



FACE RECOGNITION USING LOCAL BINARY PATTERN HISTOGRAM (LBPH) TECHNIQUE

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Abstract

Face recognition has become challenging and interesting area of research in computer vision. A large number of detection algorithms and image preprocessing techniques such as histogram equalization, morphology, color image to gray image conversion, Laplace of Gaussian, gamma intensity correction are used for this system. This paper describes the face detection system using color image to gray image conversion technique and Haar cascade algorithm. We use holistic matching method in which complete face region is considered as input data and LBPH method for recognition purpose.

Index Terms: Color image to grey image conversion, Haar cascade classifiers, LBPH.

I. INTRODUCTION

Face recognition has received significant attention because of its numerous applications in access control, security, surveillance, and internet communication and computer vision. These systems examine an individual's physiological and behavioural characteristics in order to determine their identity instead of authenticating people and granting them access to physical domains by using passwords, PINs, smart cards, tokens or keys. Passwords and PINs are hard to remember and can be guessed easily and also the card or tokens can be misplaced or duplicated. These problems of misplacing or duplicating cards are overcome in biometric techniques.

Face recognition is one of the fastest biometrics compared with other techniques such as fingerprint and iris recognition. For example, in surveillance systems, instead of requiring people to place their hands on a reader or precisely position their eyes in front of a scanner, face

recognition systems take pictures of people's faces as they enter a defined area. There is no intrusion or capture delay.

The problem with face recognition is about image size and quality. It is obvious that facial recognition requires HQ digital cameras for algorithms to operate accurately. A face detection system captures a face in a photo or screenshot from video, then the relative size of the face image will be compared with the size of the enrolled one. So, photo's quality affects the whole face recognition process. To prevent this problem, image preprocessing techniques are used to enhance the features of images.

II. RELATED WORK

Mr. Faizan Ahmad developed an image-based face detection and recognition system to evaluate various face detection and recognition techniques and provide a complete solution for image-based face detection and recognition with higher accuracy, better response rate as an initial step for video surveillance. A solution is proposed based on performed tests on various face-rich databases in terms of subjects, pose, emotions, race and light.

Mr. R.R. Karhe developed a Student Attendance Recording System Using Face Recognition with GSM-based MATLAB framework for implementation. For avoiding the problem of using RFID, they used face recognition using a Web-Cam (i-ball) with GSM-based. After having images from a Web-Cam, the image is cropped into a square shape. They also focus on the special characteristics of human facial aspects such as nose, eye, etc.

III. MAIN BODY OF THE PAPER

Principle: In our project we use color image to gray image conversion technique and Haar

cascade classifiers to extract the features from image.

Block Diagram:

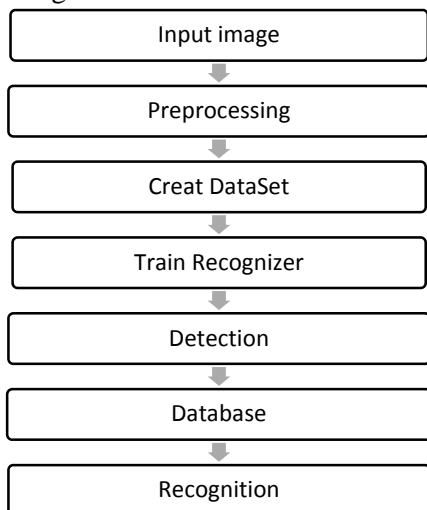


Figure 1: System block diagram

Face detection:

It is basically computer technology being used in a variety of applications that identifies human faces in digital images.

Face recognition:

It is a biometric method of identifying an individual by comparing digital image data with the stored record for that person.

Image pre-processing techniques:

For input image there is requirement of pre-processing techniques for enhance the quality of image. In our project we use color to grey image conversion technique which converts input image converts into grey scale image.

Mathematical representation for color to grey image conversion:

There are three methods for conversion-

1. Lightness
 $(\max(R, G, B) + \min(R, G, B)) / 3$
2. Average
 $(R + G + B) / 3$
3. Luminosity
 $0.21R + 0.72G + 0.07B$

DataSet:

The DataSet includes different number of images of person's face in order to recognize him/her.

Database:

In face recognition for comparing face images with image which is to be recognized database is needed.

