Face Recognition Based On Granular Computing Approach and Hybrid Spatial Features

S.Sankara vadivu[1], K. Aravind Kumar[2]

Final Year Student of M.E, Department of Computer Science and Engineering, Manonmaniam Sundaranar University, India[1]
Assistant Professor, Department of Computer Science and Engineering, Manonmaniam Sundaranar University, India[2]

Abstract—The face biometric based person identification plays a major role in wide range of applications such as surveillance and online image search. The first stage starts with face detection will used to obtain face images, which also have the normalized intensity, which are uniform in size and also the shape and only the face region Here granular computing and spatial features will presented to match the face images in the various illumination changes. The Gaussian operator also generates a sequence of low pass filter images by convolving each of constituent images with a 2-D Gaussian kernel. By this granulation method, facial features are segregated at dissimilar resolutions to provide edge details, noise, level of smoothness, and presence of blurriness in a face image. In this features extraction, WLD descriptor represents an image as a histogram of differential excitations and gradient locations, and several interesting properties like robustness to noise and illumination transforms, effective detection of edges and powerful image representation.

Keywords : Granular computation, weber local descriptor

I. INTRODUCTION

The identification of objects in the image would probably starts with the image processing techniques such as noise removal, and also by (low-level) feature extraction to locate lines and regions and possibly areas with certain textures. Here granular computing and the spatial features presented to match face images in the various illumination changes. The Gaussian operator also generates the sequence low pass filter images by convolving each of the constituent images with 2-D Gaussian kernel. Then, DOG pyramid formed by the successive iterations of Gaussian images. By this granulation, facial features also segregated at the different resolutions to provide edge details, noise, smoothness, and blurriness present in a face image.

II. LITERATURE SURVEY

A. *Improved Colour Image Enhancement Scheme using Weber's Algorithm.*

This research work deals with the enhancement which is used to detect the background in color images characterized by defective contrast. Image enhancement has been carried out by two methods based on the Weber's law notion. The first method also employs the information from the image background analysis by the blocks, while second transformation method utilizes the opening operation and closing operation, which is employed to define the multi background colour images. Morphological transformations (Opening by the reconstruction, Erosion-Dilation method) and also Block Analysis is used to detect background of colour images. Filtering out the salt and pepper noise during the time of background detection .For aiding better results, the compressed domain (DCT) technique is used exclusively for color image enhancement. These results are technique is illustrated in different backgrounds, most of them in deficient lighting condition.

B. *Gabor Features in Image Analysis.*

In applications of the computer vision and image analysis, Gabor filters have been maintaining their popularity in feature extraction for three decades. The original reason draw attention was the similarity between the Gabor filters and receptive field of the simple cells in visual cortex. A more practical reason is success of their many applications, for e.g., face detection and also recognition, iris recognition and also fingerprints matching; where Gabor features based methods are among the top performers.

C. *Image Enhancement and Background Detection Using Morphological Transformation.*

This paper deals with the enhancement of images and background detection using Mathematical Morphological [MM] theory on dark images. Due to the poor lightening background of image is not clear. This image can also be enhanced by lightening the background with the various morphological operations. Basically, Weber's Law Operator is also used to analyze the dark images which are carried out by the two methods such as the Image background detection by the block analysis while the second operator utilize opening by reconstruction of defining multi background notion.

III. EXISTING METHOD

Face is one of the new physiological biometrics due to stable and unique characteristics. The rich texture information of face offers one of powerful means in personal recognition. According to psycho-physiology study, the main visual cortex in the visual area of human brain is responsible for creating the basis of a three-dimensional map of visual space, and extracting the features about form and orientation of objects. The basic model can be expressed as a linear superposition of basic functions. This idea inspired us to implement two well known linear projection techniques, namely Principle Component Analysis (PCA) and Independent Component Analysis (ICA) to extract the face texture features. Two different frameworks of ICA [1] are adopted to compare with PCA for the recognition performances by using three different classification techniques.

