Face Recognition Using a Fuzzy Approach from a Video Sequence

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Abstract - Digital images and video are playing key roles in the present information era with increasing development in the computer science field. Human face being an important biometric object for Unique Identification in any System. In a Complex Environment such as in videos where noise conditions, illuminations, locations of subjects and pose can vary, it becomes tedious task to identify and locate human face and extract their facial features. This paper proposes a method of classifying the Human Face recognition using Dominant Rotated Local Binary Pattern (DRLBP) & Convolutional Neural Network (CNN).

Index Terms – Face Recognition, Feature Extraction, Dominant Rotated Local Binary Pattern (DRLBP), LBP (Local Binary Pattern), Convolutional Neural Network (CNN), Image Processing.

1. INTRODUCTION

Nowadays, biometric authentication methods are in demand for enhanced security purposes and Facial Recognition is a type of biometrics that can identify a specific individual in a digital image by analyzing and comparing patterns which can be used for various purposes, let it be Security/Authentication. Current face recognition systems work with numeric factor called face prints which identifies nearly 80 nodal points on a human face. Nodal points refer to points used to measure variables of a person's face, such as the unique length and width of the nose, the shape of the jaw with cheeks and the depth of the eye outlines and distance between them. In cases if the subject's face is partially visible or in profile rather than facing forward, or if the light is insufficient, the software is less reliable. In appearance-based methods, feature description is less accurate due to the entire image being considered.

The identification of objects in an image would probably start with image processing techniques such as noise removal, followed by (low-level) feature extraction to locate lines, regions and possibly areas with certain textures.

2. RELATED WORK

As mentioned above facial recognition is something that has been worked on for over a decade now and there are various methods that has been deployed or been tested to carry out this task, listed below are few:

- LBP
- LTP
- RLBP
- DRLBP

2.1. LBP (LOCAL BINARY PATTERN)

LBP or Local Binary Pattern was one of the first introduced pattern recognition techniques. The idea is to divide the picture into a 3x3 pixel group and then do a comparison of the central pixel value with the neighboring pixel value and if the value is higher or equal, then in the matrix that we obtain we use the 1 as cell value otherwise we use 0. We do the same for every division of the pixels and we get a 3x3 matrix which is coded in binary and this can be used for histograms, which can be used to get the textures descriptions and can also be used for pattern recognition. It does a really good job when it comes to patterns but this technique was not well suited for the facial recognition and thus had to be ruled out as the face isn't like an absolute pattern and based on the facial features and lighting things can change drastically.

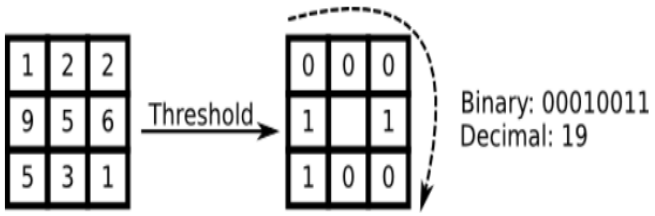

Fig 1: LBP

2.2. LTP (Local Ternary Pattern)

LTP or Local Ternary Pattern might look very similar to the LBP but has one major difference that sets it apart and gives it unique features of its own, which is that it uses three values instead of two in binary as the term ternary suggests. We have a threshold value (k), the central pixel value (c) and the neighboring values (p). The way these values are assigned/coded is shown below:

$$\begin{cases} 1, & \text{if } p > c + k \\ 0, & \text{if } p > c - k \text{ and } p < c + k \\ -1 & \text{if } p < c - k \end{cases}$$

This provides us with a way to deal with or represent noises in an image by simply assigning -1 for the noise when the comparison is made. While 0 is for the background value and 1 being the value for the foreground.

