



User Recognition Based on Face using Local Binary Pattern (LBP) with Artificial Neural Network (ANN)

Abhilasha A Patil^{#1}
[#]ECE Department
Visvesvarya Technological University

Abhilasha A Patil
IV SEM, M.Tech in Digital Communication and Networking
Department of ECE
Godutai Engineering College for Women
Kalaburagi, Karnataka, India.
abhilashapatil002@gmail.com

Lakshmi Maka^{*2}
[#]ECE Department
Visvesvarya Technological University

Lakshmi Maka
Associate Professor
Department of ECE
Godutai Engineering College for Women
Kalaburagi, Karnataka, India.
patillakshmi192@gmail.com

Abstract—As the rate of crime is increasing, it is necessary to provide secure access to every individual. face recognition is one such technique of providing security access. Face recognition is a process of identifying a person based n face. Biometrics deals with identification and authentication of individuals. There are various biometrics techniques such as finger print recognition, hand geometry recognition etc. the face recognition is a better biometric technique compared to other traits as the image can be captured without the knowledge of individual. In this paper user identification based on face using LBP with ANN is proposed. Here the features of face are extracted and trained using LBP. Then unknown face is tested using ANN method by making use of feed forward algorithm with the images already trained and stored in database. With the proposed method the efficiency is increased to 93.33%. The performance is better when compared with other techniques of face recognition .

Keywords—LBP, Biometrics, face recognition, face detection, feature extraction, ANN

I. INTRODUCTION

The face plays an important role in our society. It provides the information about human behavior. Face recognition is one of a biometric process which deals with verification, validation and identification of a person [1]. Face recognition technology has gained high importance due to its increased performance over a last few decades. Due to its various applications such as security purpose, surveillance, general identity recognition, smart card applications etc, it has become an active area of research topic in this era [2].

The basic function of face recognition is to compare a known face with unknown face. This is done by comparing facial features such as structure, shape, and distance between eyes, nose, mouth, location of eyes, nose, and mouth of an unknown image with those already present in the database. Face recognition can be applied for verification and identification. Identification is a process of comparing one user face with faces of many users saved in the database.

Verification is a process of comparing one user face with the same user face already present in the database [3].

The basic and important step in face recognition is face detection. Face detection is a process of separating a face image from a crowd consisting of non facial images. This detection plays an important role in a video images or still images because video consist of face image along with non facial images such as wall, furniture , greenery, buildings etc. detection is not used if it is a passport size image because in passport size image there is only a facial image. There are various challenges associated with detection process. Among them few are pose, occlusion, and facial expression. In pose, the face may be in different angle such as user may be seeing up, down left or right. In occlusion, the person may be wearing a glasses or hairstyle may be changed which is nothing but a disturbance. In facial expression, the person may be happy, sad, angry etc.

II. PROPOSED ALGORITHM

In this paper two algorithm have been proposed for the face recognition. They are ANN and LBP.

A. Local Binary Pattern (LBP)

Local binary patterns were introduced by Ojala et al as a fine scale texture descriptor. In its simplest form, an LBP description of a pixel is created by thresholding the values of the 3 _ 3 neighborhood of the pixel against the central pixel and interpreting the result as a binary number. The process of LBP is shown in figure below.

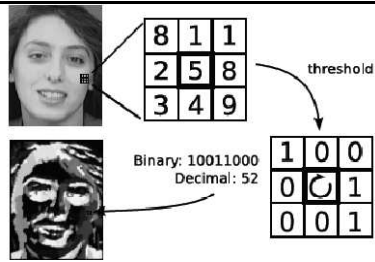


Fig 1. Concept of LBP

The LBP operator is generalized by allowing larger neighborhood radii r and different number of sampling points s . These parameters are indicated by the notation $LBP_{s,r}$. For example, the original LBP operator with radius of 1 pixel and 8 sampling points is $LBP_{8,1}$. Another important extension is the definition of “uniform patterns”. An LBP is defined as uniform if it contains at most two 0-1 or 1-0 transitions when viewed as a circular bit string. Thus the 8-bit strings 01100000 and 00000000 are uniform, while 01010000 and 00011010 are not. Using 8 sampling points, uniform patterns accounted for nearly 90% of the patterns in their image datasets. Therefore, little information is lost by assigning all non uniform patterns to a single arbitrary number. Since only 58 of the 256 possible 8 bit patterns are uniform, this enables significant space savings when building LBP histograms. To indicate the usage of two-transition uniform patterns, the superscript $u2$ is added to the LBP operator notation. Hence the LBP operator with a 2 pixel radius, 8 sampling points and uniform patterns is known as $LBP^{u2}_{8,2}$.

