To Improve Performance of Robust Face Recognition using Dominant Facial Region Extraction and Fractal Model

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Abstract— In this paper discuss about the research of Human Face Detection focuses on the faces under complex background. One aspect of this system is to cutting down false detection and speedup the processing delay. In this paper discuss about proposed technique we try to apply the Subspace Approach to Face Detection using dominant facial region extraction and fractal model. To further improve the performance of the face recognition system also proposes the techniques of statistical based feature matching. In this paper discuss about illustrating the development of "Real-Time Human Face Recognition System". The principal system consists of three major subsystems. There are Image Acquisition System, human face characteristic extraction and finally feature vector matching. For experiment, we adopted colored face image with complex background and simulate on the computer

Key words: Fractal Model, Robust Face Recognition

I. Introduction

Face Detection is the process in which system determine all the human face if it is present in the input image. Input face detection system is likely to contain a human face image which needs to identify and recognize by the automated system. The system output contains the human face image with similar features stored in the database [1]. In this we raised the issue of face recognition as detection can be traced back earlier by different researchers. A complete automatic face recognition system must contain at least two Major technical areas:"human face detection and facial feature extraction and recognition"

In the face detection application background has been far beyond the scope of face recognition system. As the network Technology and the widespread adoption of desktop video, image capture devices are becoming standard personal computer peripherals, as urgently needed services such as video conferencing technology - based compression and retrieval of content becomes a hotspot.

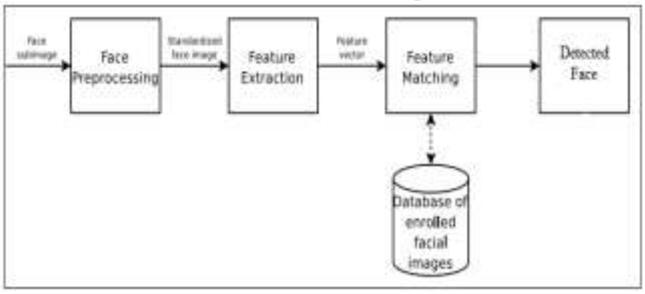

Fig. 1: General Model of Face recognition system

Recognition process of human face from a trained database is focused on multi-gesture recognition, integration of different recognition algorithm design, practical system to and multi-channel information fusion. In whole recognition process preprocessing, feature extraction and finally feature matching with stored feature vectors included. Face images taken under different illuminations can degrade recognition performance, and it needs preprocessing like illumination normalization especially for face recognition systems based on the subspace analysis, in which entire face information is used for recognition [8].

II. Proposed Algorithm

In this section presents a method to extract the dominant facial region from the input face image. We deal with the face image by Sobel Operator and binarization operator [26] to get the binary image with enhanced contour of the face. Then the binary image will be normalized to a preset size and is dealt with histogram equalization to reduce the influences of the illumination.

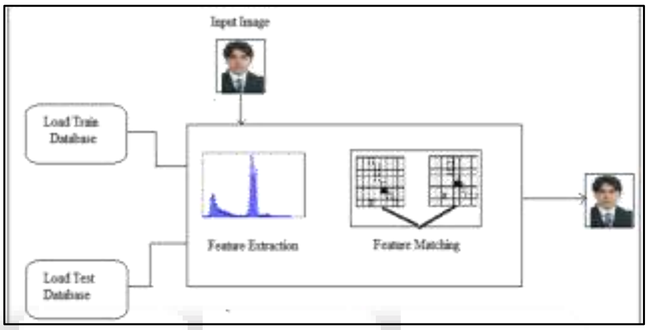

Fig. 2: Proposed Architecture

A. *Distance based Feature*

1) *Step 1:*

The input face image is first treated by Sobel operator and binarization operator to get the binary image as shown in Fig 4. By scanning from left side to right side and summarizing the number of the mark pixels in the resultant binary image column by column, when one column contains more than 8 mark pixels with value "1" and appears first, we consider this column as the left boundary of the head. By the same way, we can find the right boundary of the head. Note that the reason for choosing 8 mark pixels is to reduce the effect of noise.

