Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X
IMPACT FACTOR: 6.017

IJCSMC, Vol. 6, Issue. 2, February 2017, pg.142 – 151

Preprocessing of IRIS image Using High Boost Median (HBM) for Human Personal Identification

S.Aswin Kumar
Ph.D Research Scholar, Department of Computer Science, Erode Arts & Science College, Erode
ahahaswin@yahoo.com

S.Pannirselvam
Associate Professor & Head, Department of Computer Science, Erode Arts & Science College, Erode
pannirselvam08@gmail.com

Abstract: Due to the emergence in information technology; Digital Image Processing is a significant research area in the field of information processing system. Image processing refers to process an image by a computer it with various elemental techniques and produced the produces the desired output. To acquire better accuracy it necessary for preprocessing an image which is an essential task to eliminate the noises presents in the image and improves the quality of the corresponding image. It dominates a spectacular task in biometric images to increase the quality of image for better authentication process. Biometric images are more complex to interpret. In this paper, various types of filtering techniques are applied for pre-process an iris images for further recognition process. Four kinds of filters are proposed using hybridization with various filters. The proposed filter is experimented with POLYU database and the results are compared with the existing filters. The performance of the proposed filter is experimented with the similarity measures MSE and PSNR. Compared to other filters, the proposed High Boost filter gives high PSNR and less MSE values.
Keywords— Iris, Biometrics, Preprocessing, Median, Gaussian, High Boost, MSE, PSNR.

I. INTRODUCTION

Due to the rapid growth in the Information technology the security system was suffering with lot of issues. Today, criminals were entered into the Information technology called cyber crime leads to huge issues in every sectors in daily life. Various manual and automated systems were emerged to overcome the issues such as password, username, secret codes. These systems were due to the cyber crackers and cyber attacks. In order to solve such security issues the biometric system was open its buds with various features such as fingerprints recognition, IRIS, gait, palm print, voice, Signatures etc.

Iris recognition is the most widely and cost effective biometric system for human identification. Generally, IRIS are the pattern of human eyes with various features. It is captured with the suitable equipments and stored in the computer memory for further processes.

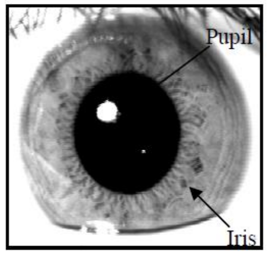

Figure 1.Typical human eye

Apart from original image acquitted the iris images are affected by external agents called noise. The noise is one kind of feature which disturbs the real pattern of the image and makes the identification process inefficient. So, there is need to eliminate this noise, and to obtain better iris from noises. This can be done by a process called pre-processing.

Pre-processing is a method of eliminating or reducing the noise presents in the finger prints. It consists of various techniques such as binarization, normalization, thinning. Another method which is done by various filters these are efficient filters are also available to reduce noise. Iris image enhancement is the method of improving the quality of the image by increasing contrast, brightness, sharpness etc. The various filter and methods used for pre-processing are discussed in the following sections.

II. RELATED WORKS

Rupesh Mude et al.,[1] used the 2D-Gabor filter for Iris on a detailed analysis of the variation between the frequency, scale, orientation and the decidability index proposes a suitable selection method for the extraction of the iris texture features. Application of the design to large-scale iris image database should be carried out in order to further validate its versatility and robustness. Hanfei and Jiang congfeng et al.,[2] developed a hybrid feature set filtering localization approach (HFSFLA) for iris recognition.. In pre-processing step we combine the advantages of the linear low pass filter algorithm and nonlinear low pass filter algorithm. In localization step we propose one hybrid feature set filtering localization approach (HFSFLA) to precisely locate the inner and outer edge of the iris image. Kazuyuki et al.,[3] used phase components in 2D Discrete Fourier Transforms (DFTs) to achieve highly accurate iris recognition even for low-quality iris images. Romany F. Mansour[4] applied the Gauss Laplace filter to recognize IRIS. It decreases noise to the maximum extent possible, retrieves essential characteristics from image and matches those characteristics with data in a database. Abdullah et al. focused on either visible light (VL), near-infrared (NIR) imaging, or their fusion. Three descriptors are used namely, Gabor-difference of Gaussian (G-DoG),Gabor-binarized statistical image feature (G-BSIF), and Gabor-multi-scale Weberface (G-MSW) to achieve robust cross-spectral iris matching[5]. Ganesh Kumar and Kiran Kumar developed a 3D median filter design for iris biometrics has been chosen to be implemented due to the low error rates. As previously used 2D median filter doesn't gives a much efficient filtering of noise in images it can be replaced by an 3D median filter for better noise removal[6].

