

A Review Paper on Face Recognition Techniques

DINESH KUMAR DANSENA,
Student of M.tech(CSE 4th sem) ,

R. N. SHUKLA,
Assistant Professor,
Computer Science and Engineering Department ,

SOUMYA MUKHERJEE
Assistant Professor

O.P. JINDAL University,Pujipatra Dist- Raigarh(Chhattisgarh,India)496111

Abstract: Face recognition has been a fastest growing up, challenging and interesting area in real time applications. A large numbers of face recognition algorithms have been developed. In paper an attempt is made to review a wide range of method used for faces recognition comprehensively. This include PCA, LDA, ICA,soft computing tool like ANN for face recognition and various high power combination of this techniques. This review investigate all these methods with parameters that challenges face recognition like illumination, pose variation, facial expressions.

Index Terms: Introduction, Face Recognition Algorithms- Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), Support Vector Machine (SVM), Independent Component Analysis (ICA), Artificial Neural Networks (ANN), Conclusion.

INTRODUCTION

Face recognition has been widely used in biometric systems for personal identification in case of driver licenses, passports, human computer interaction, database retrieval, virtual reality, banking, law enforcement like investigation , personal security, home video surveillance system etc. Face identification or face recognition is an “automated matching method for knowing the identity of a person by comparing an input face with stored face database”. Image acquisition, face detection and face recognition are the steps involved in face recognition process. Image acquisition is a process of capturing or acquiring the image from physical source like imaging hardware scanners, digital cameras, digital videos, faxed pictures etc and converting them into manageable image data. Face detection is a task of identifying and locating human faces in an image regardless of their location, scale, in plane rotation, orientation pose and illumination.

FACE RECOGNITION ALGORITHMS

- I. **Principal Component Analysis (PCA) :-** PCA also known as Karhunen-Loeve method is one of the popular methods for feature selection and dimension reduction. Recognition of any faces using PCA was first done by Turk and Pentland and reconstruction of faces was done by Kirby. The face recognition method, known as eigenface method defines a feature space which reduces the dimensionality of the original data space. This reduced data space is used for human face recognition. But poor discriminating power within the class and large computation are the well known common problems in (Principal Component Analysis)PCA method. This limitation is over come by Linear Discriminant Analysis (LDA) .
- II. **Linear Discriminant Analysis (LDA) :-** LDA is the most dominant algorithms for feature selection in appearance based methods . But many LDA based human face recognition system first used PCA to reduce dimensions and then LDA is used to maximize the discriminating power of feature selection. The reason is that linear Discriminant Analysis (LDA) has the small sample size problem in which dataset selected should have larger samples per class for good discriminating features extraction. Thus implementing (LDA) linear Discriminant Analysis directly resulted in poor extraction of discriminating features. In the proposed method Gabor filter is used to filter frontal face images and PCA is used to reduce the dimension of filtered feature vectors and then LDA is used for feature extraction. The performances of appearance based statistical methods such as PCA, LDA and ICA are tested and compared for the human face recognition of colored faces images in . PCA is better than LDA and ICA under different illumination variations but LDA is better than ICA. LDA technique is more sensitive than PCA technique and ICA on partial occlusions, but PCA is less sensitive to partial occlusions compared to LDA and ICA. PCA is used as a dimension reduction technique in and for modeling face expression deformations in . A recursive algorithm for calculation the discriminant features of PCA and LDA procedure is introduced in . This method concentrates on challenging issue of computing discriminating vectors from an incrementally arriving high dimensional data stream without computing the corresponding covariance matrix and without knowing the data in advance. The proposed incremental PCA and LDA algorithm is very efficient in memory usage and it is very efficient in the calculation of first basis vectors. This algorithm gives an acceptable human face recognition success rate in comparison with very famous face recognition algorithms such as PCA and LDA. Two appearance-based techniques such as Modified PCA (MPCA) and Locality Preserving Projections (LPP) are combined in to give a high face recognition rate. PCA is using as a feature extraction technique in . These feature are compared using Mahalanobis distances for decision making.
- III. **Support Vector Machine (SVM) :-** Support Vector Machines (SVM) are one of the most usefully techniques in classification problems. One clear example is face recognition. However, SVM technique cannot be applied when the feature vectors defining samples have missing entries. A classification algorithm that has successfully been used in this framework is the all-known Support (SVM), which can be applied to the original appearance space or a subspace of it

obtained after applying a feature extraction this method . The advantage of SVM classifier over traditional neural network is that SVMs techniques can achieve better generalization performance.

