Performance of Gabor mean Feature Extraction Techniques for Ear Biometrics Recognition System

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ABSTRACT
Ear biometric recognition is used in a lot of applications as person identification in criminal cases, investigation, and security purpose. Feature optimization stage has an important role for accuracy of correct recognition. Gabor filter have a problem of high dimension and high redundancy. Sampling filter is a problem of not reducing features optimum way. In the proposed Gabor feature extraction technique the Gabor features are filtered using proposed mean filter and obtained optimum features for ear biometric dataset.

Keywords
Ear Biometric Recognition, Gabor Filter, Analysis.

1. INTRODUCTION
Human ear biometric is a very useful and powerful source of communicative information about human identification. Auto ear biometric Recognition is used for identification of persons in crime diagnosis, person identification. Feature Selection techniques is used for reduction of redundancy and non pattern part in ear image [1]. Fajri Kurniawan et. al. [2] proposed that

Security system improves by the Biometric systems implemented on several facilities. Gonzalez, Alvarez and Mazorra [3] suggested that feature extraction is a key for ear biometric detection and feature are based on ear curves. Gabor Filter is based on spatial locality, scale, frequency and orientation on facial images [4]. Geometric or Local feature-based approach, Non-Geometric or Appearance or holistic feature based approach and Hybrid approach. Fajri Kurniawan [4] proposed statistical based feature extraction technique using variance for solving occlusion problem of transform based feature extraction technique. Karuna *et al*. [5] proposed 2 level Gabor filter feature extraction model of ear biometrics recognition while priya *et al.* [6] modified the karuna's approach using dct transformation of facial gesture recognition. Neha *et al.* analyzed detail survey of Gabor filter [7], dwt[8], dct[9] and other feature extraction technique in [10]. In this paper we are proposing 1 level average feature extraction techniques for ear biometrics recognition instead of two level feature extraction for reducing complexity with achieving good accuracy for ear biometrics recognition.

2. RELATED WORK
2.1 Gabor Filter Feature Extraction Technique
The equation of Gabor filter is given as follows [11]:

$$\psi(x,y,\lambda,\theta) = \frac{1}{2\pi s_x s_y} e^{-\frac{1}{2}\left(\frac{x_1^2}{s_x^2}+\frac{y_1^2}{s_y^2}\right)} e^{j\frac{2\pi x_1}{\lambda}} \quad (2)$$

here, (x, y), the pixel position in the spatial domain.

$\lambda=1/f$, f = frequency of pixels.

θ ,= projection angle of Gabor equation.

S_x,S_y, Standard deviation in x & y directions.

and $x1= x\cos\theta + y\sin\theta$ (3.1)

$y1 = -x\sin\theta + y\cos\theta$ (3.2)

The Gabor features are obtained through convolution of input digital image with Gabor filter bank [12]. I(x, y) is a grey scale ear biometric digital image that is of size M * N pixels.

$G_{u,v}(x,y)=I(x,y)*\Psi(x,y)$ (4)

The convolution operation is performed separately for real and imaginary part[13] of gabor coefficient as equation 5.1 & 5.2.

$Re(O(x,y))_{m,n}=I(x,y)*Re(\psi(x,y,\lambda_m,\theta_n))$ (5.1)

$Im(O(x,y))_{m,n}=I(x,y)*Im(\psi(x,y,\lambda_m,\theta_n))$ (5.2)

$|O(x,y)|_{m,n}=((Re(O(x,y))_{m,n})^2+(Im(O(x,y))_{m,n})^2)^{1/2}$

The Gabor feature matrices are multidimensional and have high redundant features so redundancy and dimensions is reduced using filter. The filtered features are kept in feature vector which is passed to classifier for classification. Classification is a supervised leaning process of data mining which is used to determine the class of test data after training [14].

3. PROPOSED WORK
To overcome loss of large feature vector dimension, decrease the size of feature vector by executing down sampling without losing any information. For this purpose, the proposed feature selection methods calculate consolidate value of Gabor feature matrices along orientation for each scale for reducing features and redundancy without losing feature values. In the proposed system, 3 scale and 9 different orientations or total 3*9= 27, Gabor matrices are generated. Thus process applied a feature reduction of Gabor feature matrices by 9 without losing any information using proposed Mean calculation of different Gabor matrices. This gabor mean matrix is converted into one dimension vector which is called G_mean feature vector and passed to second phase optimization. Second pass feature extraction technique is sampling filtering.

After sampling, this is final optimized feature vector which is passed to classifier.

4. EXPERIMENTS & RESULTS

Ear biometric recognition system is implemented using Gabor Sampling filter and proposed Gabor average feature extraction. Experimental setup mentioned in Table 1 and performance is evaluated in term of correct recognition rate which is mentioned in Table 2.

Table 1. Experimental setup for implementation of ear biometric recognition System.

Sno.	Parameters	Value
1.	Dataset	AMI Ear biometric Dataset
2.	Preprocessing	RGB to Gray Scale Conversion
3.	Feature Extraction Technique	Proposed Average Gabor Scale feature extraction Technique
3.	Classifier	AdaBoost
4.	Training/Testing Ratio	70/30

Table 2. Analysis of recognition rate for technique

Sno	Feature Extraction Method	Average Recognition Rate (%)
1	Gabor Sampling Filter method	65.00
2	Gabor PCA Extraction Method	77.00
3	Gabor Average DWT Method [5]	88.5
4	Ear Biometrics using Proposed Feature Extraction Techniques	83.5

5. CONCLUSION

The results shows that the ear biometric recognition system using Gabor sampling filter have 65% recognition rate while proposed Gabor filter have 83% recognition rate. So the performance of proposed Gabor Filter is better than compared to Gabor sampling feature extraction technique for ear biometric recognition system and proposed average Gabor filtering provide better and unique shape pattern about ear classes compared to Gabor sampling Filter.

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