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Face Recognition Using PNN Classifier and SIFT Feature Extraction

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Abstract- The main motive to design to recognize Automatic Face Recognition is the ability of person's and identity based on facial characteristics. One of the ways to do this is by comparing selected facial features from the test image and a facial database. Usually, the face image of a test subject is matched to the gallery data using a one-to-one or one-to-many scheme. The one-to-one and one-to-many matching are called verification and identification, the feature extraction on the other hand is usually applied to obtain the relevant facial features such as face regions, variations, angles or measures etc. from the data. The system proposes new approach in extension with local binary pattern called DRLBP and PNN classifier used for classification . By using these methods, the category recognition system has developed for application to image retrieval. The category recognition is to classify an object into one of several predefined categories. The discriminative robust local binary pattern (DRLBP) is used for different object texture and edge contour feature extraction process. It is robust to illumination and contrast variations as it only considers the signs of the pixel differences. The proposed features retain the contrast information of image patterns. They contain both edge and texture information which is desirable for object recognition, the simulated results will be shown that used discriminative robust local binary pattern has better discriminatory power and recognition accuracy compared with prior approaches.

Keywords- PNN classifier,DRLBP,SIFT,FER,Machine learning

I. INTRODUCTION

Facial expression recognition (FER) has become a hot research topic of human-computer interaction (HCI) and drawn a lot of attention due to its great potential in multimedia applications, e.g. digital entertainment, customer service, driver monitoring and so on. HCI would become more friendly and natural if computers are able to recognize affects as human beings, which can benefit from solving FER problems.

FER aims to analyze and classify a given facial image into one of the six commonly used emotion types where the six emotion categories are angry, disgust, fear, happy, sad and surprise. Numerous algorithms of FER have been proposed in the literatures during the past several years, including expression recognition from frontal and non-frontal facial images. Comparing to frontal FER, non-frontal FER is more challenging and more applicable in real scenarios. However, only a small part of algorithms among the proposed various methods address this challenging issue. For both frontal and non-frontal FER problems, a general recognition framework appeared in most of previous works can be divided into two major steps, one is the feature extraction and the other is classifier construction. To extract the facial features, various image features are employed in the previous papers, such as local binary pattern (LBP) local phase quantization , histograms of oriented gradients and scale-invariant feature transform (SIFT). Among the various facial features, SIFT has demonstrated promising performance due to its robust property to image scaling, rotation, occlusion and illumination differenceCommunication between two or more individuals can take place in the form of verbal or nonverbal language.

Nonverbal communication involves many different aspects as well as proxemics (physical and interpersonal space: distance and territoriality), kinesics (body orientation: body posture, body motion, and gesture), appearance (physical attractiveness and clothing), haptics (touch), paralanguage (voice, tone, rate, pitch, and volume of the speaker), and facial expression [2]All of these nonverbal communications need to be interpreted and they dominate more than 60 percent of the communication process[[3]. These nonverbal communications have a significant role in communicating the feelings, attitudes and emotions. Emotion itself is derived from the psycho physiological process stimulated by conscious and / or unconscious awareness to any event or object related with the mental state, characteristic and nature of a person [3] Emotion has a significant part in the communication between individuals. The emotion of an individual will influence the relationship with other people such as family, relatives and friends at home, workplaces or other environments that create connection with other people.

The emotion is manifested through the intonation in the voice, gesture and body posture, and most commonly facial expression

Face detection and face direction estimation are important for face recognition. In personal identification with surveillance cameras, for example, it is necessary to detect the face whose size, position, and pose are unknown. After the face detection, the face direction estimation is useful for the correct face recognition because we can select the face image of the most desirable direction from the face images taken by the multiple cameras.

