Image Enhancement Techniques in Spatial Domain using Face based matching techniques

Sunanda Nath [1],Ankit Pawria[2]

[1] M.Tech, Final Year [2]Asst. Professor
[1,2] Department of Electronics & Communication Engineering
[1,2]CBS Group of Institutions, Harayana, India
Email: [1]sunanda.etce@gmail.com , [2]akt603@gmail.com

Abstract: Image enhancement techniques in spatial domain have been widely explored in the past years. A lot of techniques have been applied in various applications. Robustness and reliability have become more and more important for these applications especially in security systems for enhancing the spatial domain. In this paper, a variety of approaches for image identification techniques recognition are reviewed first. These approaches are classified according to three basic tasks: face representation, face detection, and face identification. An implementation of the Image appearance-based face recognition method, the pattern recognition approach, is based on given data model. This method utilizes the idea of the principal component analysis and decomposes face images into a small set of characteristic feature images called image identification in spatial domain approach for fulfill the requirements of system and their identification.

Keywords: Image enhancement, Face identification , Spatial domain system.

1. Introduction

System analysis for Image enhancement techniques is the process of gathering and interpreting facts, diagnosing problems, finding out what happens in the existing system if there are problems, deciding what new features are needed and then defining exactly what new system must do. System analysis is a problem solving activity that requires intensive communication between the system users and system developers. Making use of various techniques like interviews, questionnaires, onsite observation , etc. a detailed study of the system is done. The data collected must be scrutinized to arrive at a conclusion. The conclusion is a understanding of how the system functions. This system is called the existing system. Now the existing system is subjected to close study and the problems

are identified. The solutions are given as proposal. The proposed system is presented to user for an endorsement by the user. It is then reviewed on user request and suitable changes are made. This is a loop that ends as soon as the user is satisfied with the proposal.

2. IMAGE MULTIMODAL APPROACH

Biometrics are method of identifying a person or verifying the identity of a person based on a physiological or behavioural characteristics.Only authorised authors should acess data and services. Biometric features are intrinsic to every human and are therefore suitable to authorize particular user. Biometric-based identification is preferred over traditional methods because a biometric cannot be forgotten or lost. Some of the limitations imposed by unimodal biometric systems can be overcome by including multiple sources of information for establishing identity[1] . Such systems, known as multimodal biometric systems, are expected to be more reliable due to the presence of multiple, (fairly) independent pieces of evidence .These systems are able to meet the stringent performance requirements imposed by various applications. Multimodal biometric systems are those which utilize,more than one physiological or behavioral characteristic for verification, or identification. Here in this project multimodal scheme deploying fingerprint as well as iris recognition system. Most of the biometric systems deployed in real world applications are unimodal which rely other evidence of single source of information for authentication (e.g. fingerprint, face, voice etc.). These systems are vulnerable to variety of problems such as noisy data, intra-class variations, inter-class similarities. Some of the limitations imposed by unimodal biometric systems can be overcome by including multiple sources of information for establishing identity. These systems allow the integration of two or more types of biometric systems known as multimodal biometric systems. These systems are more reliable due to the presence of multiple, independent biometrics.By combining multiple sources of information, the improvement in the performance of biometric system is attained.

3. IMAGE RECOGNITION

Fingerprint recognition is most popular method and is successfully used in many application. Human fingertips contains ridges and valleys which together forms distinctive patterns. Due to the above mentioned properties, fingerprints are very popular as biometrics measurements. Especially in law enforcement where they have been used over a hundred years to help to solve crime. Unfortunately fingerprint matching is a complex pattern recognition.The middle part curve of fingerprint image is called core.curve lines is called ridges. Through various studies it has been observed that no two persons have the same fingerprints, hence they are unique for every individual. Fingerprint recognition refers to the automated method of verifying a match between two human fingerprints.

Preprocessing Stage of Fingerprint recognition is done in following Steps.

