Improve the Performance of Face Recognition Using Feature Based and Teacher Learning Based Optimization Techniques

Gulave Sukdev Madhav
M Tech Scholar
PCST Bhopal, India
E-mail- smgulave@rediffmail.com

Prof. Surendra Vishwakarma
Department of CSE
PCST Bhopal, India
E-mail- s.vish83@gmail.com

ABSTRACT
In this paper proposed a face detection method based on feature selection and feature optimization. Now in current research trend of biometric security used the process of feature optimization for better improvement of face detection technique. Basically our face consists of three types of feature such as skin color, texture and shape and size of face. The most important feature of face is skin color and texture of face. In this detection technique used texture feature of face image. For the texture extraction of image face used Gabor feature extraction function, these function is most promising shape feature analysis. For the selection of feature and optimization of feature used multi-objective TLBO. TLBO algorithm is population based searching technique and defines two constraints function for the process of selection and optimization. For the evaluation of performance our proposed algorithm implemented in MATLAB 7.8.0 software and face image used provided by Google face image database. For numerical analysis of result used hit and miss ratio. Our empirical evaluation of result shows better prediction result in compression of PIFR method of face detection.

Keywords: - PIFR, Biometric system, Feature Extraction, TLBO.

INTRODUCTION
In recent years, face recognition has attracted much attention and its research has rapidly expanded by not only engineers but also neuroscientists, since it has many potential applications in computer vision communication and automatic access control system. Especially, face detection is an important part of face recognition as the first step of automatic face recognition. However, face detection is not straightforward because it has lots of variations of image appearance, such as pose variation (front, non-front), occlusion, image orientation, illuminating condition and facial expression. Many novel methods have been proposed to resolve each variation listed above. For example, the template-matching methods are used for face localization and detection by computing the correlation of an input image to a standard face pattern. The face is our primary focus of attention in social life playing an important role in conveying identity and emotions. We can recognize a number of faces learned throughout our lifespan and identify faces at a glance even after years of separation. This skill is quite robust despite of large variations in visual stimulus due to changing condition, aging and distractions such as beard, glasses or changes in hairstyle. The feature invariant approaches are used for feature detection of eyes, mouth, ears, nose, etc. The appearance-based methods are used for face detection with Eigen-face, neural network, and information theoretical approach. Nevertheless, implementing the methods altogether is still a great challenge. Fortunately, the images used in this project have some degree of uniformity thus the detection algorithm can be simpler: first, the all the faces are vertical and have frontal view; second, they are under almost the same illuminate condition. Face detection is used in many places now adays especially the websites hosting images like Picasa, photo bucket and Facebook. Face detection is the first step of face recognition system. Output of the detection can be location of face region as a whole, and location of face region with facial features (i.e. eyes, mouth, eyebrow, nose etc.). Detection methods in the literature are difficult to classify strictly, because most of the algorithms are combination of methods for detecting faces to increase the accuracy. Mainly, detection can be classified into two groups as Knowledge-Based Methods and Image-Based Methods. Face recognition systems have gained a great deal of popularity due to the wide range of applications that they have proved to be useful in. Broadly, two main categories for these applications exist: commercial applications and research applications. From a commercial standpoint, face recognition is practical in security systems for law enforcement situations. It is in places like airports and international borders that the need arises for a face recognition system that identifies individuals. Another application of face recognition is the protection of privacy, obviating the need for exchanging sensitive personal information. Instead, a computer-based face recognition system would provide sufficient identification. For instance, PIN numbers, user ID's, and passwords would be replaced by face recognition in order to unify personal identification. Finally, face recognition systems can be used for entertainment purposes in areas like video games and virtual reality [10]. In research applications, face recognition has opened the door for research in areas like image and video processing [1]. Section II discusses about Face recognition algorithms. Section III discusses about the proposed

methodology. Section IV discusses comparative result analysis. Finally, concluded in section V.