Hiyaneswaran et al.,[8] used the Gabor wavelet features are widely used for the iris recognition. The existing Gabor features requires more amount of computing time and the proposed modified Gabor wavelet the filter and the Gaussian envelop coefficients are varied to reduce the computing time. The pro-posed Gabor wavelet reduced the feature extraction time at average to 141 Nano seconds. Nithyanandam.S et al.,[9] developed A Canny Edge Detection scheme and a Circular Hough Transform, is used to detect the iris boundaries in the eye's digital image. The extracted IRIS region was normalized by using Image Registration technique. A phase correlation base method is used for this iris image registration purpose. The features of the iris region is encoded by convolving the normalized iris region with 2D Gabor filter. Saba et al.,[11] applied the Circular Hough transform, Canny Edge Detection, Gabor filters, Homogeneous rubber sheet model, and Daubechies wavelets methods were used based on the requirements of the Iris Pre-Processing (IIP) Module. Li Ma, Yunhong Wang, Tieniu Tan [13] developed an algorithm uses a bank of Gabor filters to capture both local and global iris characteristics to form a fixed length feature vector. Pannirselvam and Raajan[15] used an the high boost filter and Gaussian filter for efficient finger print image quality. In this work High Pass filter and the Gaussian filter is applied for noise removal. Gargi Amoli et al.,[16] Used localisation of the inner and outer boundaries of the iris is done by finding the maximum blurred partial derivative. Normalization of iris has been achieved by projecting the original iris in a Cartesian coordinate system into a doubly dimensionless pseudopolar coordinate system. CASIA Iris Database has been used to test the algorithms.

III. EXISTING FILTERING METHODS

Filtering is one of the most fundamental operations of image processing and computer vision. The choice of filter is often determined by the nature of the task, type and behavior of the image. Noise, color accuracy, optical artifacts may affect the outcome of filter functions in image processing.

3.1 Frequency and Spatial Filters

The frequency domain technique is based on the convolution theorem. It decomposes an image from its spatial domain form of brightness into frequency domain components and is represented as the following equation

$$g(x, y) = h(x, y) * f(x, y)$$

where $f(x, y)$ is the input image, $h(x, y)$ is a position invariant operator and $g(x, y)$is the resultant image from the convolution theorm.

$$G(u, v) = H(u, v)F(u, v)$$

Where G,H,F are the fourier transform of g, h, frespectively. The transform H(u,v) is called transfer function of the process. Here the edge in f(x,y) can be boosted by using H(u,v) to emphasis the high frequency component of F(u,v). In case of spatial filter works on pixels in the neighbourhood of the pixel i.e sub image is defined. The operation on sub image pixels is defined using mask or filter with the same dimension.

Mean filter is a linear filter and used to improve the image quality for human viewers. Replaced each pixel value with the average value of the intensities in the neighborhood.

The major drawback is that blurring affect features localization. The mean or average filter is defined as follows:

$$I'(i,j) = \sum_{(m,n)\in_n} h(m,n)I(i-m,j-n)$$

Where, I is the intensity function in the original image, I' is the intensity function in the filtered image, N is the local neighborhood and h is the convolution mask.

3.2 WIENER FILTER

The wiener filter tries to build an optimal estimate of the original image by enforcing a minimum mean square error constraint between estimate and original image. It is an optimum filter and to minimize the mean square error. It has the capability of handling both the degradation function as well as noise. From the degradation model, the error between the input signal f (m, n) and the estimated signal f(m, n) is given by,

E (M, N) = F (M, N) - F (M, N)

Where, f (m, n) represents input signal and f represents the intensity value. The square error is given by

$$[F (M, N) - F (M, N)]^2$$

The mean square error is given by

$$E \{[F (M, N)-F (M, N)]^2\}$$

3.3 ALPHA-TRIMMED FILTER

Alpha-trimmed mean (ATM) filter is based on order statistics and varies between a median and mean filter. It is the average of the pixel values within the window, but with some of the endpoint –ranked values excluded.

$$\propto = \frac{1}{n^{2-d}} \sum g\,(s,t)$$

Where, size of the window is n and all the pixels within the window represented by g(s, t).

IV. PROPOSED METHODOLOGY

In order to overcome the issues in the existing filtering techniques, it is necessary to propose a new hybrid filter technique which is named as Median Gaussian Filter (MGF). Median Gaussian filter improves the image quality and the filtered image is efficient for further process. The conceptual diagram of proposed median Gaussian filter is shown in figure 1.1.