A.Histogram Equalization:

Histogram equalization is to expand the pixel value distribution of an image so as to increase the perceptional information. The original histogram of a fingerprint image has the bimodal type, the histogram after the histogram equalization occupies all the range from 0 to255.

B Fingerprint Binarization:

Fingerprint Image binarization is to transform the 8-bit Gray fingerprint image to a 1-bit image with 0-value for ridges and 1-value for furrows. After the operation, ridges in the fingerprint are highlighted with black color while furrows are white.A locally adaptive binarization method is performed to binarize the fingerprint image.Such a named method comes from the mechanism of transforming a pixel value to 1 if the value is larger than the mean intensity value.

C.Region of Interest:

In general, only a Region of Interest (ROI) is useful to be recognized for each fingerprint image. The image area without effective ridges and furrows is first discarded since it only holds background information. Then the bound of the remaining effective area is sketched out since the minutia in the bound region are confusing with those spurious minutia that are generated when the ridges are out Of the sensor.

D.Thinning:

Ridge Thinning is to eliminate the redundant pixels of ridges till the ridges are just one pixel wide. In each scan of the full fingerprint image, the algorithm marks down redundant pixels in each small image window and finally removes all those marked pixels after several scans.

E. Filtering:

The thinned ridge map is then filtered by other three Morphological operations to remove some H breaks, isolated points and spikes.

4. IRIS RECOGNITION

Iris recognition has attracted a lot of attention because it has various advantage factors like greater speed, simplicity and accuracy compared to other biometric traits.Iris recognition relies on the unique patterns of the human iris to identify or verify the identity of an indivisual. Among many biometric techniques,iris recognition is one of the most promising approaches due to its high reliability for personal identification[2]. The human iris,which is the annular part between the pupil and the white sclera,has complex pattern.The iris pattern is unique to each person and to each eye and is essentially stable over a life time.Preprocessing of iris recognition system is done in following steps.

- Iris localization
- Normalization

F.Iris Localization:

This is the first step of the process which detects the inner and outer boundary in the original grayscale image. Ellipse is used for the inner boundary of the iris.

Optimal Estimate= $|S(l_1+\Delta l_1, l_2+\Delta l_2, c_1, c_2, \theta) - S(l_1, l_2, c_1, c_2, \theta)|$…….....(1)Where ($l_1$, l_2) are length of principal axes of the ellipse (c_1, c_2) and θ is rotation angle. Δl_1 and Δl_2 are small constant, and S is the N-point contour summation of pixel values along the ellipse:

$$S(l_1, l_2, c_1, c_2, \theta) = \sum_{n=0}^{N-1} f_{org}(p_1(n), p_2(n)) \quad \text{.....(2)}$$

Where

$$p_1(n) = l_1.\cos\theta.\cos\left(\frac{2\pi}{N-1}n\right) - l_2\sin\theta.\sin\left(\frac{2\pi}{N-1}n\right) + c_1.$$

$$p_2(n) = l_1.\sin\theta.\cos\left(\frac{2\pi}{N-1}n\right) + l_2\cos\theta.\sin\left(\frac{2\pi}{N-1}n\right) + c_1$$

To reduce the computation time, the parameter set ($l_1, l_2, c_1, c_2, \theta$) can be simplified depending on iris images.

G .Iris-Normalization:

This step is performed to compensate for the elastic deformation in iris texture. A fixed size block dimension is taken to unwrap the iris region. The lower half of the eyelid region is considered and polar coordinate transformation is applied to obtained normalized image. Therefore the eyelid masking is performed in the transformed iris image.Figure.1 (a) shows the lower ellipse of iris region,(b) shows the normalized image and (c) shows the normalized image with eyelid masking.

