J. Basic. Appl. Sci. Res., 1(11)2103-2107, 2011

ISSN 2090-4304
Journal of Basic and Applied Scientific Research
www.textroad.com

A New Method for Face Recognition with Nearest Neighbor in 3D Images

Mohammadreza Banan[1]; Hamed Izadi[4]; Akbar Talash[3]; Esmaeil Zeinali Kh[4]

[1]Master of Computer Sceince, Department of Computer Engineering. Islamic Azad University, Qazvin Branch, Qazvin, Iran
[2]University of Applied Science and Technology,Department of Computer, Abadeh, Iran
[3]Manager Education And Research Scientific, Applicate Ministry Of Commerce Fars Province Center
[4]Assistant Professor, Department of Computer Engineering. Islamic Azad University, Qazvin Branch, Qazvin, Iran

ABSTRACT

In recent decades, Face recognition has been one of the most important and significant issues in pattern recognition and machine vision. In this paper, a new method for face recognition is discussed. At first, nasal tip coordinates of each image point is calculated by an efficient method and obtained point is intended as a reference. At this stage a three-dimensional (3D) image is normalized to a matrix (matrix size is 100 × 100) and the simulated building is done. In part of features extraction we have used of 2D components analysis (2DPCA) to obtain characteristics. In classification stage, classification of most near neighbor is used. Experiments are tested on Three-dimensional face database (CASIA). This database includes complex changes such as changes in facial expressions, gestures and a lot of time interval between two scans of an image. Experiments on this database show that the proposed method has a high accuracy about 97.4%. Results show that detection rates of proposed method has been considerable to other methods.

KEY WORDS: Face recognition, three-dimensional face recognition, pattern recognition, two-dimensional 2DPCA, nearest neighbor classifier.

1. INTRODUCTION

Current Two-dimensional face identification systems have the conventional potential problems such as sensitivity to ambient light, sensitivity to different face scenarios (laughing, crying, wondering ,...), sensitivity to rotate the head in depth face. We have presented a face recognition system based on dimensional images to overcome this problem. Three-dimensional images are images that have the depth's information instead of pixel values of gray levels. In fact, a three-dimensional image is composed of a number of points in space with three components which the first two components are related to the location point and the third component is related to depth. Since the depth information is independent of ambient light, the 3D identification face system is quite resistant to ambient light changes. One of the fundamental problems of two dimensional systems is sensitive to changes in face states.

We have presented a simple smoothing technique to amend the effects of face states' changes in the self 3D identification system. Most research in face identification has been done on the two-dimensional images [4] and a lots works has been done on these systems, but still these systems involve in the above mentioned problems. Recently particular attention is done to the identification systems based on 3D images [5, 6]. In two dimensional identification Systems, so problems remain that are due to different light conditions and face states [8]. But three-dimensional systems act much better against these conditions. Purpose of three-dimensional face is an image which depth's information of image is located rather than gray level values. In these images, each point is determined with the coordinates of (x, y, z) that the third coordinate is the information of depth. Considering that the information of depth (the third coordinate) does not have any relation to the ambient light, it is clear that any three-dimensional systems do not have no sensitivity and solve the problem of light-sensitive in two-dimensional systems completely. In addition, solving problems of rotating images in three-dimensional detection systems is easier than two-dimensional systems [7]. In this research our goal is to provide a system that overcomes to the above identified problems as possible. We have used Local Surface Smoothing to overcome the problems caused by states face (happiness, sadness, and ...). As we will see much softening effect on the local system identification is accurate. To obtain two-dimensional features two major components of the analysis we have used [3]. Unlike the general PCA, we are working with features matrixes in Two Dimensional Principals Component Analysis. In this study, characteristics of matrices obtained from 2DPCA classification stage we have used. Classification stage classification we have used Manufacturer nearest neighbor.

***Corresponding Author:** Mohammadreza Banan, Master of Computer Sceince, Department of Computer Engineering. Islamic Azad University, Qazvin Branch, Qazvin, Iran. E-mail: engineerbanan@gmail.com.

2. Proposed method

The step of proposed methods as detailed is given in block diagram form of part (a). In continue, we will explain details of each section.

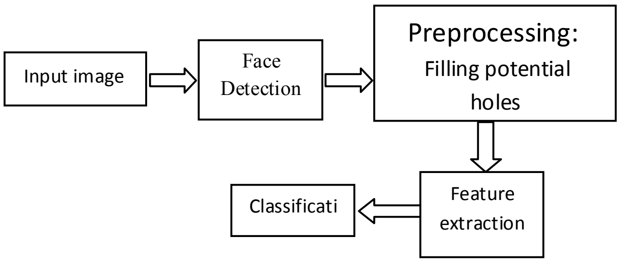

Figure 1: block diagram of three dimensional face recognition systems.

2.1 Face Detection

First, images of 3D face enter in preprocessing stage to perform a series of necessary preprocessing such as noise needle and fill possible gaps. Then the pre-processed images enter into the face detection stage. As in Figure (3) is seen, images of database includes areas like the neck, face and clothes In addition to face. These parts do not have useful information and it is necessary to be removed. At this stage, a method should be present to find a threshold for each image automatically and considered the third coordinate values (depth information) more than the threshold as the region faces and removes the rest as additional information.

