Jigar M. Pandya, Devang Rathod, Jigna J. Jadav / International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622 www.ijera.com
Vol. 3, Issue 1, January -February 2013, pp.632-635

A Survey of Face Recognition approach

Jigar M. Pandya*, Devang Rathod,Jigna J. Jadav*****

*(PG-ITNS Student, Department of Computer Engineering, Gujarat Technological University, Gujarat, India)
** (Computer Security & Forensic Expert, Cyber Octet (P) Ltd, Gujarat, India)
*** (Assistant Professor, Department of Computer engineering, C.U.Shah College of Engineering and Technology, Gujarat, India)

ABSTRACT

Face recognition is one of the most relevant applications of image analysis. It's a true challenge to build an automated system which equals human ability to recognize faces. Although humans are quite good identifying known faces, we are not very skilled when we must deal with a large amount of unknown faces. The computers, with an almost limitless memory and computational Speed, should overcome human's limitations. Face recognition is one of the most important biometric which seems to be a good compromise between actuality and social reception and balances security and privacy well. The goal of face reorganization is to implement the system for a particular face and distinguish it from a large number of stored faces with some real-time variations as well.

Keywords – Face recognization

1. INTRODUCTION

Face recognition system fall into two categories: verification and identification. Face verification is a 1:1 match that compares a face images against a template face images, whose identity being claimed .On the contrary, face identification is a 1: N problem that compares a query face image against all image templates in a face database [2]. Face recognition techniques can be broadly divided into three categories based on the face data acquisition methodology: methods that operate on intensity images; those that deal with video sequences; and those that require other sensory data such as 3D information or infra-red imagery. Humans are very good at recognizing faces and complex patterns. Even a passage of time doesn't affect this capability and therefore it would help if computers become as robust as humans in face recognition.

2. BASICS OF FACE RECOGNITION

Over the last ten years or so, face recognition has become a popular area of research in computer vision. Face recognition is also one of the most successful applications of image analysis and understanding. Because of the nature of the problem of face recognition, not only computer science researchers are interested in it, but neuroscientists and psychologists are also interested for the same. It is the general opinion that advances in computer vision research will provide useful insights to neuroscientists and psychologists into how human brain works, and vice versa.

The basic overall face recognition model looks like the one below.

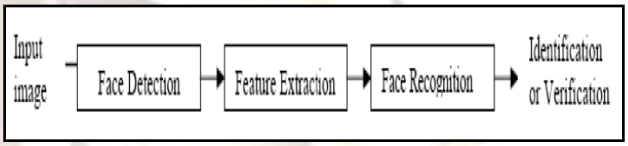

Figure 1 Flow Of Recognition

Different approaches of face recognition for still images can be categorized into tree main groups such as holistic approach, feature-based approach, and hybrid approach [1]. Face recognition form a still image can have basic three categories, such as holistic approach, feature based approach and hybrid approach [2].

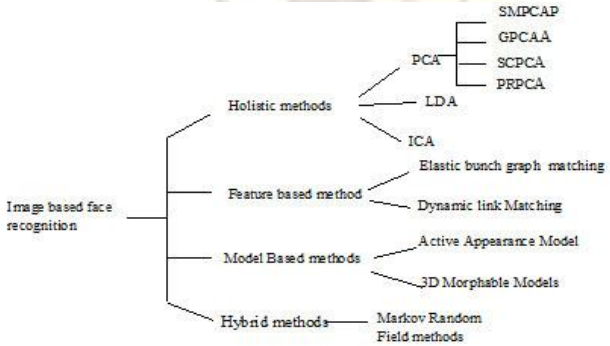

Figure 2 : Taxonomy of face recognition approaches

Holistic Approach: - In holistic approach, the whole face region is taken as an input in face detection system to perform face recognition.

Feature-based Approach: - In feature-based approach, local features on face such as nose and eyes are segmented and then given to the face detection system to easier the task of face recognition.

Hybrid Approach: - In hybrid approach, both local features and the whole face is used as the input to

the face detection system. It is more similar to the behavior or human being to recognize the face.

3. FACE RECOGNITION

Face recognition is a technique to identify a person face from a still image or moving pictures with a given image database of face images. Face recognition is biometric information of a person. However, face is subject to lots of changes and is more sensitive to environmental changes. Thus, the recognition rate of the face is low than the other biometric information of a person such as fingerprint, voice, iris, ear, palm geometry, retina, etc. There are many methods
for face recognition and to increase the recognition rate. Some of the basic commonly used face recognition techniques are as below:

3.1. Neural Networks

A neural network learning algorithm called Back propagation is among the most effective approaches to machine learning when the data includes complex sensory input such as images,
in our case face image. Neural network is a nonlinear network adding features to the learning system. Hence, the features extraction step may be more efficient than the linear Karhunen Loeve methods which chose a dimensionality reducing linear projection that maximizes the scatter of all projected samples [3]. This has classification time less than 0.5 seconds, but has training time more than hour or hours. However, when the number of persons increases, the computing expense will become more demanding [5]. In general, neural network approaches encounter problems when the number of classes, i.e., individuals increases.

