ADVANCES in NATURAL and APPLIED SCIENCES

ISSN: 1995-0772
EISSN: 1998-1090
2016 September 10(13): pages 131-137

Published BY **AENSI Publication**
http://www.aensiweb.com/ANAS
Open Access Journal

New Approach for Iris Feature Extraction

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Received 7 June 2016; Accepted 12 September 2016; Available 20 September 2016

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ABSTRACT

Texture is one of the crucial primitives in human vision. Its analysis describes the spatial variation of an image pattern based on some mathematical procedures and models to extract an information from it. Texture features can be used after that to identify the contents of an image. So, an attempt to extract iris texture features based on Gray Level Co-occurrence Matrix (GLCM) had been executed here in this work. Various statistical measures have been utilized here to calculate such features for five selected lines extracted from a normalized pure iris image. Due to the larger values of the GLCM, results prove images' uniformity through features' distribution curves which ensure the effectiveness of such used measures (i.e. Entropy, Mean and Variance) in such analysis. Besides, line's positions didn't make any unique role upon all distribution curves and hence couldn't be used to distinguish iris zones.

KEYWORDS: Entropy, Mean, Variance, Gray Level Co-ocurrence Matrix (GLCM)

INTRODUCTION

Due to its broad fields of applications, texture has been a popular research area within image processing since early 70's [1]. One of the defining qualities of texture is the spatial distribution of the gray levels [2]. In statistical methods, texture is described by a collection of statistics of selected features [3]. Many authors focuses their attention to extract iris features through different approaches, some of them like Khan et al. [4] used 1D-Gabor filter to extract such unique features. Others presented by C. and Waghmare [5] used haar wavelet and daubechies wavelet to extract features for the goal of iris recognition. C. et al. [6] used Fast Wavelet Transform (FWT) to extract the features through encoding the features to generate its iris feature codes.

Statistical methods can be classified into first order (one pixel), second-order (two pixels), etc depending on the number of pixels defining the local features of an image. The earliest method for texture feature extraction is known as Gray Level Co-ocurrence Matrix (*GLCM*) [2]. *GLCM* is a widely used texture descriptor, it computes the statistical features based on gray level intensities of the image, such features of the *GLCM* are useful in texture recognition, image segmentation, image retrieval, color image analysis, image classification, object recognition and texture analysis methods [7]. Each element of the *GLCM* represented the number of times that the two pixels with gray tone i and j are neighborhood in distance d and direction θ [2].

Because of its highly complex, unique, stability and well protected organ, iris pattern is one of the best suitable physical trait over many decades. Human iris is a visible color ring bounded by the pupil and white sclera. It is suspended in aqueous humor, behind the cornea and in front of the lens. The average diameter of the iris is approximately 12mm with a circumference of 37mm [8]. The anterior surface of the iris is separated into two zones; the pupillary zone and the ciliary zone which are separated by a circular zigzag ridgeline known as the collarette as represented in Fig.(1) [9].

To Cite This Article: Dr. Fatin Ezzat Muhy Al-Dean Al-Obaidi and Ali Jassim Mohamed Ali., New Approach for Iris Feature Extraction. **Advances in Natural and Applied Sciences**. 10(13); Pages: 131-137

In this paper, we have been presented an approach for extracting such features for a line extracted from a normalized iris image in different positions. Such extracted line represents a ring in the interior portion of the pure iris in its original image. For our personal opinion, this technique in such field has not achieved before.

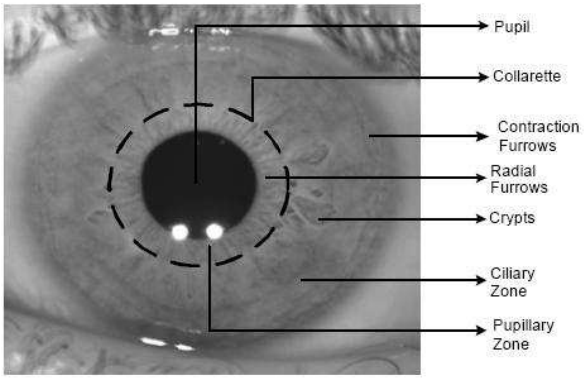


Fig. 1: Anatomy of the interior portion of the iris [9]