A. PCA.

PCA has been widely used for dimensionality reduction in computer vision. Result shows that PCA also performs well in various recognition tasks. In our context, the basis vectors, bi (x,y) generated from a set of face images are called Eigen face, as they have the same dimension as the original images and are like face in appearance. Recognition is also performed by projecting the new image into subspace spanned for the Eigen faces and then classifying into face by comparing its position in the face space also with the positions of known individuals.

$$C = \sum_{j=1}^{m} \varphi_j \, \varphi_j^t$$

B. Face Recognition based on DCT Feature Extraction.

In the field on image processing and also recognition, discrete cosine transforms (DCT) and linear discrimination is two widely used techniques. Based on, we present new face and face recognition approach in this paper. It first uses a two dimensional severability judgment select the DCT frequency bands with favorable linear severability. Fisher face method and it performs the classification by nearest neighbor classifier.

The experiments on face databases and face database demonstrate that are compared to state-of-the-art of linear discrimination methods, and our approach obtains better classification performance. It can also be significantly improve recognition rates for the face and face data and to effectively reduce the dimension of the feature space. Frequency domain analysis is the commonly used for image processing and recognition technique. To extract the frequency- domain features for image recognition. Li *et al.* extract Fourier range and angle features to identify the face image. Lai *et al.* using the holistic Fourier invariant features to recognize facial image. Also spectral feature generated from the singular value decomposition (SVD) is used by the some researchers during the past years; some work has been done to extract the frequency- domain features for image recognition. Li *et al.* extracting the Fourier range and the angle features to identify the face image. Lai *et al.* use the holistic Fourier invariant features is to recognize facial image. Another spectral feature generated from the singular value decomposition (SVD) is used by some researchers.

C. Recognition Procedure.

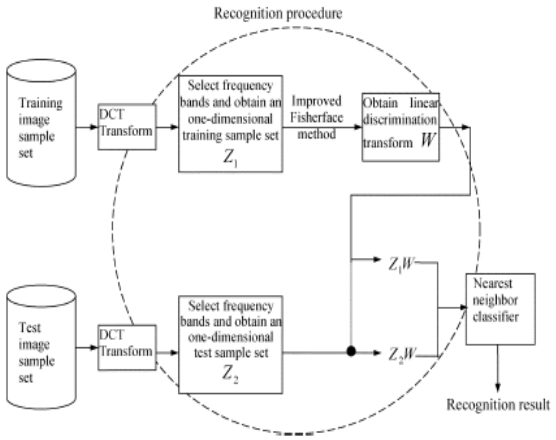


Figure 1:Recognition Procedure

D. Face Geometric Measurement.

Gender classification algorithms on well-aligned images perform quite well. For multi-view facial images, however, the issue becomes much more complex. The feature space is much larger, and designing an orientation-invariant feature is very difficult. A commonly adopted solution is dividing the feature space into several subspaces according to face locations, which decomposes the multi-view problem into easier classification tasks on simpler subspaces.

Human faces are bilaterally symmetrical. There may be some special characteristics on someone's face which could be the decisive evidence to recognize a certain person. But in the area of gender classification, the special characteristics are not so important. Thus, whether the characteristic is on the left cheek or right would not affect the result of gender classification. In most cases, the face images are exactly bilaterally symmetrical. We can identify a person in an image as a man or women according to the geometric measurements of the face and organs, the position of the facial components, the style of hair, the texture of the skin, and many other details on the face. A symmetric process will do no harm to the feature extraction of all the above information.

Figure 2: Symmetric Trick

IV. PROPOSED SYSTEM.

A . Face Detection.

- It is the process to extract face regions from input image which has normalized intensity and uniform in size.
- The appearance features are extricated from detected face part which describes changes of face such as furrows and wrinkles (skin texture).
- In this system model, an executable (.dll- dynamic link library) file is utilized to extract face region.
- It is used for face detection method which is based on haar like features and adaptive boosting method.

