ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 4, April 2018

A Survey paper for Face Recognition System

[1] A. Mallikarjuna Reddy, [2] M. Ravi Kishore, [3]P. Sreenivasulu, [4]V.Jyothi
[1][2][3][4] Assistant Professor, Dept. of CSE, Anurag Group of Institutions, Hyderabad, T.S., India.

Abstract: A facial recognition system is a computer application capable of identifying a person from a digital image or a video frame from a video source. One of the ways to do this is by relating particular facial features from the image and a face database. Recently Face recognition has received a lot of attention in biometrics, computer vision and network multimedia information access. Various methods are used for it. Comparison of various face recognition techniques has been done by several people. But so far no technique exists which has shown satisfactory results under all conditions. This paper presents comparative study of various methods of Face Recognition Systems.

Keywords: Face Recognition; Biometric; PCA; LDA; LBP;

I. INTRODUCTION

Computer Vision and image processing has been one of the most exciting and important research fields in the earlier three decades. A complete review of all face recognitions systems is not a simple task. Hence, only a cluster of the most useful systems will be discussed in this paper. The reasons come from the need of automatic recognitions and surveillance systems, the interest in human visual system on face recognition, and the design of human-computer interface. Face recognition can be used for both verification and identification.

In face recognition system it identifies faces present in the images and videos automatically. It is classified into two categories:

a. Face verification or Face authentication
b. Face identification or Face recognition

In face verification or authentication there is a one-to-one similar that relates a query face image against a template face image whose identity is being claimed. In face identification or recognition there is a one-to-many similar that relate a query face image against all the template face images in the database to determine the identity of the query face image. Another face recognition scenario involves a watch-list check, where a query face is matched to a list of suspects. The performance of face recognition systems has improved significantly since the first automatic face recognition system was developed [1]. The identification of a person by their facial images can be done in a number of various 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. Facial Recognition in visible light typically model key features from the central portion of the facial image using a wide assortment of cameras in visible light system extract features from the captured images that do not change over time while avoiding superficial features such as facial expression or hair. Several methods to model facial images in the visible spectrum are Principal Component Analysis (PCA) [2], local feature analysis, Neural Network [3], multi-resolution study etc. The challenges of facial recognition in the visible spectrum contain decreasing the impact of variable lightning and detecting a mask or photograph. Some facial recognition systems may require a stationary or posed user in order to capture image through many systems, though many systems use a real time process to detect a person's head and locate the face automatically. Major benefits of facial recognition are that it is non intrusive, hand free, continuous and accepted by most users. Most research on face recognition falls into two main categories [4] feature-based and holistic. Geometric approaches dominated in the 1980's where simple measurements such as the distance between the eyes and shapes of lines connecting facial features were used to recognize faces, while holistic methods became very popular in the 1990's with the well-known approach of Eigen-faces [5] .Feature-based approaches [6] to face recognition basically rely on the detection and characterization of individual facial features and their geometrical relationships. Such features generally include the eyes, nose, and mouth. The detection of faces and their features prior to performing verification or recognition makes these approaches robust to positional variations of the faces in the input image. Holistic or global approaches [7] to face recognition, on the other hand, involve encoding the entire facial image and treating the resulting facial "code" as a point in a high-dimensional space. Thus, they assume that all faces are constrained to particular positions, orientations, and scales. Even though holistic methods [8] such as neural networks are more complex to implement than their

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 4, April 2018

geometric counterparts, their application is much more straight forward, whereby an entire image segment can be reduced to a few key values for comparison with other stored key values and no exact measures or knowledge such as eye locations or the presence of moustaches needs to be known. The problem with this "grab all" approach was that noise, occlusions such as glasses and any other non-face image attribute could be learned by the holistic algorithm and become part of the recognition result even though such factors are not unique to faces.
Feature-based methods were more predominant in the early attempts at automating the process of face recognition. Some of this early work involved the use of very simple image processing techniques for detecting faces and their features [8, 9]. In [9], an edge map was first extracted from an input image and then matched to a large oval template, with possible variations in position and size. The presence of a face was then confirmed by searching for edges at estimated locations of certain features like the eyes and mouth. Kelly et.al [8] used an improved edge detector involving heuristic planning to extract an accurate outline of a person's head from various backgrounds.
The present paper is organized as follows. The section (II) describes the related work; section (III) presents the conclusions.

