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Feature Extraction and Selection Based Face Recognition Image using Multi-layer Classification Algorithm

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***Abstract**: FR (Face Recognition) starts with feature extracting the co-ordinates of features like as a width of wyes, pupil area and compare the consequence with the measurements deposited stored in the database and return the closest dataset in facial parameters. In current years, there are a lot of face recognition methods and techniques search and developed around the world. FR becomes an interesting research area and topic. It is established by several number of published papers regarded with FR add inf FE (Feature Extraction), FS (Feature Selection), Facial Algorithm Enhancements and Face recognition designs. The research work are to get the face recognition method (key points) given by the Scale and Localization by comparison with the existing work and algorithms. Feature Extraction using Scale Invariant Feature Extraction Algorithm. SIFT is significantly more effective strategy and extract the features in the form of key-points. Reduce the feature data using ant colony optimization algorithms are computer programs that simulate the procedures of natural evolution in arranging to solve complex and to model evolutionary systems. Classify and Recognition the reduce features i.e. Multilayer Perceptron neural network. Key-point and Select Features implement inside the Bank and Attendance System returns between 70 per cent to 90 per cent same for Real Face Images. In simulation Tool using MATLAB 2016a and enhance the accuracy rate and reduce the error rates in the given system.*

***Keywords:-** Face Recognition, Feature Extraction (SIFT), Selection Features (PSO) and Classify.*

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I. Introduction

Face Recognition is biometric software that maps features of an individual and stores the data as the face prints. The digital image stored as face print verifies the identity of an individual. The authentication and the identification of the face recognition used in high quality cameras[1]. The face recognition system consists of three steps. The basic flowcharts are described. The detection may include face edge detection, segmentation and localization, namely obtaining a pre-processed intensity face image from an input scene, either simple or cluttered [2], locating its position and segmenting the image out of the background. Feature Extraction denotes the acquirement of image features from the image such as coefficient feature, algebraic feature and attributes image[3].

Face recognition represents classification of the above image features in term of criteria. Segmentation consists of three steps which may be trivial, easy and simple for many applications which include mug shots, driver's licenses, personal ID card, and passport pictures[4]. The different people have more interest on addressing and devoted to segmentation. The face recognition system has the complex background structure.

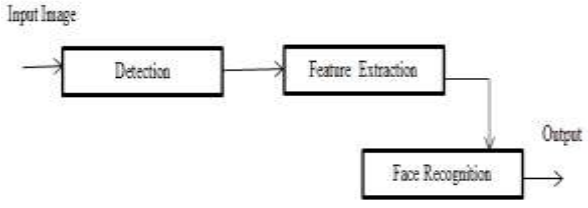


Fig 1. Flow chart in Face Recognition [5]

The application of face recognition are (i)Improved Security (ii) High Accuracy (iii) Fully Automated (iv) Automated crowd surveillance. (v) Access Control.

The main issues in face recognition system. Face Recognition is a main challenging issue in the area of digital image processing. Face Images acquired from dissimilar sources might sensitive to interferences and lighting situations. Detect of face from low-resolution and distorted is main difficult task. Also, the dimensionality of image acquired may be very huge. To resolve these issues there is required to perform some pre-processing methods or approaches. Pre-processing data images are helpful to get better accuracy rate and to enhance the performance of the system[6].

In SECTION I explained the face recognition system, process, application in face recognition and main challenges. SECTION II described that the various paper survey and defined in pointwise. In Section III. System implementation means described the methodology in proposed work and IV section explained the performance metric , conclusion and future work explained in section V.

II. Literature Survey

Ahmed El Sayed et al., 2017[7] explained on effects of the state of arts of algorithm in the field of image resolution. In this research the functionality of the algorithm, various before and after 3D face alignment cases are demonstrated using the images and labelled faces of data set. The final images are tested recognition protocol and supervised algorithm. In this research, the performance of unsupervised face recognition labelled images was recognised using single image algorithm. The effect of algorithm in recognition process was investigated. The super recognition algorithm enhances the resolution of image and additional feature was added in image. In this research, super image algorithm was implemented based on Convolution Neural Network. In this research the image peak signal to noise ratio generates high resolution image.