B. Simulated results of Difference of gaussian.

The first stage is to construct a Gaussian "scale space" function from the input image [1]. This is formed by convolution (filtering) of the original image with Gaussian functions of varying widths. The difference of Gaussian (DoG), D(x, y, σ), is calculated as the difference between two filtered images, one with k multiplied by scale of the other.

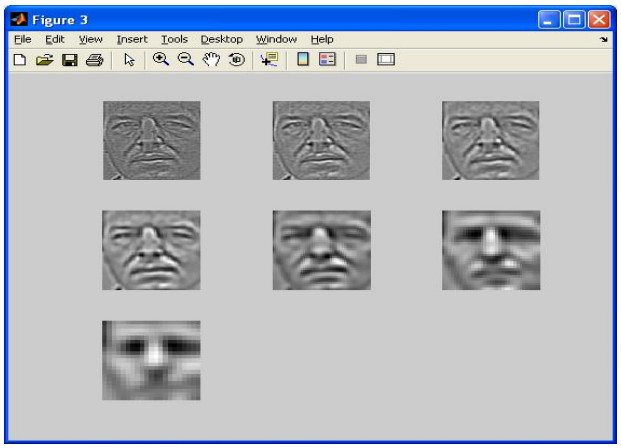


Figure 3: Simulated Results of difference of Gaussian pyramids

$$D(x, y, \sigma) = L(x, y, k\sigma) - L(x, y, \sigma)$$

These images, L(x, y, σ), are created from the convolution of Gaussian functions, G(x, y, kσ), with an input image, I(x, y).

$$L(x, y, \sigma) = G(x, y, \sigma) * I(x, y)$$

C . Webers Local Descriptor.

In this section we give an overview of basic WLD descriptor and its extension. This descriptor represents an image as a histogram of differential excitations and gradient orientations, and has several interesting properties like robustness to noise and illumination changes, elegant detection of edges and powerful image representation.

The low frequency sub bands of two source images are fused based on selection of appropriate coefficients using Gabor filtering. It is useful to discriminate and characterize the texture of an image through frequency and orientation representation. It uses the Gaussian kernel function modulated by sinusoidal wave to evaluate the filter coefficients for convolving with an image.

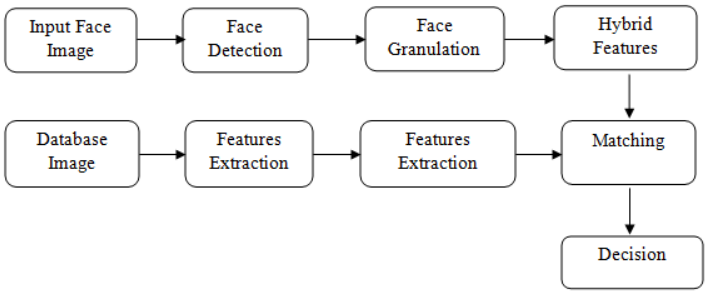
D. Features Matching.

Euclidean distance computes the resemblance between two different feature vectors using

$$ED = \sqrt{\sum_{j=0}^{j} (FV_{1,j} - FV_{2,j})^2}$$

where J, the length of the feature vector, Fvi, the feature vector for individual i.

E. System Architecture.



V. EXPERIMENTAL RESULTS

The appearance features are extracted from detected face part which describes changes of face such as furrows and wrinkles (skin texture).In this system model, an executable (.dll- dynamic link library) file is utilized to extract face region. It is used for face identification process is based on haar like features and adaptive boosting method.