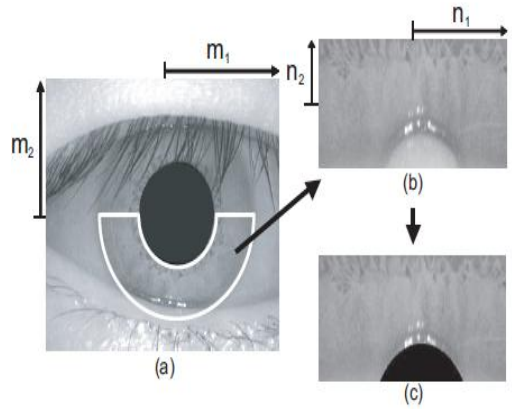


Figure.1 Iris image(a) Original Image (b)Normalized image and (c) Normalized image with eyelid masking

5. PHASE–BASED MATCHING

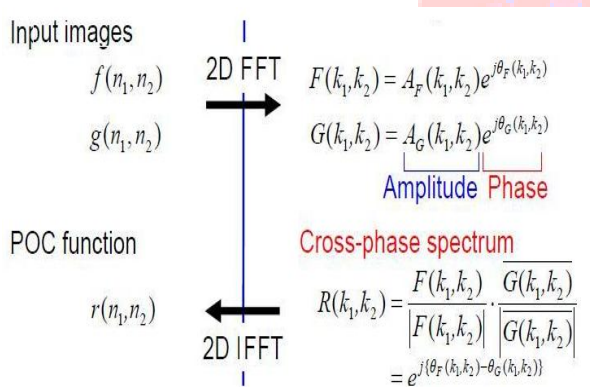
Phase-Based matching algorithm is applied for both fingerprint and iris images. Fast Fourier Transform(FFT) is performed on preprocessed images of both fingerprint and iris images and amplitude and phase components are separated, and these phase components are further used for matching stage.

- Use of phase components in Fast Fourier Transforms of fingerprint images makes possible to achieve highly robust fingerprint recognition for low quality fingerprints.

- Use of phase components in Fast Fourier Transforms of iris images makes possible to achieve highly robust iris recognition in a unified fashion.

We will convert the image from time domain to frequency domain using 2D FFT. Then we have to calculate the complex conjugate of the input image frequency plane. Then calculate the phase difference between input image and database images. Then we will perform 2D-IFFT on the phase difference. If the results gives the single high peak then the images is matching or if the results gives multiple low value peaks, than the images is not matching.

Basic Computation Flow for POC Function.



Phase Only Correlation :(POC) function has a sharp peak like a delta function (correlation peak). Height of the correlation peak indicates the similarity of images.

Matching Score Calculation: Band Limited Phase Only Correlation(BLPOC) is calculated in this step between the aligned images and evaluated the matching score. In the case of genuine matching, if the displacement between the two images is aligned, the correlation peak of BLPOC function should appear in the origin.BLPOC function between the two extracted image area is matched and matching score is evaluated.The BLPOC function may give multiple correlation peaks.The sum of the highest peaks of the BLPOC function gives the matching score.If the score is greater than threshold than it is matching and if it is lesser than threshold,then it is not matching.

Band Limited Phase Only Correlation:

BLPOC function for efficient matching and the 2D FFT of a normalized iris image contains meaningless phase components in high frequency domain, and that the effective frequency band of the normalized iris image is wider in directions. The original POC Function emphasizes the high frequency components, which may have less reliability and this reduces the height of the correlation peak. The BLPOC function provides better discrimination capability than that of the original POC function. BLPOC is half that of POC function and given by the equation.

$$r_{FGblpoc}(n_1,n_2) = IFFTR_{FG}(K_1/2, K_2/2) \quad \ldots.3$$

Figure 2 shows the structured chart of multimodal recognition where the modules are arranged in a tree structure.

