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Linear Discriminant Algorithm (LDA) Using 3d Image Face Recognition System

K.Rajakumari[1], C. Nalini[2]

Research Scholar, Asst. professor, Department of Computer Science Engineering, Bharath University, Chennai, Tamil Nadu, India[1]

Associate Professor, Department of Computer Science Engineering, .Bharath University, Chennai, Tamil Nadu, India [2]

ABSTRACT: A facial recognition system is a computer application for automatically identifying or verifying a person from a digital image or a video frame from a video source. One of the ways to do this is by comparing selected facial features from the image and a facial database. It is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition systems. Face recognition is not perfect and struggles to perform under certain conditions. There are two key problems for any face recognition problem: the illumination problem and pose problem. The performance for face recognition system drops significantly when pose variations are present in input images. This research aim to develop an automated and interactive computer vision for human face expression recognition. Facial recognition systems at a very high level work by recognizing a human face from scene and extract it. The system measures overall facial structure, distances between eyes, nose, mouth, and jaw edges, then compares these nodal points to the nodal points computed from a database of pictures in order to find a match. We furthermore show how the different images can be extended towards face recognition using pose, and illumination. This paper is a review of recent developments in face recognition techniques.

KEYWORDS: 3D Face, Face Identification, Pose, Illumination, LDA

I. INTRODUCTION

The most recent evaluation of commercial face recognition systems shows the level of performance for face verification of the best systems. Recognizing faces reliably across changes in pose and illumination as proved to be a much harder problem while the majority of research has so far focused on frontal face recognition, there is a sizable body of work on pose invariant face recognition and illumination invariant face recognition. However, face recognition across pose and illumination has received very little attention.

Face Recognition is machine and most one of the challenging research topics in the recent years. It has become an active research area which crosscuts several disciplines such as image processing, pattern recognition, computer vision, neural networks and robotics. In this chapter, an extensive and state-of-the-art study of existing approaches to handle illumination variations is presented. Several latest and representative approaches of each category are presented in detail, as well as the comparisons between them. Moreover, to deal with complex environment where illumination variations are coupled with other problems such as pose and expression variations, a good feature representation of human face should not only be illumination invariant, but also robust enough against pose and expression variations.

II. FACE RECOGNITION SYSTEMS

In general, an automatic face recognition systems are comprised of three steps. Their basic flowchart is given in Figure 1. Among them, detection may include face edge detection, segmentation and localization, namely obtaining a pre-processed intensity face image from an input scene, either simple or cluttered, locating its position and segmenting the image out of the background. Feature extraction may denote the acquirement of the image features from the image such as visual features, statistical pixel features, transform coefficient features, and algebraic features, with

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emphasis on the algebraic features, which represent the intrinsic attributes of an image[1]. Face recognition may represent to perform the classification to the above image features in terms of a[2][3] certain criterion. Segmentation among three steps is considered to be trivial, easy and simple for many applications such as mug shots, drivers licenses, personal ID card, and passport pictures[4]-[6]. Thus this problem did not receive much attention. Scholars have given more interest on addressing other problems. However, recently more effort is devoted to the segmentation problem with the advancement of face recognition systems under complex background.

Fig. 1. The basic flowchart of a face recognition

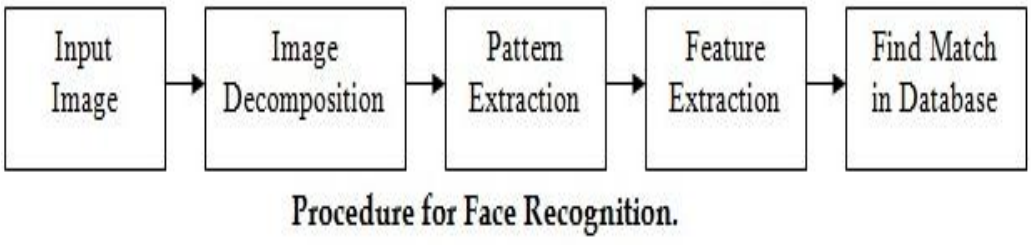

Fig. 1. The basic flowchart of a face recognition

III. DETECTION

Linear Discriminant Algorithm Pattern (LDA) features whereas Support Vector Machine (SVM) classifier is used with face detection evaluation. Haar-like features are evaluated through the use of a new image representation that generates a large set of features and uses the boosting algorithm to reduce degenerative tree of the boosted classifiers for robust and fast interferences only simple rectangular Haar-like features are used that provides a number of benefits like sort of domain knowledge is implied as well as a speed increase over pixel based systems, suggestive to Haar basis functions equivalent to intensity difference readings are quite easy to compute[7][8].

