Real Time Face Recognition using LBP Features

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***Abstract*—Facial identication is important these days, Methods are required must be fast and accurate enough to work realtime. So research in methods for face recognition seems ever growing. The measurements of an individuals data is inherent part of FR techniques. In biomedical verification and identification requires the dataset such as iris, finger prints etc. While for FR, cameras are replacing the cards at places like ATMs. It helps capturing facial images of customers, and compare these photos to the images of account holders database of banks to verify the customers identity. This paper proposes way for face recognition. Shape and texture of facial images are studied for representation. The face is Firstly divided into tiny regions. Which are used to get LBPH. These histograms merged in one partially enhanced histogram, by which we get face images effciently. KNN classier does the classication and not just effciency but the simplicity of manner allows very fast feature extraction .**

***Index Terms*—Face Recognition, Features Extraction, LBPH algorithm, KNN algorithm, Raspberry pi3.**

I. Introduction

Biometric systems for pattern recognition are in demand[12]. Face Recognition becomes subject of interest for researchers for years[1] .In past few years,computational model devlopement is difficult[7], but comuting systems got help from advanced technology to carry out face recognition. The computer applications emerged from semi-automated models to accurate mathematical model[8]. Analysing geometry of faces attained in representation of faces[14]. The implementation of this in these area, with widen use in industry solutions indicates the importance of the topic and its evolution. So, the standard of face recognition technologies raised regularly, with implementation of more accurate and faster systems. In this method, the face recognition is carried out by using real time database which consists of various expressions and illumination conditions. LBPH is utilized for the features extraction of the test image and KNN used for the training.

II. Local Binary Pattern (LBP)

Development of LBP is done for texture description.

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It is unvaried to grey- scale trans- formations, its essential for texture description and analysis to get computational simplicity.[3].texture of digital images can be explaine by LBP[15]. Features are extracted by segmenting image in tiny regions.

These extracted features has binary which explains environmental enclosings of pixels in regions. features that are derived are linked together In a one feature histogram, which describes a representation of an image. Distances in between histograms are measured to compare images.sub regions are used to get LBP histogram.[13] As study suggests FR implementing LBP method provides the expected results, in both manners speed and performance. FR developed by using local binary features is free of facial expression identification. The textual analysis and facial image analysis is done by these features.

These features has quality of resisting the changes in illumination conditions. KNN method used for training purpose. LBP made known for a one scale textual description. Its developed by thresholding values of 3 by 3 neighbourhood of against central pixel and representing the result in binary no. [3],[4],[10] In this method, database used for recognition purpose has various poses and illumination conditions. Feature extraction is carried out by LBPH and KNN trained on these features. Fig. 1. Annular symmetric set, in which when radius is 1 then the 8 neighbouring pixels are covered andfor radius 2.5 they are 12 and as radius increases the no. of neighbouring pixels covered increases.

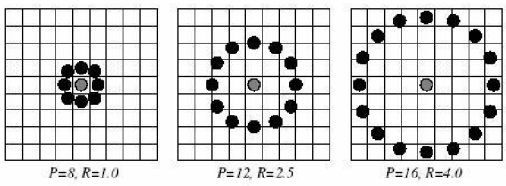

Figure 1.
circularly symmetric set[3]

Discrimination rates given by LBP for textures taken from images are good. The LBP is explained in fig.2,this version differs from its basic version. to explain local texture pattern with binary code is the fundamental idea behind this. While designing LBP we face three basic issues: The First is how to describe various local patterns. Since all have different importance to textual analysis. Second one is how to choose primary subset of these local patterns. The third one is how to employ the selected local patterns for desired output. The LBP textual analysis operator is termed as grey scale invariant texture measure. This depends on basic defnition of textual in an area neighbourhood.