Figure 2: A sample image from the CASIA database

2.2 Thresholding images

The thresholding is one of **the** important methods in the images splitting that uses the gray level histogram of images to separate an object of the background image [6]. Finding threshold level for a gray image is Easiest Threshold problem that includes two different areas and the object field. Pixels with the same values (close together) in a neighborhood are usually considered in a region. With finding a threshold from the histogram chart, the background image can be easily removed and the object is obtained. Obviously, finding the correct threshold value is important and it effects on the results very much. Thresholding levels of image can be considered as a Relation.

$$g(x,y) = \begin{cases} 0 & if \quad f(x,y) \leq T \\ 1 & if \quad f(x,y) \leq T \end{cases} \qquad (1)$$

In this relation, $g(x,y)$ is the fractionated output Image, T is the threshold value and $f(x,y)$ is the original input image? Another way for thresholding is Semi thresholding method that its formula is given in relation (2).

$$g(x,y) = \begin{cases} 0 & if \quad f(x,y) \leq T \\ f(x,y) & if \quad f(x,y) \leq T \end{cases} \qquad (2)$$

In this method, smaller amounts of discarded threshold are removed and larger amounts of it are kept. In this study, we acted like it. Here, we have considered the depth values in such amounts of gray levels and we have applied thresholding on the values of depth information . Finding T should be Adaptive and completely automated. Here, we have used Otsu thresholding method [1].

2.3 Normalization and making par of face Images

Considering that we consider a face image into a two-dimensional matrix, that the values of matrix arrays are corresponding to depth information, for make feasible the comparison between images, the size of these matrixes should be the same. The number of the third coordinates points (depth information) is approximately 10,000in the CASIA database. So here, we have converted the images to matrix with 100 × 100 size to be possible comparison between them. Then we have made normal the depth values for each image between 0 and 255. With this action, the system has been robust to image transmission. To do this work, we find minimum amount of depth for each image and then take minimum amount to zero with a shift. After that, we scale the obtained image which the maximum value is being 255. Figure (3) shows two images of database into three-dimensional network that the values of depth information are normalized between 0 and 255.

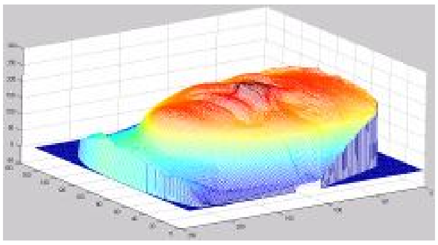

Figure (3): face Graph in a three-dimensional network

As is clear from Figure 3, face images are not the same in scale. Clearly, the comparison between above non-par images cannot have a sure result in the the similarity. For solving this problem, we have suggested making par. In this method, at first ,we find the corners of image and we extract coordinates of the tip of the nose and then put it in the middle of the matrix 100 × 100, it means point (50, 50),and consider this point as the point reference. Considering that in most images, the nose is the highest elevation, after applying the maximum function to the information depth, we can obtain the tip of nose.

2.4 Surface Smoothing of face

In Identity recognition systems based on three-dimensional images, there is the sensitive problem of accurately identify to changes in face states, but it is much easier and simpler to overcome these problems in these systems. Here we have used the Least Square Error method that minimizes the error between original image and soft image. To do this work, first, we calculate the variance of the input image and then we sweep all matrix of image by a window with p × q size. In each of sweeping, we change corresponding *element* to the center of window in accordance with relation (3). We calculate the variance and Local mean value for each window.

$$s(i,j) = \mu_{p,q} + \frac{\sigma_{p,q}^2 - \sigma_n^2}{\sigma_{p,q}^2}(I(i,j) - \mu_{p,q})(3)$$

In relation (3), $\mu_{p,q}$ and $\sigma^2{}_{p,q}$ are the mean value and variance of the depth values corresponding to the window respectively that its size is$p \times q$. σ_n^2 Is the noise variance Accommodation. Respectively S (i , j) And I(i , j) are the initial are soft images. Soft the face surfaces causes the Facial Curves convert to Smooth state and states of the face almost disappeared and it get a Natural face. This means that we have removed the states of face before features extraction. Of course, the Softening should not be done to the extent that important information and features disappear. Softening rate is determined by size of the sweep window. Whatever the window size is larger, the output figure is softer.

2.5 Feature extraction

The feature extraction step, we call 2DPCA on the soft images $F_1, F_2, \dots, F_M$ that stored in the database. Suppose the size of each F_i is n× n. Average image of $F_1$to F_M be defined as Relation (3).

$$\overline{F} = \frac{1}{M}\sum_{i-1}^{M} F_i \qquad (3)$$

The related covariance matrix two of the above M images is obtained of the relation (4).

$$c = \frac{1}{M}\sum_{i-1}^{M}(F_i - \overline{F})^T(F_i\ \overline{F}) \qquad (4)$$

In this relation, the purpose of T is transposed. Now if we obtain the specific of covariance matrix, we will have n special values and n special vector corresponding to it, That Here n is the number of rows or columns of image (images are considered square). We sort these n specific values in the descending order and we consider d specific vector numbers corresponding d, the largest specific number to a single on n × d matrix, because d can change from 1 to 100 in our identification system, it is clear that with d = 6, our size matrix of characteristic has decreased from 100 × 100 to 6 × 100 and thus speed of system increase rapidly significantly in the identification. Then per d = 6, good compromise will be established between speed and accuracy of the system.