II. RELATED WORK

Principal Component Analysis normally uses the eigenfaces in which the probe and gallery images must be the same size as well as normalized to line up the eyes and mouth of the subjects whining the images. A probe image is compared against the gallery image by calculating the distance among their respective feature vectors then corresponding result has been disclosed. The main advantage of this technique is that it can decrease the data needed to identify the specific to 1/1000th of the data presented. A face recognition system can be measured as a good system and extracted with the help of Principal Component Analysis and for recognition back propagation Neural Network [2] are used.

Linear Discriminant Analysis [10] is an appearance based technique used for dimensionality reduction and recorded a great performance in face recognition. It provides us with a small set of features that carry the most relevant information for classification purposes.

SVM is a classification technique [11] that separate two data sets with maximum distance between them. The concepts are to extend the spatial resolution around the margin by a conformal mapping, such that the divisibility between classes is increased. SVM cannot be applied directly when some of the features (face pixels) are occluded. In this case, values for those dimensions are unknown. SVM cannot be used when the feature vectors defining our samples have missing entries.

SIFT descriptor [12] which is invariant to scale, rotation, affine transformation, noise, occlusions and is highly distinctive. SIFT features consist of four major steps in detection and representation; its follows (1) finding scalespace extrema; (2) key point localization and filtering; (3) orientation assignment; (4) key point descriptor.

In 2008, H. Bay et.al [13] invents SURF descriptor which is invariant to a scale and in-plane rotation features. It consists of two phases such as interest point detector and interest point descriptor. In the first phase, locate the interest point in the image and second phase, use the Hessian matrix to find the approximate detection.

Hajer Fradi et.al [14] proposed a novel method to estimate crowd density at patch level, where the size of each patch varies in such way to compensate the effects of perspective distortions. To learn a discriminate subspace of the high-dimensional Local Binary Pattern (LBP) instead of using raw LBP feature vector. Second, an alternative algorithm for multiclass SVM based on relevance scores is proposed. The effectiveness of the proposed approach is evaluated on PETS dataset, and the results determine the effect of low-dimensional compact representation of LBP on the classification accuracy.

Ahmed Boudissa et.al [15] introduces a simple algorithm for pedestrian detection on low resolution images. While the framework of the system involves of edge orientations combined with the LBP feature extractor, a novel way of selecting the threshold is introduced. This threshold improves significantly the detection rate as well as the processing time. Furthermore, it makes the system robust to uniformly cluttered backgrounds, noise and light variations.

Zhengrong Li et.al [16] proposed a novel object-based color and texture feature fusion method based on kernel PCA. The method has been evaluated in an application of vegetation classification using aerial imagery. From the experimental results, fusing color and texture features provide improved discrimination over using them

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 4, April 2018

independently. Moreover, the proposed nonlinear feature fusion strategy has shown great progress over the serial fusion strategy, not only on reducing the dimensionality and computational cost, but also on removing noisy information and improving the discriminative power.

Li Liu et.al [17] proposed a simple, novel, yet highly effective method for robust face recognition. This technique extended set of LBP-like descriptors and have developed a very simple framework to fuse the proposed descriptors for the problem of face identification. Our main findings are as follows: (i) The suggested ELBP descriptors exploit most of the information available locally and do contain complementary information with each other, which is evidenced by the enhanced performance obtained by fused descriptors; (ii) The traditional uniform patterns approach does not apply to the proposed descriptors, (iii) The WPCA technique can further improve the recognition performance of the fused proposed features.

Cong Wang et.al [18] proposed a method to exploit the potential of Gabor phase features by using the co-occurrence information. The suggested histogram of co-occurrence of Gabor phase patterns (HCGPP) is extensively tested and compared with existing methods on the FERET and AR databases. However, the proposed descriptor HCGPP has a drawback of high dimensionality.

Won-Jae Park et.al [19] proposed a block-based speed up method for the pedestrian detection. The proposed method shows the comparable accuracy with HOG-LBP and is about three times faster than HOG-LBP and further proposed method is the rejecter with lower complexity using the selected blocks and the re-classification process which achieves almost the same accuracy as the conventional method.