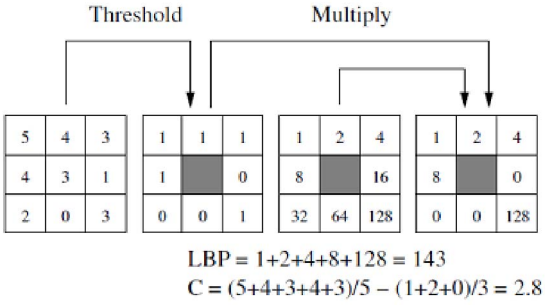

Figure 2.
Finding of the original LBP code with contrast measure.[3]

The basic idea is however stays the same: a binary code that explains that thresholding a neighbourhood by gray value of centre constructs the neighbourhood texture pattern. LBP operator indicates positive output for both accuracy and mathematical complexity.

It is observed as merged way of commonly divergent and skeletal example of texture analysis. The basic manner to prepare: Split the investigated window into cells (16 by 16 pixels per cell) for every pixel in the cell, correlate the pixel to every of the 8 neighbours[2]. Follow the pixels along circular direction.

If the central pixels value is higher than neighbours then write 1, or, write 0. The result is eight digit binary number. Find out the histogram on the cell. purposfully normalize the histogram.feature vector for a window is given by the correleted normalized histograms of cells.

lets defne texture T whilst the joint distribution of the grey quantities of P + 1 (P $>$ 0) image pixels:

$$T = t(gc, g0, ..., gp - 1), \tag{1}$$

The basic version differs from present version of LBP operator. gc could be subtracted from gp for various values of P and R:

$$T = t(gc, g0 - gc, ..., gp - 1 - gc). \tag{2}$$

it is assumed that the differences are independent of gc, the factorization can be distributed:

$$T = t(gc)t(g0 - gc, ..., gp - 1 - gc). \tag{3}$$

the general luminance of a graphic, is described by t(gc), this is distant from local image texture, it may be ignored:

$$T = t(g0 - gc, ..., gp - 1 - gc). \tag{4}$$

scaling affects the differences the despite the fact that invariant against gray scale shifts. Only the signs of variations are taken to get invariance for any gray scale transformation:

$$T = t(s(g0 - gc), ..., s(gp - 1 - gc)), \tag{5}$$

Now, each sign s(gp-gc) has given a binomial weight 2p. converting the variations in neighbourhood in a unique LBP code[12]

$$LBP_P.R(\chi_c, Y_c) = \sum_{p=0}^{-1} s(g_p - g_c)^{2p} \tag{6}$$

The first LBP is described by two ways. First, the Neighbourhood in the typical definition is indexed circularly, rendering it better to derive rotation invariant texture descriptors. Second, the diagonal pixels in the 3 by 3 neighbourhood are interpolated in LBP.[9]

III. K-Nearest Neighbour Algorithm (KNN)

In pattern recognition, the KNN is one of the method used for classification. In KNN classification: The result is a class membership.classification depends upon majority of vote of neighbours and object assigned most common class among its knn .

The neighbours are acquired from a set of objects for which the class (for K-NN classification) or the object property value (for K-NN regression) is known. , though explicit training set required, we can think of this as training set for algorthm.

It is one of the simplest methods to identify a sample from test set.[5],[11] It is named as nearest neighbour method. The object to be recognised is compared with each sample in the training set. It uses a distance measure, a likeliness measure or combination. The unidentified object is then identified as part of same class as the nearest sample in training set. This is shown by the smallest number if we use likeliness measure.

This procedure is arithmetically intensive and not very sturdy. We can make this method sturdier by taking not just the nearest samples in the training set, but by considering bunch where gc corresponds to the grey value of the centre pixel of a local neighbourhood. gp (p = 0,...,P -1) match the grey values of P equally spaced pixels on a group of radius R that form a circularly symmetric pair of neighbours[4]. Figure 4 illustrates three circularly symmetric neighbour sets of close feature vectors. This is called as KNN (K-Nearest Neighbour) method. For example, take K = 5, Then we allot the unidentified feature vector to the class that comes most often in set of KNN.

