Image Processing and Artificial Neural Networks for Efficient Face Recognition Systems

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ABSTRACT

Security and authentication of a person is a vital part of any business. There are many techniques used for this purpose. One of technique is human face recognition. Human Face recognition is an effective means of authenticating a person. The benefit of this approach is that, it enables us to detect changes in the face pattern of an individual to substantial extent. The recognition system can tolerate local variations in the face expression of an individual. Hence Human face recognition can be used as a key factor in crime detection mainly to identify criminals.

There are several approaches to Human face recognition of which Image Processing Principal Component Analysis (PCA) and Neural Networks have been included in our project. The system consists of a database of a set of facial patterns for each individual. The characteristic features called „eigenfaces‟ are extracted from the stored images using which the system is trained for subsequent recognition of new images.

KEYWORDS: Biometrics, Neural Networks (NN), Principal Component Analysis (PCA), Eigen Values, Eigen Vector, Image Processing.

I. INTRODUCTION

Face recognition is an interesting and successful application of Pattern recognition and Image analysis. Facial images are essential for intelligent vision-based human computer interaction. Face processing is based on the fact that the information about a user's identity can be extracted from the images and the computers can act accordingly. Face detection has many applications, ranging from entertainment, Information security, and Biometrics [1]. Numerous techniques have been proposed to detect faces in a single image.

To build fully automated systems, robust and efficient face detection algorithms are required. The face is detected once a person's face comes into a view [2]. Once a face is detected, the face region is cropped from the image to be used as "Probe" into the knowledge to check for possible matches. The face image is pre- processed for factors such as image size and illumination and to detect particular features [3]. The data from the image is then matched against the knowledge [4]. The matching algorithm will produce a similarity measure for the match of the probe face into the knowledge.

The goal of this effort is to develop new algorithms for a robust pose-invariant face recognition that overcome many of the limitations found in existing facial recognition systems. Specifically, we are interested in addressing the problem of detecting faces in color images in the presence of various lighting conditions and complex backgrounds as well as recognizing faces under variations in pose, lighting, and expression. This work is separated into two major components (i) Face detection and (ii) Face recognition. Specific tasks include developing modules for face detection, pose estimation, face modeling, face matching, and a user interface.
We have developed a robust, real-time face detection system from color images using a skin-tone color model and facial features. Major facial features are located automatically and color bias is corrected

by a lighting compensation technique that automatically estimates the reference white pixels. This technique overcomes the difficulty of detecting the low-luma and high-luma skin tones by applying a nonlinear transform to the color space. We have also developed a robust face detection module to extract faces from cluttered backgrounds in still images The system is easily extended to work with video image sequences The proposed system not only detects the face, but also locates important facial features, such as eyes and mouth. These features are crucial to the performance of the face recognition.

Techniques Used for Face Recognition

a. Traditional

There some facial recognition algorithms identify faces by extracting important features from an image of the subject's human face. For example, an algorithm may analyze the relative position, size, shape of the eyes, eyebrows, nose, cheekbones, and jaw. These features are then used to search for other images with matching features from stored database. Other algorithms normalize a gallery of face images and then compress the face data, only saving the data in the image that is useful for human face detection. A probe image is then compared

with the face data. Popular recognition algorithms include Eigen-face, fisherface, the Hidden Markov model, and
the neuronal motivated dynamic link matching.

b. 3D

A newly trend, claimed to achieve previously unseen accuracies, is three-dimensional face recognition. This technique uses 3D sensors to gather information about the shape of a face. This information is then used to identify unique features on the surface of a face, such as the contour of the eye sockets, nose, and chin. One advantage of 3D human face recognition is that it is not affected by changes in lighting like other techniques. It can also identify
a human face from a range of viewing angles, including a profile view.

c. Skin texture analysis

It is another trend which uses the visual details of the skin, as captured in standard digital or computer scanned images. This technique, called skin texture analysis, turns the unique lines, patterns, and spots apparent in a person‟s skin into mathematical calculations. Tests have shown that with the addition of skin texture analysis, performance in recognizing human faces can increase 20 to 25 percent.

II. EXISTING SYSTEM

- ✓ Human Face recognition is the computer application technique to recognize a human face. When a person is registered in a face recognition system, a video camera takes a series of snapshots of the human face and then represents it by a unique code
- ✓ When person has their face verified by the computer system, it captures their current appearance look and compares it with the facial unique codes already stored in the database system.
- ✓ When human faces match, the person receives authorization for the system; otherwise, the person will not be authorized. The existing human face recognition system identifies only static face images that almost exactly match with one of the images stored in the image database.
- ✓ When the current image captured almost exactly matches with one of the images which is stored in database then only the person is authorized and granted access.
- ✓ When the current image of a person is considerably different, after comparing with image database say, in terms of facial
- ✓ expression then person will be denied

III. PROBLEM STATEMENT

In face recognition system, the face detection and feature mapping is core concern to analyze the face. There is need of training for detection of faces from different perspective. The efficiency is the main concern for feature selection and multiple algorithm proposed for solve the accuracy problems. In the past techniques, there is need to provide the large test or training images to detect and assign the particular class means efficient image processing. Automatic recognition of human face is a challenging problem which has received much attention during recent years due to its many applications in different fields. Human Face recognition is one of those challenging problems and up to date, there is no technique that provides a robust solution to all situations.