3.2. Geometrical Feature Matching

This technique is based on the set of geometrical features from the image of a face. The overall configuration can be described by a vector representing the position and size of the main facial features, such as eyes and eyebrows, nose, mouth, and the shape of face outline [5]. One of the pioneering works on automated face recognition by using geometrical features was done by T. Kanade [5]. Their system achieved a peak performance of 75% recognition rate on a database of 20 people using two images per person, one as the model and the other as the test image [4]. I.J. Cox el [6] introduced a mixture-distance technique which achieved 95% recognition rate on a query database of 685 individuals. In this, each of the face was represented by 30 manually extracted distances. First the matching process utilized the information presented in a topological graphics representation of the feature points. Then the second will after that will be compensating for the different center location, two cost values, that are, the topological cost, and similarity cost, were evaluated. In short, geometrical feature matching based on precisely measured distances between features may be most useful for finding possible matches in a large database [4].

3.3. Graph Matching

Graph matching is another method used to recognize face. M. Lades et al [7] presented a dynamic link structure for distortion invariant object recognition, which employed elastic graph matching to find the closest stored graph. This dynamic link is an extension of the neural networks. Face are represented as graphs, with nodes positioned at fiducial points, (i.e., exes, nose…,), and edges labeled with two dimension (2-D) distance vector. Each node contains a set of 40 complex Gabor wavelet coefficients at different scales and orientations (phase, amplitude). They are called "jets". Recognition is based on labeled graphs [8]. A jet describes a small patch of grey values in an image I (~x) around a given pixel ~x = (x; y). Each is labeled with jet and each edge is labeled with distance. Graph matching, that is, dynamic link is superior to all other recognition techniques in terms of the rotation invariance. But the matching process is complex and computationally expensive.

3.4. Eigenfaces

Eigenface is a one of the most thoroughly investigated approaches to face recognition [4]. It is also known as Karhunen-Loeve expansion, eigenpicture, eigenvector, and principal component.
L. Sirovich and M. Kirby [9, 10] used principal component analysis to efficiently represent pictures of faces. Any face image could be approximately reconstructed by a small collection of weights for each face and a standared face picture, that is, eigenpicture. The weights here are the obtained by projecting the face image onto the eigenpicture. In mathematics, eigenfaces are the set of eigenvectors used in the computer vision problem of human face recognition. The principal components of the distribution of faces, or the eigenvectors of the covariance matrix of the set of face image is the eigenface. Each face can be represented exactly by a linear combination of the eigenfaces [4]. The best M eigenfaces construct an M dimension (M-D) space that is called the “face space” which is same as the image space discussed earlier.

3.5. Fisherface

Belhumeur et al [14] propose fisherfaces method by using PCA and Fisher’s linear discriminant analysis to propduce subspace projection matrix that is very similar to that of the eigen space method. It is one of the most successful widely used face recognition methods. The fisherfaces approach takes advantage of within-class information; minimizing variation within each class, yet maximizing class separation, the problem with

variations in the same images such as different lighting conditions can be overcome. However, Fisherface requires several training images for each face, so it cannot be applied to the face recognition applications where only one example image per person is available for training.

4.ASURVEY OF FACE RECOGNITION

Engineering started to show interest in face recognition in the 1960's. One of the first researches on this subject was Woodrow W. Bledsoe.

In 1960, Bledsoe, along other researches, started Panoramic Research, Inc., in Palo Alto, California. The majority of the work done by this company involved AI-related contracts from the U.S. Department of Defense and various intelligence agencies [13].

During 1964 and 1965, Bledsoe, along with Helen Chan and Charles Bisson, worked on using computers to recognize human faces [14, 18, 15, 16, 17]. Because the funding of these researches was provided by an unnamed intelligence agency, little of the work was published. He continued later his researches at Stanford Research Institute [17]. Bledsoe designed and implemented a semi-automatic system.

Some face coordinates were selected by a human operator, and then computers used this information for recognition. He described most of the problems that even 50 years later Face Recognition still suffers - variations in illumination, head rotation, facial expression, aging. Researches on this matter still continue, trying to measure subjective face features as ear size or between-eye distance.