2.0 Texture Used Features:
A large number of texture features can be derived from the GLCM which can be described as follow:
1- Entropy:

It is a measure for the non-uniformity in an image. If the image is heterogeneous, many elements of the *GLCM* have small values, which imply that the entropy is very large. The equation of the entropy is given by [10-12]:

$$Entropy = -\sum_{i,j=0}^{N-1} GLCM(i,j)\left(\frac{\log(GLCM(i,j))}{\log(2)}\right) \quad .....(1)$$

Where *GLCM*(*i*,*j*) is a two dimensional function and it is composed of *N*x*N* pixels in the horizontal and vertical directions, *i* and *j* are horizontal and vertical coordinates of the image.

2- Mean:

The mean is determined by the homogeneous brightness or darkness of the image. The more homogeneously bright image is, the higher in its mean and visa versa. Its equation is given by [3,10-12]:

$$\mu_i = \sum_{i=0}^{N-1} i \sum_{j=0}^{N-1} GLCM(i,j) \quad .....(2)$$

$$\mu_j = \sum_{j=0}^{N-1} j \sum_{i=0}^{N-1} GLCM(i,j) \quad .....(3)$$

3- Variance:

It is a measure of heterogeneity and it was correlated strongly with standard deviation. It characterizes the distribution of the gray levels around the mean value. The variance increased when the gray level differ from their mean value. The variance equation can be given by the next expression [1,3,10]:

$$\mathrm{var}(i) = \sum_{i=0}^{N-1} (i-\mu_i)^2 \sum_{j=0}^{N-1} GLCM(i,j) \quad .....(4)$$

$$\mathrm{var}(j) = \sum_{j=0}^{N-1} (j-\mu_j)^2 \sum_{i=0}^{N-1} GLCM(i,j) \quad .....(5)$$

3.0 The Proposed System:
3.1 Data Base Acquisition:

This paper examines iris information which extracted from images that have been obtained from (CASIA-IrisV3-Part2). In the presented work, a pure iris images have been selected only (i.e. images include irises with their full shape without eyelashes and eyelids being exist).

3.2 The Pre-Processing Algorithms:

Firstly, an iris segmentation process has been executed here to isolate the entire iris from the pupil, the sclera, upper and lower eyelids, and the eyelash boundary. Then, the extracted iris had been unwrapped and

converted to polar coordinate to produce a rectangular shape instead of its circular path. All these procedures can be best illustrated in the flowchart shown in Fig.(2).

To overcome the high computational complexity resulting from the large resulted *GLCM*, the entire extracted iris image must be quantized first into a limited number of quantized level. This has been done by using the next equation:

$$Quantized\ \mathrm{Im}age = c\,\mathrm{int}\left(\left(\frac{pixel}{255}\right)xQL - 1\right) \quad .....(6)$$

Where *QL* is the Quantization Level which is set to 16.

Then the process of *GLCM* generation shall be begin. It is commonly preferred that the distance between a pixel and its immediate neighbor is equal to one to its right with a spatial relationship equal to 0°. Before proceeding with the statistical measures, *GLCM* must be normalized by the next normalization form:

$$Normalized\ _\ \mathrm{Im}age = \frac{GLCM(i,j)}{\sum_{i=0}^{QL-1}\sum_{j=0}^{QL-1} GLCM(i,j)} \quad .....(7)$$

In the presented work, the statistical features have been calculated for a horizontal line extracted from the normalized *GLCM* in different locations through the texture as shown in Fig.(3)