IV. PROPOSED SYSTEM

The proposed human face recognition system overcomes certain pitfalls of the existing human face recognition system. It is based on extracting the important features of a set of human faces stored in the database and performing mathematical operations for the comparison on the values corresponding to them. Hence when a new image is fed into the system for recognition the important features are extracted and compute result to find the distance between the input image with the stored database images. Proposed system can tolerate some variation in the new face image. When the new image of a person varies from the images of that person stored in the database, the system will be able to recognize the new face and identify person. The proposed system is better mainly due to the use of facial features rather than the entire face. Advantages in terms of

- o Human Face recognition accuracy and better unfair power Computational cost because smaller images require less processing to train the image processing PCA.
- o The use of dominant features and hence can be used as an effective means of authentication

V. FEATURE EXTRACTION TECHNIQUES FOR FACE RECOGNITION

Face Recognition is non-nosy strategy for distinguishing singular appearances by the element extraction and characterization of countenances. Facial component extraction is a standout amongst the most critical and endeavored issues in PC vision. This paper thinks about the distinctive facial component extraction methods like geometry-based element extraction (Gabor wavelet change), appearance based procedures, shading division

based systems and format based element extraction. These systems give differing execution different variables, for example, brightening variety, face appearance variety clamor and introduction. [3]

Feature Extraction Technique

Some picture handling methods separate element focuses, for example, eyes, nose, and mouth and after that utilized as info information to application. Different methodologies have been proposed to remove these facial focuses from the pictures. The fundamental methodologies are as per the following. [4]

A. Geometry –based Technique

In this method highlight are removed utilizing the size and the relative position of critical segments of pictures. In this strategy under the main technique firstly the course and edges of imperative part is recognized and after that building highlight vectors from these edges and heading. Vigilant channel and inclination investigation typically connected in this course. Second, strategies depend on the grayscales distinction of irrelevant parts and vital segments, by utilizing highlight squares, set of Haar-like component piece in Adaboost technique [8] to change the grayscales conveyance into the element. In LBP [9] strategy, each face picture separates into squares and every piece has its comparing focal pixel.

B. Format Based Techniques

This system will remove facial component taking into account the beforehand planned formats utilizing proper vitality capacity and the best match of layout in facial picture yield the base vitality. Strategies have been proposed by Yuille et al. [12], distinguishing and portraying elements of confronts utilizing deformable formats. In deformable formats the component of interest, an eye for instance, is portrayed by a Parameterized layout. These parameterized layouts empower from the earlier information about the normal state of the elements to manage the recognition procedure [12].

C. Appearance –based approach

This methodology procedure the picture as two dimensional examples. The idea of "highlight" in this methodology is not quite the same as straightforward facial elements, for example, eyes and mouth. Any separated trademark from the picture is alluded to an element. This technique bunch discovered best entertainer in facial component extraction since it keep the vital data of picture and reject the excess data. Strategy, for example, foremost part examination (PCA) and free segment investigation are utilized to extricate the component vector. The principle reason for PCA is to decrease the substantial dimensionality of watched variable to the littler natural dimensionality of free variable without losing much data. This procedure would be later the establishment of the proposition of numerous new face recognition calculations [5]. In PCA investigation high request conditions exist and this is the detriment of this technique since much data may contain in the high request relationship.

D. Shading –based approach

This methodology utilizes skin shading to confine the face region from the non face zone in a picture. Any non-skin shading area inside the face is seen as a contender for eyes or mouth [7]. The execution of such methods on facial picture databases is fairly restricted, because of the differences of ethnical foundations [6].

E. **Color Based Feature Extraction**

With the assistance of various shading models like RGB skin district is distinguished [4], [8]. The picture acquired in the wake of applying skin shading insights is subjected to binarization. Firstly it is changed to dark scale picture and after that to a twofold picture by applying appropriate edge. This is done to dispose of the shading and immersion values and consider just the luminance part. After this luminance part is changed to parallel picture with some limit on the grounds that the elements for face are darker than the foundation hues. In the wake of thresholding clamor is expelled by applying some opening and shutting operation. At that point eyes, ears, nose facial elements can be extricated from the parallel picture by considering the limit for zones which are darker in the mouth than a given threshold.

VI. RESULTS

In this paper, a new approach to face detection with Gabor wavelets& feed forward neural network is presented. The method uses Gabor wavelet transform & feed forward neural network for both finding feature points and extracting feature vectors. From the experimental results, it is seen that proposed method achieves better results compared to the graph matching and eigenface methods, which are known to be the most successive algorithms. In the proposed algorithm, since the facial features are compared locally, instead of using a general structure, it allows us to make a decision from the parts of the face. For example, when there are sunglasses, the algorithm

compares faces in terms of mouth, nose and any other features rather than eyes. Moreover, having a simple matching procedure and low computational cost proposed method is faster than elastic graph matching methods. Proposed method is also robust to illumination changes as a property of Gabor wavelets, which is the main problem with the eigenface approaches. A new facial image can also be simply added by attaching new feature vectors to reference gallery while such an operation might be quite time consuming for systems that need training. [6]

Although detection performance of the proposed method is satisfactory by any means, in future it would be further improved with some small modifications and/or additional preprocessing of face images. Such improvements can be summarized as;

1. A set of weights can be assigned to these feature points by counting the total times of a feature point occurs at those responses.
2. When there is a video sequence as the input to the system, a frame giving the "most frontal" pose of a person should be selected to increase the performance of face detection algorithm. 3) In order to further speed up the algorithm, number of Gabor filters could be decreased with an acceptable level of decrease in detection performance. [3]

VII. REFERENCES

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