An Efficient Attendance System Using Local Binary Pattern and Local Directional Pattern

C. Ashwini [1], Vedika Kumari [2], R. Pavan Krishna [3], Preetan Natesh [4]
[1] Assistant Professor, Department of Computer Science, SRM Institute of Science & Technology, Chennai, India.
[2, 3, 4] UG Scholar, Department of Computer Science, SRM Institute of Science & Technology, Chennai, India.

Abstract – In the era of information system, authentication is one of the significant issues. One best way to maintain user authentication is by using the human facial recognition method. Human facial recognition has been an important branch of biometric verification which has been implemented in many applications, such as video monitoring/surveillance system, human-computer interaction, door access control system and network security. This paper presents an attendance system which uses Gray-Level Co-occurrence Matrix(GLCM) to detect and compare the texture of the face. The texture represents the surface and structure of an image. Gray-Level Co-occurrence Matrix(GLCM) also known as Gray-Level Spatial Dependence Matrix (GLSDM) is used to calculate how often pair of pixel with specific values and in a specified spatial relationship occur in an image. This system is based on detection, recognition and matching algorithms which automatically detects the face when the student enters the classroom.

Index Terms – Local Binary Pattern, Local Directional Pattern, GLCM, Viola Jones Algorithm.

1. INTRODUCTION

Attendance is considered as the action or state of going regularly to or being present at a place or event. Attendance system is being used in every organization around the globe. The manual attendance record system is inefficient and more time consuming . Hence a system is needed which will solve the flaws which often occurs in manual attendance. However, in the previously introduced systems it was important to identify the correct tools to use in commercial and scientific studies. Barcode readers, Radio Frequency Identification (RFID) system, Bluetooth and NFC (Near Field Communication) are just a few of the examples of such tools. However, they are expensive and therefore they had limited use. In this currently proposed system we are introducing Smart Attendance System. The automated attendance system offer more benefits to the faculty, it helps to lessen the administrative burden of its staff. Particularly, for attendance system which adopts human face recognition (HFR) technique, such a system commonly involves the process of extracting key features from any facial image of student captured. The project presents an automated attendance management using facial recognition to overcome the difficulties that are involved in manual attendance calculation. DRLBP and DRLDP techniques are used for effective face detection, feature extraction and matching process. In feature extraction stage, the discriminative robust local binary pattern is used for different object texture and edge contour feature extraction process. The discriminative robust local directional pattern (DRLDP) operator compute the edge response value in all eight directions at each pixel position and generate a code from the relative strength magnitude. The proposed feature retains the contrast information of image patterns. These features are useful to distinguish the maximum number of samples accurately and it is matched with already stored image samples in the database.

2. RELATED WORK

In the existing system, the algorithms used were PCA(Principle Component Analysis) and LDA(Local Discriminant Analysis). The main process involved in these algorithms is to compare faces and non-faces.PCA is used to reduce the large dimensionality of data space to the smaller intrinsic dimensionality of feature space which are needed to describe the data economically. It is an eigenvector method designed to model linear variation in high-dimensional data. LDA is a supervised learning algorithm. LDA searches for the project axes on which the data points of different classes are far from each other while requiring data points of the same class to be close to each other. The problems faced in the existing system is that it doesn't provide optimal results for all stages and it results in poor discrimination and low contrast information.

3. PROPOSED SYSTEM

The following system eliminates the flaws which was present in the existing system. The administrator fills up the details of the teachers and students at the start of the semester. The beauty of this system is that the class list is generated automatically. These details can be used for further semesters with minimal changes. The system allows easy attendance management using the Face Detection, which is one of the most preferred techniques. The teacher needs to carry a Digital Image Capturing Device to the lecture room and take a picture of the class with the students present inside. The teacher then needs to log-in to the computer using the login credentials. The web page provides a medium to upload the image to the computer. The system has a copy of MATLAB installed in it. System also consists of database which includes images of all the students and their personal details. The database also keeps record and

the details of the teachers. After the image is uploaded to the system, faces of students are detected from the image using MATLAB software. These images are then compared with the images of students stored in the database using face recognition algorithm and record of attendance is kept. This is how record of attendance is kept in our system.