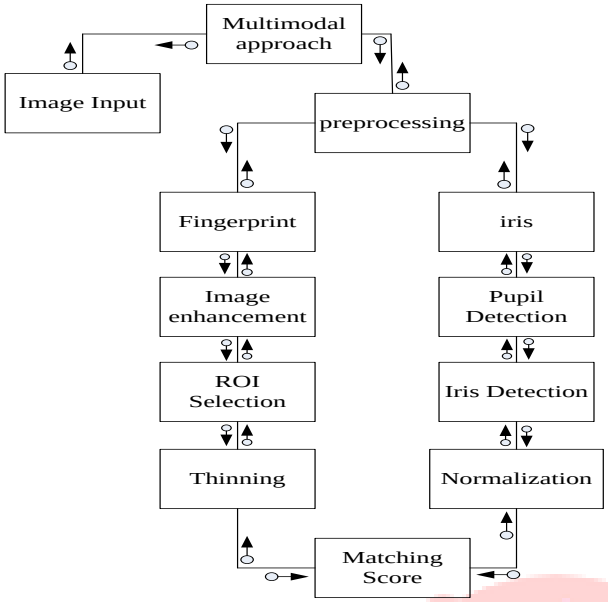


Fig 2: Structured Chart of Multimodal Recognition

6. Results and Analysis

This section presents the results of testing with the help of screen shots.Each screen shot clearly shows the details of type of output.Testing has been carried out with different inputs taken recognition.Image database is created with extensive care for fingerprint bmp/file and for iris CASIA database is taken and preprocessing of both fingerprint and iris image is done and performing FFT the phase values is stored in the database.Figure 3 shows the snapshot for recognition using phase based matching with the identified name. In figures 4 and 5 shows the snapshots of Phase Only Correlation (POC) and Bandlimited Phase Only Correlation(BLPOC) of fingerprint and iris matched with the database .It shows the single high peak if the images are matched with the database. Figure 6 shows the snapshot of identification when both fingerprint and iris are not matched with the database that is if both fingerprint and iris are not present in the database. In figures 7 and 8 the snapshots of Phase Only Correlation (POC) and Bandlimited Phase Only Correlation (BLPOC) of Unidentified fingerprint and iris with the multiple correlation peaks is shown.

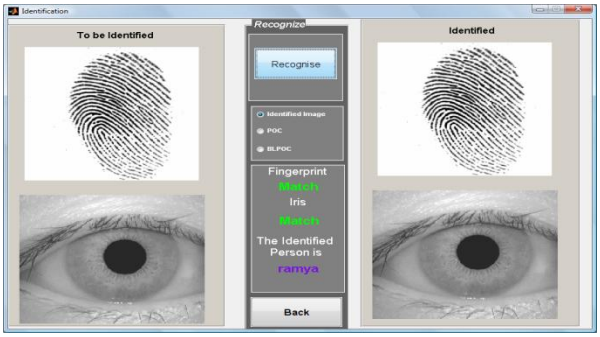


Figure 3 : Phase Based Recognition Matched with the Database

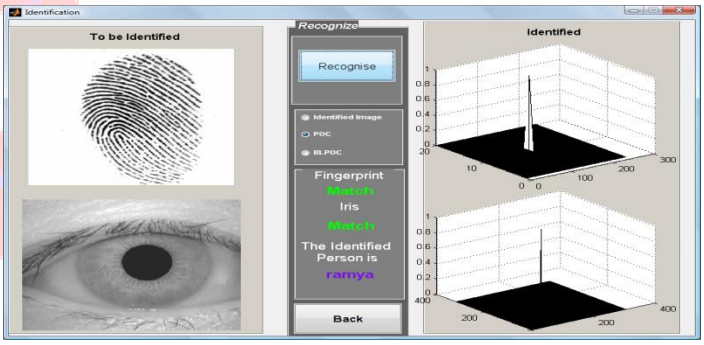


Figure 4: Phase Only Correlation (POC) of Fingerprint and Iris matched with the Single High Peak.