This is arithmetically very intensive, since we have to correlate each unidentified sample to each sample in the training set, and we also need the large training set to increase the success rate. We can minimize this arithmetic load by using Nearest Centroid. In this we take centroids for every class

from samples in training set, and then correlate the unidentified samples to the specific centroid only.

The centroid is calculated by finding average for every vector component in the training set. The repetition will stop when we get K-subclass and initial K-vector becomes way of each sub-class. KNN classifier is most suitable for classifying persons based on their images since it has lesser execution time and better accuracy than other commonly used methods which has HM Model and Kernel method [6].

Even if the methods like SVM and Adaboost are proved to be more accurate than KNN classifier, KNN classifier has a faster execution time and is effective than SVM[15]. KNN is one of the easiest in the image space. In this method label of the closest point in the learning set is assigned to image for testing. The x squre or chi squre distance metric is used to deter- mine the nearest data points in KNN. A distance is assigned between all pixels in a dataset.

Distance between 2 pixels is termed as chi.squre distance[7]. Its given by

$$d(X,Y) = \chi^2 = \sum_{i=1}^{n} \frac{(x_i - y_i)^2}{x_i + y_i} \text{ [16]} \qquad (7)$$

This x squre distance is implemented with KNN classifier . This distance between testing vector and database vector decides recognition rate. Less distance indicates more accurate recognition of face.

Algorithm

The KNN algorithm is object classification method which is based on nearest training examples in the feature space.

1. Class label is given to the every data pixel value in set = c1, , cn.

2. The data points', k-nearest neighbours (k being the number of neighbours) are then found by analysing the distance matrix.

3. The k-nearest data points are then analysed to get which class label is the most common among the set.

4.data paint has the most common class label.

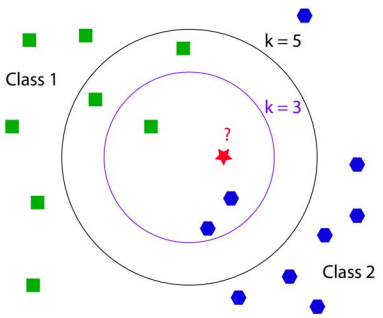

Figure 3.
KNN classification

IV. Methodology

We have created dataset by taking images from webcam, the text file is generated from images of subject. The trainer

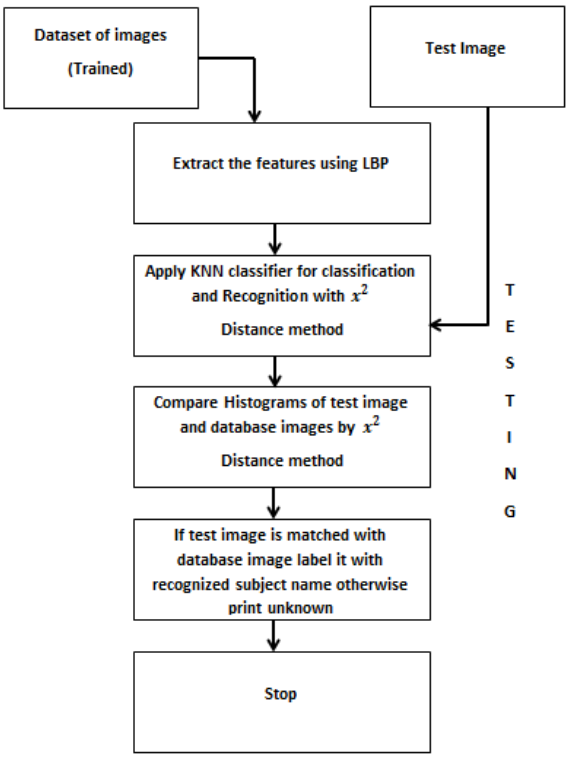

Figure 4.
Flow chart representing face recognition through LBP

then trained using this database. Current image is compared with the database for recognition. Fig. 4 shows Flow chart of the face recognition using LBP

Step1. Create database of images by taking images from webcam

Step2. Extract Features.

