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A New Approach to Face Recognition under Partial Visible Conditions Based on Fusion

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Abstract: ***In this work, presents new technique for partial face recognition based on fusion. It provides feasible way to locate the positions of two eyeballs, near and far corners of eyes, midpoint of nostrils and mouth corners from face images. This approach would help to extract useful features on human faces automatically and improve the accuracy of face recognition. A whole partial face recognition system proposed on HOG feature and NN Classifier. The Histogram of Oriented Gradients (HOG) is a feature descriptor used in machine learning and pattern recognition for the purpose of detects an object. The technique counts occurrences of gradient orientation in localized portions of an image. Nearest Neighbor Classifier is a class of non-parametric method used in statistical classification (or pattern recognition). The method classifies objects based on closest training.***

Keywords: Partial Visibility, Histogram of Gradients, Features: Color, Shape and Texture

I. INTRODUCTION

Nowadays biometrics is playing a major role in the world. Everyone is rushing towards to secure their personal things with their biological parts like eyes, face, finger, palm and iris. Biometrics is a word which is derived from the term Bio (body parts) and metrics (measuring values). It compares the input object/image with the existing image which is stored in the database and identifies the particular person or verifies the person.

A face recognition system is a computer application capable of identifying or verifying a person from a digital image or a video frame from a video source. One of the ways to do this is by comparing selected facial features from the image and a facial database. In earlier algorithms they extract the features of major landmarks or features of other parts which subjects to face like relative position, size, and/or shape of the eyes, nose, cheekbones, and jaw. With extracting these kinds of features they compare with images which are there in the database to verify or identify the face which is having/matching these extracted features. In other cases many algorithms determines the face by the extracting texture of skin. By this texture analysis it gives unique lines, patterns and it finds the spots which are easy to judge/recognize the face of a particular image.

II. REVIEW OF LITERATURE

According to Athinodoros et.al. [1] Proposed a face recognition scheme using Discrete Cosine Transform (DCT) for local and global features. Though a high recognition rate is obtained in this study, the images are restricted to a size of 128 * 128 pixels. In the authors presented a novel algorithm based on a hybrid of contourlet and manifold learning. According to Yanhong Fu [2] proposed a face extraction and recognition based on two dimensional principal component analyses (2DPCA) and extended local binary pattern (Extended LBP, ELBP) texture. First, the ELBP operator is employed to extract the local texture of the face images. Second, 2DPCA is used to reduce the dimensionality of the extracted feature and get the optimal projection space. Finally, the nearest distance classification is used to distinguish each testing image.

Blagojce Jankulovski et.al. [7] proposed an automated analysis of mammographic images is a very important and complex challenge. Five texture descriptors were used to describe the images, or image patches. Then, the resulting descriptors were classified using three classification algorithms. The best results were achieved in the case of the GLDM descriptor when the images were classified using random forest classifier.

Chitaliya et al introduced a face extraction and recognition method using Contourlet Transforms and Principal Component Analysis. The feature vector obtained after applying PCA for dimensionality reduction is used as a classifier.

III. PROPOSED METHODOLOGY

We capture full and partial face images as RGB and convert it into gray scale than binary image. Next extract the features from the image such as colors, shape, textures. Later combine the features to classify by using the methods Histogram of Oriented Gradients (HOG) and Nearest Neighbor Classifier (NNC) and the result of the classification will be matched with the full face image and partial face image by using the performance measures such as recalling, presion, F-measure etc and the recognition results will be displayed.

