AN EFFECTIVE ATTENDANCE MANAGEMENT SYSTEM USING FACE RECOGNITION

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Abstract - *In this paper various real time scenarios are considered to evaluate face recognition using image processing techniques. The proposed system involves face detection, feature extraction and matching. The face detection is to detect faces based on Viola-Jones algorithm using vision toolbox. The objective behind this research is to provide continuous monitoring by overcoming the manual work of students and faculties.*

Key Words*: face detection, feature extraction, matching, Viola-Jones algorithm,LDP,LBP*

1. INTRODUCTION

Face Recognition is a technique with minimum flaws as the facial features of every human being are unique. It is considered to be one of the most successful application of image analysis and processing. This system is widely used in various organisation.The system design is based on Viola-Jones algorithm i.e.,the real time face detetion algorithm.

The project presents an automated attendance management using facial recognition to overcome the difficulties that are involved in manual attendance calculation. DRLBP and DRLTP 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 (DRLTP) 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.

1.1 Existing system

The existing system needs the manual work of faculty members in the process of marking attendance on a sheet of paper.The coventional system includes biometric attendance management system, RFID-based system, Finger print based system, Card reader system, Iris based system and so on.The prior approaches are time consuming since queue formation, periodical monitoring and manual work is required.The traditional system faces many security issues like giving proxy attendance and by performing fraudulent activities for giving attendance.

1.2 Problems in existing system

- Time consuming.
- Workload for faculties and students.
- Too many security issues.
- Chances for flaws during computation.

2. Proposed system

The architecture for automated attendance management system is shown in Figure 1. The group image of the students is captured and stored in the database. The individual faces of every student is recognized by face detecion algorithm. Face regions are preprocessed to convert RGB image into grey-scale image. It is followed by applying DRLBP for texture extraction and DRLTP for obtaining face shape values. The face features values are then calculated to match the images in the database.

Then the mechanism is followed by the preprocessing stage. In this phase two steps are being performed.

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i.   The cropped RGB image is converted into the gray scale image with the pixel range of 128×128.

ii. The image is then resized to 256×256 pixels

The LBP and LDP techniques are applied to the resized image. DRLBP descriptor is used to extract the texture of every detected face. DRLDP descriptor is used to obtain the face shape values. The extracted unique features are then combined for further proceedings.

The image trained in the database is now processed. The features from the stored image are now extracted. The features extracted from the database and the input image is now compared using Euclidean distance. The faces of the students are recognized and the attendance is marked.

Database updating is performed in the institution's website by marking the presence and absence of every student. GSM modem is used to send the alert message for the parents whose ward was not present for the class.
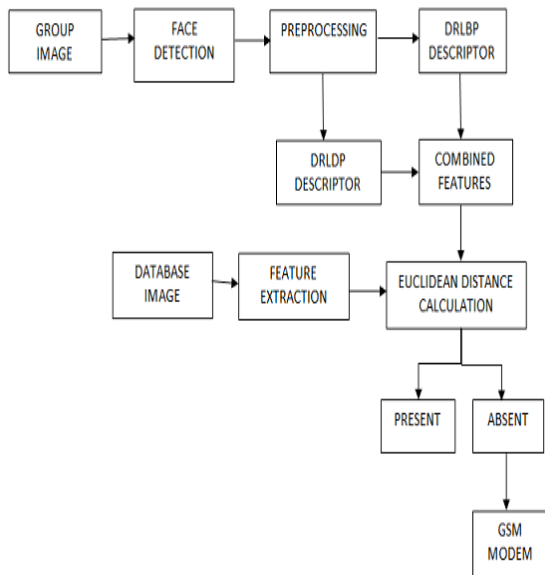
2.1.1 MODULE DESCRIPTION

2.1.2 FACE DETECTION

The first stage of face recognition is face detection module. In this phase a high quality group image is given as input. From the group image individual faces of the student is detected. This face detection is done using Viola-Jones algorithm using vision toolbox.

