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The Improved Perfromance of Face Detection Based on Partial Feature and TLBO

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***Abstract*— Face detection and recognition is important area of researcher in biometric security system. The changing of face expression and some physical component accrued for the process of face is major problem for face detection and recognition. For the improvement of face detection and recognition used various algorithm such as LBP, wavelet and many more function. In this paper proposed a hybrid method for face detection. The hybrid method of face detection is basically enhancement of local binary pattern method. For the improvement of LBP method used optimization technique for better face detection. The teacher learning based optimization is dynamic optimization technique and gives better result instead of PSO and ACO. The proposed algorithm implemented in MATLAB software and used Google image database for face detection. For the evaluation of performance used hit and miss ratio.**

***Keywords*— TLBO, Feature Extraction, Biometric Face Detection, Classification, LBP.**

I. INTRODUCTION

Biometric identification plays very important role in authentication and authorization. The process of authentication and authorization required security measure parameter for the validation of human identification. The identification of human, there are three major components are used such as face, finger and iris. The finger and iris is also important parameter for human identification. But the face detection and face recognition is major role in passport verification and document verification purpose [1, 2]. Nowadays fraud passport is issued by some illegal agencies. The authentication and validation of passport is major concern. We study various research and journal paper related to face detection based on feature extraction process. In feature extraction process the main problem is loss of face data and mismatch of face template. Some problem found in survey given below. The biometric community has long accepted that there is no 'template aging effect' for face detection, meaning that once you are enrolled in a face detection system, your chances of experiencing a false non-match error remain constant overtime.

The false match rate is how often the system says that two images are a match when in truth they are from different persons [5,6]. The false non-match rate is how often the system says that two images are not a match when in truth they are from the same person. Increase the ratio of miss decrease the ratio of Hit. In this paper modified the face detection technique based on local binary pattern. For the purpose of modification used teacher learning based optimization. The teacher learning based optimization algorithm is dynamic and memory based optimization technique. Here teacher based optimization technique optimized the local binary pattern for the better generation of template for the matching of facial data. For the extraction of feature point from the given image used various algorithm and method. But here used partial feature extractor. The partial feature extractor gives the boundary value of image for the creation of template. The creation of template used point of matching function for the process of matching and measure the score function for the process of detection [7,8]. Rest of this paper is organized as follows in Section II discusses about TLBO machine, Section III proposed algorithm IV. Experimental result analysis finally, concluded in section V.

II. TEACHER LEARNING BASED OPTIMIATION (TLBO)

The influence of a teacher on the output of learners in a class gives the effect of this optimization method. Unlike other population based methods it is also a population based method and it uses a population of solutions to proceed to the global solution. A group of learners constitute the population in TLBO [17]. Numbers of different design variables are there in any optimization algorithm. As seen in the other population-based optimization techniques, the different design variables in TLBO are similar to different subjects offered to learners and the learner's result is similar to the 'fitness'. The best solution so far is analogous to Teacher in TLBO since the teacher is considered the most learned person in the society. The process of TLBO is divided into two parts.

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The first part consists of the "Teacher phase" and the second part consists of the "Learner phase". The "Teacher phase" means learning from the teacher and the "Learner phase" means learning through the interaction between learners. In the sub-sections below we briefly discuss the implementation of TLBO.

Initialization

Following are the notations used for describing the TLBO

N: number of learners in class i.e. "class size"

D: number of courses offered to the learners

MAXIT: maximum number of allowable iterations

The population X is randomly initialized by a search space bounded by matrix of N rows and D columns. The jth parameter of the ith learner is assigned values randomly using the equation

$$x^{0}_{(i,j)}=x_j^{min}+rand\times\left(x_j^{max}-x_j^{min}\right) \quad \text{.....(1)}$$