Jalendu Dhamija et al., 2017[8] Studied on understanding the pre-existing face recognition and face detection algorithm .In this research the recognition of image with better accuracy , high speed and efficiency, in this way it helps to protect the privacy of people and hackers. The facial database demonstrates the differentiation in conditions such as poses and emotions .In this research face was recognised for the image of live video. The better and efficient surveillance and security and in government organisations the authentication procedure was increased to avoid the crimes and frauds .Moreover, the recognition of face recognise high efficient image in live video.

Edy Winarno et al.,2017[9] analysed on the dual vision of the face recognition based on pre-processing based on extraction model. The three level Wavelet Decomposition - Principal Component Analysis (3WPCA) was used for face recognition. The research based on face recognition and face data recognise the accuracy of data with 98%. In this research, the face recognition based on the pattern of facial symmetry and the facial geometry was used include the face, nose and cheeks on human face. The pattern of the face recognition based on vertical axis of the face. The face recognition and face detection based on the division of the half face or full face research. In this research, the face recognition model used to produce 2D images on camera lens. The face recognition technique, the two images are joined and the left image on left lens and the right image on right lens. In this research the process of the face recognition, face recognition model used to recognise the face image data. The propose research use face recognition method with dual vision camera by using 3WPCA as a face feature extraction.

Min Yao et al.,2016[10]detailed on the SVM(support vector machine) and PCA(Principal Component Analysis) methods used for reducing the input images and facial features of image. In this research it was analysed by the recognition of the face systems and data are provided to improve the performance of the two systems based on expressions and face variances. The face recognition has commercial attention from last few decades. In this research two face recognition systems adopts SVM (support vector machine). The comparison between two face systems analysis and face data base sets. The images are also tested based on various conditions.

R. Prema et al.,2017[11]proposed on the identification of the twins and similar faces multi scale fast radial symmetry transform technique and Gobbar filter technique. When the faces are not similar, the Gabor filter was used. The multi scale fast radial symmetry was used to differentiate identical twins with similar faces based on the facial features. In face recognition technology, a lot of research was done on face recognition system. Still there was need of enhancement of the facial recognition system due the low performance and under practical conditions. In face recognition technology, recognition of the face image and authorised person .In this research the main focus was done techniques and algorithms for differentiating the the identical twins having similar faces.

III. System Implementation

In this section explained that to extract the reasonable data in a facial image, train it as robustly as possible. Then, revenue a novel facial image[12], extract the features of novel facial image and match-up its feature with the characteristics of trained facial images. Proposal work used to complete these jobs/ tasks can be verified in methods used to perform single part of the system.

Image Acquisition in Face Image

Search a face recognition data set (Yale) form the uci machine repository site download it . Upload the face image from the database. Convert the original image to gray scale image cause of reduce the original image pixel size. Identify the noise level in the gray scale image and reduce the attack or noise in the image. Because of quality is maintained.

Data Pre-processing in Face Image

Apply edge detection approach i.e canny for edge detection based on threshold values (Maximum and Minimum values in face images).

Edge Detection that uses a multi-stage method to detect a world-wide range of regions in face images. It is a method to extract use-ful model data from dissimilar computer vision objects and dramatically optimize the amount of information to be processed. The main criteria for edge detection add:-

(i) Image detection of edge with less error rate which means that the detection should highly catch as several edges defined in the face image as possible.
(ii) Edge detection point from the algorithm shall precisely localize on the centre of edge.
(iii) Define image should be obvious once and where possible picture distortion should n't generate wrong edges.

Feature Extraction Using Scale Invariant Feature Transformation Algorithm

Feature Extraction using Scale Invariant Feature Extraction Algorithm. SIFT is significantly more effective strategy and extract the features in the form of key-points.

SIFT algorithm has been implemented for feature extract that are in-variant to moving, scaling and partially in-variant to rotation, scaling and half in-variant to alters in illumination transformation from images to perform matching of dissimilar scenes of an objects. The consequence characteristics are high distinctive.

The main steps are used :-

(i) Localization in Scale Space
(ii) Removal of Weak points
(iii) Assign Rotation and
(iv) Descriptor Build-up [13]

Feature Selection Using ACO (Ant Colony Optimization) Algorithm

Reduce the feature data using ant colony optimization algorithms are computer programs that simulate the procedures of natural evolution in arranging to solve complex and to model evolutionary systems. The reliability of original ants to search a smaller routes is normally due to their dropping of pheromone as they travel or move, individual ant prob refers to follow a direction highly rich in this solution (Chemical). In this Pheromone decays over-time, consequence in minimum pheromone on less paths. Assume that over-time the smaller route will have the higher-rate of ant traversal, in this route will be re-inforced and the others reduced till every ants follow the similar, smaller route[14].

