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Different Image and Video Surveillance Reorganization Techniques

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ABSTRACT

Face recognition and video/Image understanding are core components of video surveillance and real life applications as the systems are becoming highly important for crime investigation and suspicious movements detection due to which number of cameras installed in public space is increasing. Many cameras installed at dynamic positions are required to observe a wide and complex area, so observation of the video pictures by human becomes difficult to understand the behavior. There are different methods available like PCA, KPCA, KCA, and LDA which are used to improve the performance of the face recognition system for video. So in this paper we are going to review the different methods and techniques used to for the face and Video Surveillance.

Index Terms: Face Detection, Video Surveillance, Linear Discriminate Analysis (LDA), Kernel Fisher Analysis (KFA), Kernel Principal Component Analysis (KPCA), Principal Component Analysis (PCA).

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I. INTRODUCTION

In face recognition technique image normalization and processing are the one of the important parts. Variations in lighting conditions produce dramatically decrease of recognition performance. If an input image has dark lighting places and low contrast, its brightness and contrast should be improved. The histogram equalization used commonly cannot correctly improve all region of the image. When some places on the resulted image will remain too bright or too dark and the face image has irregularly lighted conditions. Face image has digital representation as any digital image; this mean has a binary representation of a two-dimensional image. The digital representation is an array of two dimensions called pixels. Each pixel has a numerical value which in monochromatic images appears as a grey level [1].

In last few decades, different face recognition methods and techniques have been reviewed and proposed in [2] [3] [4] [5]. Feature extraction is the most important part of the face recognition system or technique. In the current scenario an appropriate face representation system is required to analyze. This must be powerful and also computationally functional to possible extrinsic and intrinsic facial variations. There are different feature extraction methods are proposed for the face recognition system and some of the important methods are Principal Component Analysis (PCA) [2] [6], Linear Discriminant Analysis (LDA) [7], kernel methods[8],Eigenfaces [2], Laplacian faces [9], Fisherfaces [10], elastic bunch graph matching [11], neural networks[12] and support vector machine[13].In the literature of the face recognition, there are different face representation methods based on global features, including a big number of spatial-frequency techniques and some subspace-based methods [1]. In face reorganization technique large databases of face images are used to identify the individual person. The intensity of each pixel in a face image is entered as input feature, in conventional appearance-based systems. Because, there are many thousands of pixels in a face image [14], facial image data are always high-dimensional and significant computational time is required for the successful classification purpose. Thus projecting objects to a lower dimensional space entity are commonly used by subspace methods. In practical cases, one is often forced to use linear techniques when the image dimension is very large. LDA and PCA are two most important techniques used for extracting characteristics of the image. Most of the researchers mainly focused on projective transforms. Creating feature vector for each face image is the one of the

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essential part of these methods is then classify the input face image in large database by the feature selection methods. Creating feature vector also has the utility of minimizing dimension of the input images [4]. Principal component analysis (PCA) method achieved the dimension reduction by providing the real face image data onto lower dimensional subspace crossed by the best eigenvectors of the covariance matrix. Linear Discriminated Analysis (LDA) searches for the maximizing between class scatter, while constraining the data points of the same class to be as near to each other as possible, this mean searching for the minimizing within class scatter because LDA method looks for the projective axes on which the data points of two or more different classes are distant from each other [7]. Kernel PCA and kernel fisher analysis are non linear form of PCA and LDA respectively. Several researchers proposed techniques based on spatial-frequency methods, such as Discrete Cosine Transform (DCT) and Fourier transform [12] [14] [15]. In these methods, images are mapped to a low frequency domain bands having most facial differentiating features and discarding high bands[14].

The enhancement of face image is an important aspect in improving the performance of face recognition system. The main purpose of the face image enhancement is that the resulted images have better visual quality than the input one. Face image can be improved, by enhancing the brightness, contrast and resolution of image. This is the important part of pre-processing stage that can affect the feature extraction and finally recognition performance. For instance in [16], the image enhancement has been considered in face recognition technique. Song et al. [17], calculates, prior to feature extraction segmentation, the illustrate difference between right and left part of face from the input image. If there is a spacious amount of difference than take the mirror of average illuminated part.

The aim of this survey is to recognize the effect of image pre-processing on increasing the face recognition rate and to study the impact of these techniques on the image recognition system.

II. FACE RECOGNITION TECHNIQUES

There are different techniques available for image processing that apply mostly to the frontal faces. The overview of all these techniques are summarized I this section. Different advantages and disadvantages of each technique are also discussed. Techniques discussed in this section are eigenfaces (eigenfeatures), Fisherfaces, Support vector machine and neural networks. The approaches are analyzed in terms of the facial representations they used.

