Novel Average Filter as a Feature Reduction Technique for Gabor Filter for Face Recognition.

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***Abstract* — Face Recognition is used widely for human identification. The research issue in the face recognition is to improve recognition rate by improving the preprocessing of data sets, improving the feature extraction method and using the best classifier for face recognition. High dimension and high redundancy are a problem issue for Gabor filter. Dimension and redundancy are reduced through a filter technique. Sampling filter is a problem of not reducing features in an optimum way. In the proposed Gabor feature extraction technique, the Gabor features are filtered using proposed average sampling filter and obtained optimum features for face data set.**

***Keywords*-** Face Recognition, Gabor Filter.

I. INTRODUCTION

The face of a human being has an important role in conveying the identity. Computer-Aided Face Recognition System, which can identify the person by comparing the person's face to the face stored in database set, has a wide range of application [1]. The various approaches of face recognition are categorized into two categories, namely holistic based face recognition and feature based face recognition. In Face Recognition, different channels of Gabor Filter have different distribution and reasonable combination of these features can improve the performance of Face Recognition [2]. Gabor Filter is based on on spatial locality, scale and orientation of facial images. These images are most suitable for Face Recognition because these are robust to variations, expression and scale [3]. Feature Extraction is mostly concentrated on face information regions, so the mouth, eye and eyebrow regions are segmented from the images, then low dimensional features are extracted using Wavelet Transform [4].

II. RELATED WORK

Gabor Filter Feature Extraction Technique

A Gabor filter can be represented by the following equation 2.1 [5]

$$\Psi(x, y, \lambda, \theta) = \frac{1}{2\Pi SxSy} e^{-1/2\left(\frac{x'^2}{Sx*Sx}+\frac{y'^2}{Sy*Sy}\right)} e^{j2\,\Pi x'/\lambda} \quad 2.1$$

where (x,y) is the pixel position in the spatial domain, λ is the wavelength (a reciprocal of frequency) in pixels, θ is the angle of a Gabor filter, and S_x, S_y are the standard deviation along the x and y directions

consequently[6]. The parameters x' and y' are given as an equation

$$x' = x\cos\theta + y\sin\theta \quad y' = -x\cos\theta + y\sin\theta \qquad 2.2$$

The Gabor features are computed by convolution of the input image with the Gabor filter bank. I(x, y) is a grey-scale face image of size M*N pixels as equation 2.3.

$$G_{u,v}(x,y) = I(x,y) * \Psi(x,y) \qquad 2.3$$

Research Issues: - High dimension and high redundancy [7] are an issue for Gabor while it has maximum variance of features. Dimension and redundancy should be reduced using some technique. The dimension reduction technique for Gabor is called filtering so this whole technique is called Gabor filter [8].

III. PROPOSED WORK

On a face image of size 256x256 pixels, Gabor equation is projected using 8 different angles and 8 different Gabor matrices are generated of size 256x256 each. Using proposed average Gabor Filter technique, averaging of corresponding Gabor feature coefficients of all 8 matrices is evaluated and converted to a single average feature matrix of size 256x256 coefficient. These matrices are called average Gabor matrix and feature vector is called an average Gabor feature vector. Which is further reduced using down sampling process with a factor of 50 would further reduce it to a single feature vector. This vector is called average Gabor filter vector.

IV. EXPERIMENT AND RESULTS

The simulation of the proposed work is implemented in MATLAB and ORL dataset is used for evaluation of the proposed algorithm for face recognition. In my experiment 150 (70 %) are training image and 63 (30%) are testing image of size of 256 x 256 pixels in tiff image format. Adaboost Classifier is used for classification.

Table-4.1 Comparative Analysis of Gabor Sampling Filtering and Proposed Average Gabor Filter

Methods	**Gabor Filter**	**Proposed Avg. Gabor Filter Technique**
Recognition rate (%)	**60.33**	**73**

V. CONCLUSION

High dimension and high redundancy are a problem issue for Gabor while it has maximum variance of features. This high dimension and redundancy should be reduced using some filtering technique. The dimension and redundancy reduction techniques for Gabor is called filtering so this whole technique is called a Gabor filter. In the proposed Gabor feature extraction technique, the Gabor features are filtered using proposed average filter and obtained optimum features from facial dataset. The experiments result show that the proposed hybrid method have **73** % average correct classification rate, which is higher average correct classification rate compared to **60.33** % for Gabor Sampling Filter for face recognition for ORL dataset with 70/30 training/testing ratio. The results show that proposed technique have higher recognition rate compared to existing techniques.

VI. REFERENCES

[1] Z.M. Hafed and M.D Levine. Face recognition using discrete cosine transform. *Journal of Computer Vision*, 43(3):167–188, 2001.

[2] W. Chen M. J. Er and S. Wu. High speed face recognition based on discrete cosine transform and rbf neural networks. volume 16, pages 679–691, 2005.

[3] WeiFeng Liu and ZengFu Wang. Face recognition based on fusion of multiple Gabor features. In *IEEE International conference on Pattern Recognition*. IEEE, 2006.

[4] Fenguin Chen Zhiliang Wang Zhengguang Xu Jianng Xiao and Guojiang Wang. Face recognition using wavelet transform and neural network ensemble. In *Internation Symposium on Intelligent Information Technology Application*, volume 24, pages 871–875. IEEE, 2008.

[5] Sandeep, Shubhlakshmi, Yogesh, Neeta, "A Hybrid method of Feature Extraction for Facial Expression Recognition" , in seventh international conference on Signal image Technology and Internet based systems (SITIS), page(s): 422 – 425, IEEE.

[6] Zheng, D., Zhao,Y., Wang, J, "Features Extraction Using A Gabor Filter Family", *Proceedings of the sixth LASTED International conference, Signal and Image processing, Hawaii, USA* ,2004.

[7] Xiaoli Li Qiuqi Ruan Chengxiong Ruan, "Facial Expression Recognition with Local GaborFilters", International conference, IEEE, 2010.

[8] S. Nazari, M.S. Moin, "Face recognition and local Gabor features", in international conference on electrical engineering (ICEE), pp 1-4, IEEE, 2013.