II FACE RECOGINITION ALGORITHMS

FEATURE-BASED APPROACHES

Feature-based approaches build upon explicit knowledge wherein features representing a face as defined by the designer are first extracted from images [4]. Face detection is thus achieved by verifying that with a certain degree of confidence. The features extracted from an image represent a face. Representative features are Eigen features, Hear-like features, and edge features. In the following, we briefly explain each feature. Eigen faces have long been used for face detection and recognition purposes. Principal component analysis (PCA) is performed on a set of training face images to obtain the Eigen vectors, which are called as Eigen faces. The projections of the mean adjusted face images along the Eigen vectors are used as the Eigen features for training and classification purposes.

Haar-like features are the digital image features used in object recognition. Viola and Jones [9] were the first to use Haar wavelets as a basis for developing Haar-like features. A Haar-like feature considers adjacent rectangular regions at a specific location in a detection window, sums up the pixel intensities in these regions, and calculates the difference between them. This difference is then used to categorize subsections of an image. Given that in all faces the region of the eyes is darker than the region of the cheeks, a common Haar-like feature for face detection is a set of two adjacent rectangles that lie above the eye and the cheek region. The position of these rectangles is defined relative to a detection window that acts like a bounding box to the face. A window of the target size is moved over the input image, and the Haar-like feature is calculated for each subsection of the image. This difference is then compared to a learned threshold to separate non-faces from faces. The key advantage of a Haar-like feature over most other features is its calculation speed, since a Haar-like feature of any size can be computed in a constant time by using integral images. The integral images can be defined as two-dimensional look up tables in the form of a matrix with the same size of the original image. Each element of the integral image contains the sum of all pixels located on the upper-left region of the original image. This integral image uses only four lookups to compute the sum of rectangular areas in the image, at any position or scale. Edge features are used to compute the edges of the image. The canny edge detector, Roberts's edge detector, and Sobel edge detector are commonly used to extract edge features. These edges normally represent the contour lines of the face, including eyes, eyebrow, lips, nose, and face boundary.

FEATURE EXTRACTION

Feature extraction can be defined as the act of mapping the image from image space to the feature space. Now days, finding good features that effectively represent an image are still a difficult task. In this literature, a wide variety of features are used for image retrieval from the database. Image content can differentiate between visual and semantic content. Features usually represent the visual content. Visual content can be further divided into general or domain specific. For example the features that can use for searching would be representing the general visual content like color, texture, and shape. On the other hand, the features that are used for searching human faces are domain-specific and may include domain knowledge. If we talk about the semantic content of an image is not easy to extract. Annotation and/or specialized inference procedures based on the visual content help to some extent in obtaining the semantic content. For each image in the image database, its features are extracted and the obtained feature space (or vector) that is stored in the feature database.

PRINCIPLE COMPONENT ANALYSIS

PCA is an algorithm developed by Turk and Pent land that treats face recognition as a two dimensional recognition problem [2]. The correctness of this algorithm relies on the fact that the faces are uniform in posture and illumination. PCA can handle minor variations in these two factors, but performance is maximized if such variations are limited. The algorithm basically involves projecting a face onto a face space, which captures the maximum variation among faces in a mathematical form. During the training phase, each face image is represented as a column vector, with each entry corresponding to an image pixel. These image vectors are then normalized with respect to the average face. Next, the algorithm finds the eigenvectors of the covariance matrix of normalized faces by using a speedup technique that reduces the number of multiplications to be performed. This eigenvector matrix is then multiplied by each of the face vectors to obtain their corresponding face space projections. Lastly, the recognition threshold is computed by using the maximum distance between any two face projections [2]. In the recognition phase, a subject face is normalized with respect to the average face and then projected onto face space using the eigenvector matrix. Next, the Euclidean distance is computed between this projection and all known projections. The minimum value of these comparisons is selected and compared with the threshold calculated during the training phase. Based on this, if the value is greater than the threshold, the face is new. Otherwise, it is a known face [2].