The success of LBP has inspired several variations. These include local ternary patterns, elongated local binary patterns, multi scale LBP, centralized binary patterns and patch based LBP, among others. This descriptor has been used, by itself or in combination with other features, by most methods that use LBP for face recognition.

B. Artificial Neural Network(ANN)

The next step makes use of artificial neural networks. As the human brain consist of complex interconnected neurons to process the different task. They can resolve the complex and noisy data problems. Artificial Neural Networks (ANN) learns the correlated patterns of input and target values. ANN is inspired by the human biological nervous system. For Face Recognition purpose, the learning process of ANN is used with back propagation algorithm. Back Propagation is a feed forward supervised learning network. There are many types of ANN like Multilayered Perceptron, Kohonen networks and Radial Basis Function. The multilayered feed forward neural networks consist of the three layers as input layer, hidden layer and output layer as shown in Figure 2. These layers of processing elements make independent computation of data and pass it to another layer. The computation of processing elements is completed on the basis of weighted sum of the

inputs. The output is compared with the target value and the mean square error is calculated which is processed back to the hidden layer to adjust its weights. This process performs iteration for each layer to minimize the error by repeatedly adjusting the weight of each layer. Hence, it is called the back propagation. The iteration process carried on until the error falls below the tolerance level.

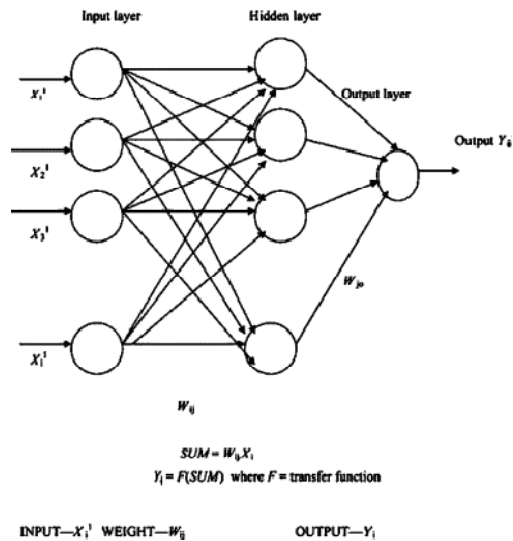


Figure 2: The basic architecture of multilayered ANN

The multilayered ANN has the different layers of processing elements. In face recognition system using ANN, the model works in the following frames:

- **Input to Feed Forward Network:** - First, the parameters are selected for required Neural Networks operation i.e. the number of input layers, hidden layers and output layers. These input neurons receive the inputs signal from the training data of face images. Each input has its own weights.
- **Back Propagation and weight Adjustment:** - The input layer processes the data to the hidden layer which computes the data further and passes it to the output layer. Output layer compare it with the target value and obtain the error signals. These errors are sent back for adjusting the weights of each layer to minimize the error as shown in Figure 3.

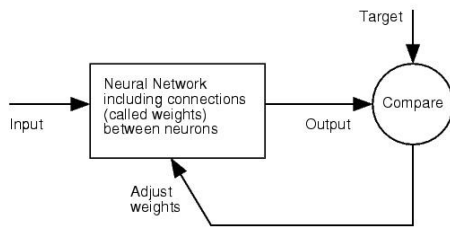


Figure 3: Back Propagation of multilayered ANN

- Mathematical Function:** - It performs the mathematical operation on the output signal. The functions can be threshold function, log-sigmoid and Tangent hyperbolic function. If the output values of the function are similar to the output values of the Tested face, the face is detected. Hence, the Neural Networks provides the response to the input which is similar to the training data.