A Sobel filter (or Sobel operator) is a simple image filter which is used to compute the gradient of an image. By applying a Sobel filter to a specific pixel in an image produces a value that represents the amount of change in color intensity at that pixel. When each pixel is redrawn based on these new values, the end result is an image where the edges in the image appear highlighted. Another operator used in this step is binarization which has the basic concept of converting intensity of pixel value to 0 and 1. A threshold value of the intensity considers which pixel converted into 0 and which converted into 1.

Fig. 3: Binary conversion of input Face Image

2) Step 2:

Detect the top of the head which is the upper boundary of the head

3) Step 3:

With row by row scanning we locate the vertical position of the neck by finding the smallest distance between right boundary and left boundary of the face in binary image.

4) Step 4:

We intend to locate the vertical position of the eyes and the mouth. In view of Fig.4, we denote the distance between head and eyes as D_he, distance between head and mouth as D_hm and distance between head and neck as D_hn. By the experimenting over tanning dataset we found that the vertical position of the eyes is about (0.430.50)*D_hn from the top of the head, we find the vertical projection of the region and its maximum is the vertical position of the facial region.

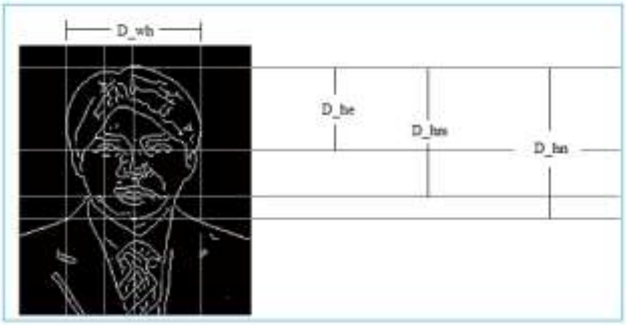

Fig. 4: Feature Distances in Binary Image

B. *Texture Feature:*

Tamura texture features has four components corresponding texture features in a psychological perspective on the four attributes, namely roughness (coarseness), contrast (contrast), the direction of the (directionality), and coarse degrees (roughness). Where in the first three components is particularly important for image recognition.

1) Characteristics

- *Roughness* can be divided into the following calculation steps. First, calculate the average image intensity values of size 2k × 2k pixels of pixels in the active window , that

$$A_k(x,y)=\sum_{i=x-2^{k-1}}^{x+2^{k-1}-1}\sum_{j=y-2^{k-1}}^{y+2^{k-1}-1} g(i,j)/2^{2k}$$

- Where k = 0, 1, 5 and g (i, j) is located in the (i, j) pixel intensity values. Then, for each pixel, which are calculated in the horizontal And the average intensity in the vertical direction between the windows do not overlap the difference.

$$E_{k,h}(x,y)=\left|A_k(x+2^{k-1},y)-A_k(x-2^{k-1},y)\right|$$
$$E_{k,v}(x,y)=\left|A_k(x,y+2^{k-1})-A_k(x,y-2^{k-1})\right|$$

- Contrast is a statistical distribution of the pixel intensity obtained. Rather, it is defined by the α4 = μ4/σ4 where μ4 is the fourth moment and σ2 is the variance. Contrast is measured by the following formula:
- Direction degrees we need to calculate the direction of the gradient vector is calculated at each pixel. And the direction of the vector mode are defined as.

$$F_{con}=\frac{\sigma}{\alpha_4^{1/4}}$$

$$|\Delta G|=(|\Delta_H|+|\Delta_V|)/2$$

$$\theta=\tan^{-1}(\Delta_V/\Delta_H)+\pi/2$$

- Coarseness has a direct relationship to scale and repetition rates. An image will contain textures at several scales; coarseness aims to identify the largest size at which a texture exists, even where a smaller micro texture exists. Computationally first takes averages at every point over neighbor-hoods the linear size of which are powers of 2. The average over the neighbor-hood of size 2k ×2k at the point (x, y) is

$$A_k(x,y)=\sum_{i=x-2^{k-1}}^{x+2^{k-1}-1}\sum_{j=y-2^{k-1}}^{y+2^{k-1}-1} f(i,j)/2^{2k}$$

III. HISTOGRAM BASED STATISTICAL FEATURES:

An image histogram is a type of histogram that acts as a graphical representation of the tonal distribution in a digital image. It plots the number of pixels for each tonal value..