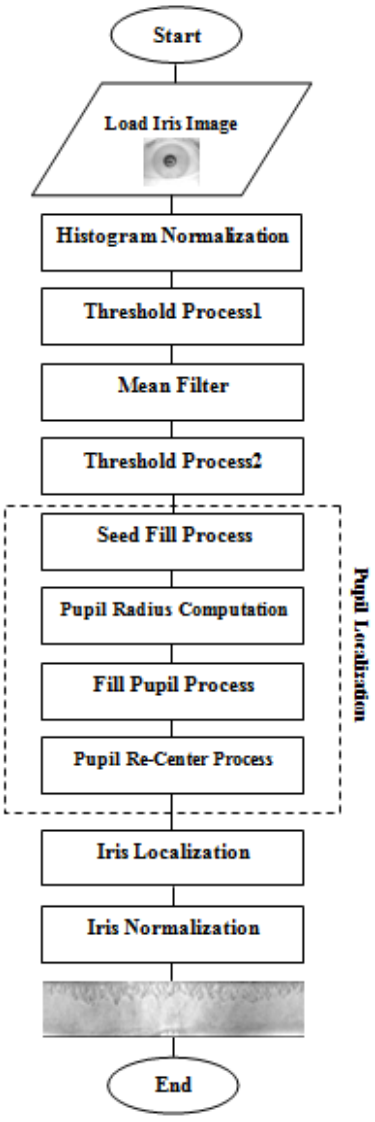
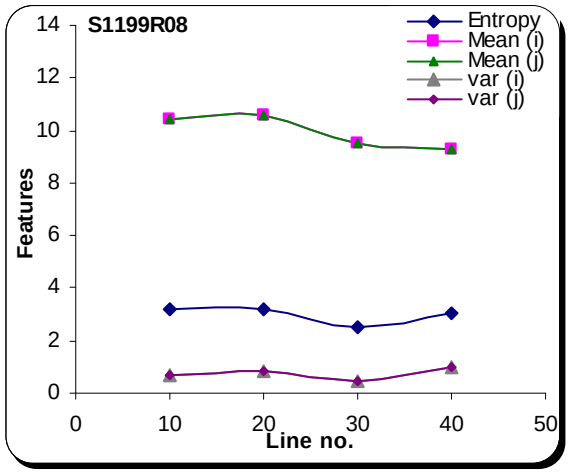


Fig. 2: Flowchart for the Pre-Processing Algorithm For isolating iris region

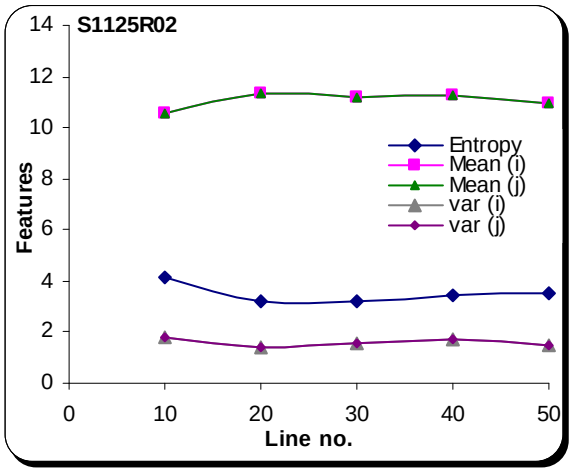
Fig. 3: The horizontal extracted lines' Positions upon the normalized *GLCM*

RESULTS AND DISCUSSIONS

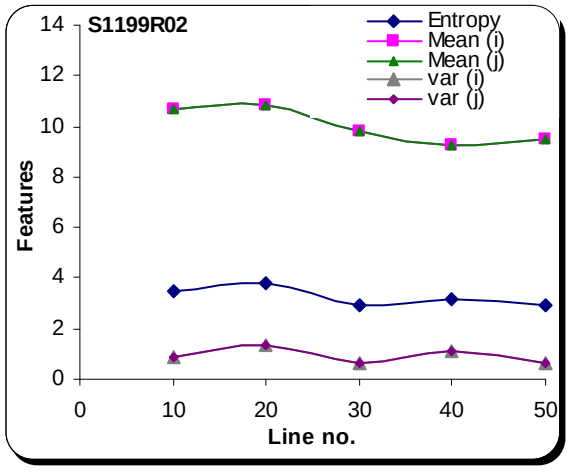
Various statistical measures using *GLCM* have been adopted here. Figures(4) & (5) show the distributions of such measures as a function of the extracted line number positions. The behavior for entropy and variance distribution curves seems identical. For all used irises, one can noticed the uniformity for such used image which is due to the large values of their *GLCM*, this explains the smallest values for entropy and variance distribution curves. In contraction to the previous considerations, an increase in mean distribution curves can be seen because of the homogeneously bright texture images. Such curves don't have a unique behavior for all figures, this can be caused by the differences in illumination conditions which may occurred during the process of image acquisition. There is a relative role for the position of the extracted line upon such images and hence line's position didn't make any assign for features within iris texture region.