Cuicui Kang et.al [20] proposed a novel kernel coordinate descent (KCD) algorithm based on the covariance update technique for l1 minimization problem in the kernel space and further this technique applied the new algorithm in the sparse representation classification framework for face recognition, and have shown that the powerful LBP descriptor can be utilized in the suggested framework with two kernels based on the $\chi 2$ distance and the Hamming distance.

A. Porebski et.al [21] proposed a score based LBP histogram selection for color texture classification. It consists in assigning to each histogram a score which measures its efficiency to characterize the match of the textures within the dissimilar classes. The histograms are then ranked according to the proposed score in order to select the most discriminant ones and thus build a low dimensional relevant subspace, in which a classifier operates.

Yunyun Cao et.al [22] proposed a modified Local Binary Pattern (LBP) feature extraction method for pedestrian detection at night/dark environment, in three steps (i) utilizing the magnitude component to weight the LBP code, (ii) using multiresolution to reduce the influence of noise, and (iii) exploiting multi-scale information to obtain more co-occurrence information of the grey scale patterns and further the proposed method can overcome partially, if not completely, the main problems of low contrast, image blur, and image noise at night/dark environment.

Yonggang He et.al [23] presented that the LBP distribution of different small regions in the same texture image might be different. The conventional LBP approaches just calculated the LBP histogram in the whole image and neglected the LBP statistic feature in local regions. In order to use full potential of local binary patterns and extracted the rotation invariant LBP histograms in small regions to learn the LBP texton dictionary for texture description. All the texture images were represented with the occurrence of textons, not the occurrence

Zhou Lubing et.al [24] proposed novel facial descriptor based on LGIP for facial expression recognition. The LGIP operator combines the strengths of gradient, uniform patterns and LDP. It depicts the local intensity increasing trend, and possesses good stability to noise and non-monotonic illumination changes. The LGIP histogram based facial descriptor contains information on pixel, regional and global levels. Thus, the descriptor displays encouraging discriminativeness for expression classification.

Lin Zhang et.al [25] proposed a novel training free rotation invariant texture classification technique, namely M-LBP. It combines two Rotation invariant measures, the local phase and the local surface type extracted by the 1st-order and 2nd- order Riesz transforms, with the traditional uniform LBP operator.

Zhenhua Guo et.al [26] proposed three kinds of directional statistical features. The mean value and standard deviation of the local directional differences, as well as the adaptive coefficients to minimize the local differences. These statistical features were used to weight the LBP histogram distances for texture classification.

Ching-Te Chiu et.al [27] proposed a new face descriptor for face recognition by combining the LBP and SQMV feature. Besides, the features are only extracted from eye regions rather than whole face image to decrease the computation complexity of the face recognition method. First, a simple and effective face recognition method based on texture classification and LBP is proposed to achieve better recognition rate than the original LBP methods and further the computation complexity is reduced with well face recognition rate.

Vinh Dinh Nguyen et.al [28] an adaptive local ternary-derivative pattern is proposed to capture more discriminating information and to sustain noise better than LBP and LDP. Experimental result for BP using three datasets indicates that the proposed method significantly improves the disparity quality of BP in CBD.

Hidenori Maruta et.al [29] presented a novel smoke detection method based on anisotropic LBP descriptors and AdaBoost. Anisotropic LBP descriptors are designed to have good properties to handle smoke information. That is, anisotropic LBP descriptors are considered to be effective to illumination variations and it can handle the deformation of smoke by environmental conditions.

Marcelo Musci [30] proposed a novel texture descriptor that results from concatenating the histogram of a texture binary code (either LBP or LPQ) and the histogram of a local variance estimate.
Jie Chen et.al [31] proposed a new framework for dynamic texture segmentation based on spatiotemporal features.

Jianfeng Ren et.al [32] proposed super histogram and further to improve the reliability. The temporal information is partially transferred into the super histogram.
Zhe Wei et.al [33] proposed a new feature set MS-LTP for face detection is presented. Comparisons are made among Haar, LBP, LTP, MB-LBP and MS-LTP as feature sets for face detection.

Gonzalo Vegas-Sanchez-Ferrero et.al [34] proposed a plaque characterization method for IVUS images based on the probabilistic behavior of speckle in each tissue class in dissimilar tissue types. A gamma distribution is assumed for the probabilistic description of the speckle because it has shown better performance than the Rayleigh and Nakagami distributions under the operations of down sampling and interpolation of the echo envelope. As each plaque type may present different echogenic content, a GMM is adopted for modeling each class.