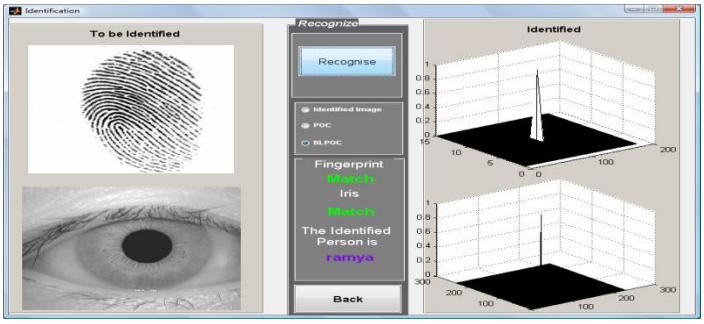


Figure 5: Bandlimited Phase Only Correlation (BLPOC) of Fingerprint and Iris matched with the Single High Peak

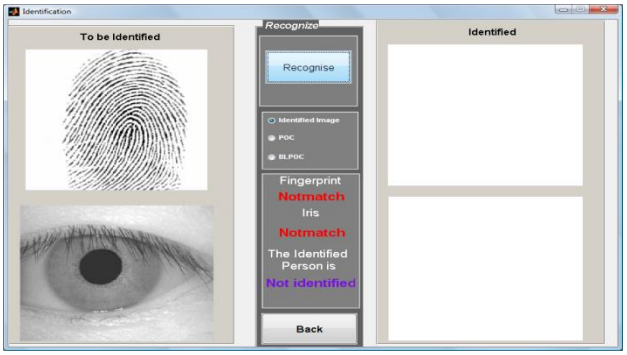


Figure 6: Fingerprint and Iris are Unidentified with the Database

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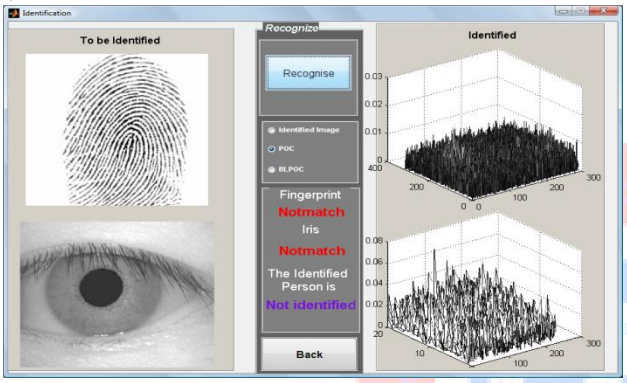

Figure 7 Phase Only Correlation (POC) of Unidentified Fingerprint and Iris with the Multiple Correlation Peaks

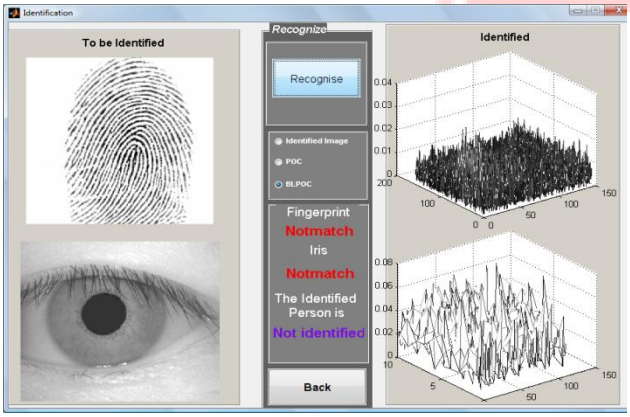

Figure 8 Band limited Phase Only Correlatio(BLPOC) of Unidentified Fingerprint and Iris with the Multiple Correlation Peaks.

7. CONCLUSION

Image database is created with three different images of same classes of iris and fingerprint. Results are satisfactory as testing has been carried out with different inputs taken for recognition. A multimodal biometric system generally means the multiple biometrics system, In the proposed novel approach, an efficient algorithm for fingerprint recognition as well as iris recognition using phase components in 2D Fast Fourier Transformation is used in order to achieve the highly robust recognition system.

8. REFERENCES

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