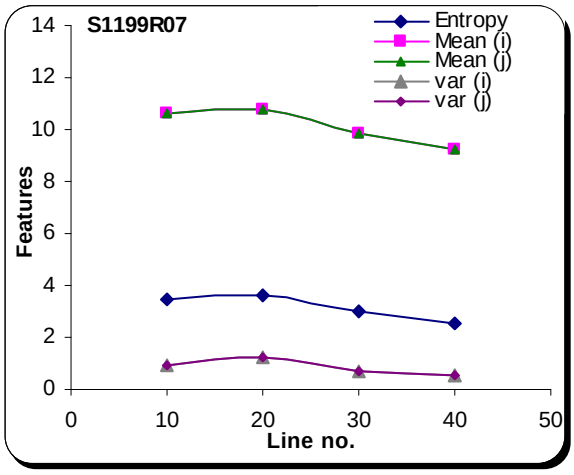
(a)



(b)



(c)



(d)

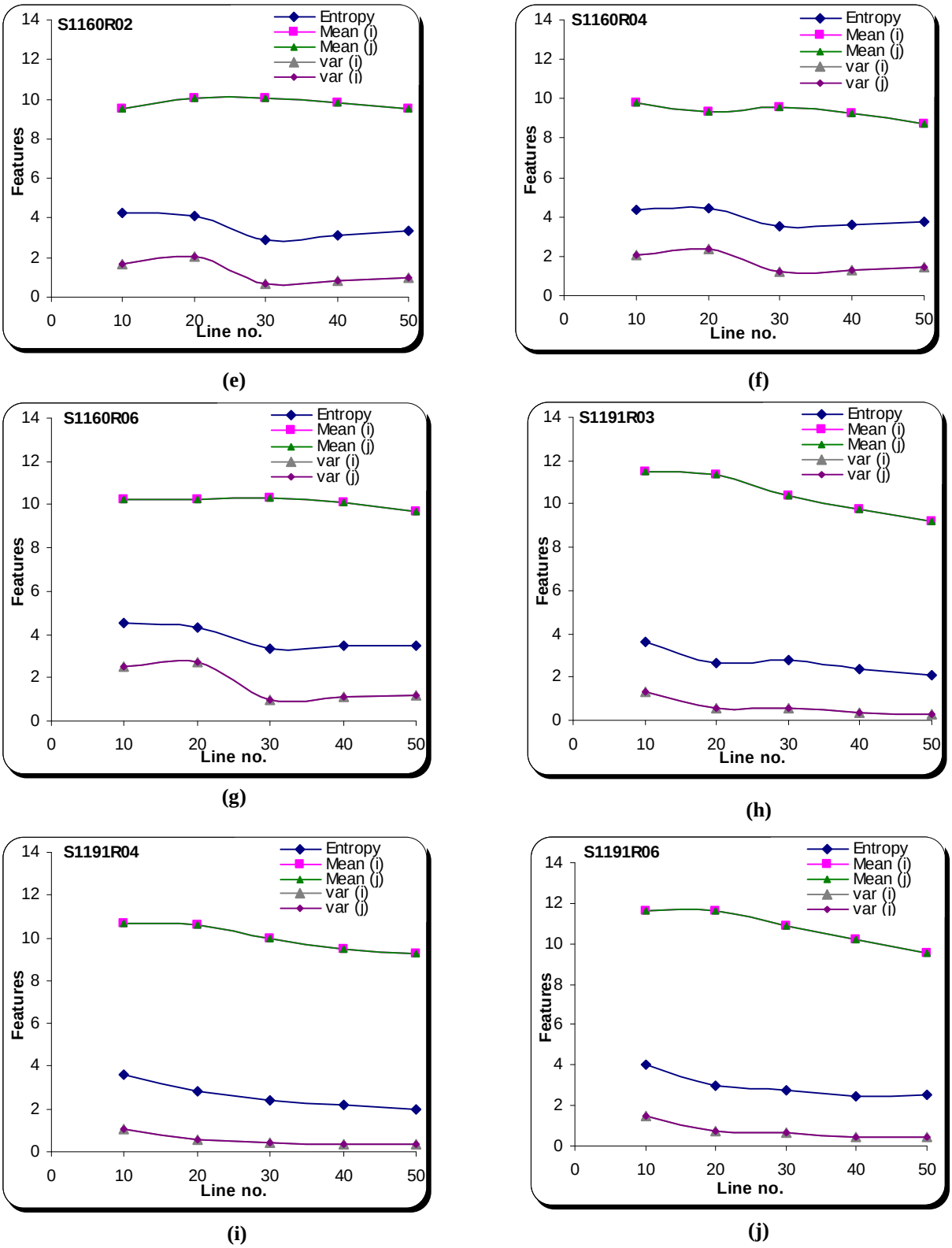


Fig. 4: The distribution of the statistical features with line's position for right eyes

