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Face recognition based on Bias-Variance method

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ABSTRACT: *Face recognition(FR) is challenging issue due to variations in illumination, aging, expressions, pose, fading etc. The bottleneck problem in face recognition is due to differences in pose, we will try to minimize this using Bias-variance tradeoff.In this paper bias variance method is used to solve face recognition problems.This method is based on analysis of confidence interval.The variance projection function is developed and employed to locate landmark on human face which are then used to guide the detection of position of different points on face.In Bias variance method smoothing interval of each image is calculated,then estimated value of each interval is calculated to determine confidence interval,variance is defined for each pixel, after that filtering is done for smoothing of image. Smoothing factor and variance are the main feature vectors for face extraction.*

Keyword-*Bias-Variance, Discrete Cosine Transform (DCT), Discrete Wavelet Transform (DWT), Face recognition (FR)*

I. INTRODUCTION

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 method to do this by comparing selected facial features from image and a facialdatabase. It is typically used in security systems and can be compared to other biometrics such as finger prints or iris recognition and many other systems.

Some face recognition algorithms identify facial features by extracting landmarks or features, from an image of the subjects face. Forexample, an algorithm may analyze the relative position, size or shape of eyes, nose, cheekbones and jaw.

Recognition algorithm can be divided into two main approaches, geometric which looks at distinguishing features, or photometric which is statistical approach that distills an image into values and compares the values with templatesto illuminate the variances.

There are many popular face recognition algorithms such as principle component analysis (PCA)[1] and Linear Discriminant analysis (LDA)[7]. In PCAthe 2D face images are transformed into ID vectors. The resulting vectors leadsto a high-dimensional space, where the evaluation of the covariance matrix became more difficult due to the big size or the great number of training samples. Linear Discriminant analysis (LDA) is closely related to principle component analysis.LDA works when the measurements made on independent variables for each observation are continuous quantities.The major drawbacks with these techniques are the performance drop due to variations in factors such as illumination, expression, pose, accessories and aging.

On the other hand, multi-resolution techniques have been used for feature extraction in many face recognition systems[2-4]. from them, the most popular are the discrete wavelet transform (DWT)[5], Gabor wavelets [6] and DCT [2].In DWT the face image is decomposed into different subbands and the subbands which contain the discriminatory formation for face recognition are selected for

face representation With the DCT pyramid, each face image is described by a low-pass filtered image (approximation subband) and the reversed L-shape blocks containing the high frequency coefficients of the DCT pyramid in the detail subbands.

In this paper face recognition approach is based on bias variance. we are trying to fix the variance between the points using bilateral filter.The basic idea is to nonlinearly map the input data from the input space to higher dimensional feature face and perform bias variance in feature space.

II. MULTIRESOLUTION ANALYSIS

We will briefly review multi-resolution decomposition techniques such as DWT and DCT.Bias variance scheme is then introduced.

2.1 Discrete wavelet decomposition

[8] Multi-resolution methods are mostly used in facial feature extraction, image/video compression applications. Wavelet based decomposition is the most widely used multi-resolution technique in image processing. The 2-D wavelet transform uses a family of wavelet functions and its associated scaling function to decompose the original image into different subbands, namely the low-low (LL), low-high

(LH), high-low (HL) and high-high (HH) subbands, which are also known as *A,V,H,D* respectively. The decomposition process can be recursively applied to low frequency channel (LL or A) to generate decomposition at the next level.

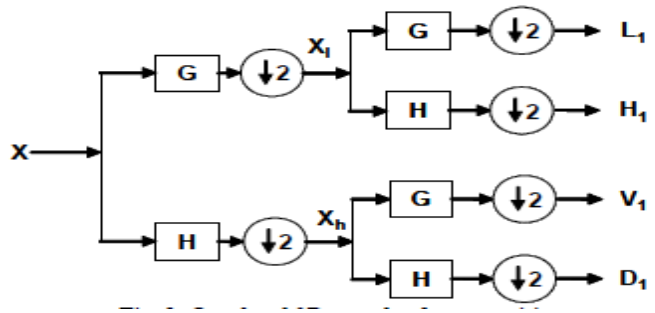


Fig.1 One level 2D wavelet decomposition.

