New Improved Feature Extraction Approach of IRIS Recognition

Jyoti poonia\textsuperscript{A}, Parvati Bhurani\textsuperscript{A}, Sandeep Kumar Gupta\textsuperscript{B}, Shubh Lakshmi Agrwal\textsuperscript{C}

\textsuperscript{A}Government Mahila Engineering College, Ajmer 
\textsuperscript{B}JECRC University, Jaipur, India 
\textsuperscript{C}The ICFAI University, Jaipur, India

Abstract

Iris recognition is used for identify the person by recognizing iris pattern of eye of a person. Currently there is no method of IRIS recognition system that have 100% recognition rate using Gabor filter. So research issues are to improve recognition rate by improving the pre-processing of datasets, improving the feature extraction method and using the best classifier for iris recognition. Feature extraction is the key step on which recognition rate depends for iris recognition. Gabor filter extract the edge information of iris pattern using the projection on iris image but have a problem of huge dimension and high redundancy. In the proposed technique, the dimension and redundancy is reduced effectively in order to increases accuracy.

Keywords: IRIS Recognition, Gabor Filter, DWT, DCT.

I. INTRODUCTION

The iris recognition is better than other identification technique due to not change over the years and age in iris pattern. The iris recognition includes iris image preprocessing, feature extraction and classification. Wavelet transform and hybrid wavelet transforms concluded that hybrid transforms are better than simple transform wavelet transform for better accuracy. Local iris features is used for iris recognition but Man Zhang [1] et. al. Proposed both geometric and photometric features extraction technique in order to get a better result. They proposed that iris image should be decomposed into lowpass and band pass components based on non sub sampled contoured transform ant then the geometric features were extracted from bandpass component and ordinal measure of local iris region from lowpass components. R. Rizal Isnanto [2] extracted the image feature based on energy after the Wavelet transforms using Haar and Daubechies and concluded that higher recognition rate is achieved using Haar compared to Daubechies wavelet transform. R. Rizal Isnanto [3] suggested that textural characteristics of the iris pattern can be extracted for unique identification. They used wavelet transform feature extraction technique for extracting the information from iris image. K. Nguyen et. al. [4] presented feature-domain super resolution framework for Gabor-based face and iris recognition. They used super resolution to improve the resolution and the recognition performance and suggested that Current existing feature-domain super resolution approaches are limited to simple linear features such as Principal Component Analysis(PCA) and Linear Discriminant Analysis(LDA), which are not the most discriminant features for biometrics. Priya et. al [5], presented a new improved feature extraction technique based on average Gabor scale. They suggested two stage reduction technique of feature extraction

II. RELATED WORK

A. Gabor Filter Feature Extraction

In spatial domain, Gabor filter is given by equation (1) [6].

\[
\psi(x,y,\lambda,\theta) = \frac{1}{2\pi s_x s_y} e^{-\frac{1}{2} \left( \frac{x^2}{s_x^2} + \frac{y^2}{s_y^2} \right)} e^{i \frac{2\pi}{\lambda} x \cos \theta - \frac{2\pi}{\lambda} y \sin \theta}
\]

(1)

Where \((x, y)\), the pixel location in the digital image and \(S_x, S_y\) Standard deviation in the x & y directions respectively, \(\lambda\) is inverse of central frequency and \(\theta\) is angle applied in the Gabor filter equation. The parameters \(x_1\) and \(y_1\) are given as equation (2).

\[
x_1=x\cos\theta + y\sin\theta \\
y_1=-x\cos\theta + y\sin\theta
\]

(2)

The Gabor features are evaluated using convolution operation of Gabor filter bank \(\Psi (x,y)\) with input image \(I (x, y)\) which is defined in equation (3).

\[
G_{m,n}(x,y) = I (x, y) * \Psi (x,y)
\]

(3)

The Gabor filter bank \(G_{m,n}(x,y)\) is complex number so a convolution operation of Gabor filter is performed separately for real and imaginary part as defined in equation 4 and 5.

\[
\text{Re}(O(x,y))_{m,n} = I (x, y) * \text{Re}(\psi(x,y,\lambda_m,\theta_n))
\]

(4)

\[
\text{Im}(O(x,y))_{m,n} = I (x, y) * \text{Im}(\psi(x,y,\lambda_m,\theta_n))
\]

(5)

The final amplitude of Gabor filter bank is calculated as equation 6[7].

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

(6)
B. Discrete Wavelet Transformation

The term wavelet transform is explained as decomposition of the data or the image into wavelet coefficients, comparing the detail coefficients with a given threshold value, and shrinking these coefficients close to zero to take away the effect of noise in the data. The image is reconstructed from the modified coefficient which is known as the inverse discrete wavelet transforms. DWT transformation converts the iris image into four different frequency sub band as LL, LH, HL and HH as figure 1. Where range of frequency is represented as LL< LH< HL< HH. The feature or characteristics of iris is represented by low frequency coefficients or LL sub band so LL frequency sub band is extracted for further feature reduction.

DWT transformation converts each Gabor feature matrix into four different frequency sub band as LL, LH, HL and HH as figure 1. Where range of frequency is represented as LL< LH< HL< HH. The feature or characteristics of iris is represented by low frequency coefficients or LL sub band so LL frequency sub band is extracted for further feature reduction.

After the DWT stage, DCT is applied on each LL sub band which converts it into DCT feature matrix. In the feature extraction, DCT extract the energy information of the image from low frequency region and then it will focus on some specific features located in the upper left Corner.

After above stage the resultant matrix is converted into a single feature vector (FV) and feature vector is passed to classifier.

IV. EXPERIMENT AND RESULTS

The 7 different angles are applied for Gabor projection with 3 scales of iris image. The CASIA dataset is used for experiment with ratio 80/20 of training/testing. In the proposed system, 3 different scales and 7 different orientations or total 3*7= 21, Gabor matrices are generated. The extraction features are reduced using proposed reduction technique for iris recognition. The adaboost classification technique is used with 70/30 training testing ratio which provides the 92.5% correct recognition rate.

<table>
<thead>
<tr>
<th>S no.</th>
<th>Methods</th>
<th>Avg. Recognition Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>DWT feature extraction technique based iris recognition</td>
<td>82%</td>
</tr>
<tr>
<td>2.</td>
<td>DCT feature extraction based iris recognition</td>
<td>75%</td>
</tr>
<tr>
<td>3.</td>
<td>Gabor filter + PCA based iris recognition</td>
<td>77%</td>
</tr>
<tr>
<td>4.</td>
<td>Gabor Scale + PCA based iris recognition</td>
<td>82.5%</td>
</tr>
<tr>
<td>5.</td>
<td>Proposed Feature Extraction Technique</td>
<td>92.5%</td>
</tr>
</tbody>
</table>

V. CONCLUSION

The classification results of proposed work are compared with results of iris recognition method based on existing Gabor feature extraction technique and table 1.2 shows that proposed technique increased the accuracy of iris system to 92.5% which is much better than existing accuracy of Gabor Scale PCA and other feature extraction technique.
REFERENCES