Classification of the face Images

Classify and Recognition the reduce features i.e Multilayer perceptron neural network. Network of Neural is a computational scheme inspired by the arrangement, dispensation technique, and knowledge ability of an organic brain[15]. The essential dispensation rudiments of neural systems are named artificial neurons. It is simplifying arithmetical mold of the neuron.

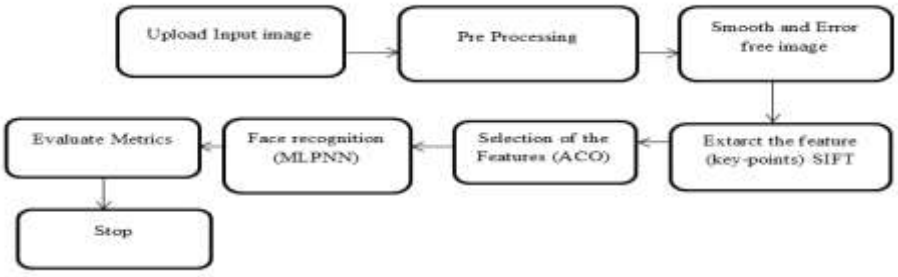


Fig 2. Proposed Flow Chart

IV. Performance Metrics

Evaluate the performance parameters i.e False acceptance rate, False rejection Rate and Accuracy and compare the existing performance parameters i.e accuracy. It shows that the training step and testing step. In training step is collection the raw data using YALE database face images. In this is downloading by the UCI machine learning Repository Site. The testing steps to compare the face image in train database then recognize the facial. Defines that the clicks the upload button then search the pathname and filename from the dataset.

Evaluate the performance parameters i.e False acceptance rate, False rejection Rate and Accuracy and compare the existing performance parameters i.e accuracy.

1. **False Acceptance Rate:** The false acceptance rate, or FAR, is the measure of the likelihood that the biometric security system will incorrectly accept an access attempt by an unauthorized user. A system's FAR typically is stated as the ratio of the number of false acceptances divided by the number of identification attempts.

$$\mathbf{FAR}=\frac{\textbf{Total no.of illustrations}-\textbf{No.of illustrations Falsely accepted}}{\textbf{Total no.of illustrations}}$$

2. **False Rejection Rate:** The false recognition rate, or FRR, is the measure of the likelihood that the biometric security system will incorrectly reject an access attempt by an authorized user. A system's FRR typically is stated as the ratio of the number of false recognitions divided by the number of identification attempts.

$$\mathbf{FRR}=\frac{\textbf{Total no.of illustrations}-\textbf{No of illustrations falsely accepted}}{\textbf{No of illustrations}}$$

3. **Accuracy :**The accuracy of a test is its ability to differentiate the patient and healthy cases correctly. To estimate the accuracy of a test, we should calculate the proportion of true positive and true negative in all evaluated cases. Mathematically, this can be stated as:

Accuracy=TP+TN/ TP+TN+FP+FN

Where TP is True Positive, TN is True Negative, FP is False Positive and FN Is false negative.

Fig 3 Upload Image, Gray scale Image and Image Histogram

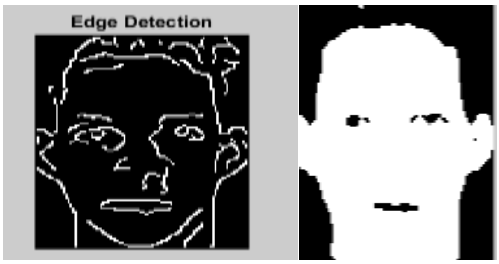
Fig 3 defined that to upload the real face (YALE) image from the database. Second one to convert the original image to gray-scale form cause of optimize the image pixel-size in the real image. We plot the histogram of the original image, which is search the minimum and maximum frequency of the image number of bits.

Fig 4. Distorted Image (Poission , Salt & Pepper)

The above figure 4 shows the noisy image. We add two type of distortion in the gray scale image i.e salt and pepper , Poisson noise . An image containing salt-and-pepper noise will have dark pixels in bright districts and optimistic pixels in dark regions. It generates Poisson noise from the data instead of adding artificial noise to the data.