Step3. Train the recognizer on this database.

Step4. Apply KNN classifier for classification and Recognition with chi squre Distance method.

Step5. Compare Histograms of test image and database images by chi squre Distance method.

If test image is matched with database image label it with recognized subject name otherwise print unknown.

In fig. no.4 flowchart shows the working of the system.

V. Experimental Setup

The experimental setup has combination of hardware and software.The block diagram is shown in fig no. 5.

The Raspberry Pi 3 is important part of the system.It has 1.2 GHZ quad-core ARM Cortex A53 with GPU Broadcom VideoCore IV @ 400 MHz and Memory 1 GB LPDDR2-900 SDRAM, it has 4 USB and with network specifications of 10/100 MBPS Ethernet, Wireless LAN, Bluetooth 4.0

The programming language used in this project is python(2.7.9) and openCV(3.0.0), the whole project is divided into 3 parts collectiong the facial data, training with the help

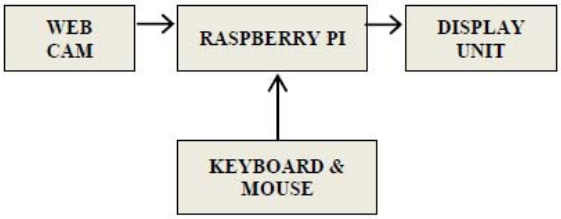

Figure 5.
Block Diagram of Experimental setup [15]

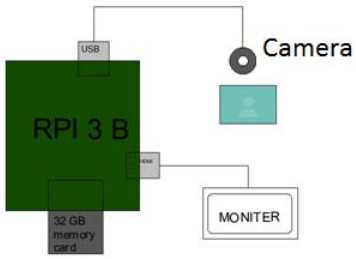

Figure 6.
Circuit diagram of face recognition using Raspberry Pi

of that dataand lastly the recognition of the faces. we have used the USB camera for this project.

VI. Experimental Results

A dataset of face images collected from various individuals, by using webcam are stored in the base64 format. System should recognize them individually. recognizer then trained on these images, 100 samples have been taken for each subject, during test these 1 image are taken for testing.

All these test images are acquired using webcam to test accuracy of recognition system in real time environment settings. During the normal conditions 90 percent images are recognized accurately and when illumination changes have done the accuracy is up to 80 percent.

The following figures show the known and unknown faces which are detected by the system.

following image no 8 and 9 respectively shows the identification of images as known and unknown faces.

Table no.1 shows experimental results.

Table no.01	
Parameter	Range
No. of training images	100
No.of testing images	01
Normal	90 percent
Illumination	80 percent
known face	30.25 confidence
unknown face	0.00 confidence

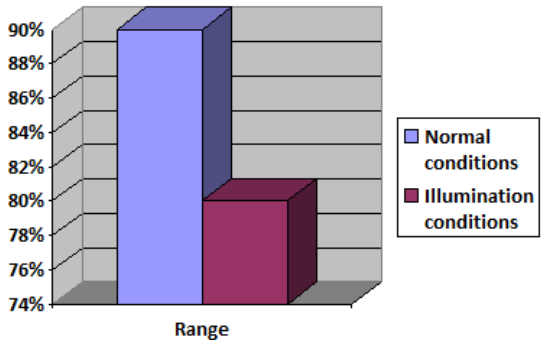

Figure 7.
graphical representation of the results

VII. Conclusion

The LBP used to get features extracted. The facial images for detection and identification are taken by webcam and stored in database. LBPH recognizer is trained by the extracted features from database.KNN classifier is used with x squre or chi squre distance method for recognition of the face,by comparing histograms of test image and database image.Images stored in Database are compared with test image.if database have the images of that subject, then image is recognized, otherwise it shows that image as a unknown.

Figure 8.
Known face

Figure 9.
Unknown face

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