2.2 DCT pyramid Decomposition-

[1, 2] Another multi-resolution technique is DCT pyramid decomposition. In DCT pyramid decomposition an image is break into two different components which are low-pass filtered image and high frequency components contains number of reversed L-shape blocks. DCT decomposition is performed in three parts-Processing steps for segmentation of face, feature selection process and the classification.

III. PROPOSED FACE RECOGNITION SYSTEM:

Proposed face recognition system is based on Bias-variance. Each face recognition system performs face recognition in three steps such as face detection, facial feature extraction and face recognition.

3.1 Preprocessing:

First step in any face recognition system is face detection. Face detection system is classified in to types of face detectors geometry based face detectors and skin based face detectors. Skin based face detectors involves face detection based on skin color and in geometry based face detection system need to find the geometrical relation between different points on face such as eyes,nose and mouth.Geometrical face detectors are only useful for frontal face images and suffers problem in complex images. Moreover skin color based detectors are useful for face detection.

In processing stage of face recognition system uses skin based face detectors that is it is statistical face detection system.

3.2 Facial feature vector extraction:

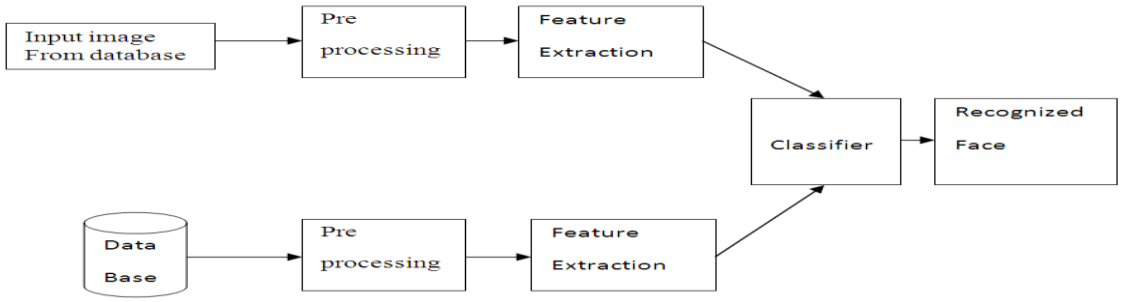
There are different feature extraction methods are based on DWT, WPD and DCT transform. For two level of decomposition these transform consist of one approximation image and 6, 15, different number of reversed L-shaped blocks of DWT, WPD and DCT respectively. All these transform consist of huge amount of information which increases the complexity of system. In order to reduce complexity another way is using statistical measures are as smoothing factor andvariance.

To find the location of any point minimum two points reference points required and the comparison is based on that point. At least one reference is common for two different views. First we will calculate smoothing interval an image, then estimated value of each interval is calculated to determine confidence interval, variance is calculated for each pixel, after that filtering is done for smoothing of image.

Variance is defined as:

$\sigma_{ij}^2 = \frac{1}{M1xN1} \sum_{y=1}^{M1} \sum_{x=1}^{N1} (sij(y,x) - \mu ij)2$

And M1 and N1 are sizes of each block having values $S_{ij}(y, x)$ at each decomposition level and μ_{ij} isthe mean.



Block diagram of face recognition system a) Feature extraction and Recognition

IV. EXPERIMENTAL RESULTS:

The recognition experiment will be conducted on standard database such as ORL DATABASE, FERET database or Yale database.ORL database contains 400 images of 40 individuals; each person has 10 different images. Yale database contains 165 images of 15 individuals; each person has 11 different images.FERET database contains 13539 face images of 1565 individuals.

V. CONCLUSION

This paper has proposed a face recognition approach based on Bias-Variance decomposition feature extraction. The dimension of the feature vectors is reduced using a set of block-based statistical measures extracted from each pixel. Moreover, using a block-based statistical feature such as variance has provided a good basis for face recognition. The advantages of using this method are accurate and fast identification, high usability and security, user friendly design. This proposed method can be used for Law Enforcement, counter terrorism, immigration, E-commerce, voter verification.Thus I would like to conclude by saying that, considering all requirements, identification systems that use face recognition and speaker identification seem to us to have the most potential for wide-spread application.

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