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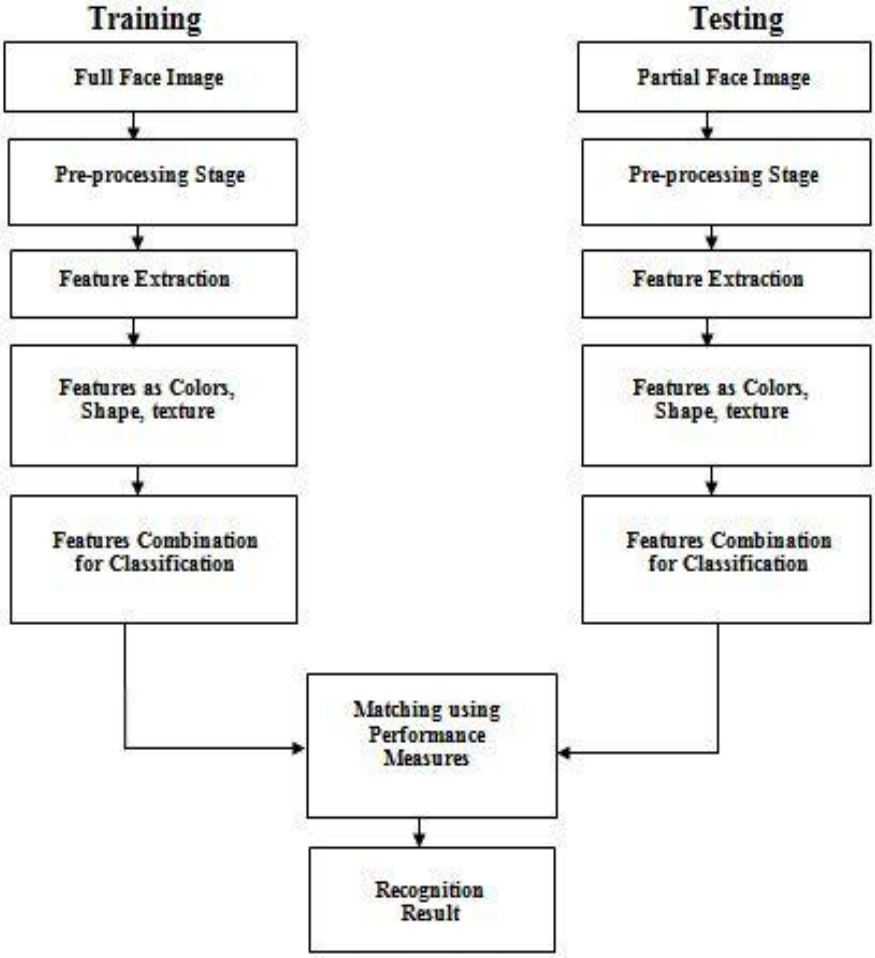

Figure 1: Structural view of Proposed System

3.1 Pre-processing Stage

The full face image is resizing the images keeping an aspect ratio. RGB color image is converted into gray scale, because the intensity value of the gray scale is less than RGB images.

Figure 2: Resized Image

Figure 3: Gray Scale Image

3.2 Feature Extraction

In pattern recognition and in image processing, feature extraction is a special form of dimensionality reduction. When the input data to an algorithm is too large to process and it is suspected to be notoriously redundant (much data, but not much information), then the input data will be transformed into a reduced representation of set of features (also named features vector). Transforming the input data into the set of features is called features extraction. If the features extracted are carefully chosen it is expected that the feature set will extracted the relevant information from the input data in order to perform the desired task using this reduced representation instead of the full size input. Features often contain information relative to gray shade, texture, shape or context. To classify an object in an image, first we have to extract some features out of the image.

In feature extraction, we are using the HOG feature which is known as Histogram of Oriented Gradients. It is a feature descriptor used in computer vision and image processing for the purpose of object detection. The technique counts occurrences of gradient orientation in localized portions of an image.

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Figure 4: Histogram of Oriented Gradient Image

3.3 Color Histogram

In image processing and photography, a color histogram is a representation of the distribution of colors in an image. For digital images, a color histogram represents the number of pixels that have colors in each of a fixed list of color ranges that span the image's color space, the set of all possible colors. The color histogram can be built for any kind of color space, although the term is more often used for three-dimensional spaces like RGB or HVS. For monochromatic images, the term intensity histogram may be used instead. For multi-spectral images, where each pixel is represented by an arbitrary number of measurements (for example, beyond the three measurements in RGB), the color histogram is *N*-dimensional, with N being the number of measurements taken. Each measurement has its own wavelength range of the light spectrum, some of which may be outside the visible spectrum. If the set of possible color values is sufficiently small, each of those colors may be placed on a range by itself; then the histogram is merely the count of pixels that have each possible color. Most often, the space is divided into an appropriate number of ranges, often arranged as a regular grid, each containing many similar color values. The color histogram may also be represented and displayed as a smooth function defined over the color space that approximates the pixel counts.