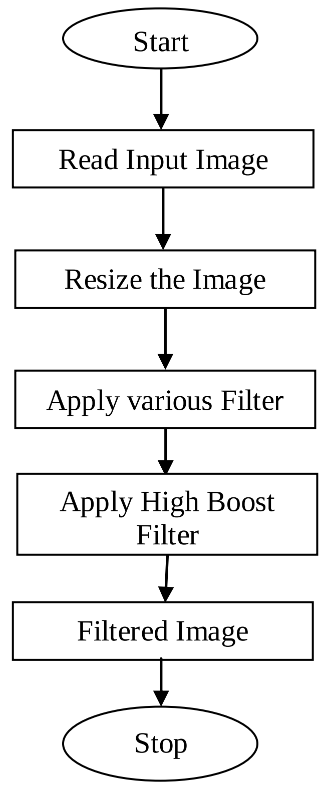

Figure 1.2 Process of High Boost Filter

Figure 1.2 describes the flow of filtering process. In this proposed method, filtering process was done by using Median Gaussian filter. The input mammogram image should be selected from the database which is input to the median filter. From the resultant image, Gaussian filter should be applied which is the final preprocessed filtered image.

4.1 INPUT IMAGE

The input mammogram image is selected from the database which is gray in color. The gray color image consists of pixel intensity between 0-255, where 0 represent black and 255 used for white.

4.2 MEDIAN FILTER

Median filter sorts all the pixel values in the window and then change the middle value with the pixel value being considered. It preserves the sharp edges. The basic function for median filter is written below in equation (1),

$f(x, y) = \text{median}\{g(i, j)\}\ i, j \in N$

Where f(x, y) specifies the filtered image and g(i, j) specifies the original image

4.3 High boost filtering

A high boost filter is also known as a high frequency emphasis filter. A high boost filter is used to retain some of the low-frequency components to and in the interpretation of a image[1].

In high boost filtering the input image f(m,n) is multiplied by an amplification factor A before subtracting the low pass image are discuss as follows.

High boost $= A \times f(m, n)$ - low pass

Adding and subtracting 1 with the gain factor

High boost = $(A - 1) \times f(m, n) + f(m, n)$-low pass

But $f(m,n)$ - low pass= high pass
High boost= $(A-1)\times f(m,n)$ +*high pass*

V. PERFORMANCE EVALUATION

In the proposed system, various filtering techniques are worked out on mammogram image and the performances of image quality are evaluated based on two metrics:

- MSE(Mean Square Error)
- PSNR (Peak-Signal-To Noise Ratio)

5.1 MSE (Mean Square Error)

Mean Squared Error is the difference between the original image and a distorted image. It examines each pixel in the image and adds the difference of all the pixels and divides it by the total pixel count.

$$\mathrm{MSE} = \frac{1}{\mathrm{mn}} \sum_{0}^{\mathrm{m}-1} \sum_{0}^{\mathrm{n}-1} \| \mathrm{f(i,j)} - \mathrm{g(i,j)} \|^2$$

Where,

f- Original Image
g- Degraded Image
M, n- Number of rows and columns
$\max_f$ - maximum signal value

5.2 PEAK-SIGNAL-TO NOISE RATIO (PSNR)

The term peak signal-to-noise ratio is an expression to find out the difference between the maximum value of a signal and the power of distorting noise that changes the quality of the image. PSNR is usually expressed in terms of the logarithmic decibel scale [2]. The mathematical representation of the PSNR is as follows:

$$PSNR = 20 \log_{10} \left(\frac{Max_f}{\sqrt{MSE}} \right)$$

Where, Max_f represents maximum signal value and MSE represents mean square error.

ALGORITHM FOR HIGH BOOST FILTER

Input: Input Images.

Output: Preprocessed Images.

Step 1: Read the input Image of size M x N
From the image database
Step 2: Resize the image of size 300 x 300.

Step 3: Apply various filters.

Step 4: Apply High Boost Filter
Step 5: Compute MSE and PSNR

Step 6: Repeat the step 1 and 5 for all images in
The database
Step 7: Select the best performed Filter

The proposed methodology is experimented with polyu image databases and the results are presented separately. The It contains 322 images, the sample images from the database are shown below.