Where rand represents a uniformly distributed random variable within the range (0, 1), xmin j and xmax j represent the minimum and maximum value for jth parameter. The parameters of ith learner for the generation g are given by

$$X^{g}_{(i)}=\left[x^{g}_{(i,1)},x^{g}_{(i,2)},\dots\dots\dots\dots x^{g}_{(i,j)}\dots\dots\dots,x^{g}_{(i,D)},\right] \dots\dots(2)$$

A. Teacher phase

Mg which is the mean parameter of each subject of the learners in the class at generation g is given as

$$M^{g}=\left[m_1^{g},m^{g}_{2,\dots\dots\dots\dots\dots m_j^{g,}\dots\dots\dots\dots\dots m_D^{g}}\right] \dots\dots\dots(3)$$

The teacher Xg Teacher for respective iteration is considered as the learner with the minimum objective function value. Shifting the mean of the learners towards its teacher takes place in the Teacher phase of the algorithm. A random weighted differential vector is formed from the current mean to obtain a new set of improved learners and the desired mean parameters and added to the existing population of learners.

$$Xnew^{g}_{(i)}=X^{g}_{(i)}+rand\times\left(X^{g}_{Teacher}-TFM^{g}\right) \quad \text{.....(4)}$$

TF is the teaching factor which decides the value of mean to be changed. Value of TF can be either 1 or 2.

The value of TF is decided randomly with equal probability as,

$$T_{F=round[1+rand(o,1)\{2-1\}]} \dots\dots\dots\dots\dots\dots(5)$$

Where TF is not a parameter of the TLBO algorithm. The value of TF is not given as an input to the algorithm and its value is randomly decided by the algorithm using Eq. (5). So many experiments are conducted on many benchmark functions and it is concluded that the Teacher based optimization algorithm performs better if the value of TF is between 1 and 2. If the value of TF is either 1 or 2, however, the algorithm is found to be performing much better and hence to simplify the algorithm, the teaching factor is suggested to take either 1 or 2 depending on the rounding up criteria given by Eq. (5). If Xnew is found to be a superior learner than Xg in generation g , than it replaces inferior learner Xg in the matrix.

B. Learner phase

This phase consists of the interaction of learners with one another or between them. The knowledge of the learners tends to increase by the process of mutual attraction. The random interaction among learners improves his or her knowledge. For a given learner Xg , another learner Xg is randomly selected (i≠ r). The ith parameter of the matrix Xnew in the learner phase is given as[18]:

$$Xnew^{g}_{(i)}=\begin{cases}x_i^{g}+rand\times\left(X_i^{g}-X_r^{g}\right) & if\ f(X_i^{g})<f(X_r^{g})\\ X_i^{g}+rand\times\left(X_r^{g}-X_i^{g}\right) & otherwise\end{cases} \quad \text{.....(6)}$$

III. Proposed Algorithm

This section describes the proposed algorithm of face detection based on feature selection and feature optimization process. Face image data base is used and passes through partial feature extractor at first and a shape feature of face image database is given by the feature extractor. The extracted shape features pass 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 calculate the hit and miss ratio of detected face [18]. The process of algorithm discusses step by step in below section. Here discusses the step:

1. Input F1,F2….Fn in O1,O2,……..On fo Ftotal population
2. Map feature to search space(Si, Oi)

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3. Define feature as teacher and pass
4. Do
5. feature each teacher do
6. feature each Oi do
7. Select next feature
8. End for
9. Estimate feature template
10. Passes through LSVM
11. If estimated value Vi equal to template, then
12. Load map (Oi, Si)
13. Update the face template
14. End if
15. End forG
16. Population is empty
17. Face is detected
18. Process is terminated