Many methods have been proposed in the field of the face detection. One of them is based on the matching of facial template images. However, the size and pose of the face are limited because it takes terrible computation cost to consider all sizes and poses of the template image. On the other hand, the methods based on a skin color can detect any sizes and poses of the face. Because it is difficult to detect the face from a skin color background, the methods use in addition a head shape information [4] and a hair color information. Moreover it is necessary to make sure that there is a face actually in the region detected by the methods in order to reject the false detection. To make sure whether there is a face actually or not, the approach to extracting facial features such as pupils, a nostril and a mouth is considered. For the facial features extraction, the method based on the geometric face model is proposed [5]. However, the method assumes the nearly frontal face**.**

II. RELATED WORK

Many previous image processing methods discard low frequency components of images to extract illumination invariant for face recognition. However, this method may cause distortion of processed images and perform poorly under normal lighting. Although 3D face imaging is increasingly popular, many 3D facial imaging systems have significant noise components which need to be reduced by post-processing if meaningful recognition results are desired.

Biometric image recognition is the process of studying the closest match region in between the examining images. The study of the recognition is done about the spatial pixels (picture element) among the image. Recognition of two different biometric features, fingerprint and face images are attempted. One of the major challenges encountered by current Face Recognition (FR) techniques lies in the difficulties of handling varying poses and illuminations. In this paper we propose three novel techniques, viz. Face Recognition (FR) under varying lighting conditions and pose is very challenging. This paper proposes a novel approach for enhancing the performance of a FR system, employing a unique combination of Active Illumination Equalization (AIE), Image Sharpening (IS) the appearance of the face varies drastically when background, pose and illumination change. Variations in these conditions make Face Recognition (FR).

M. Sushama et.al The detection of human face from images plays a vital role in Computer vision, cognitive science and Forensic Science. The various computational and mathematical models, for classifying face including Scale Invariant Feature Transform (SIFT) and Dominant Rotated Local Binary Pattern (DRLBP) have been proposed to yield better performance. This paper proposes a novel method of classifying the human face using Artificial Neural Network. This is done by pre-processing the face image at first and then extracting the face features using SIFT. Then the detection of human faces is done using Back Propagation Network (BPN). The process of combining[8]

Nthabisenget.al The choice of a face database should solemnly depend on the problem to be solved. In this research work, we use the Face Recognition Technology (FERET) database to address the challenge of face pose variations. The Scale Invariant Feature Transform (SIFT) is used to represent these face images in the database. SIFT has been proven to be a robust and a powerful method for general object detection in the past years. This method is now popular in the field of face recognition for purposes of extracting key points which are scale and orientation invariant from the face image. This work demonstrates that through extracting SIFT features from different face image patches and at different sigma σ values a face pose can be classified towards better pose invariant face recognition.[9]

Lilly Jebarani et.al In recent days, a number of face recognition and authentication mechanisms are developed in the computer vision applications. The human faces may be obstructed by other object that makes the acquisition of fully holistic image processing as a complex task.

To overcome this problem, a new partial face recognition system is introduced in this paper. This work includes the pre-processing, face detection, feature extraction and classification tasks. At first, the given face image is pre-processed by using the Gaussian filtering technique, which efficiently removes the noise and smoothens the image. Then, the Viola Jones algorithm is implemented to detect the face from the filtered image. Here, the Scale Invariant Feature Transformation (SIFT) technique is employed to extract the features for better classification. After that, the Robust Point Set Matching (RPSM) technique is used to align the probe partial face to gallery facial images even with the presence of occlusion, random partial crop and exaggerated facial expression. Finally, the Probabilistic Neural Network (PNN) classification technique is developed to classify the given face image. The experimental results evaluate the performance of the proposed face recognition system in terms of sensitivity, specificity, accuracy, precision and recall.[10]

III. PROPOSED APPROCH

we propose the new method of the face detection. We first extract the face candidate regions by using the skin and hair color information and then seek the facial features to make sure that there is a face actually in the face candidate region. To extract the facial features of the face whose pose is unknown, we extract the candidates of the facial features by using the color and shape information and then match them to the face models of three directions: front, left and right. This module also detects the surface of the object in the detected area of the face and transforms and reduces the face. The element extraction module is used to create a face representation.

Detects the main points of the SIFT and creates a set of SIFT descriptors to display the face image. The following module is used to select the most representative face vectors to create an accurate face model, The recognized face is compared with the face models stored in the Face Gallery and the most similar model is selected as the recognized face. The last reliability module is to identify whether the recognition result is correct, followed by a classifier.

