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Review of Face Recognition System Using MATLAB

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ABSTRACT
Face recognition is one of the most important image processing research topics which is widely used in personal identification, verification and security applications. In this review, a face recognition system, based on the principal component analysis (PCA) and the feed forward neural network is explained. The normal face recognition systems were developed earlier, but research on faces with makeup has covered lesser area, we are developing a system consisting of two phases which are the PCA preprocessing phase, and the neural network classification phase. PCA is applied to calculate the feature projection vector of a given face which is then used for face identification by the feed forward neural network. The proposed PCA and neural network based identification system provides improvement on the recognition rates, when compared with a face classifier based on the PCA and Euclidean Distance, all the data base will be created with a number of faces with different makeups.
Keywords:- Image Restoration, LDA, ICA, SVM and Image Processing.

I. HISTORY OF FACE RECOGNITION

The subject of face recognition is as old as computer vision because of the practical importance of the topic and theoretical interest from cognitive scientists. Despite the fact that other methods of identification (such as fingerprints, or iris scans) can be more accurate, face recognition has always remains a major focus of research because of its non-invasive nature and because it is people's primary method of person identification.

Perhaps the most famous early example of a face recognition system is due to Kohonen, who demonstrated that a simple neural net could perform face recognition for aligned and normalized face images. The type of network he employed computed a face description by approximating the eigenvectors of the face image's autocorrelation matrix; these eigenvectors are now known as `Eigen faces.'

Kohonen's system was not a practical success, however, because of the need for precise alignment and normalization. In following years many researchers tried face recognition schemes based on edges, inter-feature distances, and other neural net approaches. While several were successful on small databases of aligned images, none successfully addressed the more realistic problem of large databases where the location and scale of the face is unknown.

Kirby and Sirovich (1989) later introduced an algebraic manipulation which made it easy to directly calculate the eigenfaces, and showed that fewer than 100 were required to accurately code carefully aligned and normalized face images. Turk and Pentland (1991) then demonstrated that the residual error when coding using the eigenfaces could be used both to detect faces in cluttered natural imagery, and to determine the precise location and scale of faces in an image. They then demonstrated that by coupling this method for detecting and localizing faces with the Eigen face recognition method, one could achieve reliable, real-time recognition of faces in a minimally constrained environment. This demonstration that simple, real-time pattern recognition techniques could be combined to create a useful system sparked an explosion of interest in the topic of face recognition.

II. RELATED WORK

Alaa Eleyan et al (2005) has analyzed that face recognition is one of the most important image processing research topics which is widely used in

personal identification, verification and security applications. In this paper, a face recognition system, based on the principal component analysis (PCA) and the feedforward neural network is developed. The system consists of two phases which are the PCA preprocessing phase, and the neural network classification phase. Jawad Nagi et al (2008) recognized that automatic recognition of people is a challenging problem which has received much attention during recent years due to its many applications in different fields. Face recognition is one of those challenging problems and up to date, there is no technique that provides a robust solution to all situations. This research presents a new technique for human face recognition. Shamla Mantri et al (2011) proposed to label a Self-Organizing Map (SOM) to measure image similarity. To manage this goal, the author feed Facial images associated to the regions of interest into the neural network. At the end of the learning step, each neural unit is tuned to a particular Facial image prototype. Facial recognition is then performed by a probabilistic decision rule. This scheme offers very promising results for face identification dealing with illumination variation and facial poses and expressions. Mohammod Abul Kashem et al (2011) investigated that face recognition has received substantial attention from researches in biometrics, pattern recognition field and computer vision communities. Face recognition can be applied in Security measure at Air ports, Passport verification, Criminals list verification in police department, Visa processing , Verification of Electoral identification and Card Security measure at ATM's. In this research, a face recognition system for personal identification and verification using Principal Component Analysis (PCA) with Back Propagation Neural Networks (BPNN) is proposed. Sasikumar Gurumurthy et al (2012) analyzed that human Face Recognition systems are an identification procedure in which a person is verified based on human traits. This research describes a fast face detection algorithm with accurate result. Lip Tracking is one of the biometric systems based on which a genuine system can be developed. Since the uttering characteristics of an individual are unique and difficult to imitate, lip tracking holds an advantage of making the system secure. The author use pre- recorded visual utterance of speakers has been generated and stored in the database for future verification. Nisha Soni et al (2013) introduced that face recognition (FR) is a challenging issue due to variations in pose, illumination, and expression. The search results for most of the existing FR methods are satisfactory but still included irrelevant images for the target image. Navneet Jindal et al (2013) give an idea of face detection from a long database of face images with different backgrounds is not an easy task. In this work, the author demonstrated the face detection system of colored face images which is invariant to the background and acceptable illumination conditions. Cunjian Chen et al (2013) analyzed that the facial makeup has the ability to alter the appearance of a person. Such an alteration can degrade the accuracy of automated face recognition systems, as well as that of methods estimating age and beauty from faces.