III PROPOSED METHODOLOGY

In this paper proposed a face group face detection algorithm. The proposed algorithm is a combination of Gabor transform and teacher learning based optimization technique. The Gabor transform well knows feature extraction in mode of texture. The texture feature is major part of face image. The extracted feature is optimized by teacher learning based optimization algorithm. The Teacher learning based optimization algorithm is basically based on dynamic population based optimization technique.

In this section discuss the proposed algorithm of face detection based on feature selection and feature optimization process. Initially used face image data base and passes through Gabor feature extractor and this feature extractor

gives a shape feature of face image database. The extracted shape feature passes through TLBO algorithm and selects the proper feature and optimized the feature and finally passes through the support vector machine for classification of feature and finally detected the face and calculates the hit and miss ratio of detected face. The process of algorithm discuss step by step in below section.

1. Select data set for feature extraction
2. apply Gabor transform function
3. Start generation of feature matrix in terms of texture data.
4. convert feature matrix as row wise and make vector of these feature
5. Initialized a number of student feature N=100
6. Compare the length of vector is student population
7. If value of feature greater than vector value
8. Processed for new set of student
9. Check the value of teacher factor value TF=1
10. After that generate new set of teacher.
11. These optimal value of teacher is passes through SVM
12. If the value of shape not classified go to the selection process of TLBO
13. Else optimized classified shape is generated.
14. the optimized texture feature passes through the liner support vector machine
15. support vector machine classified the texture value
16. finally detected the face
17. calculate the hit and miss ratio of input image
18. exit

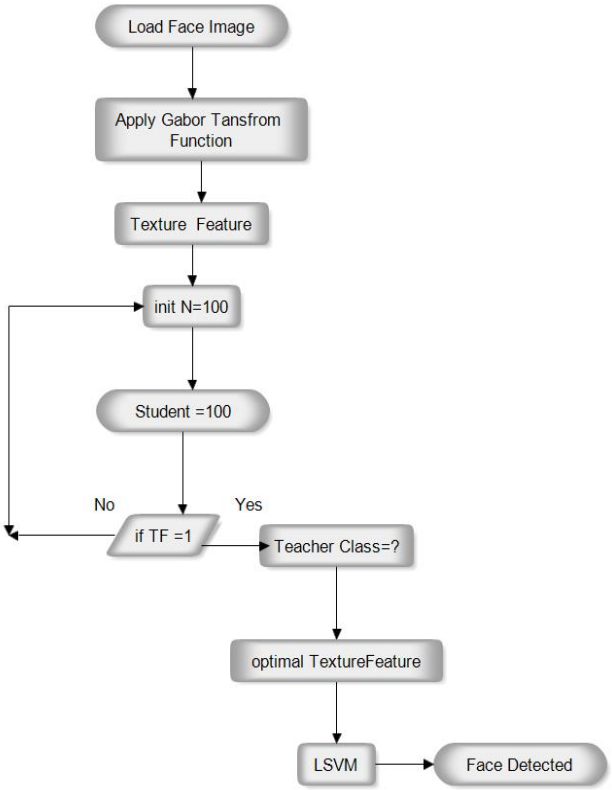

Figure 1: Block diagram of proposed model.

IV EXPERIMENTAL RESULT ANALYSIS

In this section discuss the comparative result analysis of previous algorithm with our proposed method used. To evaluate the performance of proposed method of Face detection we have use MATLAB software 7.8.0 with a variety of group image dataset used for experimental task. In this chapter we will describe the MATLAB simulation of the proposed face detection method. We will give the details of the simulation tool, input methods & formats, simulation steps, group image collecting and processing steps, feature extraction method and finally get result group images.

