Face Recognition Technology-A Review

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Abstract- Face recognition is the hot research topic from last few years but still it has become so difficult and large problem. The face recognition is the modulus operandi that human performs in their daily lives. The main challenges faced by the researchers are variation caused due to different expression and pose. Face recognition is the process of identification of a person by their facial image. This technique makes it possible to use their facial image of person to authenticate him into a secure system.

Keyword- *Face Recognition, SVM, Gabor Filter, Feature Extraction.*

I. INTRODUCTION

The identification of a person by their facial image can be done in a number of different ways such as by capturing an image of the face in the visible spectrum using an inexpensive camera or by using the infrared patterns of facial heat emission. Using wide assortment of cameras, the visible light systems extract features from the captured image that do not change over time while avoiding superficial features such as facial expressions or hair. Several approaches to modeling facial images in the visible spectrum are Principal Component Analysis.

Some of the challenges of facial recognition in the visual spectrum include reducing impact of variable lighting and detecting a mask or photograph. Some facial recognition systems may require a stationary or posed user in order to capture the image, though many systems use real time-process to detect a person's head and locate the face automatically. Major benefits o facial recognition is that it is non-intrusive, hands-free, and continuous and accepted by most users.

A general statement regarding the problem of machine recognition of faces can be formulated as follows: given still or video images of a scene, identify or verify one or more persons in the scene using a stored database of faces [1]. To address this given problem, a general procedure can be established by face detection, feature extraction, and recognition. Face detection is used to separate face-like objects from cluttered scenes. To be recognized, faces are usually represented in terms of vectors in a lower dimensional feature space extracted from the images [2]. Once the face features are available, the recognition step is based on the establishment of a similarity between feature vectors. Such a relation between two vectors of a known and an unknown identity is normally carried out by means of a similarity score.

II. SYSTEM ARCHITECTURE

Over the last two decades, research has focused on how to make face recognition systems fully automatic by dealing with problems such as localization of a face in a given image or video sequence and extraction of features such as eyes, mouth, etc. Meanwhile, significant advances have been made in the design of classifiers [3]. A face recognition system generally consists of four modules as depicted in Fig. 1 detection, alignment, feature extraction, and matching, where localization and normalization (face detection and alignment) are processing steps before face recognition (facial feature extraction and matching) is performed[4].

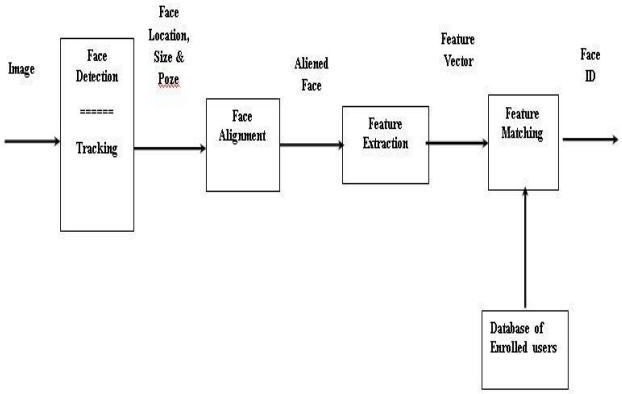

Fig.1: A typical face recognition system architecture.

Face detection segments the face areas from the background by coarse estimating its location and scale in a given scene. In the case of video, the detected faces may also need to be tracked using a face tracking component [3]. The purpose of the face alignment is to refine the location and to normalize the faces provided by the face detection. Facial components, such as eyes, nose, mouth and facial outline, are prior located. Based on their positions, the input face image is normalized with respect to geometrical properties, such as size and pose, using geometrical transforms or morphing. The face is usually further normalized with respect to photometrical properties such as illumination and gray scale [5]. Subsequent to the alignment step, the feature extraction is performed on this stable representation to provide effective information that is useful for distinguishing among faces of different persons [6]. Afterwards, on the face matching stage, the extracted feature vector of the input face is matched (similarity measurement) against those of enrolled faces in the database to determine the identity of the face when a match has sufficient confidence or to

indicate that the face is unknown otherwise [7]. Face localization and normalization are the basis for extracting effective features to represent the face pattern. They play a crucial role in how efficient the classification methods will distinguish between faces. Some other attributes that may classify face recognition systems consider its operational scenario. Within the possibilities significant differences exist. They are in terms of static images or video-based, image quality, amount of background clutter, variability of the images of a particular individual that must be recognized, matching criterion, and the nature, type, and amount of input from a user.