Amit Satpathy et.al [35] proposed a novel edge-texture feature, Discriminative Robust Local Binary Pattern (DRLBP), for human detection to alleviate the limitations of Local Binary Pattern (LBP) and Non-Redundant LBP (NRLBP). LBP differentiates a bright human against a dark background and vice-versa. For human detection, this differentiation makes the intra-class variation of humans larger. NRLBP mitigates the problem of LBP by choosing the minimum of a LBP code and its complement. However, NRLBP maps LBP codes and its complements in the same block to the same code. This causes some structures to be misrepresented by NRLBP. Furthermore, LBP and NRLBP discard contrast information in their representation. As a result, similar regions with different contrast have related feature representation. For human detection, this is not desired as the human contour contains the most relevant information. By ignoring the contrast information, the contour is not effectively discriminated by the features. The new feature, DRLBP, considers both the gradient weighted sum and absolute difference of the bins of the LBP codes with their respective complement codes. In this way, DRLBP alleviates the problems of LBP and NRLBP for human detection.

A. Porebski et.al [36] proposed a score based LBP histogram selection for color texture classification. It consists in assigning to each histogram a score which measures its efficiency to characterize the match of the textures within the different classes. The histograms are then ranked according to the proposed score in order to select the most discriminant ones and thus build a low dimensional relevant subspace, in which a classifier operates.

Gulden Olgun et.al [37] Proposed a new algorithm for representing and classifying colon tissue images. In this algorithm and introduce a set of new high-level texture descriptors called local object patterns. And further define these descriptors on tissue objects, which approximately

ISSN (Online) 2394-2320

International Journal of Engineering Research in Computer Science and Engineering (IJERCSE)
Vol 5, Issue 4, April 2018

represent histological tissue components. Specify a set of neighborhoods with different locality ranges and construct a binary string for each of these neighborhoods to encode spatial arrangements of the objects within the specified local neighborhoods. And further characterize tissue objects using the decimal equivalents of the binary strings as descriptors and construct bag-of-words representation of an image from its characterized objects.

III. CONCLUSION

In this paper, we presented a summary of the most important face recognition systems. Face recognition is a both exciting and important recognition technique. Among all the biometric techniques, face recognition approach holds one great advantage, which is its user-friendliness. In this paper, we have given an introductory survey for the face recognition technology. This paper can provide the readers a better understanding about various face recognition systems, and we encourage the readers who are fascinated in this topic go to the references for more complete study.

