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Face Recognition Using Bank of Gabor Filters

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Abstract- In recent trends, face recognition is an important tool for security identification besides law enforcement, excess control and several navigation aids. The proposed algorithm applies a different 40 Gabor filters bank on an image. As a result of which 40 images with different angles and orientation were received. Subsequently, maximum intensity points in each filtered image were calculated and marked as fiducial points. The system reduced these points in accordance to distance between them which were followed by calculating the distances between the reduced points using distance formula. At last, the distances were compared with database. The distances matched with database were referred to image recognition.

Keywords- **Fiducial Points, Gabor Filter Distance Formula, Face Recognition Image.**

I. INTRODUCTION [1]

Face recognition has attracted much attention due to its potential values for applications as well as theoretical challenges. Due to the various changes by expression, illumination and pose etc, face images always change a lot on grey level. How to extract representation robust to these changes becomes an important problem.

Up to now, many representation approaches have been introduced, including Principal Component Analysis (PCA) [11], Linear Discriminant Analysis (LDA) [2], In-dependent Component Analysis (ICA) [3] etc. PCA provides an optimal linear transformation from the original image space to an orthogonal Eigen-space with reduced dimensionality in sense of the least mean square reconstruction error. LDA seeks to find a linear transformation by maximizing the ratio of between-class variance and the within-class variance. ICA is a generalization of PCA, which is sensitive to the high-order relationships among the image pixels.

Recently, the textons based representation has achieved great success in texture analysis and recognition. The term textons was first proposed by Julesz [6] to describe the fundamental micro-structures in natural images and was considered as the atoms of pre-attentive human visual perception. However, it is a vague concept in the literature because of lacking a precise definition for grey level images. Leung and Malik [7] re-invent and operationalize the concept of textons. Textons are defined as a discrete set which is referred to as the vocabulary of local characteristic features of objects. The goal is to build the vocabulary of textons to describe the perceptually distinguishable micro-structures on the surfaces of objects. Several of these concepts have been applied to the problem of 3D texture recognition successfully [4, 7, and 12].

II. PROPOSED ALGORITHM

A. Load an Input Image

Here we load an image from offline database. For Evaluations purpose we have used grimace face database which is available as an open source. Two female and six male faces are used. We have used total fifteen types of gesture appearance to verify accuracy of our system. We apply proposed algorithm on total 120 images. Each image is stored in .mat format along with its calculated face points distance vector.

B. Normalization

Normalization is basically pre-processing step. In normalization we are doing rescaling of image by the image resize option in mat lab and making and image of 128*128.In these we are taking a dataset of 120 images of 10 different people for training purpose. The proposed algorithm is show in Fig-1.

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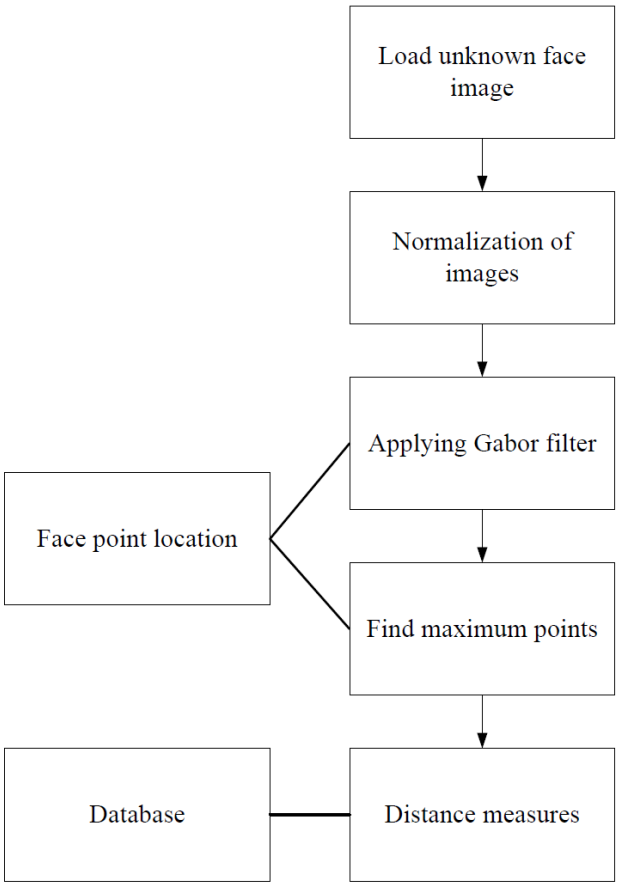