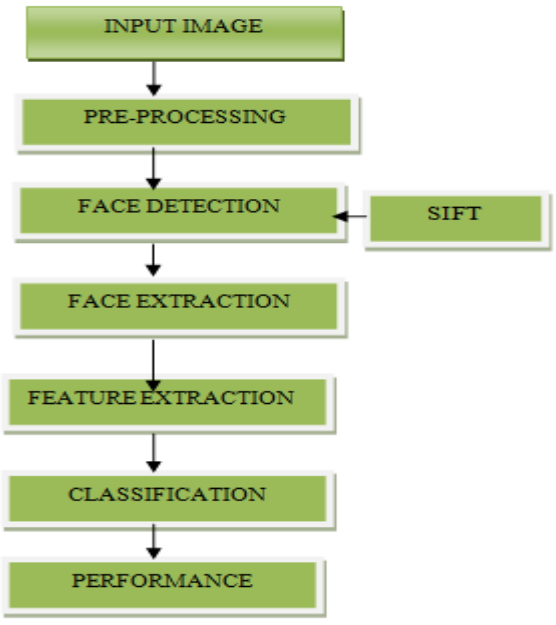

Fig.1 proposed flow chart

1.Binary image this is the simplest image with two grayscale values, 0 and 1, or black and white. Each pixel is represented by one bit. This type of image is useful in computer vision applications where only image or overview information is required. It can be created based on a grayscale image that uses 0 for pixels with a gray level below the threshold value and 1 for other pixels, but this way of creating is not useful because most of the information is lost and the result of the image is smaller.

2. Gray image- these images contain brightness information. The number of bits used to display each pixel is related to the number of different available brightness levels. A typical image contains 8 bits per second. Pixel, so there are 256 different possible grayscale (Ng) values or intensity values from 0 to 255.

3. Color image- images are usually displayed as RGB models (red, green, blue) and each pixel has 24 bits. Brightness and color information is linked and displayed in many applications. The two information is separated by transferring information to the RGB

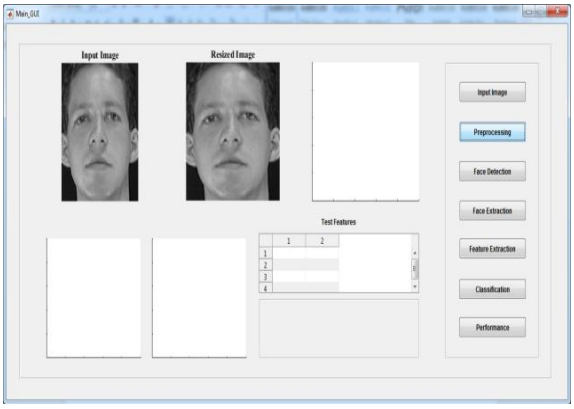

Fig 2 GUI Window

Face representation storage is displayed by Face Gallery. Images from the dataset gallery that handle the first module Resize & Normalization, followed by the pre-processing of this pre-processing module, converts a colour image to the grayscale view and then performs face detection.

Fig 3 GUI Window Detected Face

Then face recognition. Compare the recognized face with the face pattern stored in the "Face Gallery" and select the model that looks like the recognized face.

4.Feature Extraction- Feature detection employs a particular description to distinguish or retrieve the information of interest within images or blocks, such as edges, corners, colors, etc., for the establishment of the

corresponding characteristic value (e.g. eigenvalue) of information in order to facilitate general search.

5. SIFT -The scale-invariant feature transform (SIFT) is a feature detection algorithm in computer vision to detect and describe local features in images. SIFT keypoints of objects are first extracted from a set of reference images and stored in a database.

