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Pose Invarient Face Recognition System

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Abstract: ***For intelligent vision based human computer interaction and research works images having faces are indispensable. Images containing faces are also essential for face processing which includes face recognition; face tracking, pose estimation and expression recognition. Face recognition is one of the biometrics methods which are used in identification of faces. Biometrics means life measure. In biometrics there are various criteria for recognition of individuals like finger printing, iris, voice, face etc. However human faces are easily collectible under various situations. So we use face recognition as a biometric measure. There are various factors which affect the recognition of faces. These factors are illumination, pose variation, resolution etc. For security purposes face recognition is important in many places like organizations, air ports, crime scene etc. It is also used in civil applications and law enforcement. Variations in poses have been major challenges in face recognition. This paper presents the method of face recognition which solves the problem of pose variation.***

Keywords: Biometrics, pose variation, face recognition

1. Introduction

Recognition of faces is something that people do without any apprehensive thought and effort, and then also in the area of computer vision it remained a difficult problem. In past decades, for researchers face recognition have been active area of interest. Despite of significant challenges Automatic face recognition have been active topic. Its performance has been improving continuously. Face recognition problem can be stated as 'individual identification from images of face'. Face recognition comes under biometric methods. Biometric is derived from combination of two Greek words 'bios' (life) and 'metric' (measure). One of the important parts in human interaction is knowledge of person. Humans know the person with whom they have social interaction and one expects from the computers of the future to have same capabilities. To authenticate identity of person, a number of biometrics traits have been developed and are used. Individual identity is called personal identification. A system requires certain personal recognition schemes based on that it can agree or disagree identity of individual. Based on behavioral and psychological characteristics of individuals biometrics refers to automatic recognition of individuals. There are various criteria for individual recognition in biometrics like finger prints, iris, face, voice etc. Traditional means of access control include token based identification systems and knowledge based identification systems. Driver's license or passports are examples of token based identification systems where as password or personal identification number are examples of knowledge based identification systems. Biometric identifiers are more reliable in verifying identity of person than token based and knowledge based identification systems as they are unique to individuals. However collection of biometric identifiers raises privacy concern issues.

Biometric method is divided in to two parts namely verification and identification. Verification process is done to authenticate the person. This is done to check whether a person is that actual person whom he claims to be. This is done by matching that person biometric with template of claimed identity. It is based on one to one matching i.e. who the user is and what the user knows. In verification mode the common use is positive recognition.

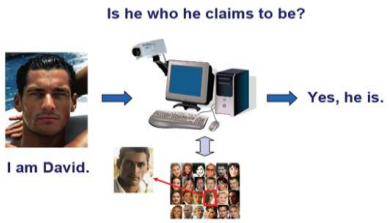

Fig 1. Verification Scheme

In identification/ recognition process one too many matching is performed. Here with template of each identity of database individuals biometric is compared. Results of comparison are based on threshold values. If within the value of threshold the comparison of biometric data to a stored template lies then we get success in comparison process. In recognition process the common use is either positive recognition or negative recognition.

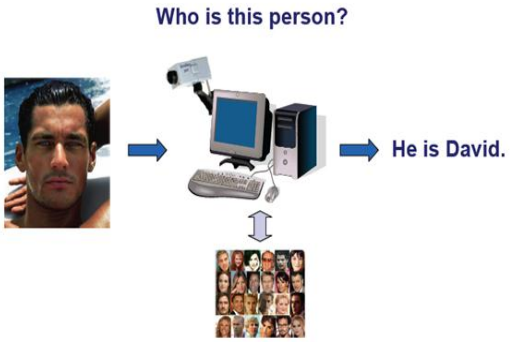

Fig 2. Identification scheme

LITERATURE REVIEW

A various number of new face recognition techniques have been proposed. Some uses multi modal approach which uses 2D+3D images. [1] operates information from intensity image and depth map. Here a depth map is introduced to enrich the performance of face recognition. It also uses a multi modal approach where combination of 2D and 3D is used. Through Gabor filters, Gabor features are extracted and then it is passed to enhanced local mix derivative pattern. Information is obtained with intensity image and depth map. Enhanced local mix derivative pattern is separately applied on depth map and 2D intensity image. In the last step the extracted features of two parts are combined and multiplied by resembling confidence weights. PCA is used here for dimension reduction.

Paper [2] recognizes face under pose and expression using advantages of thermal and visible images. The performance of classical PCA is highly improved by this combination. Here principle component analysis is applied in thermal as well as in visible spectrum. Complementary information is obtained from both spectrums through computation of Eigen faces. As a result for recognition fusion of both spectrums is done by computing Euclidian distance for K nearest neighbor classification and support vector machine.

In paper [3] one to one matching is described. Here query image is matched with gallery images. Here 3D generic elastic model is used to geometrically correct the view point of face. To invoke the pose tolerance subspace modeling and l1 minimization is used to extract sparse representation. This enables the combination of coequal frontal looking face which can be used in recognition.

In paper [4] for multi view face recognition it focuses on completely automatic method. For each frontal target face 3D model is build. This 3D model is used to generate synthetic target image. Target faces are generated with the help of Multiview face detector in such a way that it reduces the pose difference between query image and target image. Face alignment is done in next step using procrustes analysis. Key points are detected by MSTPM. For face matching block based MLBP features are used.