Fig 1 Proposed Algorithm

C. Gabor Filter Generation

For extracting features of face, we applied Gabor filter on gray scale image. Gabor filter has unique property of finding out facial pattern as per orientation and frequency occurrence. Orientation of face is extracted by eight different angles and occurrence of face pattern is obtained by five frequencies. Bank of Gabor Filter is shown in Fig- 2 with two orientation and frequency. Fig.-3 to 5 shows generation of Gabor Filter and its response with various orientations and frequency.

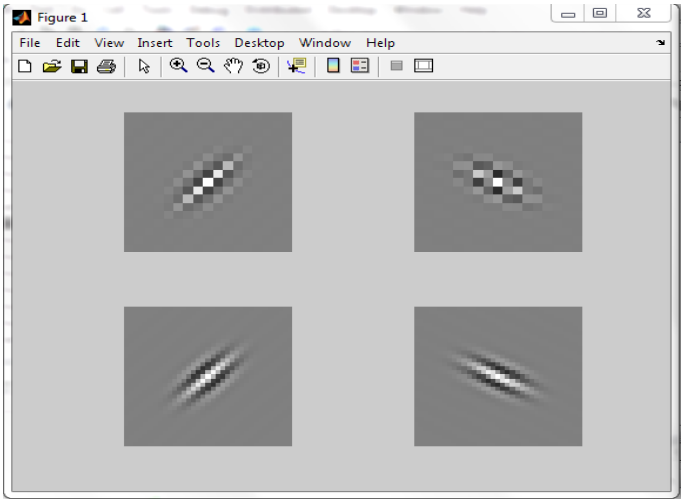

Fig 2 Gabor Filter of Brian with Two orientations and Frequency

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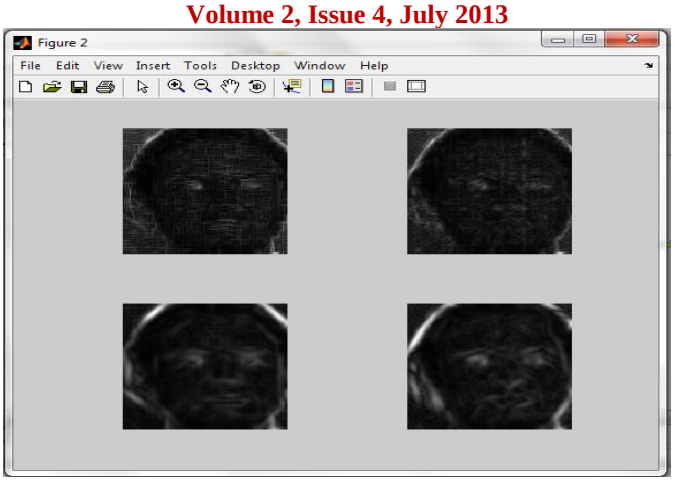