The 1990's saw the broad recognition of the mentioned Eigen face approaches the basis for the state of the art and the first industrial applications.

In1992 Mathew Turk and Alex Pent land of the MIT presented a work which used eigenfaces for recognition [21]. Their algorithm was able to locate, track and classify a subject's head. Since the 1990's, face recognition area has received a lot of attention, with a noticeable increase in the number of publications. Many approaches have been taken which has lead to different algorithms. Some of the most relevant are PCA, ICA, LDA and their derivatives.

CONCLUSION

Face recognition is a challenging problem in the field of image analysis and computer vision that has received a great deal of attention over the last few years because of its many applications in various domains. Research has been conducted vigorously in this area for the past four decades or so, and though huge progress has been made, encouraging results have been obtained. Here in this paper I define different approaches of face recognition algorithms to implement particular applications.

REFERENCES

[1] Tan X., Chen S., Zhou Z.-H. and Zhang F.(2006) Pattern Recognition, vol. 39, no.9, pp. 1725–1745.
[2] Abate A. F., Nappi M., Riccio D. and Sabatino G. (2007) Pattern Recognition Letters, vol 28,no. 14, pp. 1885–1906.
[3] Zhao W., Chellappa R., Phillips P. J. and Rosenfeld A. (2003) ACM Computing Surveys, vol. 35, no. 4, pp. 399–458
[4] H. Moon, "Biometrics Person Authentication Usingm Projection-Based Face Recognition System in Verification Scenario," in International Conference on Bioinformatics and its Applications. Hong Kong, China, 2004, pp.207 213.
[5] D. McCullagh, "Call It Super Bowl Face Scan 1," in Wired Magazine, 2001.
[6] docs.opencv.org/modules/contrib/doc/facerec/facerec_tutorial.html
[7] http://bias.csr.unibo.it/research/biolab/
[8] http://face.rec.org.
[9] S. L. Wijaya, M. Savvides, and B. V. K. V. Kumar, "Illumination-tolerant face verification of low-bitrate JPEG2000 wavelet images with advanced correlation filters for handheld devices," Applied Optics, Vol.44, pp.655-665, 2005.
[10] E. Acosta, L. Torres, A. Albiol, and E. J. Delp, "An automatic face detection and recognition system for video indexing applications," in Proceedings of the IEEE International Conference on Acoustics, Speech and Signal Processing, Vol.4. Orlando, Florida, 2002, pp.3644-3647.
[11] J.-H. Lee and W.-Y. Kim, "Video Summarization and Retrieval System Using Face Recognition and MPEG Descriptors," in Image and Video Retrieval, Vol.3115, Lecture Notes in Computer Science: Springer Berlin /Heidelberg, 2004, pp.179-188.
[12] C. G. Tredoux, Y. Rosenthal, L. d. Costa, and D. Nunez, "Face reconstruction using a configural, eigenface-based composite system," in 3rd Biennial Meeting of the Society for Applied Research in Memory and Cognition (SARMAC). Boulder, Colorado,USA, 1999.

[13] M. Ballantyne, R. S. Boyer, and L. Hines. Woody bledsoe: His life and legacy. AI Magazine, 17(1):7–20, 1996.

[14] Hong Duan, Ruohe Yan, Kunhui Lin, "Research on Face Recognition Based on PCA", 978-0-7695-3480-0/08 2008 IEEE.

[15] W. Zheng, C Zou, and L. Zhao, "Real-time face recognition using Gram-Schmidt orthogonalization for LDA," CPR"04, August, 2004, Cambridge UK, pp. 403-406.

[16] W. W. Bledsoe. Some results on multicategory patten recognition. Journal of the Association for Computing Machinery, 13(2):304–316, 1966.

[17] W. W. Bledsoe. Semiautomatic facial recognition. Technical report sri project 6693, Stanford Research Institute, Menlo Park, California, 1968.

[18] A. Golstein, L. Harmon, and A. Lest. Identification of human faces. Proceedings of the IEEE, 59:748–760, 1971.

[19] R. Bruneli and T. Poggio, "Face recognition: features versus templates," IEEE Trans. Pattern Analysis and Machine Intelligence, vol. 15, pp. 1042-1052, 1993.

[24] R.J. Baron, "Mechanism of human facial recognition," Int'l J. Man Machine Studies, vol. 15, pp. 137-178, 1981.

[20] M. Fischler and R. Elschlager. The representation and matching of pictorial structures. IEEE Transactions on Computers, C-22(1):67 – 92, 1973.

[21] CNN, "Education School face scanner to search for sex offenders." Phoenix, Arizona: The Associated Press, 2003.