An Advance 2D Face Recognition by Feature Extraction (ICA) and Optimize Multilayer Architecture

Rajwant Kaur
Department of Computer Science
Chandigarh Group of Colleges
Landran, India.
rimmysaini13@gmail.com

Dolly Sharma
Department of Computer Science
Chandigarh Group of Colleges
Landran, India.
dolly.azure@gmail.com

Amit Verma
Department of Computer Science
Chandigarh Group of Colleges
Landran, India.
dramit_verma@yahoo.com

Abstract - **Facial recognition has most significant real-life requests like investigation and access control. It is associated through the issue of appropriately verifying face pictures and transmit them person in a database. In a past years face study has been emerging active topic. Most of the face detector techniques could be classified into feature based methods and image based also. Feature based techniques adds low-level analysis, feature analysis, etc. Facial recognition is a system capable of verifying / identifying a human after 3D images. By evaluating selected facial unique features from the image and face dataset. Design from transformation method given vector dimensional illustration of individual face in a prepared set of images, Principle component analysis inclines to search a dimensional sub-space whose normal vector features correspond to the maximum variance direction in the real image space. The PCA algorithm evaluates the feature extraction, data, i.e. Eigen Values and vectors of the scatter matrix. In literature survey, Face recognition is a design recognition mission performed exactly on faces. It can be described as categorizing a facial either "known" or "unknown", after comparing it with deposits known individuals. It is also necessary to need a system that has the capability of knowledge to recognize indefinite faces. Computational representations of facial recognition must statement various difficult issues. After existing work, we study the SIFT structures for the gratitude method. The novel technique is compared with well settled facial recognition methods, name component analysis and eigenvalues and vector. This algorithm is called PCA and ICA (Independent Component Analysis). In research work, we implement the novel approach to detect the face in minimum time and evaluate the better accuracy based on Back Propagation Neural Networks. We design the framework in face recognition using MATLAB 2013a simulation tool. Evaluate the performance parameters, i.e. the FAR (false acceptance rate), FRR (False rejection Rate) and Accuracy and compare the existing performance parameters i.e. accuracy.**

Keywords- **Face recognition; Features of face; Eigen values and Vectors; Neural Network.**

I. INTRODUCTION

Normally, a facial recognition study has a main focus on the features such as expression, pose, quality, disguise and plastic surgery and most of the times, these trials or characteristics are identified individually. Although, a real world submissions the methods to manage unrestrained situations, where videos and pictures have various features. For example, pose and blur could be present in an individual video and picture pose could be experiential infamous celebrity pictures. Various research exertions are recently underway to implement effective methods for unrestrained structures and huge amount research projects such as MATLAB 2013a simulation tool used [1].In existing study, various mathematical model designs have been proposed for identifying, single characteristics in facial recognition, such as matching and verification. Although, it's challenging to implement math's model that identify several similar features. The designing math's structures given require labeled training data with information require considered training data with information about every feature which is very costly to gain [2].

In current years, various illustration knowledge based approaches have been proposed to identify the experiment of unrestricted face recognition. Amongst these methods, Machine learning methods have shown encouraging approaches have defined talented consequences near towards enhancing state of art in facial identification. In this research, we performed a segmentation approach using Zack Algorithm to detect the region based on threshold and feature extraction using the PCA algorithm to extract the features based on Eigen Values and Vectors In this algorithm detect the regions in texture forms. After that, for feature extraction, we implement the ICA (Independent Component Analysis) Algorithm to extract the features in texture form i.e called Component analysis. It defines a model for the experimental multi-variant information, which is normally defined as a huge data set of sample images. The variables are supposed non-Guassian and changes independent and they are known as ICA algorithm of the considered data. This ICA algorithm also called factoring and base data could be found by ICA[3,4].

The Back Propagation Neural Network used for classification purpose. In this algorithm design the two phase's i.e, training section and training section. In the training section to train the optimize features. In this algorithm train the data based on hidden neurons. Then testing phase, we use simulation tool to analyze the results[5,6].