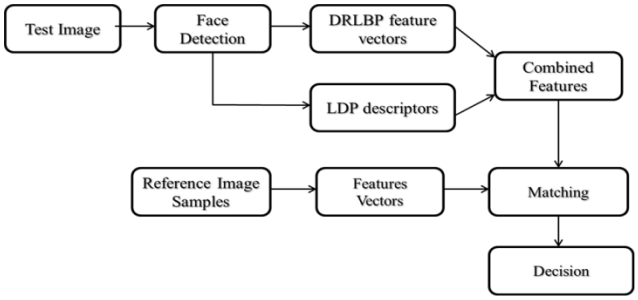

Figure 1.Basic system architecture

3.1 Face Detection

Viola Jones Algorithm: The characteristics of Viola–Jones algorithm which make it a good detection algorithm are:

- Robust – very high detection rate (true positive rate) & very low false-positive rate always.
- Real time – For practical applications at least 2 frames per second must be processed.
- Face detection - The goal is to distinguish faces from non-faces

The speed with which features may be evaluated does not adequately compensate for their number, however. For example, in a standard 24x24 pixel sub-window, there are a total of possible features, and it would be prohibitively expensive to evaluate them all when testing an image. Thus, the object detection framework employs a variant of the learning algorithm Ada Boost to both select the best features and to train classifiers that use them.

The algorithm has mainly four main stages:

- Haar Features Selection
- Creating Integral image
- Ada boost Training algorithm
- Cascaded Classifiers

The features sought by the detection framework universally involve the sums of image pixels within rectangular areas. As such, they bear some resemblance to Haar basis functions, which have been used previously in the realm of image-based object detection. However, since the features used by Viola and Jones all rely on more than one rectangular area, they are generally more complex. The figure on the right illustrates the four different types of features used in the framework. The value of any given feature is the sum of the pixels within clear rectangles subtracted from the sum of the pixels within shaded rectangles. Rectangular features of this sort are primitive when compared to alternatives such as steerable filters. Although they are sensitive to vertical and horizontal features, their feedback is considerably coarser.

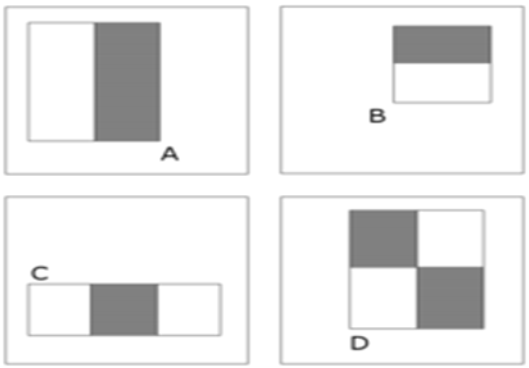

Figure 2. Feature types used by Viola Jones

Local Binary Pattern: The descriptor local binary pattern is used to compare all the pixels including the center pixel with the neighboring pixels in the kernel to improve the robustness against the illumination variation. An LBP code for a neighborhood was produced by multiplying the threshold values with weights given to the corresponding pixels, and summing up the result.LBP codes are weighed using gradient vector to generate the histogram of robust LBP and discriminative features are determined from the robust local binary pattern codes. DRLBP is represented in terms of set of normalized histogram bins as local texture features. It is used to discriminate the local edge texture of face invariant to changes of contrast and shape.audio signal is constantly changing, so to simplify things we assume that on short time scales the audio signal doesn't change much. So we frame the signal into 20-40 ms frames. Hamming window is applied on each frame and it rid of some information at start and at end of frame so to reincorporate this information back into our extracted features overlapping is applied on frames.

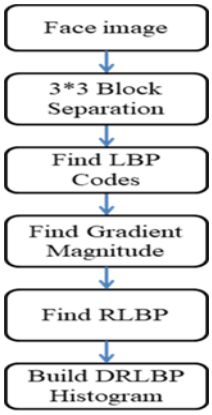

Figure 3. LBP Process Flow

Local Directional Pattern: At feature extraction stage, Local directional pattern descriptor is used to describe local primitives including different types. The curves, corners and junctions are the different types present. The main process involved in LDP is to compute the edge response values in all eight directions at each pixel position and generates a code from the relative strength magnitude. LDP uses kirsch templates for each local block in all eight orientations to determine edge details and it is converted into binary codes to generate the directional pattern. The binary codes are determined by find difference between centre and neighboring pixels and label '1' to difference pixel values which are greater than or equal to 0 and label '0' to remaining. The LDP features will be represented as histogram bins and each bins are giving normalized LDP Codes.