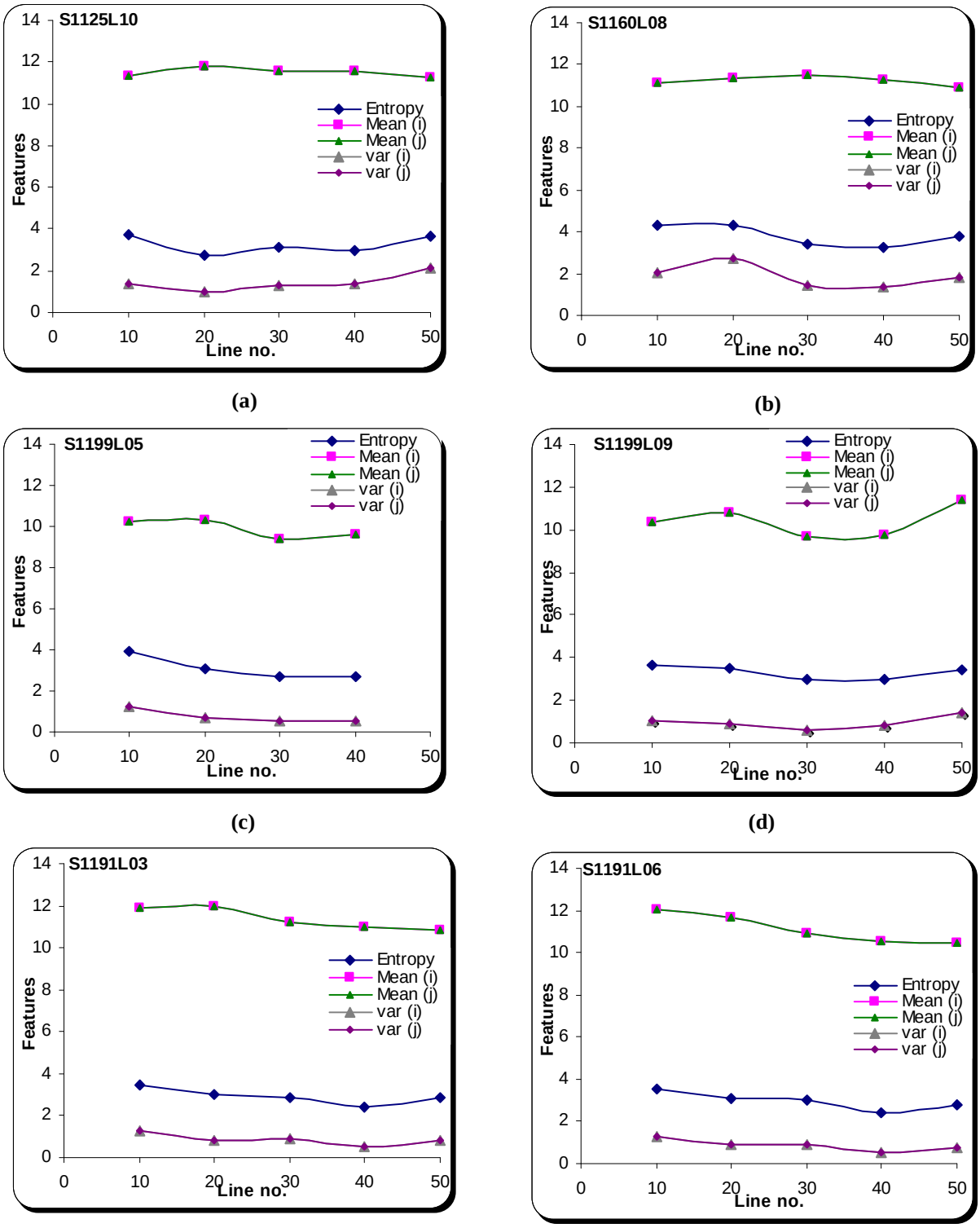


Fig. 5: The distribution of the statistical features with line's position for left eyes

Conclusion:

This approach presented a new method for extracting iris features from pure images through a horizontal extracted line. The current work used the *GLCM* for extracting iris texture features which describe the spatial distribution of such texture. Results show the effectiveness of such used measures (i.e. Entropy, Mean and Variance) to represent the homogeneity of iris texture image. Such effectiveness appeared through an increase/decrease in Mean/Entropy and Variance distribution curves respectively. The extracted line's position

in its application for extracting features couldn't be used in this situation as a good indicator for distinguishing iris zones. The subject of this work can be used in future toward further aspects in such field.

REFERENCES

1. Konak, E.S., 2002. A content-based image retrieval system for texture and color queries, M. S. thesis, Department of Computer Engineering, The Institute of Engineering and Science, Bilkent University, Turkey.
2. Pathak, B and D. Barooah, 2013. Texture analysis based on the gray-level co-occurrence matrix considering possible orientations. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, 2(9): 4206-4212.
3. Vs, K.R., 2011. Comparative evaluation with alternate segmentation strategies. In Ph.D thesis: Texture based image segmentation and analysis of medical image, Computer Science, Faculty of Science, Mahatma Gandhi Unversity, India, pp: 124-145.
4. Khan, M.T., D. Arora and S. Shukla, 2013. Feature extraction through iris images using 1-D Gabor filter on different iris datasets. In the Proceedings of 2013 Sixth International Conference, pp: 445-450.