Face detection seperates the facial area by eliminating the noise and background images. It is a process to extract face regions from input image which has normalized intensity and uniformin size. The appearance features are extracted from detected face part which describes changes of face such as skin textures.

2.1.2 FACE EXTRACTION

Feature extraction is achieved using featured based technique for distinguishing between faces of different persons. Principal Component Analysis (PCA) is a statistical method used to extract the unique characteristics of the image.

In feature extraction stage the Discriminative Robust Local Binary Pattern (DRLBP) is used for different object texture and edge contour feature extraction process. DRLBP is als used to compare all the pixels including the center pixel with the neighbouring pixel in the kernel to improve the robustness against the illumination variation. The extracted facial features are matched with the database samples.

2.1.3 FEATURE MATCHING

The final phase of the system is feature matching process. The extracted features are compared to those stored in the database and decision are made according to the match. The query image feature will be matched with database image feature for person verification using Euclidean Distance Metric.

It is defined by,

$$Ed = sqrt(sum(Q\text{-}D_i).^2)$$

Where,

Q= input image features.

D= database features.

i= number of samples in the database 1 to N.

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 only (not recognition) - The goal is to distinguish faces from non-faces (detection is the first step in the recognition process).

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 AdaBoost to both select the best features and to train classifiers that use them.

This algorithm constructs a "strong" classifier as a linear combination of weighted simple "weak" classifiers.

$$h(x) = sign \left(\sum_{j=1}^{M} \alpha_j h_j(x) \right)$$

Each weak classifier is a threshold function based on the feature   .

$$h_j(x) = \begin{cases} -s_j & if \ f_j < \theta_j \\ s_j, & otherwise \end{cases}$$

The threshold value $\theta_j \theta_j$ and the polarity $s_j \in \pm 1 s_j \in \pm 1$ are determined in the training, as well as the coefficients $\alpha_j \alpha_j$

Here a simplified version of the learning algorithm is reported:

Input: Set of N positive and negative training images with their labels (x^i, y^i). If image ii is a face , if $y^i = 1$ if not $y^i = -1$.

1. Initialization: assign a weight $w_1^i = \frac{1}{N}$ to each image i.

2. For each feature f_j with $j = 1, ..., M$
    1. Renormalize the weights such that they sum to one.
    2. Apply the feature to each image in the training set, then find the optimal threshold and polarity θ_j, s_j that minimizes the weighted classification error. That is

    $$\theta_j, s_j = \arg\min_{\theta,s} \quad \sum_{i=1}^{N} w_j^i \varepsilon_j^i$$

    where

    $$\varepsilon_j^i = \begin{cases} 0 & if \ y^i = h_j(\alpha^i, \theta_j, s_j) \\ 1, & otherwise \end{cases}$$

    3. Assign a weight α_j to h_j that is inversely proportional to the error rate. In this way best classifiers are considered more.
    4. The weights for the next iteration, i.e. w_{j+1}^i, are reduced for the images i that were correctly classified.
3. Set the final classifier to

    $$(x) = sign \left(\sum_{j=1}^{M} \alpha_j h_j(x) \right).$$

The advantages of using Viola-Jones algorithm[7] are:

i) Feature computation is extremely fast and efficient

ii) Feature selection is efficient compared to other face detection algorithm.

iii) The scaling of image is replaced by scaling of features in each pixel.

CONCLUSION

The project presented the robust human face recognition system based on discriminative robust local binary pattern and LDP for automatic attendance system. The discriminative robust local binary pattern was used for different object texture and edge contour feature extraction process. A local directional pattern was used to extract the features from face regions to discriminate the illumination changes. These approaches were well used to identify the illumination changes, intensity distributions characteristics. Here, matching was done between input and original samples using Euclidean distance metrics. These features were useful to distinguish the maximum number of samples accurately Finally the simulated results shows that used methodologies provides better recognition rate with minimum error rate for all samples.

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