II . RELATED WORK

Changxing Ding, Dacheng Tao, 2016 [7] author did their research on face recognition on the basis of some video contents. In this field the main problem is moving objects in a video may degrade the quality of an image so it's hard to classify the object in the system. Author use Convolutional Neural Networks (CNN) to enhance the performance of the system. It classifies the objects based on artificial intelligence and provide high accuracy rate in VFR. First step in this research is to train the CNN with existing dataset along with still images. The overall process is handled with the help of feature set. Trunk-Branch Ensemble CNN performs the automatic face detection with selection of facial features to reduce the error probability. The proposed approach to performing, the better in terms of various parameters evaluated in this research. The performance evaluation is based on COX face videos, PaSC videos and youTube videos. **Ningthoujam Sunita Devi, K.Hemachandran, 2016 [8],** the most powerful system is face recognition used for image content analysis and access the properties of various images to understand their relations. Author proposes the hybrid approach to perform the face recognition with SVM classification. Some feature extraction techniques are also used for the classification like PCA, Wavelet transformation. Some other term Euclidean Distance is used to analyze the similarity factor for uploading image to find the most common content from the training set. Various parameters are used to compare the proposed system's performance and compare with other systems that already exist. The parameters, accuracy and time are compared to check the performance of the proposed system. The accurate is higher in proposed approach and able to recognize more efficiently from the dynamic dataset. **Angshul Majumdar, Richa Singh, Mayank Vatsa, 2016 [9], the** author used the face verification with a image feature extraction and learning system. The proposed system is based on class of extracting features. The author divides the feature on the basis of class system and with the help of that training it's easier to find the solution of test data in the system. The proposed model is a multi-layer concept in this research. The processing of dataset is derived through multiple layers to manage the high accuracy rate. The two databases PaSC and LFW are used to check the presentation of the proposed approach. The proposed approach shows improved results as compared in the research. **E.Varadharajan,R.Dharani, S.Jeevitha, B.Kavinmathi, S.Hemalatha, 2016 [10],** author did their research to find the face similarity and recognize for verifying the face in attendance system. It is a biometric system which can helps to verify the face and mark as attend and absent. The proposed approach worked on real time captured images from the class room and recognize the student with any human interaction to process the attendance. Proposed approach use Eigen method to recognize the faces from the captured image and provide the classified data in terms of attendance. In this the Eigen feature set is a combination of various Eigen vectors which can improve the vision possibility of an automatic computer system. **Yashaswini M.J, V.S. Vishnu, 2016 [11],** in real world various applications is used to recognize the facial properties. The different layers of levels are used in this process to find the correct sample of facial image. The first step is preprocessing which helps to find the right object from the image and eliminate the noise factor and another problem which could disturb the presentation of the system. In a next step the feature extraction process used to find the unique properties of a facial sample and train the dataset to construct the knowledge-based for enhancing the accuracy level of detection. In the last phase the classification takes place which provides the similarity factor of uploaded content and their knowledge base. The proposed approach worked with a neural network, which classify the images with the help of their hidden layer processing system and provide high accuracy rate for object detection.

TABLE 1. LITERATURE SURVEY REVIEW IN FACE RECOGNITION

Author Name	Technique Used	Gap /Problems	Parameters
Changxing Ding [2016]	Trunk-Branch Ensemble CNN	Video-to-Video Maching	False Positive Rate and False Negative Rate
Ningthoujam Sunita Devi [2016]	PCA,SVM and Gabor Filter	Semantic Gap	Recall, Precision and F-score
Angshul Majumdar [2016]	Supervised and Deep Learning	Non-convex Problem.	FAR (False Acceptance Rate)
E.Varadharajan[2016]	Principle Component Anaylysis	Computer vision problem	Recognition Rate
Yashaswini M.J [2016]	PCA and FFNN		Accuracy

III. ISSUES IN FACE RECOGNITION

Face recognition is a poster recognition job evaluated definitely on facials. It could be labelled as categorizing a facial either "known" or "unknown", after associating it with deposits called individuals. It is also necessary to have a system that has the ability of learning to recognize unknown faces [12]. Computational representations of facial recognition must discourse numerous problematic issues. This exertion rises from the fact that expressions must be categorized in a way that best utilizes the available face information to distinguish a particular face from all other faces. Faces pose a particularly difficult, problematic in this respect since all faces

are similar to one additional in that they comprise the same set of geographies such as eyes, nose, and mouth agreed in incompletely the same manner. In interpretation of the high rate of crime, fraud and terrorism in the world today, it is becoming increasingly more important to have remote monitoring systems that work well with other security devices. As safety threats and deceptions become increasingly rampant, it is necessary to have systems that allow recognition and monitoring of unauthorized people being in an area, using equipment.