Fig 3 Gabor Filter Response of Brian form the dataset

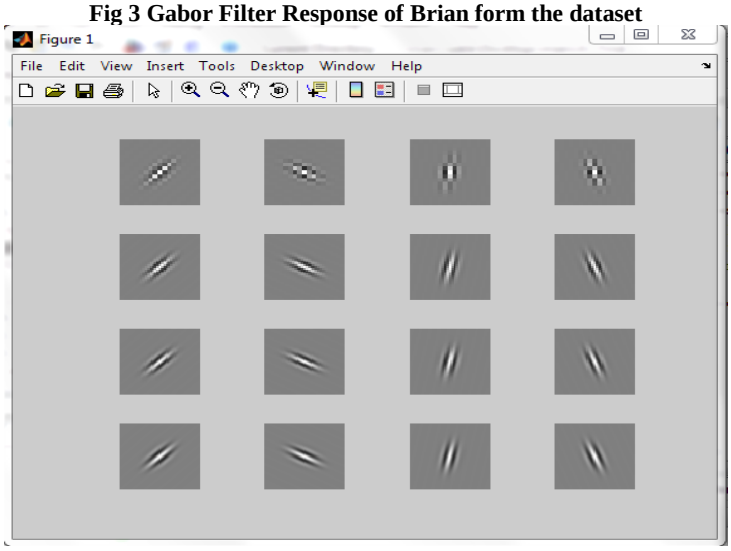

Fig 4 Gabor Filter with Four orientation and frequency

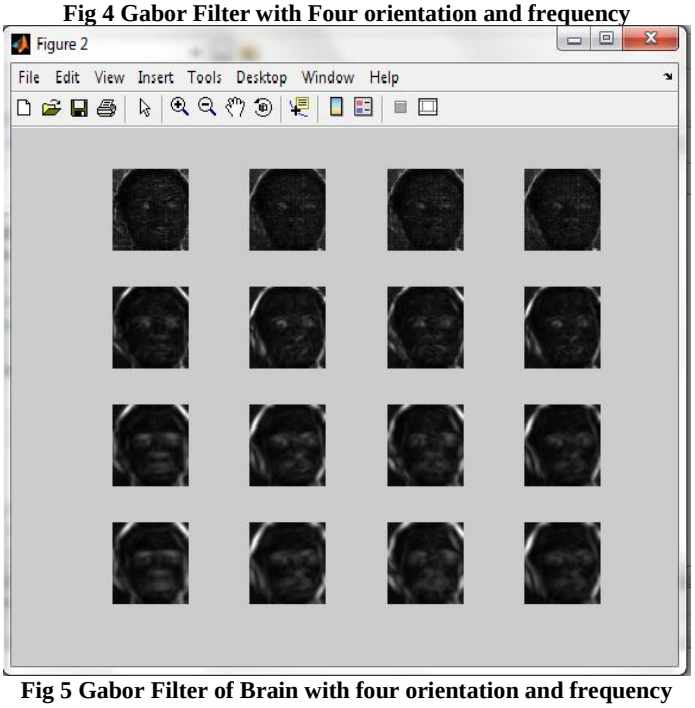

Fig 5 Gabor Filter of Brain with four orientation and frequency

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D. Face Points Extraction

As next step after Gabor Filtration is to find maximum intensity point on image out of forty Gabor filtered images. Extracted forty points of Gabor images are shown in Figure- 6 .Now Face points are minimized as discussed in chapter. After minimization of face points extracted points coordinates are noted down and stored in database as base image face points. During recognition process this coordinates are used to calculate distance between base images and image to be recognized. Extracted face points coordinates for 'Brian' is shown in Table I.