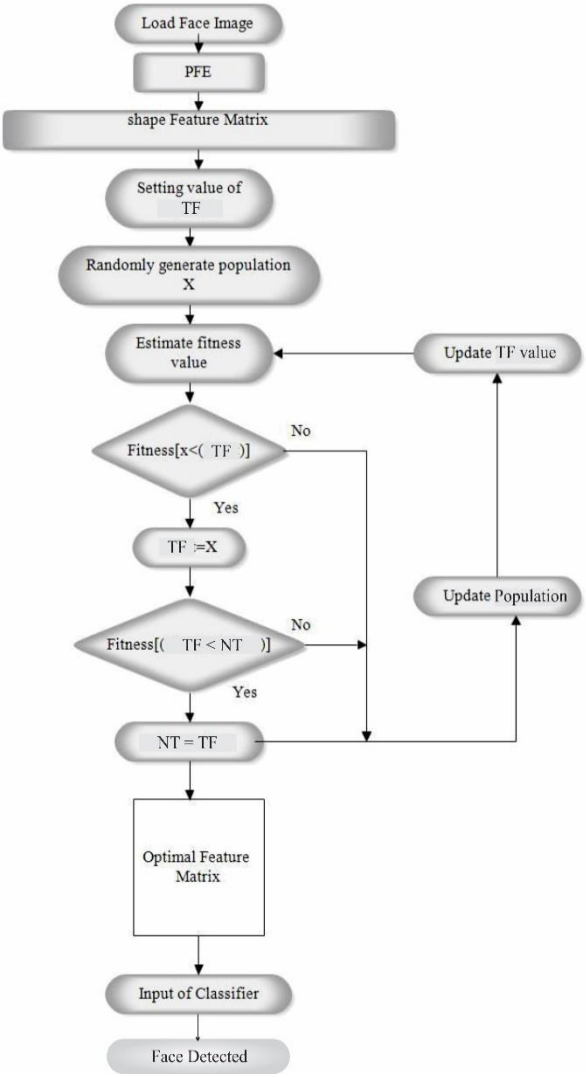

Fig.1. Shows the proposed block diagram of face detection

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IV. Experimental Analysis

In this section discuss the experimental result analysis. The proposed algorithm implemented in MATLAB software and used goggle image database for face detection. For the evaluation of performance measure hit and miss ratio of detected face.

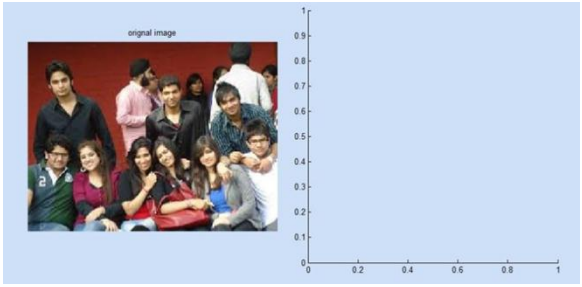

Fig.2. Shows the original input image 2 for face detection using LBP method.

Fig.3. Shows the result image 2 for face detection using proposed method.

TABLE I
SHOWS THE COMPARATIVE RESULTS FOR GROUP IMAGE 1 WITH USING LBP AND PROPOSED METHOD

Group Image Name	Method	Total No Of Face	Hit	Miss	Detection Ratio %
Group image 1	LBP	35	5	2	14.28
	Proposed	35	25	3	71.42

TABLE II
SHOWS THE COMPARATIVE RESULTS FOR GROUP IMAGE 2 WITH USING LBP AND PROPOSED METHOD

Group Image Name	Method	Total No Of Face	Hit	Miss	Detection Ratio %
Group image 2	LBP	15	1	1	6.66
	Proposed	15	3	1	20

TABLE III
SHOWS THE COMPARATIVE RESULTS FOR GROUP IMAGE 3 WITH USING LBP AND PROPOSED METHOD

Group Image Name	Method	Total No Of Face	Hit	Miss	Detection Ratio %
Group image 3	LBP	25	8	0	32
	Proposed	25	21	1	84

TABLE IV
SHOWS THE COMPARATIVE RESULTS FOR GROUP IMAGE 4 WITH USING LBP AND PROPOSED METHOD.