A. Eigenfaces

Karhunen-Loeve is based on the eigenfaces technique in which the Principal Component Analysis (PCA) is used. This method is successfully used in order to perform dimensionality reduction. In mathematical terms definition, the eigenfaces are the main components of the distribution of faces. This is also called as the eigenvectors which is the covariance matrix of the set of face images. Principal Component Analysis is used by Turk and Pentland for face recognition and detection [2]. The main objective of the PCA is to find the eigen-vectors, called as also "EigenFaces", of the covariance matrix corresponding to the generic training images (sample image). To show the different amount of the variation, the eigenvectors are ordered respectively, among the faces. Each face can be considered as a linear combination of the eigenfaces. The face is calculatd by using the eigenvectors having hightest eigenvalues. The best M eigenfaces define an M dimensional space, which is called as the "face space". Principal Component Analysis is also used by L. Sirovich and M. Kirby [18] to efficiently represent pictures of faces. They defined that images can be arround redesigned with a small collection of weights for each face and a standard face picture (eigenpicture). The weights describing each face are obtained by projecting the face image onto the eigenpicture.

B. Fisherfaces

Linear/Fisher Discriminant Analysis (LDA) was developed by R. A. Fisher in 1930 [19]. The Fisherface method is the face recognition method which is based on the appearance. The Linear Discriminant analysis technique has shown the useful result in the face recognition process. The LDA has demonstrated in (Ye and Li., 2004) [20]. All of these have used Linear Discriminant Analysis (LDA) to find a set of basis images which provides the help to maximize the ratio of between-class scatter to that of within-class scatter. There is one problem with LDA that within the class the scatter matrix is always single, since the number of pixels in image is larger than the number of images so it can increase detection of error rate if there is a variation in pose or lighting condition within same face images. So to overcome the single matrix problem, many algorithms have been proposed. [21]. Because the fisherfaces approach use the advantage of within-class information so it minimize the variation within each class, but due to it there is the increase in class separation. So the problem with variations in the same images such as different lighting conditions can be overcome.

C. Support Vector Machines

Support vector machines are learning machines that classify data by shaping a set of support vectors [22]. SVMs provide a generic mechanism to robust the surface of the hyper plane to the data through. Another benefit of SVMs is the low expected probability of generalization errors [23].nce the data is classified into two classes, an appropriate optimizing algorithm can be used if needed for feature identification, depending on the application [24]. SVM creates a hyper-plane between two sets of data for classification; in our work, we separate the data into two classes: face belongs to the train database and face doesn't belong to the train database. Input data X that fall one region of the hyper-plane, $(XT \bullet W - b) > 0$, are labeled as +1 and those that fall on the other area, $(XT \bullet W - b) < 0$, are labeled as -1.

D. Neural network

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The applications of neural networks are in many pattern recognition problems, like character recognition, object recognition, and autonomous robot driving. The main advantage of neural network in the face recognition is feasibility to capture the complex class of face patterns.
To get the best performance by the neural network, it has to be extensively tuned (number of layers, number of nodes, learning rates, etc.)[25]. The neural network is widely used because it is non linear in the network. So, the feature extraction step may be more efficient than the linear Karhunen-Loève methods in a dimensionality reducing linear projection is selected which increase the scatter of all projected samples. The authors reported that there was 96.2% accuracy in the face recognition process when 400 images of 40 individuals are considered. The classification time is less than 0.5 second, but the training time is as long as 4 hours features in a hierarchical set of layers and provides partial invariance to translation, rotation, scale, and deformation. In general, neural network approaches encounter problems when the number of classes (i.e., individuals) increases.

Database used	PCA	LDA	KPCA	KFA
Original PGM ORL db	66.07 %	86.07%	49.29%	85.07%
Haar 10 de-noised DB	66.43%	89.29%	51.07%	86.07
de-noised DB by (Haar+Bior1.1)10	72.50%	90.71%	51.43%	88.57%
HE DB	66.43%	85.36%	50.36%	81.43%
Adjust DB	72.14%	88.21%	54.95%	87.86%
Adjust +hist DB	75.00%	91.43%	3.21%	86.43%

Table 1. Comparisons in the performance PCA, LDA, KPCA and KFA face recognition methods [26].

III. CONCLUSION

This paper has attempted to review a significant number of papers to cover development in the field of human facial and voice recognition. Various techniques can be used for better recognition rate. Techniques with higher recognition rate have greater performance .These approaches provide a practical solution to the problem of facial expression recognition and can work well in constrained environment. Emotion detection using facial expression is a universal issue and causes difficulties due to uncertain physical and psychological characteristics of emotions that are linked to the traits of each person individually. Therefore, research in this field will remain under continuous study for many years to come because many problems have to be solved in order to create an ideal user interface and improved recognition of complex emotional states is required 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.

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