III. ALGORITHMS

PCA

PCA also known as Karhunen-Loeve method is one of the popular methods for feature selection and dimension reduction. Recognition of human faces using PCA was first done by Turk and Pentland [8] and reconstruction of human faces was done by Kirby and Sirovich [9]. The 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 recognition. But poor discriminating power within the class and large computation are the well known common problems in PCA method. This limitation is overcome by Linear Discriminant Analysis (LDA). LDA is the most dominant algorithms for feature selection in appearance based methods [9]. But many LDA based 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 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 directly resulted in poor extraction of discriminating features. In the proposed method [10] 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.

III. SUPPORT VECTOR MACHINE (SVM)

Support Vector Machines (SVM) are one of the most useful techniques in classification problems. One clear example is face recognition. However, SVM 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 Vector Machines (SVM) [13], which can be applied to the original appearance space or a subspace of it obtained after applying a feature extraction method [14] [15] [16]. The advantage of SVM classifier over traditional neural network is that SVMs can achieve better generalization performance.

IV. INDEPENDENT COMPONENT ANALYSIS (ICA)

Independent component analysis (ICA) is a method for finding underlying factors or components from multivariate (multidimensional) statistical data. There is need to implement 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 [7] [8] [9] . What distinguishes ICA from other methods is that, it looks for component that are both statistically independent and non gaussian [7]. The ICA is similar to blind source separation problem [3] that boils down to finding a linear representation in which the components are statistically independent. The comparison of face recognition using PCA and ICA on FERET database with different classifiers [1] [2] were discussed and found that the ICA had better recognition rate as compared with PCA with statistically independent basis images and also with statistically independent coefficients. Face recognition using ICA with large rotation angles with poses and variations in illumination conditions was proposed in [3]. A novel subspace method called sequential row column independent component analysis for face recognition is proposed in [4].

V. LINEAR DISCRIMINANT ANALYSIS (LDA)

The linear discriminant analysis (LDA) is a powerful method for face recognition. It yields an effective representation that linearly transforms the original data space into a low-dimensional feature space where the data is well separated. However, the within-class scatter matrix (SW) becomes singular in face recognition and the classical LDA cannot be solved which is the under sampled problem of LDA (also known as small sample size problem). A subspace analysis method for face recognition called kernel discriminant locality preserving projections (MMDLPP) was proposed in [6] based on the analysis of LDA, LPP and kernel functions. A nonlinear subspace which can not only preserves the local facial manifold structure but also emphasizes discriminant information.

VI. CONCLUSION

This paper has attempted to review a significant number of papers to cover the recent development in the field of face recognition. Present study reveals that for enhanced face recognition 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 detailed understanding of the approaches described is enlisted. We 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]Kelly, M. D. Visual identification of people by computer. Tech. rep. AI-130, Stanford AI Project, Stanford, CA. 1970

[5]Kanade, T. Computer recognition of human faces. Birkhauser, Basel, Switzerland, and Stuttgart, Germany 1973

[6] Chellapa, R., Wilson, C. L., and Sirohey, S. Human and machine recognition of faces: A survey. Proc. IEEE, 83, 705–740.1995

[7] Samal, A. and Iyengar, P. Automatic recognition and analysis of human faces and facial expressions: A survey. Patt. Recog. 25, 65–77.1992

[8] M. Turk and A. Pentland, "Eigenfaces for recognition," J. Cognitive Neuroscience,vol. 3, 71-86., 1991.

[9] D. L. Swets and J. J. Weng, "Using discriminant eigenfeatures for image retrieval", IEEE Trans. PAMI., vol. 18, No. 8, 831-836, 1996.

[10] Alaa Eleyan and Hasan Demirel, "Face Recognition System Based on PCA and Feedforward Neural Networks" in Springer-Verlag Berlin Heidelberg 2005.

[11] Jawad Nagi, Syed Khaleel Ahmed and Farrukh Nagi, "A MATLAB based Face Recognition System using Image Processing and Neural Networks" in International Colloquium on Signal Processing and its Applications in 2008.

[12] Shamla Mantri and Kalpana Bapat, "Neural Network Based Face Recognition Using Matlab" in IJCSET in Feb 2011.

[13] Mohammod Abul Kashem, Md. Nasim Akhter, Shamim Ahmed, and Md. Mahbub Alam, "Face Recognition System Based on Principal Component Analysis (PCA) with Back Propagation Neural Networks (BPNN)" International Journal of Scientific & Engineering Research Volume 2, Issue 6 in 2011.

[14] Sasikumar Gurumurthy and B.K.Tripathy, "Design and Implementation of Face Recognition System in Matlab Using the Features of Lips" in I.J. Intelligent Systems and Applications in 2012.

[15] Nisha Soni, Garima Mathur and Mahendra Kumar, "A Matlab Based High Speed Face Recognition System Using Som Neural Networks" International Journal of Engineering Research and Applications (IJERA) in 2013.

[16] Navneet Jindal and Vikas Kumar, "Enhanced Face Recognition Algorithm using PCA with Artificial Neural Networks" in International Journal of Advanced Research in Computer Science and Software Engineering in 2013.

[17] Cunjian Chen, Antitza Dantcheva and Arun Ross, "Automatic Facial Makeup Detection with Application in Face Recognition" in IEEE in 2013.