should be extracted for every possible point. For this, concentricity circles is drawn that the center is the possible point. Radius should be increased by a fixed step as u see in figure (4). Choosing distance between the radiuses is particularly important. This algorithm will be more accurate if the small distance is selected, but it makes the algorithm slower. In addition, decreasing the distance make the algorithm less Accurate. So selecting a good distance is one the important part of this algorithm. The appropriate distance experimentally should be obtained.

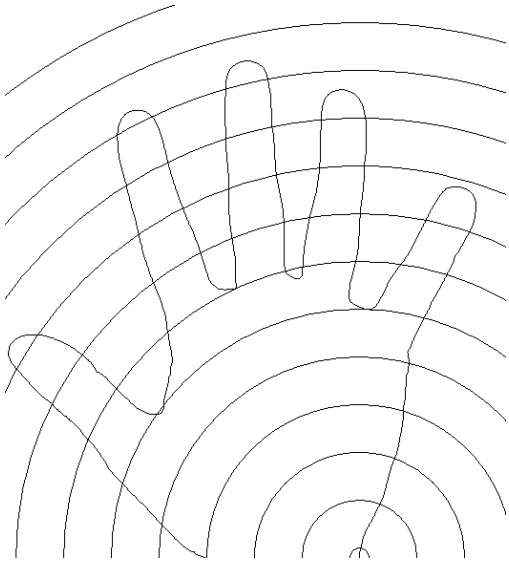

FIGURE 4: CONCENTRICITY CIRCLES

After drawing offices, black pixels are counted that are between the circles and store it in a one-dimensional array as hand's features. However, due to the several possible points, there are several features array. So, these arrays could be used for hands matching.

Features that are extracted in the previous step are stable to the rotation but they are not stable to the zooming. To eliminate this problem, the numbers in the previous step in the d (distance between center of mass to the farthest point) is divided, so the features extracted are stable to zooming.

IV. MATCHING METHOD

After preparing the database and extracting features for different people's hands, it can be used to identify individuals. For this purpose the matching algorithm is used. So, the input image data is compared to the information's that stored in the database and if they matches the person's identity information is extracted. Different stages of the matching algorithm are as follows:

Edge of Input image and the contour of hand should be extracted. Now all necessary steps such as thinning and waste edge removal can be applied.

The features of the hand can extract by using mass center and the farthest points.

Similarity coefficient of input image characteristics and features in the database is calculated. A variety of methods exist to obtain the similarity coefficient that in this paper, SSD method is used for calculating the similarity coefficient. This method is formulated and is shown by Eq.(2).

$$ssd = \frac{\sqrt{\sum(feature2[i] - feature1[i])}}{n} \quad (2)$$

The Number 'n' is the number of features that has been extracted. This division is for normalizing the number obtained to the number of features. Also feature1 [i] is the ith feature of first image and feature2 [i] is ith feature of second image. Note that all probability for farthest point is considered, for each image several feature groups is extracted. So all possible modes and the minimum 'ssd' is the similarity measure of two images is concerned.

Using the coefficients obtained in the previous step, an image in database with the highest similarity (lowest ssd) with the input image should be selected. If ssd rate calculated for the selected image is less than a threshold, Input image with the database image are considered similar.

V. NUMERICAL RESULT

For The results of this algorithm 120 samples from different people's hand images in experiments have been used. The implementation of this algorithm is in Visual studio 6 environment and by C++ language. PC which has been used in the testing is Intel ® Pentium ® 4-2.6GHz-256MB of RAM. To show lack of sensitivity of the algorithm to zooming and rotating, the zoomed and rotated images of different people in experiments have been used.

The value that radius should be increase can be obtained experimentally. This value equal to 30 pixels in the tests carried out. The size of images is 600 * 600 pixels and the file format is Bitmap. The proposed algorithm by two methods has been tested. In the first method, input image in the images collection was searched. In the second method, input image in collection which the input image isn't on it was searched. In the fist way the objective is the understanding that if the method can know that this image is not in collection. Considering the selected parameters, the success rate is 100 percent. This means all images matched right. While in previous methods the success rate is 94 percent [7]. Percentage of success in the second way is equal to 97 percent. It should be noted however, many existing methods are sensitive to zooming and rotation.

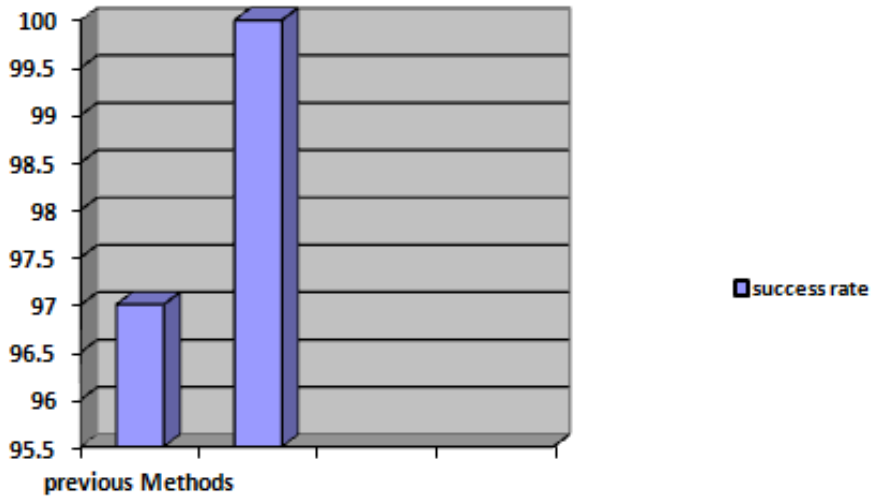

FIGURE 6: SUCCESS RATE OF PREVIOUS METHODS

VI. CONCLUSION

In this paper a new method for identification using hand geometry is presented. In this method, the contour information is used for matching. To this end, by applying a pre-processing algorithms and edge detection contour of the hands image extracted and by circles obtained the feature of the hands. The features are the number of pixels between these circles. Extracted features should be matched to collected hands image and the inputs hands image could be identified. Benefits of the proposed method can be its lack of sensitivity to rotate and zoom the image. Due to experimental results and precision of this method, this method can be used for identification.

Suggestions in improving this algorithm are also provided. For example, other lines in the palm and fingers in matching could be used. Therefore, the result of this method could be improved by using other features even in the larger collections of images. In addition, a variety of applications for these methods is available. This method could be used in matching of signatures, geographic maps, ear and lip.

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