5. C, V.R.E and L.M. Waghmare, 2013. Pupil detection and feature extraction algorithm for iris recognition. AMO-Advanced Modeling and Optimization, 15(2): 409-420.
6. C, A.O., Sadiku, J.S, A.K.S and J.R.G., 2014. Iris feature extraction for personal identification using fast wavelet transform (FWT). International Journal of Applied Information Systems (IJAIS) Foundation of Computer Science FCS, 6(9): 1-6.
7. Rao, C.N., S.S. Sastry, K. Mallika, H.S. Tiong and K.B. Mahalakshmi, 2013. Co-occurrence matrix and its statistical features as an approach for identification of phase transitions of mesogens. International Journal of Innovative Research in Science, Engineering and Technology, 2(9): 4531-4538.
8. Thainimit, S., L.A. Alexandre and V.M.N. de Almeida, 2013. Iris surface deformation and normalization. In the Proceedings of 13th International Symposium on Communications and Information Technologies: Communication and Information Technology for New Life Style Beyond the Cloud, pp: 501-506.
9. Boyce, C., A. Ross, M. Monaco, L. Hornak and X. Li., 2006. Multispectral iris analysis: a preliminary study. In the Proceedings of Computer Vision and Pattern Recognition Workshop (CVPRW'06), pp: 51.
10. Sassi, O.B., L. Sellami, M.B. Slima, K. Chtourou and A.B. Hamida, 2012. Improved spatial gray level dependence matrices for texture analysis. International Journal of Computer Science & Information Technology (IJCSIT), 4(6): 209-219.
11. Kadim, A.M., 2011. Iris texture recognition using co-occurrence matrix features with k_means algorithm. Journal of Al-Nahrain University, 14(4): 185-190.
12. Kerim, A.A and S.J. Mohammed, 2014. New iris feature extraction and pattern matching based on statistical measurement. International Journal of Emerging Trends & Technology in Computer Science (IJETTCS), 3(5): 226-231.