2.6 Similarity criterion and classification

In fact, Similarity criterion is a quantity of similarities between feature vectors (here, matrix characteristics) according to a number expressed Euclidean distance between two vectors Y and X as the relationship (6) is defined.

$$d(X,Y) = \sqrt{\sum_i^n (X(i) - Y(i))^2} \qquad (6)$$

Euclidean distance to compare the similarity between vectors is the right size. Since all the images in our database to 100 × 100 matrix, and thus we have become a feature matrices with rank 6 × 100 arrived, so all the same size and feature vectors we use the Euclidean distance pose.

3. RESULTS

The proposed method in this article is done on the CASIA database. This database has been collected using three-dimensional camera, mindta vivid 910, which works fast in the laboratory, between the months of August and September 2004 [2]. This database contains 123 individual and everyone has 33 images. Total of images is 4059 images. In Figure (6) the number of facial, images in this database, is shown.

Figure - 7: Facial dimensional changes in CASIA

In this article, first 16 images is considered for each person that they are 1968 images at total. We consider 70% of database images as training and the remaining 30% as testing. At this point, the systems are checked by changes in lighting and facial expressions. Proposed method is compared with the DCT technique that results are observed in Table (2).

Rated rate	DCT	Proposed method
Smile	89.9%	94.8%
Laugh	91.5%	96.6%
Anger	93.9%	97%
Surprise	96	99.3%
Eye Close	94.4%	98.9%
mean	93.14%	97.32%

Table - 2: Comparison of detection speed for proposed method

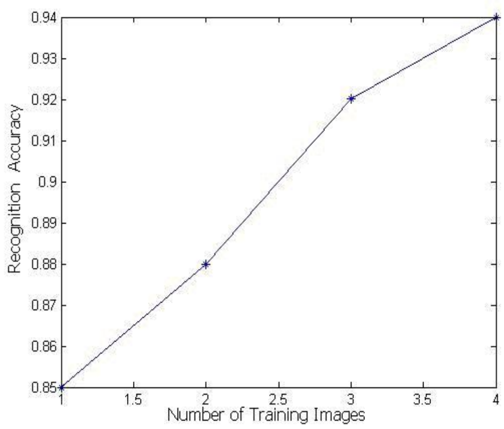

Figure (6): accuracy of system identification per number of training images

4. Conclusion

In this paper, we presented a new approach to automatic three-dimensional face recognition using range data. First, face image is placed in face detection stage, that the background and some non-essential areas such as around the head, neck and ears is deleted by the threshold, three-dimensional data. The scale-invariants (between 0-255) are been scale for identification. Then we obtained coordinates of the nose' tip and we make normal the images with it. Local properties were obtained through the extraction of features and we have used two-dimensional analysis of the basic components (2DPCA) to obtain specifications. In the classification stage, we have used the nearest neighbor classification.

REFERENCES

[1] N. Otsu, "A threshold selection method from gray-level histogram," IEEE Transactions on Systems, Man and Cybernetics, Vol.8, No.1, 1979, pp.62-66.

[2] Chenghua Xua, StanLia, TieniuTana, LongQuanb, "Automatic 3D face recognition from depth and intensity Gabor features", Pattern Recognition, 2009, 1895 - 1905

[3] C.Xu,Y.Wang,T.Tan,L.Quan, "A new attempt to face recognition using 3D Eigenfaces", in:Proceedings of the Asian Conferenceon Computer Vision, no.2, 2004, pp.884–889.

[4] R. Chellappa, C.L. Wilson, and S. Sirohey, "Human and Machine Recognition of Faces: A Survey", Computer Vision Laboratory, University of Maryland, 1994.

[5] S. Malasiotis and M.G. Strintzis, "Pose and illumination compensation for 3D face recognition", IEEE International Conference on Image Processing (ICIP), Singapore, 2004, 24-27.

[6] F. Tsalakanidou, D. Tzovaras and M. Strintzis, "Use of depth and color eigenfaces for face recognition," Pattern Recognition Letters, Vol. 24, 2003, pp. 1427-1435.

[7] C. Xu, Y. Wang, T. Tan, and L. Quan, "A new attempt to face recognition using 3D eigenfaces," the 6th Asian Conference on Computer Vision (ACCV), Vol.2, 2004, pp.884-889.

[8] B.Gokberk, H. Dutagaci, A.Ulas, L.Akarun, B.Sankur, "Representation plurality and fusion for 3D face recognition, "IEEE Transactions on Systems, Man and Cybernetics, PartB, 2008.