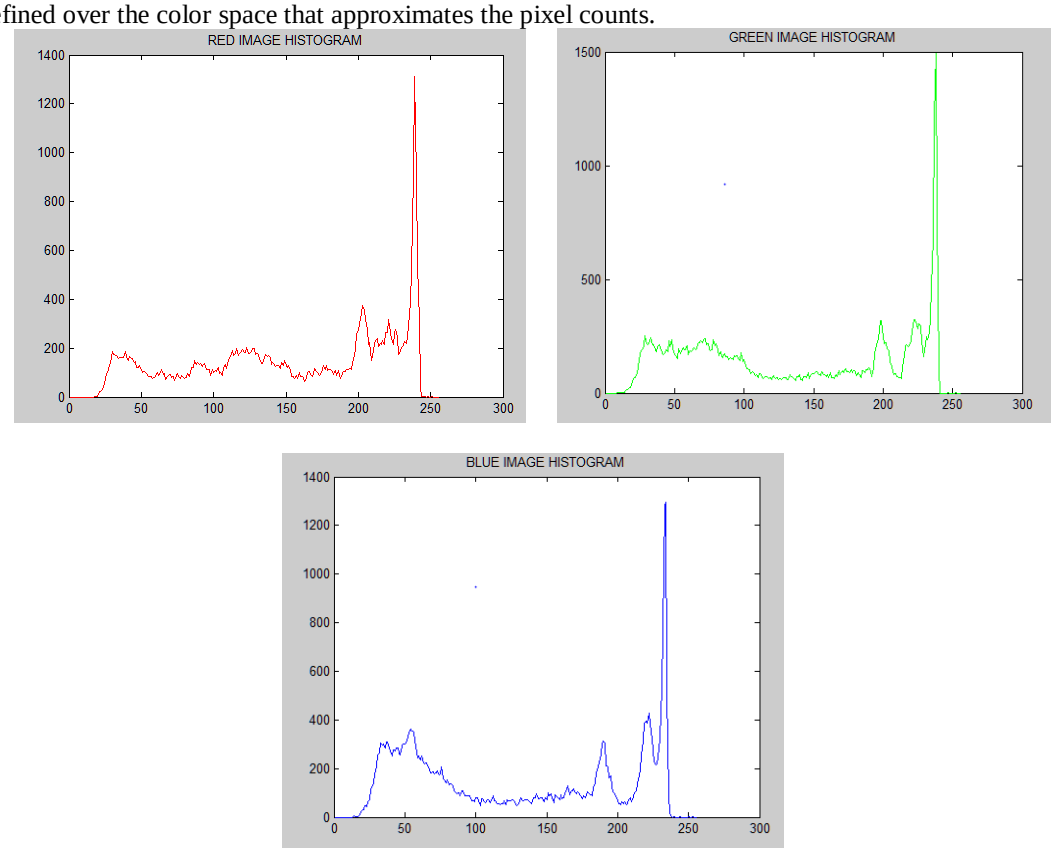

Figure 5: Color Histogram Image

3.4 Texture Method

Texture is an important characteristic for analyzing the different types of images. It can be seen in all images, from multi spectral scanner images obtained from aircraft or satellite platforms to microscopic images of tissue samples. Image texture, defined as a function of the spatial variation in pixel intensities (gray values), is useful in a variety of applications and it has been a subject of intense study by many researchers. One immediate application of image texture is the recognition of image regions using texture properties. Texture is the most important visual cue in identifying these types of homogeneous regions. This is called texture classification.

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Texture is also a combination of repeated patterns with a regular frequency. Texture analysis is defined as the classification or segmentation of textural features with respect to the shape of a small element, density and direction of regularity. In the case of digital image, it is difficult to treat the texture mathematically because texture cannot be standardizing quantitatively since the data volume is so huge. Image analysis techniques have played an important role in several medical applications. In general, the applications involve the automatic extraction of features from the image which is then used for a variety of segmentation and classification tasks, such as distinguishing normal tissue from abnormal tissue. Depending upon the particular classification task, the extracted features capture morphological properties, colour properties, or certain textural properties of the image.