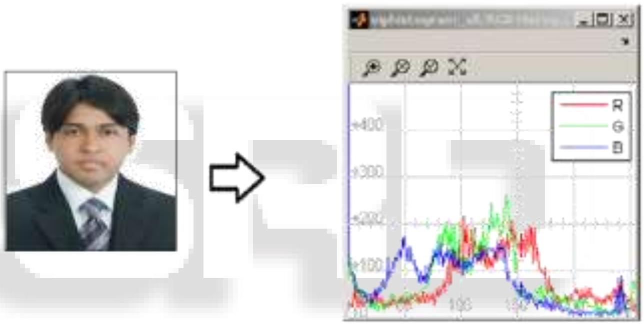

Fig. 5: RGB Histogram of the Image

IV. EXPERIMENT RESULT

The dataset we used to test our proposed technique includes images of standard database. All the images tested over proposed system and get corrected result of 96%. With this testing process we conclude that the system accuracy is increased and it gives better result for both verification and recognition process. We have also tested proposed system on different dimensions with different image formats.

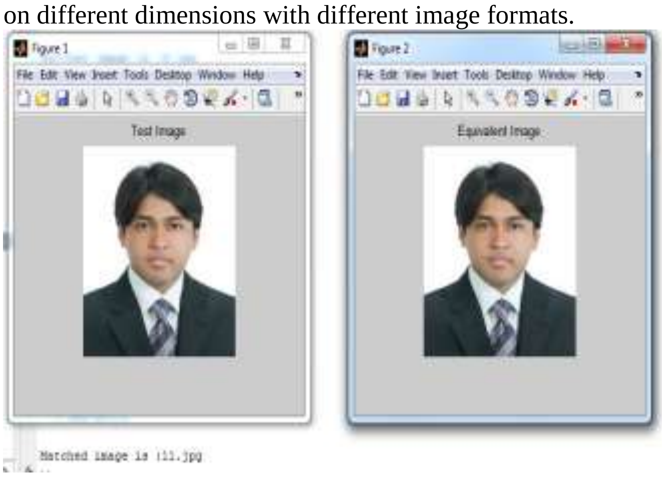

Fig. 6: Matched face image (Resolution480x720)

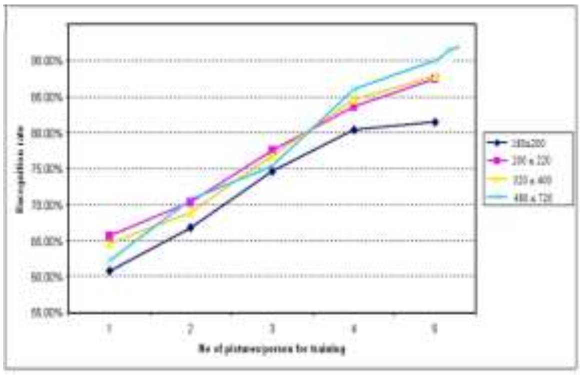

Fig. 7: Graphs for Recognition Rate

Images with high resolution gives better result as depicted in the graph of fig.7 This graph presents the experimental result which has number of images on the X-axis and the recognition rate on Y-axis.

V. CONCLUSION

This chapter presented the summary of implementing a face recognition system. In order to obtain a robust recognition system, only the features which have the same value across multiple variations of the same person were extracted. In order to increase the accuracy of the system, weights were associated to the selected features based on their discriminative power between the people from the database.

VI. FUTURE WORK

Face recognition systems used today work very well under constrained conditions, although all systems work much better with conditional zone images and constant lighting. Next generation person recognition systems will need to recognize people in real-time and in much less constrained situations. There are several ways by which the performance of face recognition can be further improved. Face is a 3D object and the image is its 2D representation. If 3D information of the face can be obtained from 2D face image, then the performance can be improved. One way could be to use mosaiting techniques in which multiple variations of a face image are captured and seamlessly stitched together to get a mosaiced face.

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