10	8	4
2	5	4
3	6	5

→

1	1	-1
-1	0	-1
-1	1	0

Fig 2: LTP

2.3. RLBP (Rotated Local Binary Pattern)

RLBP or Rotated Local Binary Pattern solved the issues that was faced in the LBP without changing the binary numbers unlike LTP, which in fact kept it simple. As there is circular pattern in the weights, so the rotation can't be handled with the LBP because the weights will still be fixed and this is where the RLBP comes in, if the image is rotated then rotating the weights by the same angle will fix this issue. And thus, reference was needed to rotate the weights with the same angle as the image. And then there were two ways to do it, the first taking the gradient.[1]

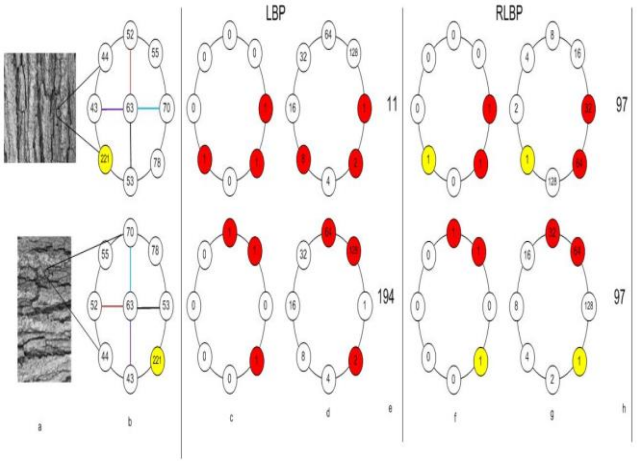

Fig 3: RLBP

2.4. DRLBP (Dominant Rotated Local Binary Pattern)

DRLBP or Dominant Rotated Local Binary Pattern is a more refined method of approaching this problem of facial recognition as it was seen in [1] that it gave promising results than the former methods in pattern and object recognition. This method is better because, instead of being rotated based on gradient reference, it is rotated based on the dominant direction and thus there is no rotation variance. This solves the purpose of recognizing a face even if it is not aligning exactly with the reference image, now the weights can be adjusted accordingly.

3. PROPOSED MODELING

The proposed system is a face recognition system that is supposed to take videos as input and then extract the frames from it, once the frames are extracted it will then select the suitable frame for the face and then the images will go through the process of grayscale conversion, DRLBP, after that these features and pattern will be used for the histogram and then the process for the facial feature extraction will be completed. These features will be fed to the convolutional neural network(CNN) in order to learn these features of the face so that these features can be matched with the features in the database to find if they match or not.

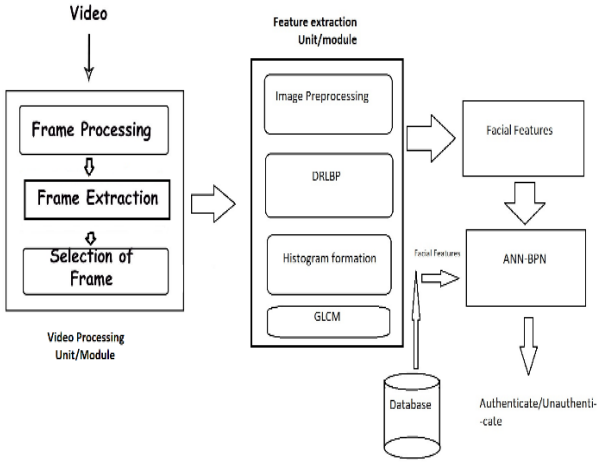

Fig 4: System Architecture

The person to be found or matched must be in the database and the features should been learned by the neural network only then it will be able to identify the person.

4. RESULTS AND DISCUSSIONS

The simulation for the proposed system was performed on the MATLAB. The video was fed through the webcam and the code for the DRLBP was used for the facial feature extraction to train the neural network afterwards it was used against a life video feed from the same camera to see if the system could identify the person in the video, whose data was present in the database and we found that the system was able to give results as it was expected out of it.

The camera was exposed to a picture of person in order to extract the features and then keep it for the database after training the neural network

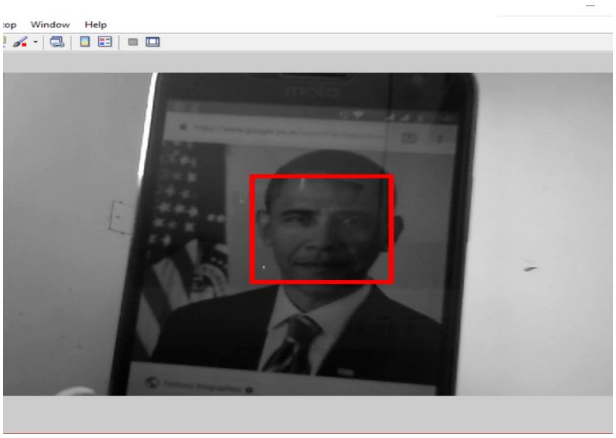

Fig 6: Face taken through webcam using an image

After the image was taken the system worked in order to generate the DRLBP for the face and train the CNN.