III. PROPOSED METHOD

The proposed system will work in the following three phases:

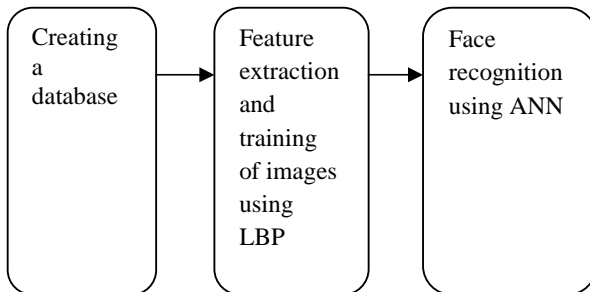


Fig 4. Basic block diagram of proposed system.

A. Creating a database

This is the first step in which we add face images of different person in the database. Here we take 100 images of different persons with 10 instances of each person. Among those instances some are used for training and some for testing [6].

B. Feature Extraction and training of images

Each and every person face is unique and expression of face also varies. Therefore face recognition depends on extracting the facial features such as boundary of face, edges, background, width and height of face etc. Before extracting the features preprocessing of images is done to reduce the variation in face, background. The input for preprocessing is the face

instances of different persons. The output of preprocessing is an image with good resolution. After preprocessing few instances of each person is trained using LBP. Features are extracted and stored in the database created in matlab [7].

C. Face Recognition

In this step, the instances which have not been used for training are used. Here ANN is used for testing and recognition. Again in the ANN feed forward and back propagation algorithm is used. Initially the features of those instances are extracted and a threshold of infinity value is set. If the values are near to the threshold value then the match is not perfect and output is displayed as no match found. If the value is less then it recognizes correctly and display class is detected. If we give any instances other then 100 images of different persons then the threshold value is set to 0.001. any value below this will be declared as no match found [8].

IV. RESULTS AND DISCUSSION

First a LBP classifier is designed and then the experiment is performed for different trained instances i.e., 100, 200, 300, 400, 500 and 550 where 10 different features are calculated for 100, 200,300, 400, 500 whereas for 550 we improve the feature extraction and passed to the classifier. Then the classifier is tested on validation set using ANN, immediately after training cycle is completed. The performance of the system was found to be 10%, 25%, 63.33%, 80% and 93.33 % respectively as shown in the table 1.

Table 1. Performance of the proposed system.

No of instances trained	No. of instances tested	No of mismatched instances	Accuracy in %
1*100	40	36	10
2*100	40	30	25
3*100	60	22	63.33
4*100	80	16	80
6*100	90	6	93.33

V. CONCLUSION AND FUTURE SCOPE

This paper mainly deals with the face recognition using LBP with ANN. Here Indian persons faces have been used for database and they are used to test the proposed algorithm.LBP is used to train the images and extract the features. ANN is used for testing and face recognition. It is observed that proposed method shows better performance. The accuracy obtained with proposed method is found to be 93.33%.



International Journal of Ethics in Engineering & Management Education

Website: www.ijeee.in (ISSN: 2348-4748, Volume 2, Issue 5, May 2015)

Future Improvements: The accuracy of the system may be improved by training more samples and by using other advanced technique.

REFERENCES

- [1]. K. Kim, "Intelligent Immigration Control System by Using Passport Recognition and Face Verification,"
- [2]. Naveed Khan Balcoh, M. Haroon Yousaf, Waqar Ahmad and M. Iram Baig, " *Algorithm for Efficient Attendance Management : Face Recognition based approach,*" IJCSI International Journal of Computer Science Issues, Vol. 9, Issue 4, No 1, July 2012.
- [3]. Xiao Zeng and Hua Huang, "Super-resolution method For multiview face recognition from a single image per person using nonlinear mappings on coherent features", IEEE Signal Processing Letters, Vol.19, No.4, pp. 195-198, April 2012.
- [4]. Michel F. Valstar and Maja Pantic, "Fully automatic recognition of the temporal phases of facial actions", IEEE Transaction on Systems, Man and Cybernetics, Vol.42, No.1, pp. 28-42, February 2012.
- [5]. Quan-xue Gao, Lei Zhang and David Zhang, "Face recognition using FLDA with single training image per person", Applied Mathematics and Computation, pp. 726-734,2008.
- [6]. S.Ravi and Sadique Nayeem, "Study on face recognition technique based on Eigenface", International Journal of Applied Information Systems, Vol.5, No.4, pp. 57-62, March 2013.