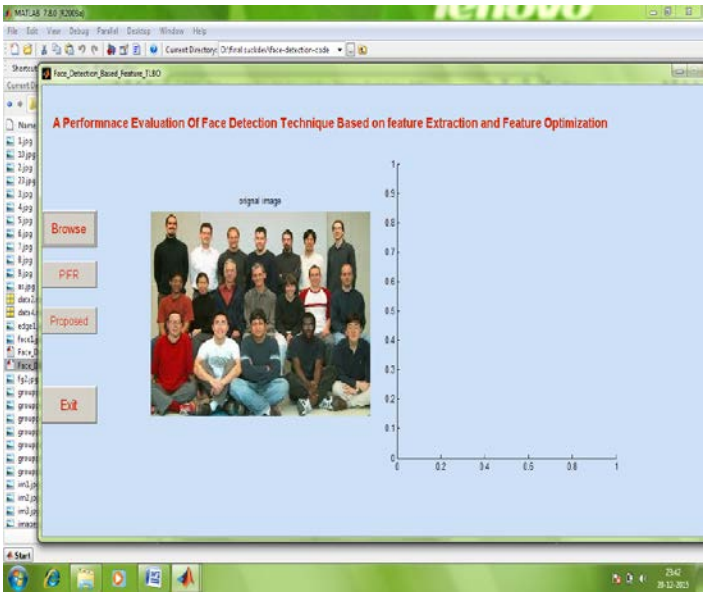

Figure 2: Shows that the input image 1 for face detection.

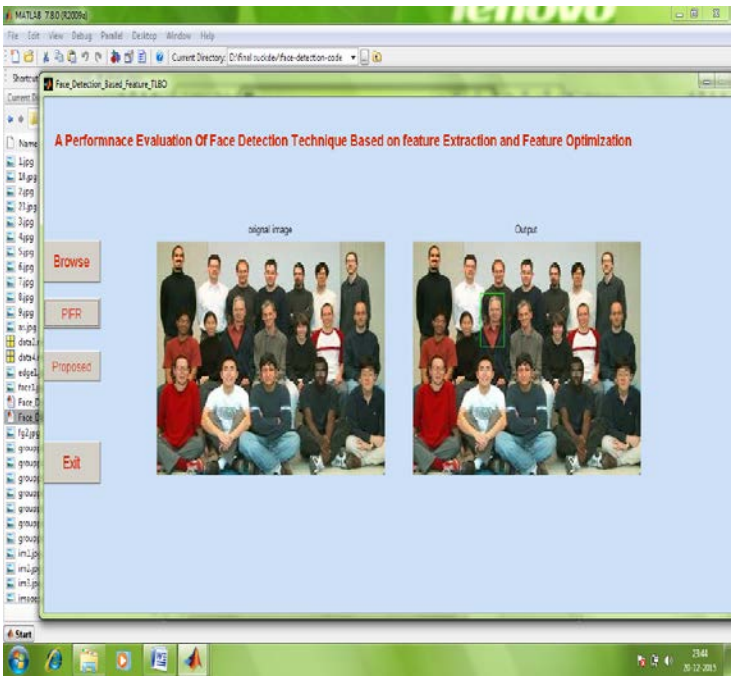

Figure 3: Shows that the result image 1 for face detection using PIFR method.

Figure 4: Shows that the result image 4 for face detection using PIFR method.

Group image name	Method	Total no of face	hit	miss	Detection ratio %
Group image 1	PIFR	19	17	2	90
	Proposed	19	18	1	95

Table 1: Shows that the comparative study for group image 1 with using PIFR and proposed method.

Group image name	Method	Total no of face	hit	Miss	Detection ratio %
Group image 2	PIFR	28	25	3	89
	Proposed	28	26	2	93

Table 2: Shows that the comparative study for group image 2 with using PIFR and proposed method.