- IV. **Independent Component Analysis (ICA):-** ICA is a method for finding underlying factors or components from multivariate statistical data. There is need to implement human face recognition system using ICA for facial images having face orientations and different illumination conditions, which will give better results as compared with existing systems. What distinguishes independent component Analysis(ICA) from other methods is that, it looks for component that are both statistically independent and non gaussian method. The Independent Component Analysis(ICA) is similar to blind source separation problem that boils down to finding a linear representation in which the components are statistically independent. The comparison of face recognition using PCA and ICA technique on FERET database with different classifiers were discussed and found that the ICA technique had better recognition rate as compared with PCA technique with statistically independent basis images and also with statistically independent coefficients. Face recognition technique using ICA method with large rotation angles with poses and variations in illumination conditions was proposed in . A novel subspace method called sequential row column independent component analysis for face recognition technique is proposed in. In ICA method each face image is transformed into a vector before calculating the independent components. RC and ICA reduces face recognition error and dimensionality of recognition subspace become smaller. A novel technique for face recognition method combined the independent component analysis (ICA) model with the optical correlation technique was proposed in. This approach hope on the performances of a strongly discriminating optical correlation method along with the robustness of the ICA model. Independent component analysis (ICA) model had sparked interesting in search for a linear transformation to express a set of random variables as linear combinations of statistically independent source variables. Independent component analysis (ICA) provided a more powerful data representation than PCA as its goal was that of providing an independent rather than uncorrelated image decomposition and representation. A fast incremental principal non Gaussian directions analysis algorithm called IPCA and ICA was proposed in. This algorithm computes the principal components of a sequence of image vectors incrementally without estimating the covariance matrix and at the same timing transform these principal components to the independent directions that maximize the non-Gaussianity of the source. IPCA and ICA is very efficient in the calculation of the first basis vectors. PCA and ICA achieves higher average success rate than Eigenface, the Fisherface and FastICA methods. Gabor features are also using for gait recognition and gender recognition recently. In this servey paper, it was observed that though Gabor phases are sensitive to local variations, they can discriminate between patterns with similar magnitudes, i.e. they provide more detail information about the local image features. Therefore, the Gabor phase's can work comparably well with the magnitudes, as long as its sensitivity to misalignment and local variations can be compensated carefully. In previous year work, authors proposed to represent face images using the local Gabor binary patterns (LGBP), which combines Gabor magnitudes with local binary patterns (LBP) operator. Improved results were achieved when comparing with the LBP and the GFC.
- V. **Artificial Neural Network (ANN) :-**Multi-Layer Perceptron (MLP) with a feed forward learning algorithms was chosing for the proposed system because of its simplicity and its capability in supervised pattern matching. It has been successfully applying to many pattern classification problems A new approach to face detection with Gabor wavelets & feed forward neural network (FNN) was presented in The method used Gabor wavelet transform and feed forward neural network (FNN) for both finding feature points and extracting feature vectors. The experimental results, have shown that proposed method achieves better results compared to the graph matching and eigenfaces methods, which are known to be the most successfully algorithms. A new class of convolutional neural network (CNN) was proposed in where the processing cells are shunting inhibitory neurons. Previously shunting inhibitory neurons have been used in a conventional feedforward architecture for classification and non-linear regression and were shown to be more powerful than MLPs. A hybrid neural network (HNN) solution was presented in which combines local image sampling, a self-organizing map neural network (NN), and a convolutional neural network. The selforganizing map provides a quantization of the image samples into a topological space where inputs that are nearby in the original space are also nearby in the output space, there by providing dimensionality reduction and invariance to minor changes in the image sample, and the convolutional neural network CNN provides for partial invariance to translation, rotation, scale, and deformation. PCA+CNN & SOM+CNN methods are both superior to eigenfaces technique even when there is only one training image per person.SOM +CNN method consistently perform's better than the PCA+CNN method. A new face detection method is proposed in used polynomial neural network (PNN) The PNN functions as a classifier to evaluate the face likelihood of the image patterns of the multiscale shifted local regions. The PCA technique used to reduce the dimensionality of image patterns and extract features for the polynomial neural network (PNN). Using a single network the author had achieved fairly high detection rate and low false positive rate on images with complex background. In comparison with a multilayer perceptron, the performance of polynomial neural network (PNN) is superior. To best reflect the geometry of the 3D face manifold and improve face recognition, Spectral Regression Kernel Discriminate Analysis(SRKDA) based on regression and spectral graph analysis introduced in proposed method. SRKDA(Spectral Regression Kernel Discriminate Analysis) can efficiently give more exact solutions than ordinary subspace learning approaches. It not only solves high dimensional(HD) and small sample size problems, but also enhances feature extraction from a face local non-linear structure. Detailed comparisons between SRKDA, PCA, LPP, OLPP, SR, and KDA to show the efficiency of proposed method for 3D face recognition method , especially with respect to expression variations. SRKDA(Spectral Regression Kernel Discriminate Analysis) only needs to solve a set of regularized regression problems and no eigenvector computation involved, which is a huge saving in computational cost. A novel Haarlet Pyramid based face recognition method was proposed in. Here face recognition

algorithm is done using the image feature set extracted from Haarlets on gray plane. PCA is usually using technique but it is very time consuming. In paper authors have shown the comparative study of different face recognition algorithm for plastic surgery Based on the experimentation carried out by authors it has been concluded that face recognition algorithm such as PCA ,FDA ,LLA ,LBP & GNN have shown face recognition rate more than 40% for local plastic surgery.

CONCLUSION

In this paper has attempted to review a significant number of papers to cover the recent development in the field of face recognition method. Present study reveals that for enhanced face recognition method a new algorithm has to evolve using hybrid methods of soft computing tools such as ANN, SVM, SOM may yields better performance. The list of references to provide more details understanding of the approaches described is enlisted. I apologize to researchers whose important contributions may have been overlooked.

REFERENCES

- [1] Bruner, I. S. and Tagiuri, R. The perception of people. In Handbook of Social Psychology, Vol. 2, G. Lindzey, Ed., Addison- Wesley, Reading, MA, 634–654.1954
- [2] Bledsoe, W. W. The model method in facial recognition. Tech. rep. PRI:15, Panoramic research Inc., Palo Alto, CA.1964
- [3] Ekman, P. Ed., Charles Darwin's The Expression of the Emotions in Man and Animals, Third Edition, with Introduction, Afterwords and Commentaries by Paul Ekman. Harper- Collins/Oxford University Press, New York, NY/London, U.K.1998
- [4] IEEE International Conference on Recent Advances and Innovations in Engineering (ICRAIE-2016), December 23-25, 2016, Jaipur, India