III. DIFFERENT ALGORITHM FOR FACE RECOGNITION

Popular recognition algorithms are:

- Face Recognition using Principal Component Analysis with eigen faces
- Face Recognition using Linear Discriminant Analysis (LDA)
- Face Recognition using Elastic Bunch Graph Matching (EGBM) fisher face
- Face Recognition using Hidden Markov model
- Face Recognition using Neuronal motivated dynamic link matching
- Face Recognition using Skin texture analysis based on unique lines, patterns, and spots apparent in a person's skin

IV. DISCUSSIONS

Faces are usually represented by digital images whose dimension m×n related to the number of pixels is a high number even for small images. Methods which operate in this pure representation have a number of potential shortcomings, most of them related to the well-known curse of dimensionality. However, much of the surface of a face is smooth and has regular texture, which means that the value of a pixel is typically highly correlated with the values of its neighbors. Moreover, faces constraints such as symmetry can be also considered somehow a kind of redundancy in its representation [8].

The sensing of faces represented as high-dimensional arrays of pixels often belongs to a manifold of lower dimension. As a consequence, face recognition and computer vision research in general has shown increasingly interest in techniques that take advantage of this observation and apply algebraic and statistical tools to extract and analyze such manifolds. The features in these manifolds (i.e., subspaces) provide more prominent and richer information for recognition than the raw image. The use of subspace modeling techniques has significantly advanced face recognition technology [9].

To deal with the dimensionality problem, the approach used is Eigen Face approach (PCA) using Gabor Wavelets and Support vector Machine (SVM).

V. CONCLUSIONS & FUTURE SCOPE

Eigen faces approach is used to analyse the face and non-face images. The eigen faces are formed using PCA. PCA can significantly reduce the dimensionality of the original feature without loss of much information in the sense of representation, but it may lose important information for discrimination between different classes. So for increase performance in future works additional methods such as combination of PCA and LDA can be applied also recognition time can be reduced using it. Instead of Gabor filter and SVM the ANN network can also be applied for analysing the eigen faces.

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REFERENCES

[1]. De-Song Wang, Jian-Ping Li, Yue-Hao Yan "A Novel Authentication scheme of the DRM System based on Multimodal Biometric Verification and Watermarking Technique", IEEE 2008.
[2]. Lin Lin Shen , " Recognition faces- An approach based on Gabor Wavelets", , pg-1-5, July 2005
[3]. De-Song Wang, Jian-Ping Li, Yue-Hao Yan "A Novel Authentication scheme of the DRM System based on Multimodal Biometric Verification and Watermarking Technique", IEEE 2008.
[4]. Stan Z. Li, Anil K. Jain, "Handbook of Face Recognition", Springer Science and Business Media, 2005.
[5]. Kang Ryoung Park, Dae Sik Jeong, Byung Jun Kang, and Eui Chul Lee, "A Study on Iris Feature Watermarking on Face Data", ICANNGA 2007, Part II, LNCS 4432, pp. 415-423, 2007.
[6]. De-Song Wang Jian-Ping Li Yue-Hao Yan "A Novel Authentication Scheme of the DRM System based on Multimodal Biometric Verification and Watermarking Technique" ICACIA 2008.
[7]. Edward, S.; Sumathi, S.; Ranihemamalini, R. "Person authentication using multimodal biometrics with watermarking", July ICSCCN. 2011.
[8]. Zhenan Sun," Improving Iris Recognition Accuracy Via Cascaded Classifiers", IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS—PART C: APPLICATIONS AND REVIEWS 1094-6977© 2005 IEEE
[9]. Desong Wang; Jianping Li; Memik, G "Authentication Scheme of DRM System for Remote Users Based on Multimodal Biometrics, Watermarking and Smart Cards" Intelligent Systems, 2009.
[10]. Panpan Li, Renjin Zhang,"The evolution of biometrics" in the proc. Conference of the multi-media Computer Assisted Instruction Institute Guizhou Normal University Guiyang, China, ISBN 978-1-4244-6734-1/10.