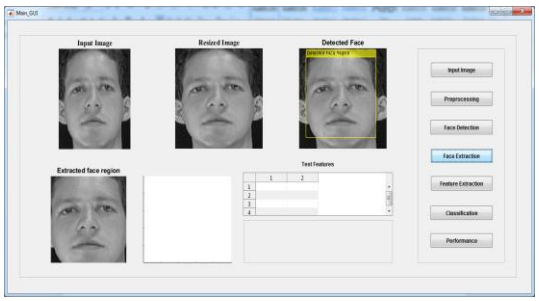

Fig 4 GUI Window Extracted Region

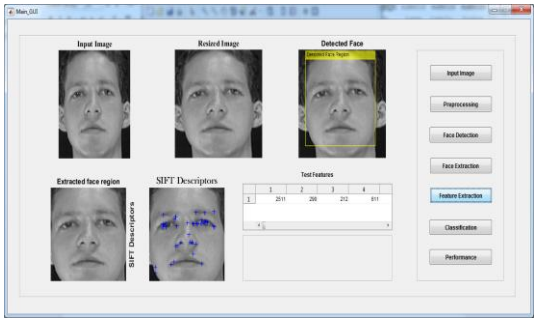

Fig 5 GUI Result Window

Fig 6 GUI Window.

The scale-invariant feature transform (SIFT) is an algorithm used to detect and describe local features in digital images. It locates certain key points and then furnishes them with quantitative information (so-called descriptors) which can for example be used for object recognition

6. Classification- The purpose of the classifier is to compare the features of the test surface with the features of the template and make a final decision on some similarity measures. For face recognition, the most commonly used classifier is N-neighbor classifier. When designing an NN classifier, it is important to measure the consistency. One direct method is to measure the similarity of the two compared images. Another possible method is to calculate the distance between the two imaging functions

A PNN is a feed forward neural network, which was derived from Bayesian network and a statistical algorithm called Kernel Fisher discriminant analysis [10]. It was introduced by D.F. Specht.PNN made three assumptions: if each classification probability density function has the same type, then it is the Gaussian distribution and it is also the normal distribution. Each classification which Gaussian distribution probability density function of the covariance matrix is diagonal matrix and each values is the same
The following sets up the PNN.
Step 1. Read in the file of exemplar vectors and class numbers
Step 2. Sort these into the K sets where each set contains one class of vectors
Step 3. For each k
define a Gaussian function centered on each exemplar vector in set k define the summed Gaussian output function
Once the PNN is defined, then we can feed vectors into it and classify them as follows.
Step 1. Read input vector and feed it to each Gaussian function in each class
Step 2. For each group of hidden nodes, compute all Gaussian functional values at the hidden nodes
Step 3. For each group of hidden nodes, feed all its Gaussian functional values to the single output node for that group
Step 4. At each class output node, sum all of the inputs and multiply by constant
Step 5. Find maximum value of all summed functional values at the output nodes.

The discriminative robust local binary pattern (DRLBP) is used for different object texture and edge contour feature extraction process. It is robust to illumination and contrast variations as it only considers the signs of the pixel differences. The proposed features retain the contrast information of image patterns. They contain both edge and texture information which is desirable for object recognition.

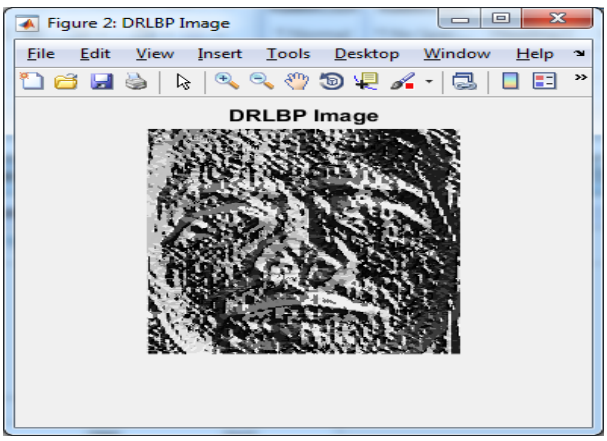

Fig.7 DRLBP Image

The DRLBP discriminates an object like the object surface texture and the object shape formed by its boundary. The boundary often shows much higher contrast between the object and the background than the surface texture0