IV. PROPOSED MODEL

In Facial recognition, where the concept the face image is saved in database and used other applications. Face recognition system consists of:

- Image acquisition
- Pre-processing
- Feature Extraction
- Optimization
- Classification
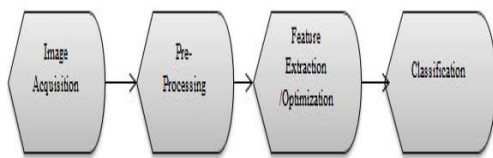
Fig 1 Proposed Flow Chart

The above fig 1. defined explanation structure of facial recognition system. The explanation of every process is defined below:

A. Image Acquisition

Search a face recognition data set 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.

B. Pre-processing

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

C. Feature Extraction

Feature Extraction using independent component analysis. ICA is significantly more effective strategy. ICA is begun from numerous application fields, databases, monetary pointers and estimation and so forth.

D. Optimization

Reduce the feature data using genetic algorithms are computer programs that simulate the procedures of natural evolution in arranging to solve complex and to model evolutionary systems. The genetic optimization approach is design to solve the difficult problems (Complexity, cost, energy and Time consumptions). This algorithm is an initialize the set of size i.e., called population. Problem Solutions from individual population are used and reserved to new population. This is hope, that the novel population would be better than previous one. Results which are particular to form novel solution i.e. data stream bits are selected with the help of fitness function, the suitable phases they have to regenerate. GO techniques, to solve an optimization issue by repetition the following three operators:

- Selection
- Crossover
- Mutation

E. Classification

Classify the reduce features i.e back propagation neural network. Network of Neural is a computational scheme inspired by the arrangement, dispensation technique, and knowledge ability of an organic brain. The essential dispensation rudiments of neural systems are named artificial neurons. It is simplifying arithmetical mold of the neuron. Evaluate the performance parameters i.e false acceptance rate, false rejection Rate and Accuracy and compare the existing performance parameters i.e accuracy.

V. DATASET CONSIDERED

The data set comprises 5160 individual nimble basis pictures of 9 focuses individual seen below 556 viewing circumstances (9 postures x 63 brightness circumstances). For each focus in a specific posture, an double with ambient (contextual) brightness was also apprehended. Later, the total amount of images is in detail 5760+90=5850. The entire scope of the compacted database is about 1GB. The 65 (64 decorations + 1 ambient) images of a topic in a specific pose have been "tarred" and "zipped" into a normal file. There are 90 (10 themes x 9 poses) '*.tar.gz' files. Each '*.tar.gz' file is about 11MB big. All filenames begin with the ignoble name 'yaleB' tailed by a binary digit amount suggesting the question number (01 - 10). The two digit amount after '_P' indicates the posture number (00 - 08). Some example images from the dissimilar facial images are shown as below:
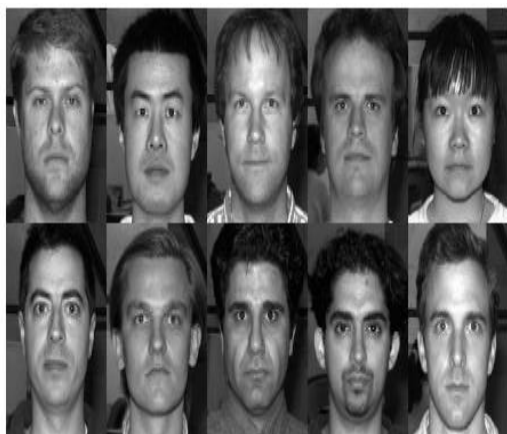
Fig 2 Dataset Images

VI. RESULT ANALYSIS

In this section, we implement the facial recognition based on ICA, GA and BPNN algorithm. We are using the MATLAB 2013a simulation tool used and Graphical User Interface tool box used. In various user interface control used in this research work like push buttons, edit text and some Uicontrol user interface. We determine the evaluated results of the proposed digital image processing concept for Face recognition. Also the percentage of recognize the face determined with the overall accuracy of the concept is evaluated.

Fig 3. Facial Image

In this fig 3 defines that the original image from the dataset. Second one converts the original image to gray scale form cause of reduce the image pixel size in the original image. We plot the histogram of the original image, which finds the minimum and maximum frequency of the image number of bits.