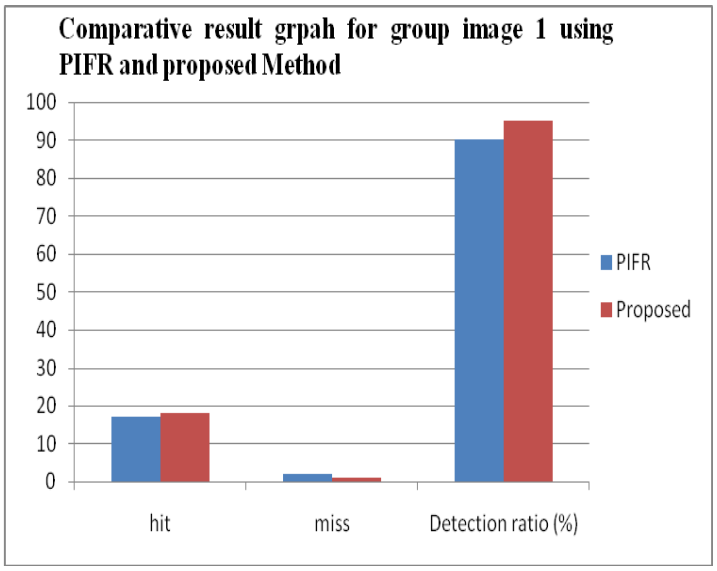

Figure 5: Shows that the Comparative result graph for group image 1 and find the no. of person in an image, hit ratio, miss ratio and detection ratio on the basis of PIFR and our proposed method, then we find that the our proposed method result is always better than the PIFR method.

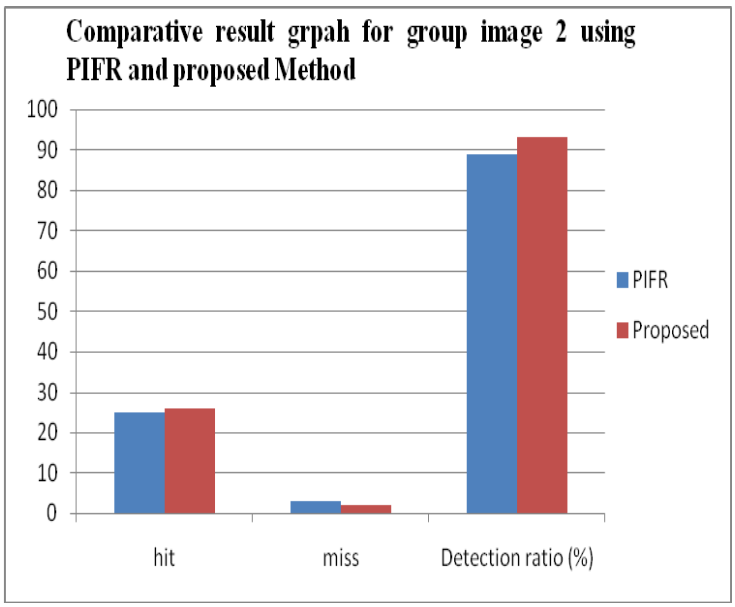

Figure 6: Shows that the Comparative result graph for group image 2 and find the no. of person in an image, hit ratio, miss ratio and detection ratio on the basis of PIFR and our proposed method, then we find that the our proposed method result is always better than the PIFR method.

V CONCLUSION AND FUTURE WORK

In this paper improved Face Detection System using Gabor feature extractor and features selection process by TLBO algorithm. After extraction of feature of face used feature optimizations technique for better selection of feature. The localized face image is transformed from layered form of

transform function for extraction of facial feature. The optimized feature selection process gives better result in compression of PIFR and support vector machine based detection technique. In the process of feature extraction we used Gabor feature extraction function, Gabor feature extraction process implied as shape feature.
The proposed method work in two phases in first phase used feature optimization and second phase used face detection. For the selection of feature and optimization of used two different functions in TLBO algorithm, the selection of feature process satisfied the given condition of feature constraints then select feature and passes through matching of feature for the process of optimization.

The proposed algorithm for face detection is very efficient in case of individual as well as group face. The proposed algorithm used Gabor feature extractor function with TLBO algorithm. The process of feature optimization and feature selection is very complex for two different constraints function of optimization and detection. The optimization and detection increase the time complexity but incase the value of hit ratio. In future reduces the time complexity of proposed algorithm and improved the efficiency of overall system.

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