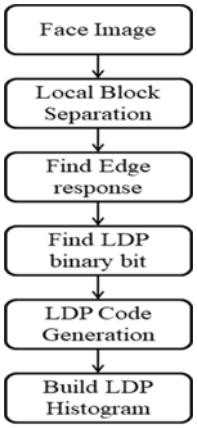

Figure 4. LDP Process Flow

3.2 Face Recognition

Histogram Of Oriented Gradient: The technique counts occurrences of gradient orientation in localized portions of an image. This method matches with edge orientation histograms, scale-invariant feature transform descriptors, and shape contexts, but it stands out unique in a way that it is computed on a dense grid of uniformly spaced cells and uses overlapping local contrast normalization for improved accuracy. Firstly the face image gets divided into small regions which are known as cells. Secondly, the histogram of edge orientation gets computed for each one over the pixels of the cell using discrete derivative masks. Each pixel in the cell will be a parameter for edge orientation and the gradient element is attached to it, thus the computation is performed for orientation bins. The histogram channels are spread in an even manner. That is 0–180 degree or 0–360 degree, depending on the gradient which is 'unsigned' or 'signed'. To determine the histogram of local binary pattern the gradient will be obtained from the input image. Then it will be utilized to find the robust and discriminative features. It involves two descriptors such as, gradient magnitude and orientation. The gradient will be measured in both horizontal and vertical directions with derivative operators.

The gradient magnitude and orientation will be described by,

Magnitude: Gm = Sqrt(Fx.^2 + Fy.^2);

Where, Fx ,Fy = First order derivatives along rows and columns.

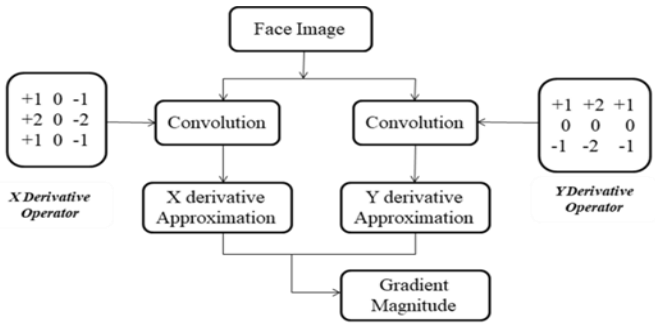

Figure 5. Gradient Detection Flow

3.3 Texture Analysis Using Gray Level Co-occurrence Matrix

Texture is a property that represents the surface and structure of an image. Texture can also be defined as a regular repetition of an element or pattern on a surface. Textures of an image are complex visual patterns that are composed of entities or regions with sub-patterns with the characteristics of brightness, shape, size, etc. Texture analysis characterizes the spatial variation of image pattern based on some mathematical procedures and models to extract information from it. One of the methods used for texture feature extraction was proposed by Haralick et al. known as Gray-Level Co-occurrence Matrix (GLCM).

Gray Level Co-occurrence Matrix: The GLCM, which is a square matrix, can reveal certain properties about the spatial distribution of the gray-levels in the texture image. It was defined by Haralick et al. in 1973. The GLCM explains how often a pixel value known as the reference pixel with the intensity value = i' occur in a specific relationship to a pixel value known as the neighbor pixel with the intensity value j.

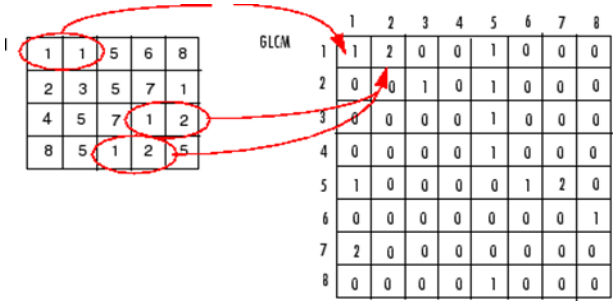

Figure 6: GLCM Matrix

So, each element (i, j) of the matrix is the number of occurrences of the pair of pixel with value = i' and a pixel with

value = j ‘ which are at a distance d relative to each other. The spatial relationship between two neighboring pixels can be specified in many ways with different offsets and angles, the default one being between a pixel and its immediate neighbor to its right.

4. CONCLUSION

This paper successfully presents an automated attendance system created using human face recognition technique such as Grey Level Co-Occurrence Matrix works quite well. This method has a better discriminatory power in texture representation. As it is robust to illumination changes this provides good edges texture representation at different orientations.

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