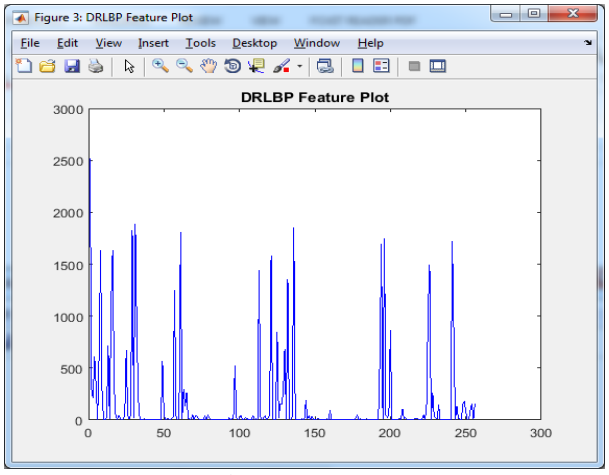

Fig.8 DRLBP Histogram

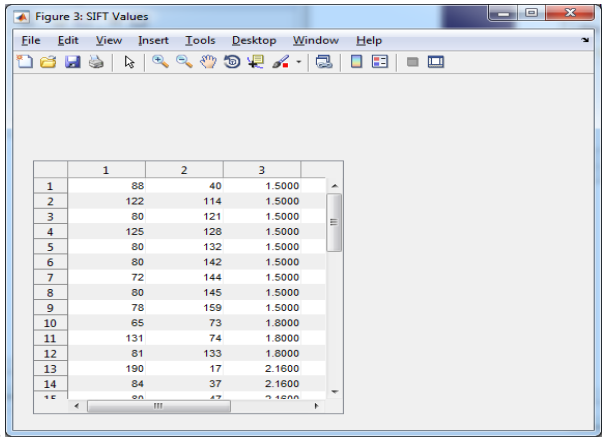

Fig9 . SIFT feature Values

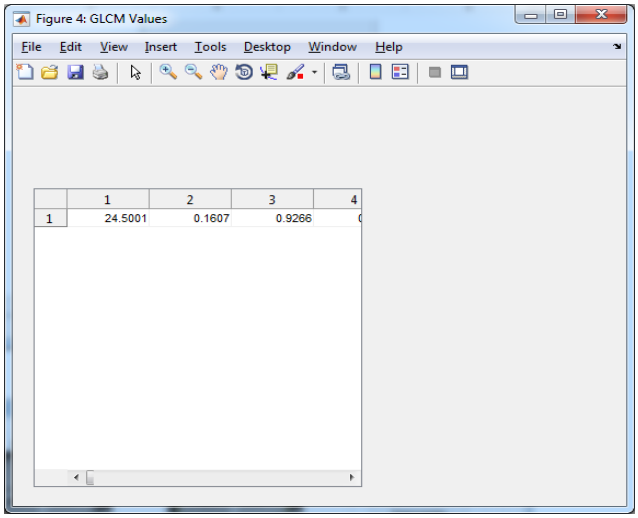

Fig.10 GLCM feature Values

Gray Level Co-Occurrence Matrix-A **GLCM** is a histogram of co-occurring greyscale values at a given offset over an image. In this example, samples of two different textures are extracted from an image: grassy areas and sky areas. For each patch, a **GLCM** with a horizontal offset of 5 (distance=[5] and angles=[0]) is computed. Theproposed work show the recovery accuracy. Finally, evaluate performance factors such as accuracy, recall, and accuracy.

Table1 Result Comparison

	Accuracy	Specificity	Sensitivity
Proposed work	98.92	98.54	99.86
Previous work[1]	75	60	86

V. CONCLUISON

Facial feature extraction plays an important step in automated visual interpretation and human face recognition. Detecting facial feature is a crucial role in a wide variety of application such as human computer interface, facial animation and face recognition, etc. The major objective of this paper is to review the recent developments on the methods of facial feature extraction. This paper presents different methods for feature point extraction and highlights their performance. Various applications on feature point extraction are also summarized in this study to provide a guide reference source for the researchers involved in facial feature extraction and their applications. Use the SIFT function to extract the first function of the object and detect the frames that match the object of interest. Since the SIFT algorithm is used in feature extraction, the tracker representation of the object of interest is unchanged. this method can improve the recovery accuracy. Finally, evaluate performance factors such as accuracy, recall, and accuracy.Therefore, evaluate to the Viola-Jones algorithm, it has higher performance by using parameters such as sensitivity, specificity and accuracy. The prospect range of this article be able to be implemented in video-based kind. In the future, we can expand our work on detecting moving objects with non-static backgrounds and have more cameras that can be used for real-time monitoring applications.

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