Group Image Name	Method	Total No Of Face	Hit	Miss	Detection Ratio %
Group image 4	LBP	6	5	1	83.33
	Proposed	6	6	4	100

TABLE V
SHOWS THE COMPARATIVE RESULTS FOR GROUP IMAGE 5 WITH USING LBP AND PROPOSED METHOD

Group Image Name	Method	Total No Of Face	Hit	Miss	Detection Ratio %
Group image 5	LBP	4	1	0	25
	Proposed	4	4	0	100

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In this section we show the comparative result analysis in the form of graph for various group images using for face detection on LBP and proposed method. The result shows the no. of person in a group images and we find the miss ratio, hit ratio and detection ratio for respective image. The summary of each group images describe below:

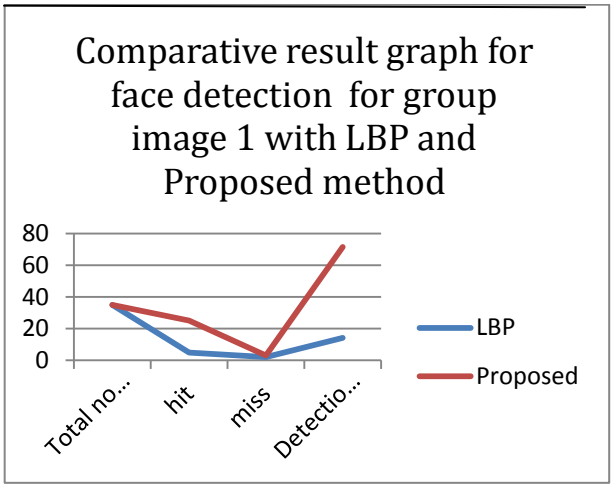

Fig.4. Shows that the Comparative result graph for group image 1 and find the no. of person in an image, hit ratio, miss ratio and detection ratio on the basis of LBP and our proposed method, then we find that the our proposed method result is always better than the LBP method.

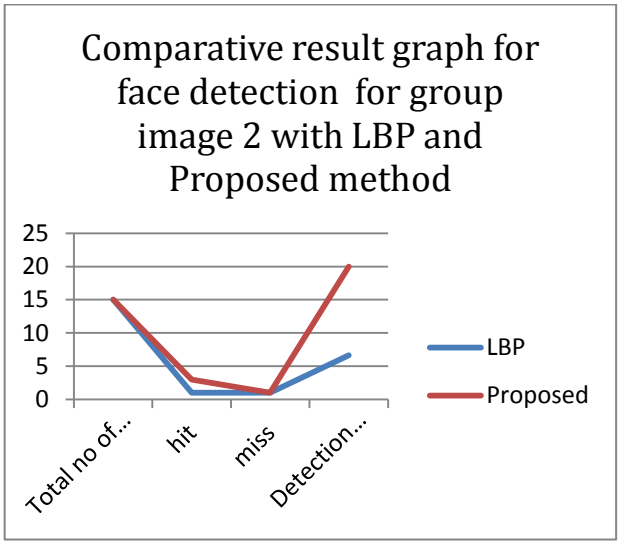

Fig.5. Shows that the Comparative result graph for group image 2 and find the no. of person in an image, hit ratio, miss ratio and detection ratio on the basis of LBP and our proposed method, then we find that the our proposed method result is always better than the LBP method.

