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Face Recognition and Verification by Histogram based Method in Spatial Domain

Deepak Kumar[1], Indu Bala[2] and Sanghamitra V. Arora[3]

[1,2,3]Department of Electronics and Communication Dronacharya College of Engineering Gurgaon (Haryana)
E-mail: [1]dkdeepak45@gmail.com

Abstract—*The proposed analysis consists of face and eyes detection followed by a histogram-based feature extraction algorithm. The database is taken from Cambridge University. It consists of 40×10 images of 40 different subjects, which are restricted to a size of 92×112 pixels. The face and eyes are first extracted from image by using detector algorithm to reduce the background. Cumulative distribution histograms of the face as well as the eyes are extracted for the recognition purpose. Hence a nonlinear transformation that considers the accumulative distribution of the original image generates a resulting image whose histogram is approximately uniform. Further testing is done on the basis of the Euclidean distance for comparing the test image with database and verification and identification is done. The recognition problem is made difficult by the great variability in head rotation and tilt, lighting intensity and angle, facial expression, etc. Our results indicate that the method provides the best results with the extracted eyes vectors. The recognition system achieved an error rate of 7.78% with face models and 5.6% with eyes vectors. Since the concept is computationally inexpensive, it could also be extrapolated to computers; by using a web cam to capture a digital image of a person, the face could replace the commonly used password as a means to log-in and thus, authenticate oneself.*

Keywords*: Image histogram, Euclidean distance, face recognition*

1. INTRODUCTION

Unique is best, one of the most suitable feature which best distinguishes a person is face. Face recognition the computer application used to identify and verify person from a digital image from a source automatically. Which attracted various field of study and its boom in government as well as private sector for security purpose, now it has been the subject of research due to its reliable nature to accurately identify individual. Person's face plays a very vital role in day today life, relying its identity. When we come to the face recognition it act as an imperative key to security, due to the various advantages it is center of attention because of its numerous variety of applications in both law- enforcement and non-law enforcement. After getting several years of comparative analysis with other biometrics systems using fingerprint, palm print, face recognition has distinct advantages of attraction because of its non-contact process as well as it is a safe and secure systems. In past years the security systems were only concerned with "what we have" i.e., id cards, passwords, number etc. which results into flaws, crime, and rise in hacking and disturb the security system .but now the access control system is attracting towards "who we are" only because of safe and secure access system i.e., face is an imperative part of who you are and how people identify you because it is arguably a person's most unique physical characteristics.

2. METHODOLOGY

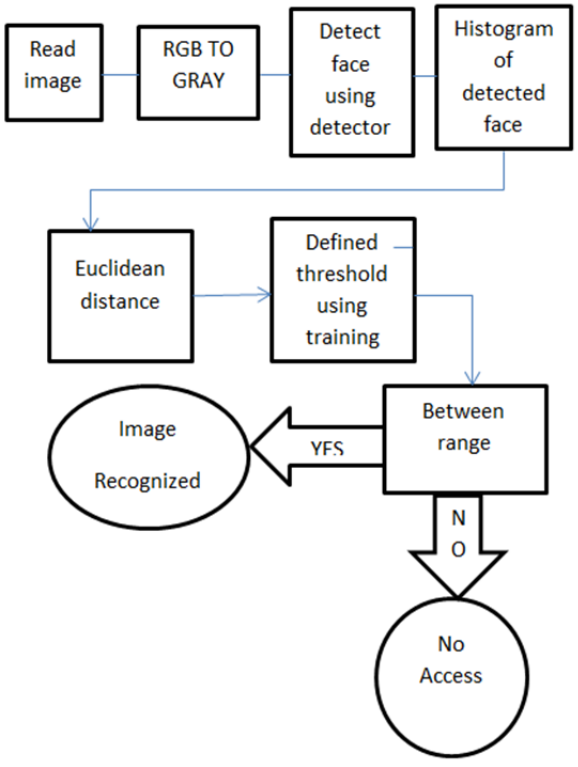

Fig. 1.1: Block Diagram for face recognition

The above block diagram shows how the system runs for face recognition:

Face and eye Detection:-

Detection which is a step after reading the image and then converting it into gray scale to make it easier. In this paper we use viola jones detector for the detection of the face as well as eyes from the image. This detector is used because of its accuracy and its speed in detecting the object. The detected face and eyes can be seen below, after the detection these detected parts are cropped and subjected to histogram for further processing.

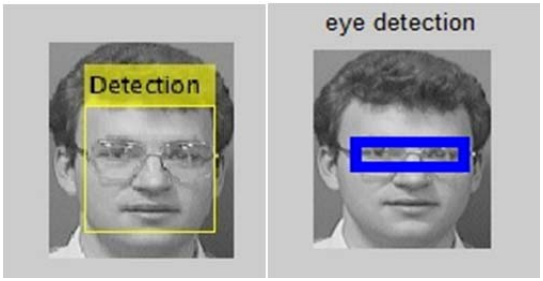

Fig. 1.2: Face and eyes detection using detector

Histogram:

Histogram based method have proved simplicity and usefulness in last decade for recognizing faces from the image database. Histogram of image is a type that acts as a graphical of the lightness/color distribution in a digital image.it plots the number of pixels for each value.

Why histogram? It act as a basis for numerous spatial domain processing techniques, its manipulation can be effectively used to provide useful image statistics .In mat lab the histogram can be easily find by using

A=imhist (f);

Where f is the input image and given below is equation which is used to find histogram of an image

$$h(v) = round\left(\frac{cdf(v) - cdf_{min}}{(M \times N) - cdf_{min}} \times (L-1)\right)$$

Where cdf_{min} is the minimum non-zero value of the cumulative distribution function (in this case 1), M × N gives the image's number of pixels (for the example above 64, where M is width and N the height) and L is the number of grey levels used (in most cases, like this one, 256).

Euclidean distance:

- Euclidean distance is the term which is used to find the distance between the two images(between test image and database image) with the help of its formulae

$$D(p,q) = d(p,q)$$
$$= \sqrt{(q1 - p1)2 + (q2 - p2)2 + \cdots \ldots . (qn - pn)2}$$

Where q and p are the two points from the two different images to be compared.

Procedure:

In order to do face recognition we have to follow two step i.e., verification and identification. First the system compares the given individual says they are and give yes or no decision is known as verification and when the system compares the given individual to all other individuals in the database and gives a ranked list of matches is identification. In this paper we have trained the system in which the image is read and converted into gray scale further it is crop and detected by using detector to remove the background of image .we consider ORL database which consist of 60 images for the training purpose, histogram of detected eyes as well as face is taken and further the Euclidean distance is calculated for testing purpose. We consider 50 images for testing and certain range is define for eyes as well as face and the testing sample is compared with the database which define whether the image is matched or not and also identify to which class it belongs. In this way the whole systems run.

3. RESULTS

The below two tables show the face recognition and eyes recognition error rates separately and their average is also calculated.

(A). Face recognition (error rate) has been tabulated below:-

	Face recognition (error rate)
Samples used in training	**7.7%**
Samples not used in training	**11.11%**

(B). Eyes recognition (error rate) has been tabulated as follows:-

	Eye recognition (error rate)
Samples used in training	**5.6%**
Samples used in training	**9.1%**

Clearly from the above stats we can see the eyes are having less error rate compared to face error rates.

4. CONCLUSION

While considering the eyes we are getting less error rate as compared with face. Also facial characteristics also change with ageing.

Further our focus will be on improving the proposed system by decreasing the error rate to some extent by using some transform methods.

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