The GLDM method calculates the Gray level difference method probability density function for the given image. This technique is usually used for extracting statistical texture features of a digital mammogram. From each density function five texture feature are defined: Contrast, Angular Second moment, Entropy, Mean and Inverse Difference Moment. Contrast is defined as the difference in intensity between the highest and lowest intensity levels in an image thus measures the local variations in the grey level. Angular second moment is a measure of homogeneity. If the difference between gray levels over an area is low then those areas are said to be having higher ASM values. Mean it gives the average intensity value. Entropy is the average information per intensity source output. This parameter measures the disorder of an image. When the image is not texturally uniform, entropy is very large. Entropy is strongly, but inversely, correlated to energy

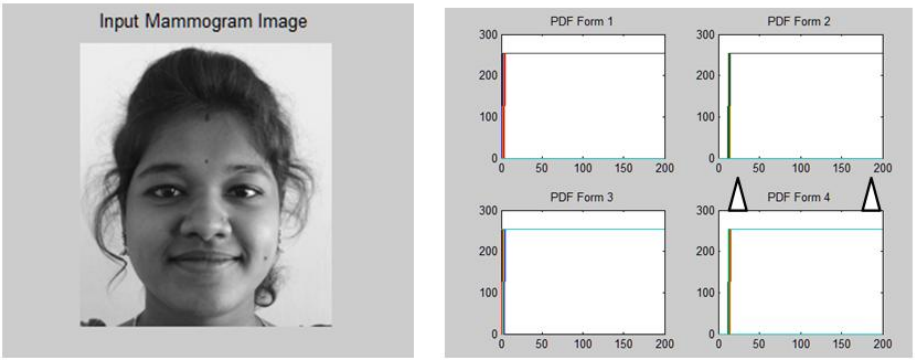

Figure 6: GLDM Texture Image in PDF Forms

3.5 Shape

The Prewitt operator is used in image processing, particularly within edge detection algorithms. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function. At each point in the image, the result of the prewitt operator is either the corresponding gradient vector or the norm of this vector. The prewitt operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical directions and is therefore relatively inexpensive in terms of computations. On the other hand, the gradient approximation which it produces is relatively crude, in particular for high frequency variations in the image.

Figure 7: Prewitt Edge Detector

IV. EXPERIMENTAL RESULTS AND ANALYSIS

We have captured images from digital camera and totally collected 500 samples of face images for training and testing.

Figure 8: Sample face images

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Observations: First, we retrieve the input image from the database than the input image is resized to aspect ratio in the pre-processing stage. The resized image is used to extract the feature using HOG feature extractor.

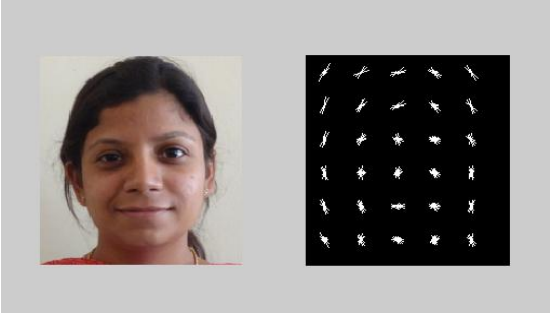

Figure 9: Input Image and HOG Image

After feature extraction we apply color histogram to the input image so we separate the RGB color channels of the histogram and plot the histogram diagram. Calculate the peak value of the histogram and store in the database.