Fig 4. Noisy Image

We add two type of noise in the gray scale image i.e salt and pepper, Poisson noise . An image comprising salt-and-pepper noise will have dark pixels in bright regions and enthusiastic pixels in dark regions. It generates Poisson noise from the data in its place of adding artificial noise to the data.
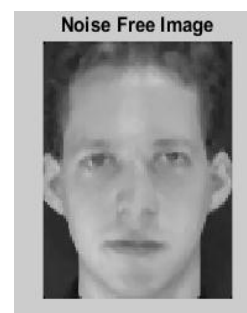

Fig 5. Noise Free Image

The fig 5 defines that the noise free image using median filter which has converted the noisy image into the 2d transformation. It is desirable to be able to perform some type of noise removal on an image. The median filter is a non-linear digital filtering approach.

In median filtered, consists every pixel in the image in the move and looks at its closest to decide whether or not it is representative of its immediacy. The simply moving the pixel value with the sum of the closet pixel values, it with the MEDIAN of these values. This filtration process is evaluated by initial changing all the pixels from the immediate closest into integer –order and then moving the pixel being evaluated with the pixel value.

Fig 6. Edge Detection

Fig 6. Edge detection means to detect the single edges in the gray scale image. It uses a multi-stage technique to detect a wide range of edges in images.

Fig 7. Segmented Image

The fig 7 segmentation is defined in the gray intensity histogram of the left sub image components; a line is created between the highest histogram value and lowest histogram value. The histogram values representative the subtracted area have been ignored. This procedure is particularly actually when the object pixels yield a weak peak in the histogram.
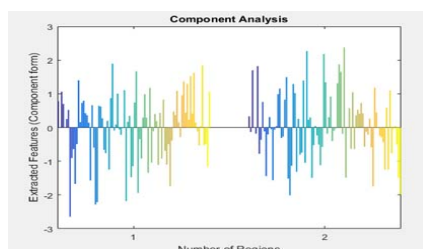

Fig 8. Feature Extraction using the ICA algorithm

Fig 8 defined that the extracted feature in the noise free image. ICA (Independent Component Analysis) is an assessable and computational strategy.

ICA is an all-purpose model for multivariate information. In this model information, variables are thought to be shortest and other obscure variables are thought to be inert variables. The inactive variables are called autonomous segments of the watcher information.
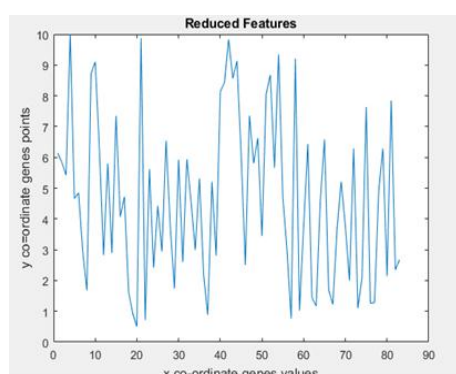

Fig 9. Optimize Features

Fig 9 defined that defined that the optimized features based on the improved genetic algorithm. Genetic algorithm is mainframe programs that simulate the actions of accepted evolution in positioning to solve complex and to model evolutionary systems.
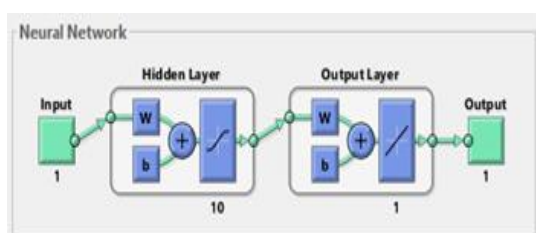

Fig 10. Neural Network

The above fig 10. represents that the back propagation neural network, it is the classification technique to classify the face recognition training state data set. We transfer the information between hidden layers to the output layer. Hidden layer checks the backup information then transfer the information in the next layer. Activation function used to filter the information. We used the 1000 iterations used; the time consumed the 7 seconds, performance measure, gradient, and mutation and validation checks.

TABLE 2 PERFORMANCE PARAMETERS PROPOSED PARAMETERS

Number of Iterations	Mean Square error rate	False Acceptance Rate	False Rejection Rate	Accuracy
20	0.097	0.0047	0.002	95.5
40	0.200	0.0101	0.0051	96.3
60	0.308	0.0149	0.0078	97
80	0.4055	0.01994	0.0105	98.4
100	0.5082	0.02474	0.0127	98.9