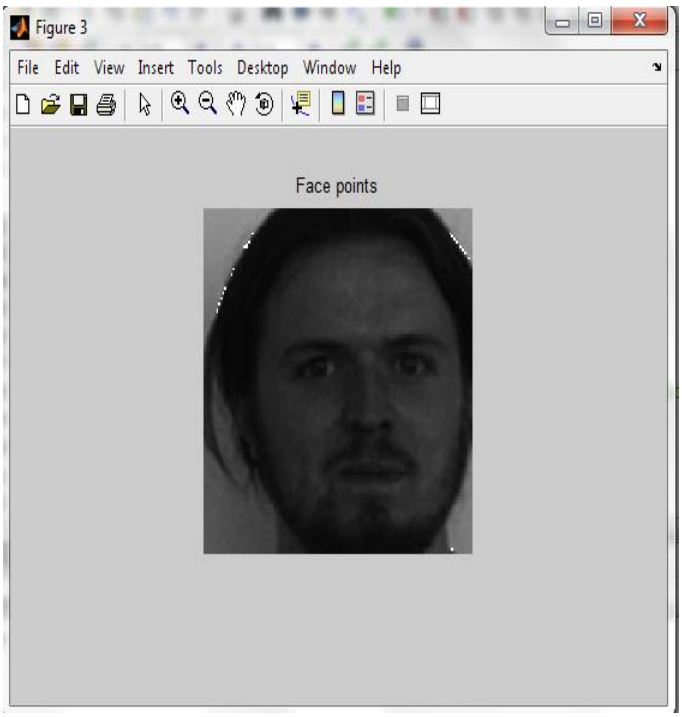

Fig 6 Face Points Extraction of Brain

TABLE I EXTRACTED FACE POINTS

Pixel No.	X coordinates	Y Coordinates	Pix-el No.	X coordinates	Y Coordinates
1	9	48	21	6	59
2	18	104	22	1	74
3	19	107	23	33	21
4	18	104	24	7	53
5	18	104	25	1	73
6	5	64	26	2	69
7	9	48	27	1	74
8	9	49	28	1	73
9	29	117	29	3	67
10	5	80	30	1	74
11	33	120	31	34	21
12	37	122	32	7	53
13	6	82	33	1	74
14	35	121	34	3	66
15	30	118	35	1	73
16	7	53	36	1	74
17	28	115	37	3	66
18	1	72	38	1	74
19	76	120	39	1	73
20	1	73	40	2	69

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III. RESULTS OF PROPOSED ALGORITHM

From the proposed algorithm we found the results that for the female we get high corrected results as compared to the males and therefore accuracy is also high for female as compared to male which is shown below in Table II and in chart form of different person database .Now the Fig -7 of correctly recognized images and Fig-8 shows accuracy of correctly recognized images

TABLE II RESULTS OF PROPOSED ALGORITHMS

Face Name	Gender	Correctly Recognized Out of 15	Accuracy in %
'Thomas'	Male	10	67%
'Robin'	Male	11	74%
'John'	Male	14	94%
'Smith'	Male	12	80%
'James'	Female	14	94%
'Brian'	Male	13	87%
'Jammy'	Male	12	80%
'Ian'	Female	15	100%

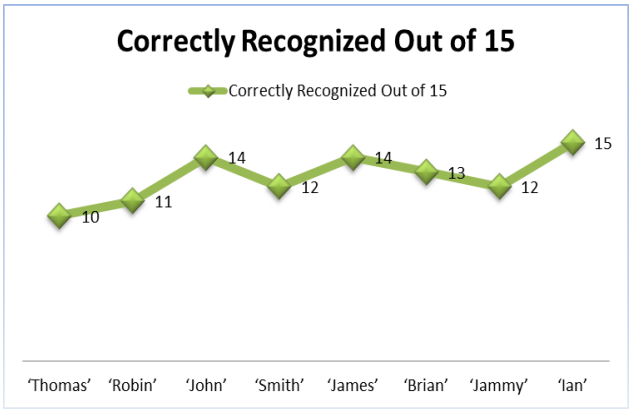

Fig 7 Correctly Recognized Images

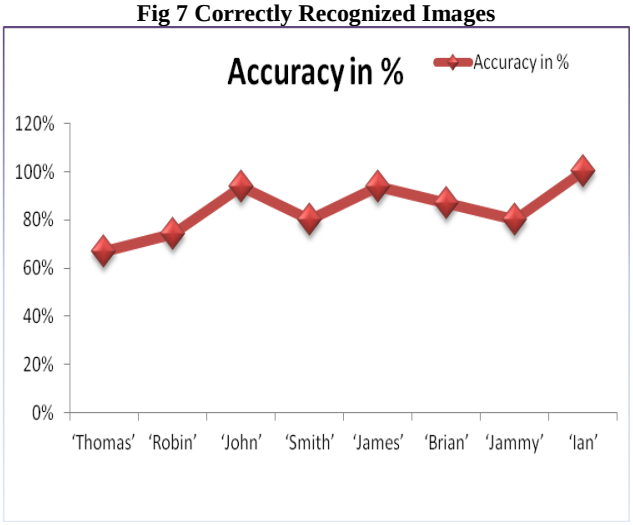

Fig 8 Accuracy of recognized image

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IV. CONCLUSION

Application of various linear and nonlinear techniques to face recognition studied cannot say that there is ONE technique that performs uniformly best. As system fails to recognize face in few cases at high accuracy, so we need to go for some additional enhancement steps that are Local Binary Pattern. It also represents the texture pattern of human faces. As per our literature survey we can change our preprocessing steps of image normalization too. In place of Gabor filter feature we may also proceed for Gabor Energy features or Principal Component Analysis to have high efficiency. And finally we conclude that Gabor filter is efficient method which mainly used for finding texture pattern for image.

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