Figure 4: Input Image

Figure 5: Face Detection

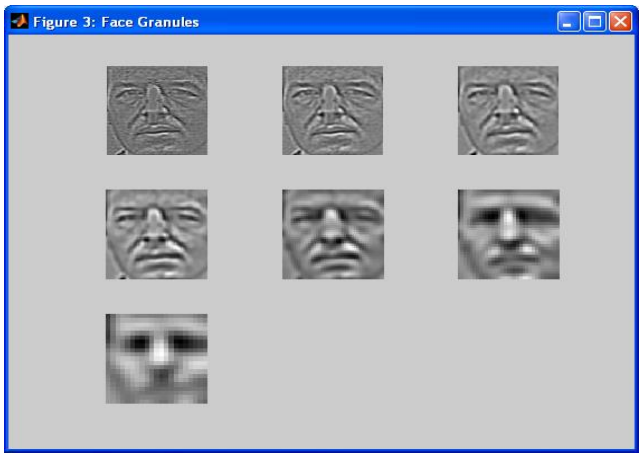


Figure 6: Face Granules

To detect face granules, 2D Gaussian low pass filter is used to generate difference of Gaussian between two successive filtering at each reduced version of image. At each iteration level, the image will be down sampled to desire size to make difference of Gaussian pyramid. These granules are used to provide facial features such as level of smoothness, edge details and blurriness.

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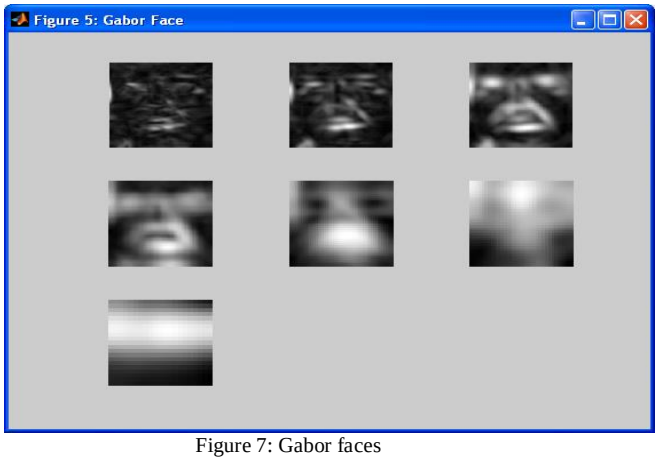

Figure 7: Gabor faces

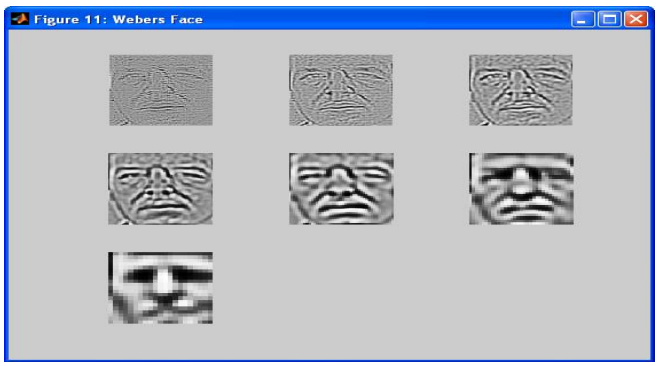

Figure 8: Weber faces

In this we give the overview of the basic WLD descriptor and also its extension. This descriptor represents the image as a histogram of the differential excitations and also gradient positions, and has several interesting properties like robustness to noise and illumination changes, detection of edges and image representation.

VI. CONCLUSION

The project presented the robust human face recognition system based on granular computation and hybrid spatial features extraction. Here granular computing based on the Gaussian operator was used to decompose the image into different scale spaces for effective texture representation. The texture descriptors called Gabor filter bank and Weber's local descriptor was used here to characterize the face appearance. These approaches were well used to identify the illumination changes, intensity distributions characteristics. Here, matching was done between input and original samples using Euclidean distance metrics. Finally the simulated results shows that used methodologies provides better recognition rate with minimum error rate for all samples.

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AUTHORS PROFILE

S. Sankara vadivu has received B.E. degree in Computer Science and Engineering from Francis Xavier Engineering college, Tirunelveli, Tamilnadu, India. He is pursuing his M.E. degree in Computer Science and Engineering from Manonmaniam Sundaranar University, Tirunelveli, India in 2015. Her subjects of interest include Image Processing and Computer Networks.

K. Aravind Kumar. M.E. is working as a Assistant Professor in Department of Computer Science and Engineering, Manonmaniam Sundaranar University, Tirunelveli, Tamilnadu, India. His subjects of interest include Computer Networks and Data Mining.