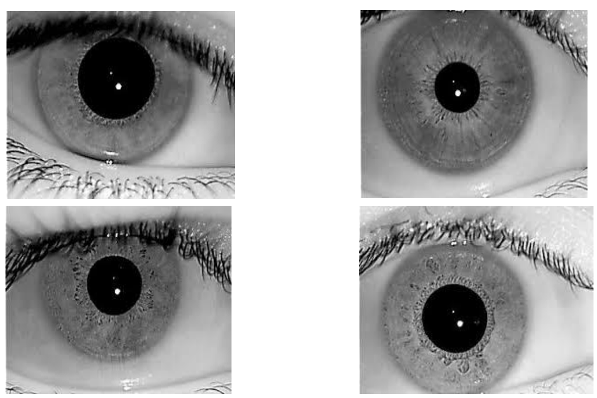

Figure 1.3 Sample Images from POLYU

In the proposed method, median Gaussian filter is used to remove the noise. The single mammogram image as input and the output of median Gaussian pre-processed image as follows,

During preprocessing process, various filters such as median, Low pass, Gaussian, High Boost, Gaussian, and median are worked out on iris.

The Table.1.1 and 1.2 shows the output of the preprocessed images MSE and PSNR values. The average values of MSE and PSNR values for 10 images are tabulated in table 1.1. From the experimental results it is concluded the High Boost filter is best for noise removal and gives better performance by estimating the PSNR values. Figure 1.4&1.5 gives the graphical representation for MSE value of table 1.1&1.2.

Table.1.1 MSE values of Filtered Images

Methods	Low Pass	Median	Gaussian	Weiner	igh Boos
Iris1	20.7419	6.3149	26.6205	15.082	5.8651
Iris2	11.8286	7.1976	26.6588	16.743	6.4742
Iris3	9.9663	9.2135	20.4536	16.995	7.8874
Iris4	20.9658	16.086	37.1458	17.809	10.109
Iris5	22.6506	18.311	42.6237	15.665	12.091
Iris6	28.2301	7.4276	39.6891	15.971	5.8987
Iris7	29.7673	3.8588	46.4476	15.061	3.9053
Iris8	26.3011	10.975	49.1872	17.567	9.9875
Iris9	35.9132	12.059	49.6473	16.904	10.247
Iris10	28.3552	6.234	38.0961	17.861	6.1143

Table.1.2 PSNR values of Filtered Images

Methods	Low Pa	Median	Gaussian	Weiner	igh Boos
Iris1	28.514	42.683	14.785	38.902	27.335
Iris2	30.854	42.224	15.366	36.068	27.327
Iris3	31.598	41.473	14.869	37.674	28.476
Iris4	28.369	38.981	14.763	38.692	25.885
Iris5	28.033	38.113	15.435	40.768	25.287
Iris6	27.077	42.144	15.43	39.533	25.598
Iris7	26.846	45.505	15.959	38.312	24.091
Iris8	27.384	40.546	17.207	39.554	24.665
Iris9	26.031	40.719	15.468	38.643	23.458
Iris10	27.057	43.705	15.761	40.128	26.648

From the below figure 1.4 High Boost have less MSE value, which means, High Pass have good image quality because of less MSE value and high PSNR value. Figure 1.5 gives the graphical representation for PSNR value of table 1.2.