REFERENCES

1) T.Kanade, M.Haaao "Edge and Line Extraction in Pattern Recognition", FMC. Inst. neet. Corn. -8. Japan, V01.55, No.12, pp.1618-1627, Dec. 1972
2) L. Sirovich and M. Kirby. Low-dimensional procedure for the characterization of human faces. Journal of the Optical Society of America A - Optics, Image Science and Vision, 4(3):519–524, March 1987.
3) T. J. Stonham. Practical face recognition and verification with wisard. In H. D. Ellis, editor, Aspects of face processing. Kluwer Academic Publishers, 1986
4) Chellappa, R., Wilson, C., Sirohey, S., 1995. Human and machine recognition of faces: A survey. Proceedings of the IEEE 83, 705–740.
5) M. Turk and A. Pentland. Eigenfaces for recognition. Journal of Cognitive Neurosicence, 3(1):71–86, 1991.
6) R. Diamond and S. Carey. Why faces are and are not special. An effect of expertise. Journal of Experimental Psychology: General, 115(2):107– 117, 1986.
7) A. Nefian and M. Hayes. Hidden markov models for face recognition. In Proc. of the IEEE International Conference on Acoustics, Speech, and Signal Processing, ICASSP'98, volume 5, pages 2721–2724, Washington, USA, May 1998.
8) M. Kelly, "Edge Detection by Computer Using Planning," in Machine Intelligence VI, Edinburgh Univ. Press, Edinburgh, 1971, pp. 397-409.
9) Sakai, T. 1969. Two new genera and twenty-two new species of crabs from Japan. Proc. BioI. Soc. Washington 82: 243-280.
10) P. Belhumeur, J. Hespanha, and D. Kriegman. Eigenfaces vs. fisherfaces: Recognition using class specific linear projection. IEEE Transactions on Pattern Analysis and Machine Intelligence, 19(7):711–720, July 1997.
11) P. Jonathon Phillips "Support Vector Machines Applied to Face Recognition" Advances in Neural Information Processing Systems, pp 803-809, 1999.
12) G. Guo, S. Li, and K. Chan. Face recognition by support vector machines. In Proc. of the IEEE International Conference on Automatic Face and Gesture Recognition, pages 196–201, Grenoble, France, March 2000.
13) Herbert Bay , Andreas Ess, Tinne Tuytelaars and Luc Van Gool "Speeded-Up Robust Features (SURF)" Elsevier Computer Vision and Image Understanding, Vol 110, pp 346-359, 2008.
14) Hajer Fradi, Jean-Luc Dugelay "A New Multiclass Svm Algorithm And Its Application To Crowd Density Analysis Using Lbp Features"
15) Ahmed Boudissa, Joo Kooi Tan, Hyoungseop Kim, Seiji Ishikawa "A simple pedestrian detection using LBP-based patterns of oriented edges"
16) Zhengrong, Yuee, Ross Hayward, Rodney Walker "Color And Texture Feature Fusion Using Kernel Pca With Application To Object-Based Vegetation Species Classification"
17) LiLiu, Paul Fieguth, Guoying Zhao and Matti Pietik "Extended Local Binary Pattern Fusion For Face Recognition"
18) Cong Wang, Zhenhua Chai, Zhenan Sun "Face Recognition Using Histogram Of Co-Occurrence Gabor Phase Patterns"
19) Won-Jae Park, Dae-Hwan Kim, Suryanto "Fast Human Detection Using Selective Block-Based Hog-Lbp"
20) Cuicui Kang, Shengcai Liao "Kernel Sparse Representation With Local Patterns For Face Recognition"
21) A. Porebski, N. Vandenbroucke, D. Hamad "Lbp Histogram Selection For Supervised Color Texture Classification"
22) Yunyun Cao, Sugiri Pranata "Local Binary Pattern Features For Pedestrian Detection At Night/Dark Environment"

23) Yonggang He, Nong Sang and Rui Huang "Local Binary Pattern Histogram Based Texton Learning For Texture Classification"
24) Zhou Lubing, Wang Han "Local Gradient Increasing Pattern For Facial Expression Recognition"
25) Lin Zhang, Lei Zhang, Zhenhua Guo, and David Zhang "A New Approach For Rotation Invariant Texture Classification "
26) Zhenhua Guo, Lei Zhan2, David Zhang and Su Zhang "Rotation Invariant Texture Classification Using Adaptive Lbp With Directional Statistical Features "
27) Ching-Te Chiu and Cyuan-Jhe Wu "Texture Classification Based Low Order Local Binary Pattern For Face Recognition"
28) Vinh Dinh Nguyen, Thuy Tuong Nguyen, Dung Duc Nguyen "Adaptive Ternary-Derivative Pattern For Disparity Enhancement"
29) Hidenori Maruta, Yusuke Iida, Fujio Kurokawa "Anisotropic LBP Descriptors For Robust Smoke Detection"
30) Marcelo Musci, Raul Queiroz Feitosa "Assessment Of Binary Coding Techniques For Texture Characterization In Remote Sensing Imagery"
31) Jie Chen, Guoying Zhao, Mikko Salo "Automatic Dynamic Texture Segmentation Using Local Descriptors And Optical Flow"
32) Jianfeng Ren, Xudong Jiang "Dynamic Texture Recognition Using Enhanced Lbp Features"
33) Zhe Wei†, Yuan Dong, Feng Zha‡, Hongliang Bai "Face Detection Based On Multi-Scale Enhanced Local Texture Feature Sets"
34) Gonzalo Vegas-Sanchez-Ferrero, Angel Serrano-Vida, Santiago Aja-Fernandez "Gamma Mixture Classifier for Plaque Detection in Intravascular Ultrasonic Images"
35) Amit Satpathy, Xudong Jiang, How-Lung Eng "Human Detection Using Discriminative And Robust Local Binary Pattern"
36) A. Porebski, N. Vandenbroucke, D. Hamad "Lbp Histogram Selection For Supervised Color Texture Classification "
37) Gulden Olgun, Cenk Sokmensuer, and Cigdem Gunduz-Demir "Local Object Patterns For The Representation And Classification Of Colon Tissue Images"