In paper [5] pose and expression invariant faces are recognized using elastic radial curves. Here elastic radial curves are examined to model 3D facial deformations. Facial surfaces are represented through pointer collection of radial curves originating from nose tips. Comparison of corresponding facial shapes is done through corresponding facial curves. To address the missing data and large pose variations, quality control module is defined. This module inspects the quality of curves and rejects the bad quality curves.

Paper [6] recognizes face across pose variation and the 3S problem. This paper breaks the assumption that when small sample size and pose variation problem are taken together, face recognition becomes complex and does not produce good results. Here interperson frame is used to extract facial features. These frames are generated through mesh morphing technique. Linear Discriminant analysis is used for generation of local and global features. Then local and global features are combined using weighted sum rule for projection of features in combined subspace

Paper [7] also uses multimodal face recognition using block based curvelet features. To compute depth map for stereo face images, stereo vision technique is used. Various mathematical measures such as mean, standard deviation, entropy, variance are extracted independently for both depth and intensity images. For computation decision score for depth and intensity map K nearest neighbor is used. For improvement in face recognition rate these decision scores for depth and intensity map are combined in decision level.

METHOD

In this section step by step whole method is introduced. First flow diagram of method is shown and then it is explained.

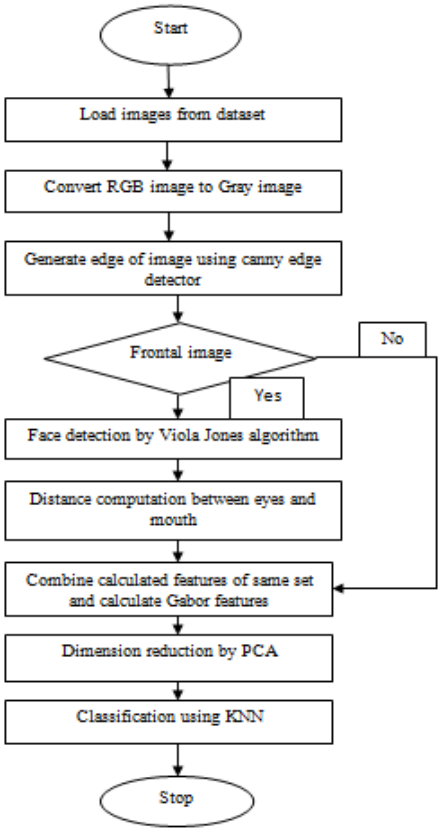

Fig 3. Flow Diagram Of Face Recognition System

Algorithm

Step 1: Load images from dataset-
Here images are loaded from the dataset.

Step 2: Conversion of RGB image into Gray scale -
RGB image is converted in to Gray scale for further processing.

Step 3: Edge detection through Canny-
Canny edge detector is used to detect edges. In this technique before finding edges, noise is removed from the image.

Step 4: Face detection through Viola Jones algorithm-
Viola Jones algorithm is used for face detection. The basic principle in which this algorithm works is to scan a sub window which is capable of detecting faces through input image.

Step 5: Feature extraction –
Various features are extracted in this step.

Step 7: Dimension reduction by PCA
Step 8: Classification by using K Nearest Neighbor algorithm

RESULT AND DISCUSSION

The performance of this algorithm is calculated by some performance evaluation parameters which are-

Precision-
Precision may be defined as the number of true positives in a class divided by total number of elements in true positive class.

Recall-
Recall is defined as the total number of true positive divided by the total number of elements that actually belongs to positive class.

Accuracy-
Accuracy is defined as sum of true positive and true negative divided by sum of all classes.

$$accuracy = \frac{tp + tn}{tp + tn + fp + fn}$$

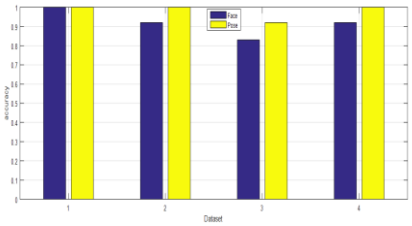

Fig 4: Bar graph for accuracy

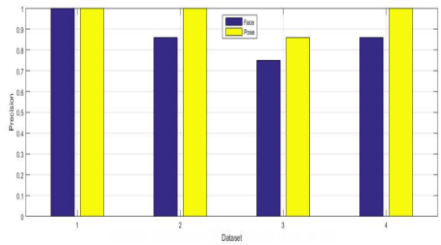

Fig 5: Bar graph for precision

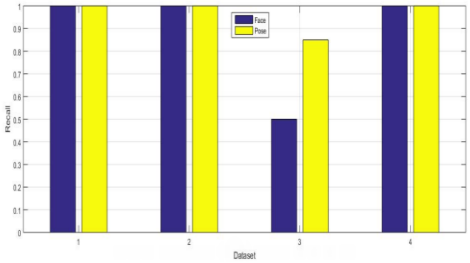

Fig 6: Bar graph for recall

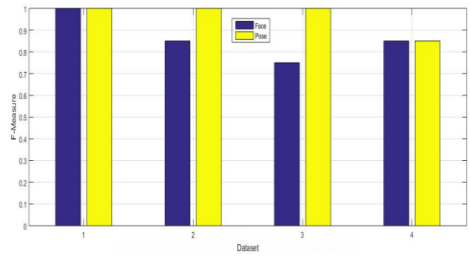

Fig 7: Bar graph for F- measure

CONCLUSION

Here a method pose invarient face recognition is presented and demonstrated on various performance measures – accuracy, precision, recall, f-measure. Here whole dataset is divided in to 4 groups. On this basis average accuracy for face is 92.5% and for pose is 98%

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