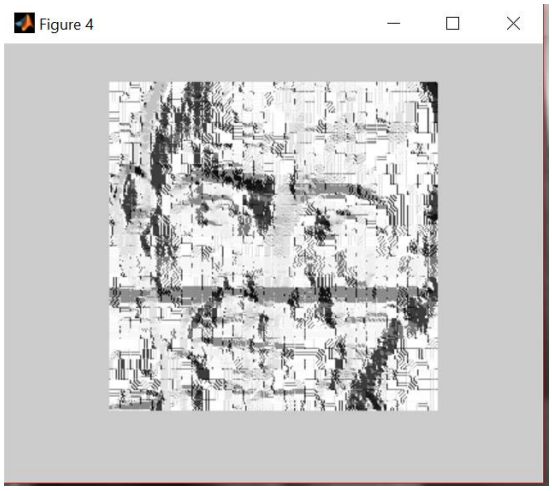

Fig 6: DRLBP for the face

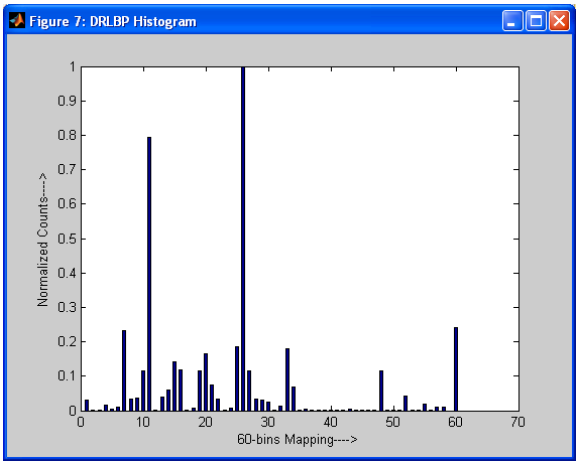

Fig 7: DRLBP Histogram

Once the training for the features was completed and the database was updated we again subjected the webcam to the image of the person in order to see if the face could be recognized or not and. Even after the glare of the screen, it was still able to pick out the person in the image that was fed to the webcam.

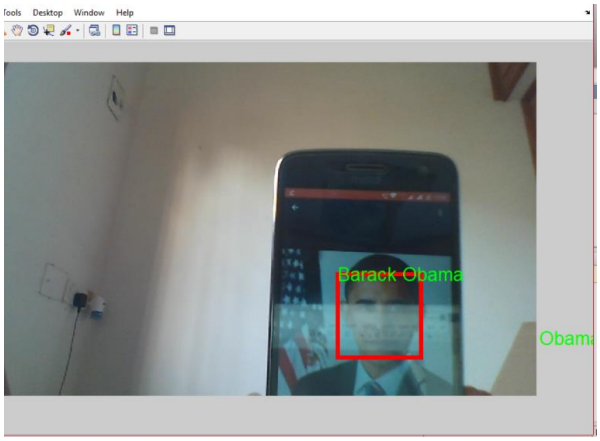

Fig 8: face recognized

5. CONCLUSION

In this paper we proposed a system that can recognize a person based on their face (Face Recognition) using the DRLBP method that has been used for the pattern classification and detection. It is a step taken towards advancements in the field of Artificial Intelligence and in that, in Face Recognition. The DRLBP (Dominant Rotated Local Binary Pattern) for recognition of faces from various angles, which helps in identifying faces and thus because of it being rotation independent it can be used for various biometric or security purposes. The method used gives better results than the LBP,LTP and therefore is more reliable. After testing and performing the experiment plenty of times it was also found that the performance depends on the quality of the video which is one of the limitation along with some inaccuracy that could arise due to facial expressions. Research is being conducted in order to help identify emotions of a person based on the facial features and expressions.

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