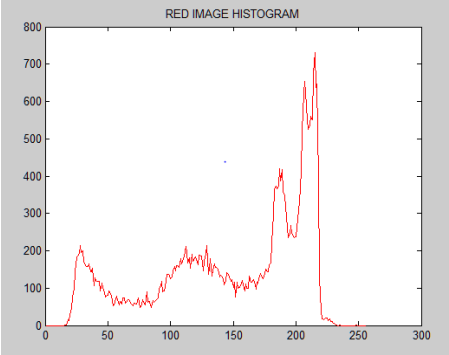

Figure 10: Red Channel of Histogram

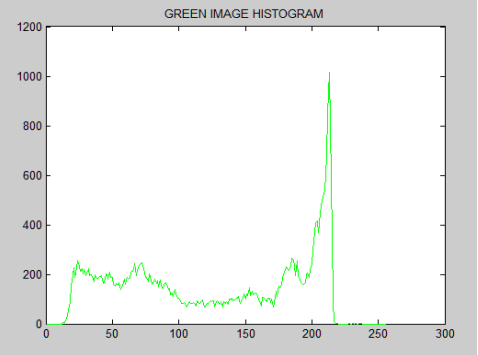

Figure 11: Green Channel of Histogram

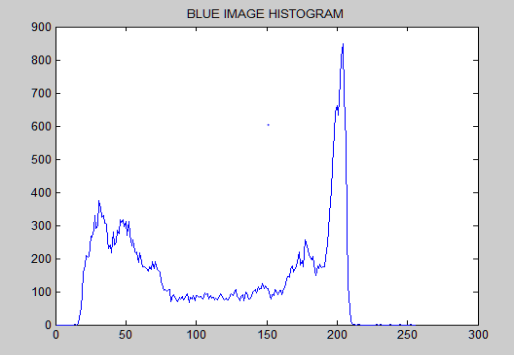

Figure 12: Blue Channel of Histogram

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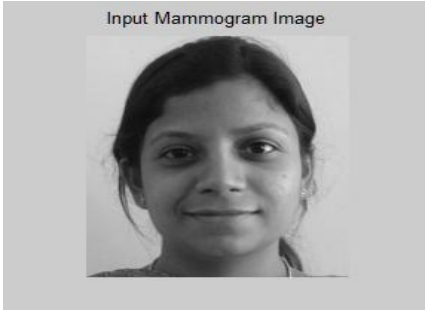

Figure 13: Input Mammogram Image

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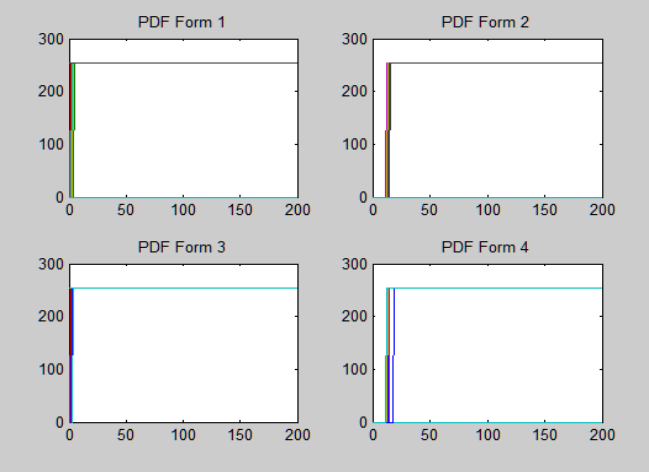

Figure 14: GLDM Texture Image in PDF Forms

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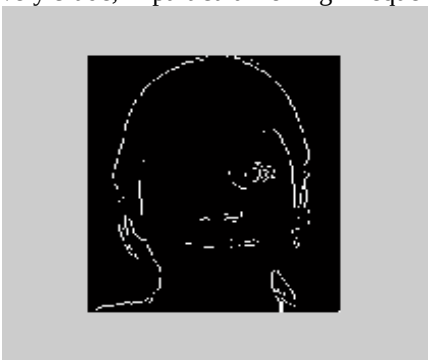

Figure 15: Prewitt Edge Detector

V. CONCLUSION AND FUTURE WORK

This paper has present a new approach to partial face recognition technique based on HOG feature which tries to detect the object and NN Classifier which extract the similar pixels from the image features and extract the edges of the features and display the dimensionality of the features of the image. The drawback of this project is it can't tell the difference between identical twins. In our project we have worked on limited features such as color, shape and texture. It can implement on other features also such as angle, rotation, scale etc. We have used HOG feature extraction to extract features of the image, additional we can use other extraction feature such as PCA, LBP and LAD etc. We combined two features each in the feature combination for classification, more than two features we can combine and classify it. For performance measuring we used existing methods such as Precision, Recall, F-measure and Euclidean, it can also measure using sorting techniques.

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