Figure 5. Filtered Image

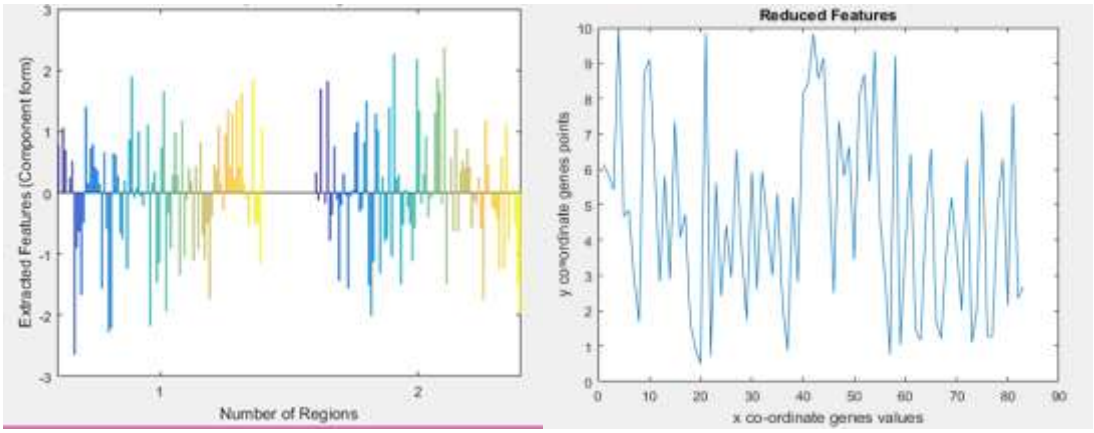
The above figure 5 shows that the filtered face image using 2D transformation algorithm which is convert the noisy image into the 2D matrix. It is desirable to be able to perform some type of interference removal on an image. The 2D transformation filter is a non-linear digital filtering approach. Given used to remove noise.



(i) (ii)

Figure 6 (i) Edge Detection and (ii) Segmentation Facial Image

Fig 6 (i) defined that the edge detection means to detect the individual edges in the gray- scale image. It is uses a multi-stage technique to detect a wide range of edges in images. The figure 6(ii) shows that the segmentation is defined in the gray intensity histogram of the left sub image components; a line is constructed between the highest histogram value and lowest histogram value. The histogram values representing the subtracted area have been ignored. This technique is particularly effective when the object pixels produce a weak peak in the histogram.



(i) (ii)

Fig 7. (i) Feature Extraction Using SIFT algorithm and (ii) Optimization Process

The above figure 7(i) shows that the feature extraction using SIFT algorithm. It fetch the unique properties of the face image and stored the data in matrix format. Feature extraction algorithm is used for detecting static feature points of an image. Every such point provides a set of feature that describes a small image region around a point.The above 7 (ii) figure shows that the selected feature based on ACO algorithm. is used to find the approximate solution to difficult optimization problems. A set for of software called as artificial ants for the optimization problem. The process of finding the best path on a weighted graph is the method of solving the transformation problem. The artificial ants build the solution by moving the graph and the process is called as pheromone model. In pheromone model nodes and edges of the graphs are modified at the runtime by the ants. Ant Colony Optimization (ACO) is a probabilistic technique for solving the computational problems.

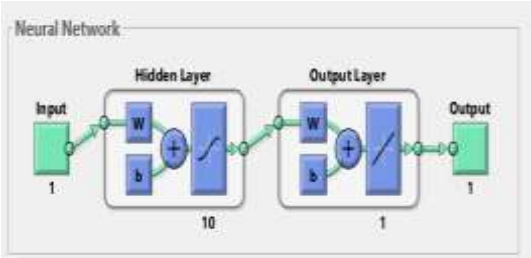
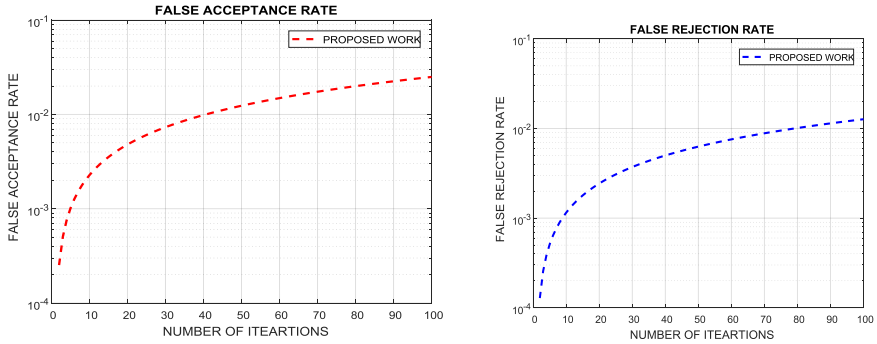