Implementation of a system that used such features would provide a feature set that was far too large, hence the feature set must be only restricted to a small number of critical features which is achieved by boosting algorithm, The original LDA operator labels the pixels of an image by thresholding the 3-by-3 neighborhood of each pixel with the center pixel value and considering the result as a binary number. Each face image can be considered as a composition of micro-patterns which can be effectively detected by the LDA operator. To consider the shape information of faces, they divided face images into N small non-overlapping regions[9].

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Fig. 3 Face detection

To reduce pose variation and illumination in extracted faces two extra actions performed in pre-processing stage to improve recognition results: 1) Eyes detection is been used to remove head turn, tilt, slant and position of face, demonstrated in figure 4; 2) Histogram equalization is been performed[10].

IV. FACE RECOGNITION

Eigenface considered as 2-D face recognition problem, faces will be mostly upright and frontal. That's why 3-D information about the face is not required that reduces complexity by a significant bit. It convert the face images into a set of basis functions which essentially are the principal components of the face images seeks directions in which it is more efficient to represent the data. This is mainly useful for decrease the computational effort. Linear discriminant analysis is primarily used here to reduce the number of features to a more manageable number before recognition because face is represented by a large number of pixel values. Each of the new dimensions is a linear combination of pixel values, which form a template. The linear combinations obtained using Fisher's linear discriminant are called Fisherfaces[11][12].

LDA is an order set of binary comparisons of pixel intensities between the center pixel and its eight surrounding pixels. filters can exploit salient visual properties such as spatial localization, orientation electivity, and spatial frequency characteristics. Considering these devastating capacities and its great success in face recognition Haar features are insensitive to transformations as illumination, pose and expressions although Haar transform is not specially designed for face recognition. Its transformation formula is predefined instead of learned from the face training data. Moreover PCA and LDA classifier consider global features whereas LDA and HAAR classifier consider local features, based on current facts experimental results are stated below[13].

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Table 2: Face recognition results summery

Dataset	Recognition			
	PCA	LDA	LBP	Gabor
[1]	72.10%	79.39%	85.93%	93.49%
[2]	69.87%	76.61%	80.47%	89.76%
[3]	70.95%	78.34%	84.14%	92.68%
[4]	74.79%	81.93%	86.45%	96.91%
[5]	68.04%	73.21%	77.69%	88.93%
Mean	**71.15%**	**77.90%**	**82.94%**	**92.35%**

V. DATASET

Five datasets been used for above experiments. In dataset, face collection with plain green background; no head scale and light variation but having minor changes in head turn, tilt, slant, position of face and considerable change in expressions[14]. In dataset , face collection with red curtain background, variation is caused by shadows as subject moves forward, having minor changes in head turn, tilt and slant; large head scale variation; some expression variation, translation in position of face and image lighting variation as subject moves forward, significant lighting changes occur on faces moment due to the artificial lighting arrangement. In dataset, face collection with complex background; large head scale variation; minor variations in head turn, tilt, slant and expression; some translation in face position and significant light variation because of object moment in artificial light. In dataset, face collection with plain background; small head scale variation; considerable variation in head turn, tilt, slant and major variation in expression; minor translation in face position and light variation. In dataset face collection with constant background having minor head scale variation and light variation; huge variation in turn, tilt, slant, expression and face position[15].

VI. CONCLUSION

The above is a walkthrough some of the researches in the face recognition methods. Face recognition is improves the accuracy of face recognition on expressional face images pose, illumination and lighting variations. Some methods performed consistently over different datasets whereas other methods behave very randomly however based on average experimental results performance is evaluated, five datasets been used for this purpose. Face detection and recognition method's result summery is provided in table 1 .In current system Haar-like features reported relatively well but it has much false detection than LDA which could be consider being a future work in surveillance to reduce false detection in Haar-like features and for the recognition part is reported well as it's qualities overcomes datasets complexity.

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