Table 2. Describes that the performance parameters in the proposed work (Mean square error , false acceptance rate, false rejection rate and accuracy).
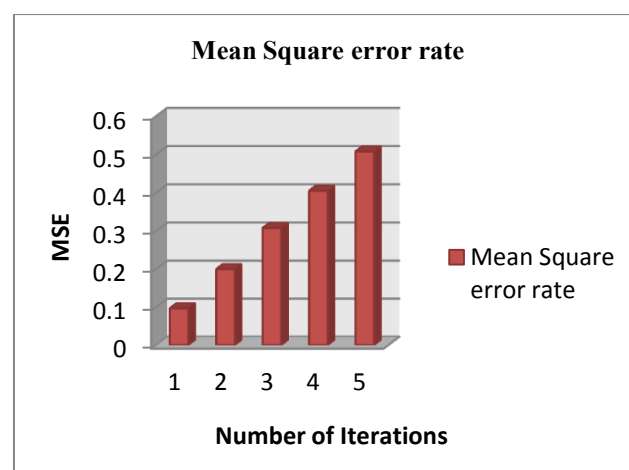

Fig 11. Mean Square Error

The figure means square error shows that the performance based on the number of iterations with respect to the average of the training and testing error. We evaluate the performance of the MSE parameters i.e 0.046, 0.026, 0.35 and 0.506 etc.
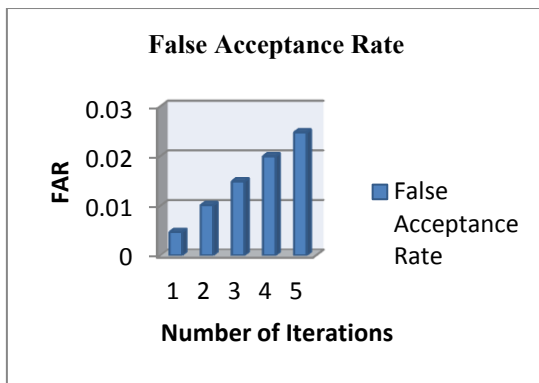
Fig 12 False Acceptance Rate

The above figure shows that the FAR(false acceptance rate), means is the amount of the probability that the biometric security organization will incorrectly receive an access effort by an unauthorized user. A system's FAR typically is stated as the ratio of the number of false acceptances alienated by the number of documentation attempts.
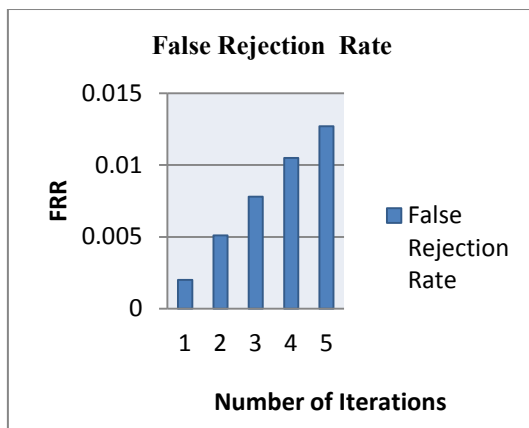

Fig 13 False Rejection Rate

In FRR (False Rejection Rate) means is the quantity of the probability that the biometric traits secure system will incorrectly reject an access attempt by an lawful user. An organization's FRR typically is stated as the ratio of the amount of false rejections divided by the amount of documentation attempts.
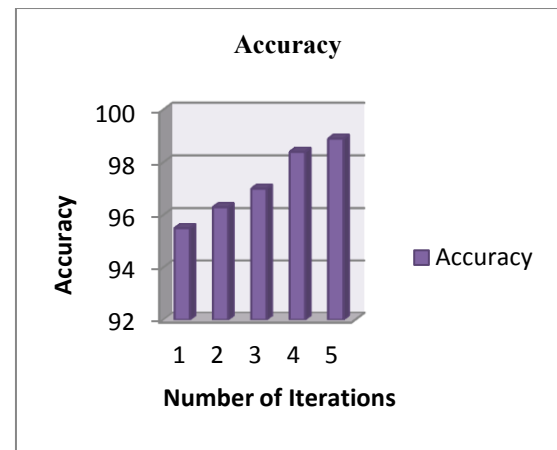

Fig 14 . Accuracy

The accuracy of a test is its capability to distinguish the enduring and strong cases properly. To estimation the correctness of a test, we should compute the amount of TP (true positive) and TN (true negative) in all assessed cases.