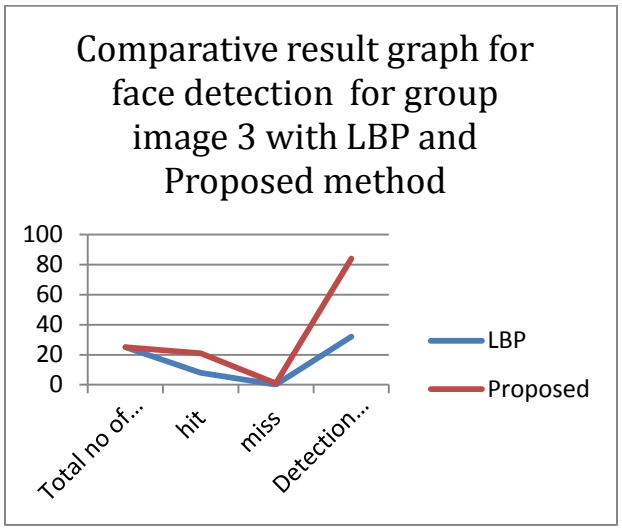

Fig.6. Shows that the Comparative result graph for group image 3 and find the no. of person in an image, hit ratio, miss ratio and detection ratio on the basis of LBP and our proposed method, then we find that the our proposed method result is always better than the LBP method.

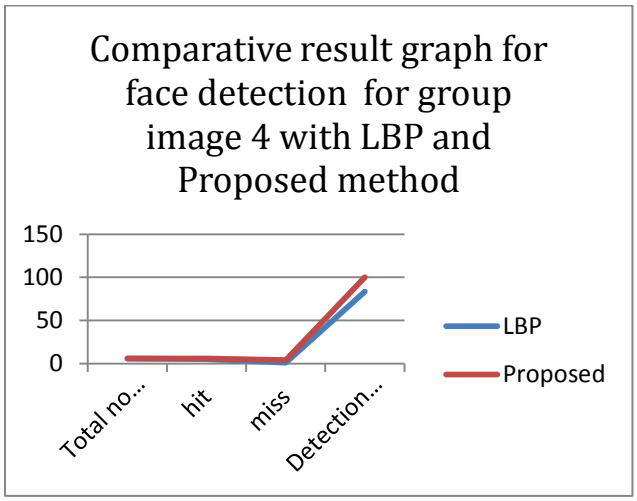

Fig.7. Shows that the Comparative result graph for group image 4 and find the no. of person in an image, hit ratio, miss ratio and detection ratio on the basis of LBP and our proposed method, then we find that the our proposed method result is always better than the LBP method.

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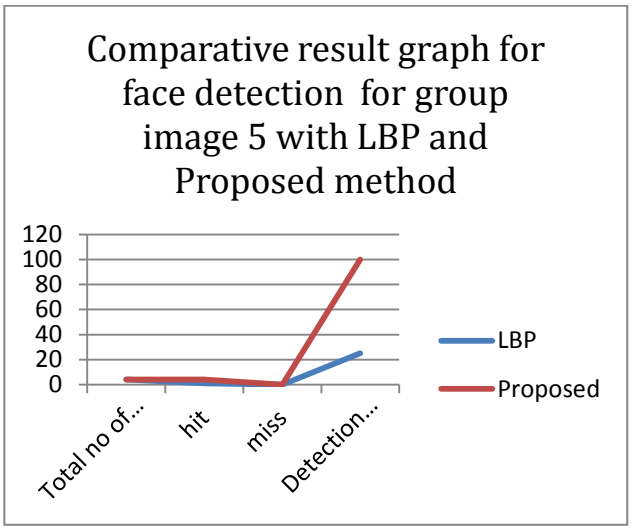

Fig.8. Shows that the Comparative result graph for group image 5 and find the no. of person in an image, hit ratio, miss ratio and detection ratio on the basis of LBP and our proposed method, then we find that the our proposed method result is always better than the LBP method.

V. Conclusion And Future Scope

In this paper proposed the hybrid method of face detection. The hybrid method is combination of partial feature extractor and teacher learning based optimization technique. The teacher learning based optimization technique optimized the feature of face data and improves the performance of face detection. The proposed algorithm implemented in MATLAB software and for the validation of algorithm used goggle image dataset. For the evaluation of result used hit and miss ratio of face image. The proposed method gives better result instead of LBP method. The improved method of face detection increases the time complexity of detection. Now in future reduces the time complexity of algorithm.

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