[11]. Jain, A.K., Bolle, R. Pankanti, S., "Biometrics: Personal Identification in Networked Society", Kluwer Academic Publications. ISBN 978-0792383451.
[12]. Isenor D K.Zaky S G, "Fingerprint identification using graph matching"2rd, 1986.
[13]. Hao Chen, "The Advantages and Characteristic of Identity Technology", China Anti-Counterfeiting Report.1rd, 2008.
[14]. Anil.K.Jain, Patrick Flynn, Arun A.Ross, "Handbook of Biometrics", Springer Science and Business Media, 2008.
[15]. R.Sanchez-Reillo,C.Sanchez-Avila and J.A.Martin-Pereda, "Minimal Template Size for Iris Recognition", Proc. of the first Joint BMHS/EMBS Conference, Atlanta(U.S.A), October 1999.
[16]. Raul Sanchez-Reillo, "Smart Card Information and Operations using Biometrics" IEEE AESS Systems Magazine, April 2001. ISBN 08856/8985/01.
[17]. D.Maltoni, D.Maio, A.Jain, and S.Prabhakar, "Handbook of fingerprint Recognition." Springer Professional Computing, 2009.
[18]. Wildes R.P., "IRIS Recognition: An Emerging Biometric Technology", Proceeding of IEEE, 85(9):1348-1363, 1997.
[19]. A. Jain, R. Bolle, and S. Pankanti, "Biometrics: Personal Identification in Networked Society", Kluwer Academic Publishers, 2002.
[20]. M. Burge and W. Burger. "Ear Biometrics in Computer Vision". Proc. 15th International Conf. of Pattern Recognition, vol. 2, pp. 822–826, 2000.
[21]. W. Zhao, R. Chellapa, P. J. Phillips, and A. Rosenfeld, "Face Recognition: A Literature Survey, ACM Computing Surveys", 35(4):399–458, December 2003. chiacchia
[22]. Sheng Zhang and Matthew Turk (2008), Scholarpedia, 3(9):4244
[23]. Michael Kirby, "Geometric data analysis", JohnWiley & Sons, Inc., 2001.
[24]. N. Petkov and P. Kruizinga, "Computational models of visual neurons specialized in the detection of periodic and a periodic oriented visual stimuli: Bar and grating cells", pp. 83–96, 1997.
[25]. Gui Feng, and Qiwei Lin, "Iris feature based watermarking algorithm for personal identification", Proc. of SPIE, Vol. 6790, pp.679045, 2007.
[26]. Seyed Mohammad Ahadi, Nima Khademi Kalantari, "A Robust Image Watermarking in the Ridge let Domain Using Universally Optimum Decoder" IEEE Transactions on circuits and systems for video technology, Vol 20, NO. 3 March 2010.
[27]. P. Campisi, D. Kundur, and A. Neri "Robust digital watermarking in the ridge let domain," IEEE Signal Process. Lett., vol. 11, no. 10, pp. 826–830, Oct. 2004.
[28]. LinLin Shen and Li Bai. "A review on Gabor wavelets for face recognition, Revision submitted", Pattern Analysis and Application, 2005.
[29]. Zhi Zhou," Transforming Traditional Iris Recognition Systems to Work on Non-ideal Situations", 978-1-4244-2773-4/09©2009 IEEE
[30]. Meihua Wang, Kefeng Fan " A Novel Digital Content Protection System Based on Iris Biometric" FSKD 2007

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