TABLE 3 COMPARISON BETWEEN MSE PROPOSED AND EXISTING WORK (ORL, AR AND YALE) DATASET

Number of Images	YALE (Proposed)	ORL (Existing)	AR(Existing)
1	0.006	0.075	0.006
2	0.0081	0.05	0.0081
3	0.0069	0.03	0.049
4	0.0064	0.1	0.061
5	0.0056	0.45	0.047

To check the performance of our proposed algorithm, we have considered the concepts of LDA and Improved BPNN. For comparison, an average value is considered by taking the mean of minimum possible and maximum value of the each concept.
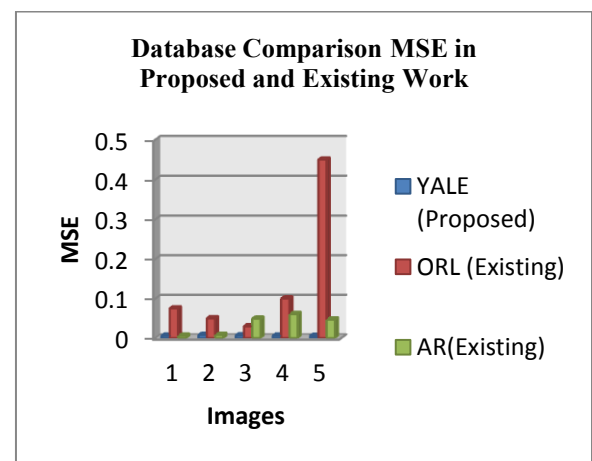

Fig 15 . Comparison between mean square error (Existing and Proposed Work)

The figure shows that the comparison between mse existing and proposed work in various types of datasets (ORL,AR and YALE). We improve the performance parameters as compared to previous one.
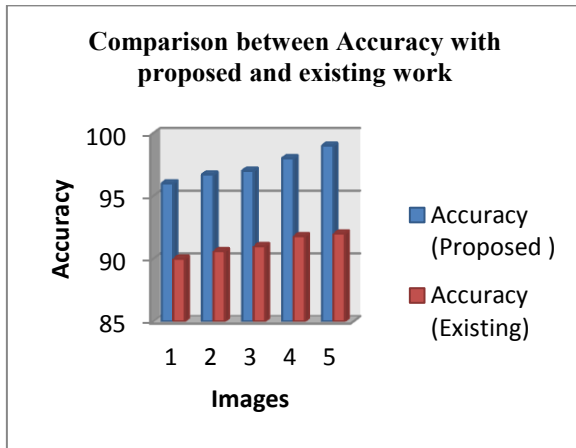

Fig 16. Comparison between Accuracy (Proposed and Existing)

The figure defines that the comparisons between proposed and existing work. We improved the performance of the accurate result using BPNN and existing one is SIFT and PCA.

TABLE 3 COMPARISON BETWEEN ACCURACY (PROPOSED AND EXISTING WORK)

Number of Facial Images	Accuracy (Proposed)	Accuracy (Existing)
1	96	90
2	96.7	90.6
3	97	91
4	98	91.8
5	99	92

VII. CONCLUSION AND FUTURE SCOPE

The novel approach for face recognition based on matching features based on independent component analysis. The novel approach is compared to component based comparison to component data and Eigenvectors, Eigenvalue, Sift features and proved superior to together with them in all trials, especially with tiny preparation set sizes. Upon searching the actual number of component characteristics' required for dependable matching, the experiments reveal that we need only 50% of the features, which saves 70% of the interval time required to match all the extracted features. In addition, the ICA features approach continues to provide superior performance for up to 40% reduction in resolution. An attempt to assess the significant number of ICA features required for dependable matching of face images, several experiments were performed using only a subset of the extracted ICA features in the identification process. The ICA features were sorted descending according to their scale, and only the principal p% of the regular number of structures was used. The results accuracy for ORL, AR and Yale databases.

These are the average results for 10 independent runs, using 70% training and 30% testing. Evidently, the accuracy upsurges with the quickly increasing number of ICA characteristics used and then start to saturate. Using component based features only 30% of the features produces accuracy better than that of Eigen faces and Fisher faces. This can significantly diminution the run time for ICA matching process, as the number of corresponding actions is O (n2) where n is the amount of structures to be matched. Later, using only 30% of the structures takes only 9% of the period cast-off to contest all the points. In the future, it's required to assimilate with another algorithm such as IDA to improve the practicality and time of the recognition system. There is huge scope for use of these techniques in real-time applications like surveillance systems where an alarm can be raised on detecting un-identified person in the premises.

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