Training set:

Recognition is done by comparing the face to be recognized with some training set of known faces. In the training set we supply the algorithm faces and tell it to which person they belong. When algorithm is asked to recognize some unknown face, it uses training set to make the recognition.

There are three methods of Face recognition: Eigenfaces, Fisherfaces and Local Binary Patterns Histograms (LBPH). Each of three mentioned methods uses training set differently. Eigenfaces and Fisherfaces find a mathematical description of most dominant features of training set as a whole. LBPH analyses each face in the training set separately and independently.

LBPH:

In this method we characterize each image in dataset locally, and when a new unknown image is provided, we perform the some analysis on it and compare the result to each of the images in the dataset. The way which we analyse the images is by characterizing the local patterns in each location in the image. This is simpler method than other.

LBPH Algorithm description:

A more formal description of the LBP operator can be given as:

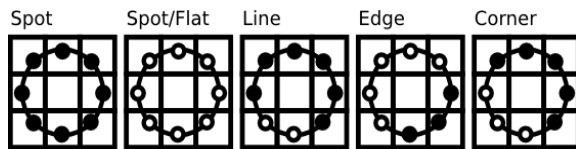
$$LBP(x_c, y_c) = \sum_{p=0}^{P-1} 2^p s(i_p - i_c)$$

Here the (x_c, y_c) as central pixel with intensity i_c ; and i_n being the intensity of the the neighbor pixel. s is the sign function defined as:

$$s(x) = \begin{cases} 1 & \text{if } x \geq 0 \\ 0 & \text{else} \end{cases} \quad (1)$$

The idea is to align an arbitrary number of neighbors on a circle with a variable radius,

which enables to capture the following neighborhoods:



For a given Point (x_c, y_c) the position of the neighbor $(x_p, y_p), p \in P$ can be calculated by:

$$x_p = x_c + R \cos\left(\frac{2\pi p}{P}\right)$$

$$y_p = y_c - R \sin\left(\frac{2\pi p}{P}\right)$$

Where R is the radius of the circle and P is the number of sample points.

The Extended LBP is the extension operator to the original LBP codes, also it is referred as circular LBP. If the points coordinates on circle are does not corresponds to image coordinates, then the point gets interpolated. The OpenCV implements the bilinear interpolation:

$$f(x, y) \approx \begin{bmatrix} 1-x & x \end{bmatrix} \begin{bmatrix} f(0,0) & f(0,1) \\ f(1,0) & f(1,1) \end{bmatrix} \begin{bmatrix} 1-y \\ y \end{bmatrix}.$$

Haar cascade classifiers:

In face detection, initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, haar features are used.

Each feature is a single value obtained by subtracting sum of pixels under white rectangle from sum of pixels under black rectangle.

IV. PERFORMANCE AND EXPERIMENTS

The project is performed by Local Binary Patterns Histograms (LBPH). Instead of using Eigenface method, by using LBPH method for face recognition, it will probably work better in different environments and light conditions, however, it will depend on your training and testing data sets. We need around 10 different images of this person's face in order to be able to recognize him/her. The main idea of eigenface is to get the features in mathematical sense instead of physical face feature by using mathematical transform for recognition. One another method is Fisherface Concept it is differing from the

Eigenface concept, the fisherface method tries to maximize the ratio of the between-class scatter versus the within-class scatter. The LBPH method can improve better accuracy than fisherface method.

V. RESULTS

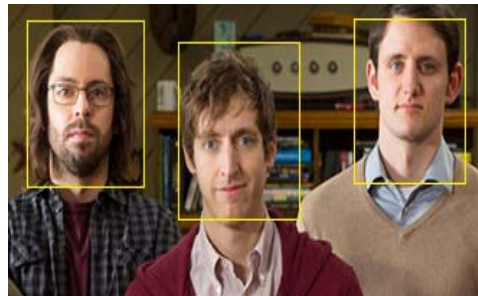


Figure2: Detected image



Figure3: Recognized image

VI. RESULT ANALYSIS

To perform Face Recognition firstly dataset is created which gives number of face images of person, then there is need of training set to recognize his/her face image. The face detection is done through haar cascade classifier method. By comparing current face image with face image in database recognition of respective person is carried out.

VII. CONCLUSION

Among all biometric techniques, face recognition approach possesses one of the great advantage, which is its user-friendliness. In our project we use Haar cascade classifiers and Local Binary Pattern Histogram which gives better accuracy than other methods for implementing system.

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