Fig 8. MLPNN Algorithm

Above figure shows that the classification architecture to show the Multilayer Perceptron Neural Network the units are arranged in the nodes. Each layer have fully connected network and composed of the nodes [6]. Each MLP composed of minimum three layers i.e, one input layer, one or more hidden layer and other is the output layer. The input layer distributes the input to the subsequent layers. Each hidden and the

output node have threshold value associated with weights. Each hidden nodes have nonlinear activation functions and the outputs have linear activation functions. Hence, each signal of the node feeding into a node in a subsequent layer. The subsequent layer has the original input multiplied by a weight with a threshold added which is passed through an activation function that may be linear or nonlinear.



(i) (ii)

Figure 9 (i) False Acceptance rate (FAR) and (ii) False Rejection Rate (FRR)

The above figure 9 (i) is also a performance parameter as show how the system working and classify the biometrics. As much as low FAR shows better classification of a classifier. Here in the above figure the calculated values as show better results on the behalf of number of iterations. Fig 9(ii) False rejection rate is also used to check the classification and overall performance. Higher of FRR show high accuracy of detection the biometrics and user authorizations. In the above figure is shows better quality classification with higher rate of false rejection rate.

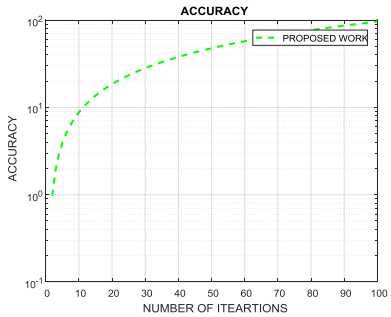


Figure 10. Accuracy

On of the most important parameter is accuracy. it shows the overall results and closly matching with the actual. Higher accuracy shows the better performance of the system as in the figure the accuracy of the developer algorithm is more than 96%.

Table no. 1 Performance Parameters MSE proposed parameters

Number of Iterations	False Acceptance Rate	False Rejection Rate	Accuracy
20	0.0042	0.0023	96
40	0.0111	0.0053	96.5
60	0.0151	0.0079	97.5
80	0.02994	0.0107	98.2
100	0.02574	0.0129	98.8

Table no. 1 Describes that the performance parameters in proposed work (Mean square error , false acceptance rate, false rejection rate and accuracy). Table 2 below defined that the comparison accuracy rate with different number of iterations 100,200 and 300 in PSO-MLPNN, RBF and ANN Network.

Table no.2 Comparison Parameters

Number of Iterations	Proposed Work (PSO-MLPNN) Accuracy Rate	ANN Accuracy Rate	RBF Accuracy rate
100	95%	89%	75%
200	97%	90%	83%
300	98.2%	92%	90%

V. Conclusion And Future Scope

Face Recognition is a very complex system, because human faces alter depending on their age, terms etc. It is a lot of expressions for a human-being. So, it is n't possible to study all kinds of terms into the network. Face recognition localization approach is implemented and a novel feature extraction, selection and MLPNN approach is developed for human facial recognition.The MLPNN structure combined with ML and AF functions is designed and the network is trained and tested section. From these consequences, it concluded that recognition accuracy rate attained by this technique is very high. In this approach can be suitably prolonged for images and facial images with altering background. The major aim of our face recognition system was to obtain a structure that is simple to learn that is minimization of learning interval period, respond –well with dissimilar face terms with distortion input and select the feature and optimize the recognition as possible. In our research work, we utilized YALE face dataset with MLPNN algorithm for supervised learning because novel approach takes various feature extract, select and classify. Then improve the accuracy rate and reduce the false acceptance rate and error rates.

The future work, can to develop an effective method for face detection and scaling. The system is to not real-time. So, it requires to acquire and process image normally. Next phase , can develop a real-time system which acquire and process facial images automatically and convert it into the raw-format.

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