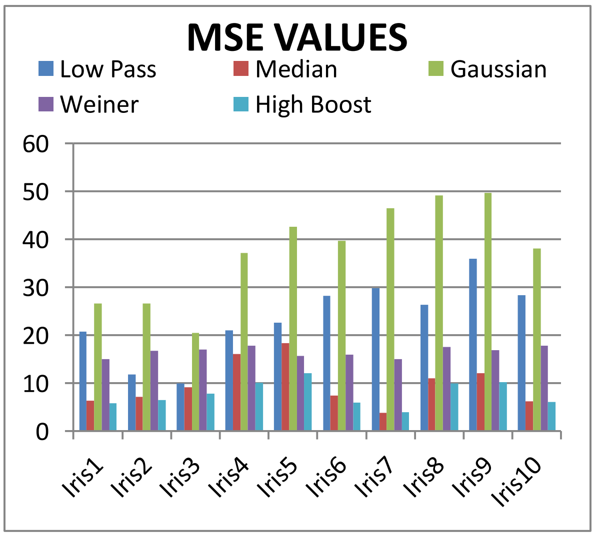

Figure.1.4. MSE values of Filtered Images

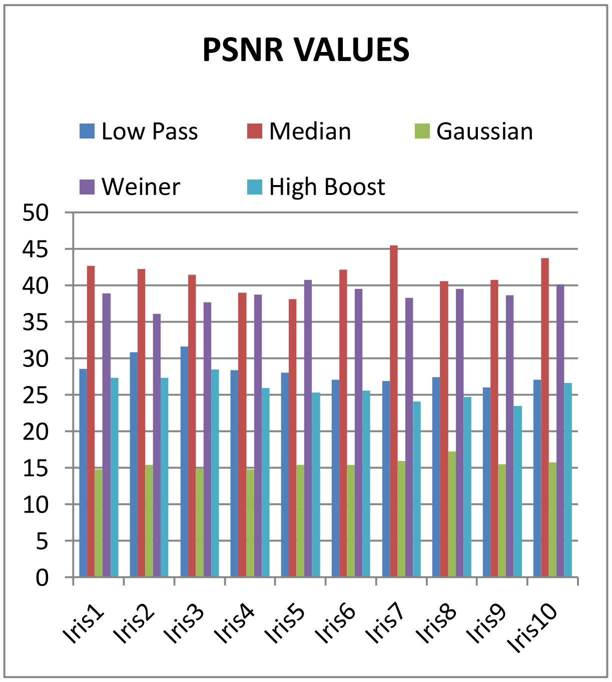

Figure.1.5. PSNR values of Filtered Images

VII. CONCLUSION

Pre-processing technique is used for enhancing the content of medical image based on removal of special markings and noise. Removal of noise in biometric images will increase the quality of image segmentation. Here three types of filtering techniques for pre-processing of mammography images are considered. And, proposed four hybrid filtering techniques. It compared to simulated output parameters such as mean square error and Peak signal to noise ratio. The comparisons of filters are tested for iris images. From the experimental and results it is conclude that High Boost filter is best for mammogram image. It gives high PSNR values and less MSE values.

REFERENCES

1. Rupesh Mude " Gabor Filter for Accurate IRIS Segmentation Analysis", International Journal of Innovations in Engineering and Technology (IJIET) Volume 6 Issue 1 pp 148-153, 148 ISSN: 2319 – 1058 Oct 2015.
2. Hanfei and Jiang Congfeng " One Hybrid Feature Set Filtering Localization Approach for Iris Recognition", International Journal of Signal Processing, Image Processing and Pattern Recognition Vol.8, No.7 (2015), pp.243-254
3. *Kazuyuki Miyazawa, Koichi Ito, Takafumi AokiKoji Kobayashi, Atsushi Katsumata,"* AN IRIS RECOGNITION SYSTEM USING PHASE-BASED IMAGE MATCHING", 1424404819/06/$20.00 ©2006 IEEE 325 ICIP 2006 328.

4. Romany F. Mansour,"Iris Recognition Using Gauss Laplace Filter" *American Journal of Applied Sciences*© 2016. This open access article is distributed under a Creative Commons Attribution (CC-BY) 3.0
5. Abdullah *et al.."*A novel framework for cross-spectral iris Matching", Chambers1 IPSJ Transactions on Computer Vision and Applications *IPSJ Transactions on Computer Vision and Applications* (2016) 8:9DOI 10.1186/s41074-016-0009-9
6. K. Ganesh Kumar1, Dr. K. Kiran Kumar2," 3D Median Filter Design for Iris Recognition" International Journal of Modern Engineering Research (IJMER), Vol. 3, Issue. 5, Sep - Oct. 2013 pp-3008-3011 ISSN: 2249-6645.
7. Thiyaneswaran. 2Padma," ANALYSIS OF GABOR FILTER PARAMETER FOR IRIS FEATURE EXTRACTION", *International Journal of Advanced Research in Computer Engineering & Technology Volume 1, Issue 5, July 2012 ISSN: 2278 – 1323 pp 45-48*
8. Nithyanandam.S, Gayathri.K.S, Priyadarshini P.L.K " A New IRIS Normalization Process For Recognition System With Cryptographic Techniques ",IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 4, No 1, July 2011 ISSN (Online): 1694-0814 www.IJCSI.org 342-348
9. B.Sabarigiri, T.Karthikeyan,Acquisition of Iris Images, Iris Localization, Normalization, and Quality Enhancement for Personal Identification", *International Journal of Emerging Trends & Technology in Computer Science (IJETTCS),* Volume 1, Issue 2 July-August 2012 Page 271 -275 ISSN 2278-6856
10. Li Ma, Yunhong Wang, Tieniu Tan, Iris Recognition Based on Multichannel Gabor Filtering", ACCV2002: The 5th Asian Conference on Computer Vision, 23--25 January 2002, Melbourne, Australia. 1-5
11. Dr. S. Pannirselvam P. Raajan,"An Efficient Finger Print Enhancement Filtering Technique with High Boost Gaussian Filter (HBG), International Journal of Advanced Research in Computer Science and Software EngineeringVolume 2, Issue 11, November 2012 ISSN: 2277 128X 370-378
12. Gargi Amoli1 Nitin Thapliyal2 Nidhi Sethi3, Iris Preprocessing, International Journal of Advanced Research in Computer Science and Software Engineering Volume 2, Issue 6,pp.301-304, June 2012 ISSN: 2277 128X.