

Digital Images Enhancement

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ABSTRACT

Image enhancement is one of the basic branches of image processing. It enables details of image more clearer. It is an operation by which the data of original image will be enhanced and substituted by new data. This is for making the image more clear and suitable for new operation. Seven methods were conducted to enhance the image. Matlab language was used to measure the efficiency of enhancement methods by calculating the entropy value and the standard deviation value of the original image and image after enhancement. In this research color images were operated and images of tissues were also selected because of the scientific importance.

Keywords: Image Enhancement, Entropy, Standard Deviation.

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INTRODUCTION

Image enhancement is the task of applying some transformations to the original image to get an image whose visually more pleasant, more detailed. The application of an image enhancement algorithm is produced by increasing the brightness and contrast of the original. Enhancements are used to facilitate visual interpretation and image understanding. The digital image feature allows us to manipulate pixels value in digital images.^[1]

Image enhancement algorithms provide a variety of methods to modify images to achieve visually acceptable images. It is applied in many fields where the image must be understood and analyzed. For example medical image analysis and image analysis of satellites.^{[2][3][4]}

METHODS

In this research, seven methods are selection and execution to enhancement histological images, these methods are: Contrast Stretching^[5], Histogram Equalization^{[5][6][7]}, Gamma Intensity Correction (GIC)^{[8][9]}, Logarithmic Function (Log fn.)^{[10][11]}, Exponential Function (Exp Fn.)^[3], Image Smoothing^[12] and Image Sharpening^[13].

Histology: Is a science specialized in the study of tissues and organs.^[14]

Tissue: Group of cells that specialized to do limited function.^[15]

Histological sections:

Histological sections are thin, flat slices of fixed and stained tissues and organs mounted on glass slides. Such sections are normally composed of cellular, fibrous, and tubular structures.

In this research, three medical images (Histological images) are selection and execution, these images are^[14]: Image1 represent Large Intestine: Colon and Mesentery, Image2 represent Large Intestine: Colon Wall and Image3 represent Appendix.

Performance Evaluation Factors:

In this research two factors were used to evaluate the methods of image enhancement, these factors are:

1-Entropy:

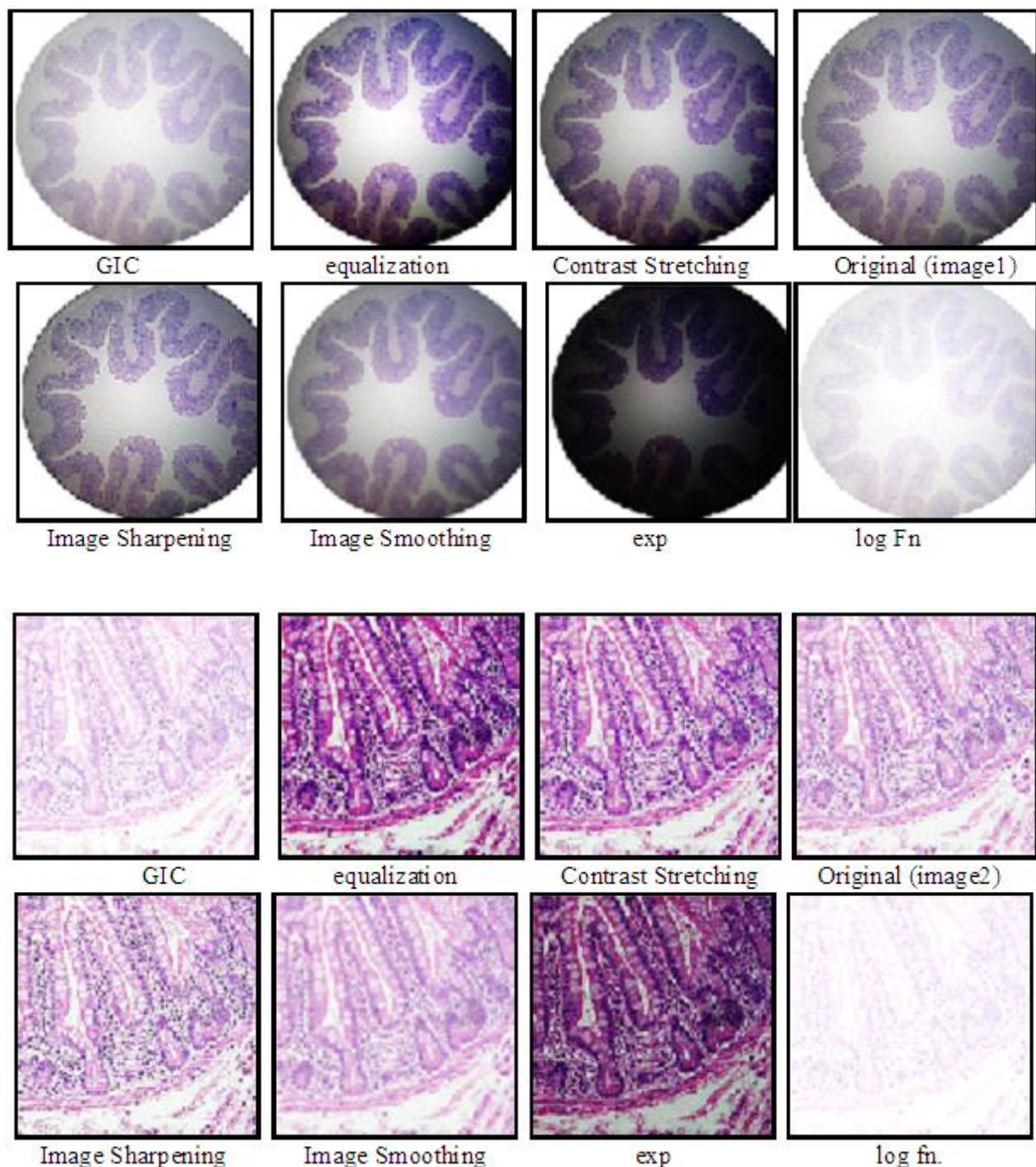
It is used to measure the quality of information in the image. The largest value of the entropy in the image indicates that the measured image is better than the original image.^{[16][17]}

2-Standard Deviation:

It is one of the important statistical measures used frequently in statistical dispersion. Standard deviation is associated with the arithmetic mean and is influenced by extreme or divergent values. The high value of standard deviation indicates that data points are distributed over a wide range of values. While the low value of standard deviation indicates that the data points tend to be very close to the average value.^{[17][18]}

RESULT AND DISCUSSION

In this research, three images were selected for the tissue. Seven methods were applied to enhancement the images as shown in Figure (1). The entropy values and the standard deviation values of the original image and images after execution were calculated as shown in Table (1). The histogram of the results obtained is shown in Figure (2-7).



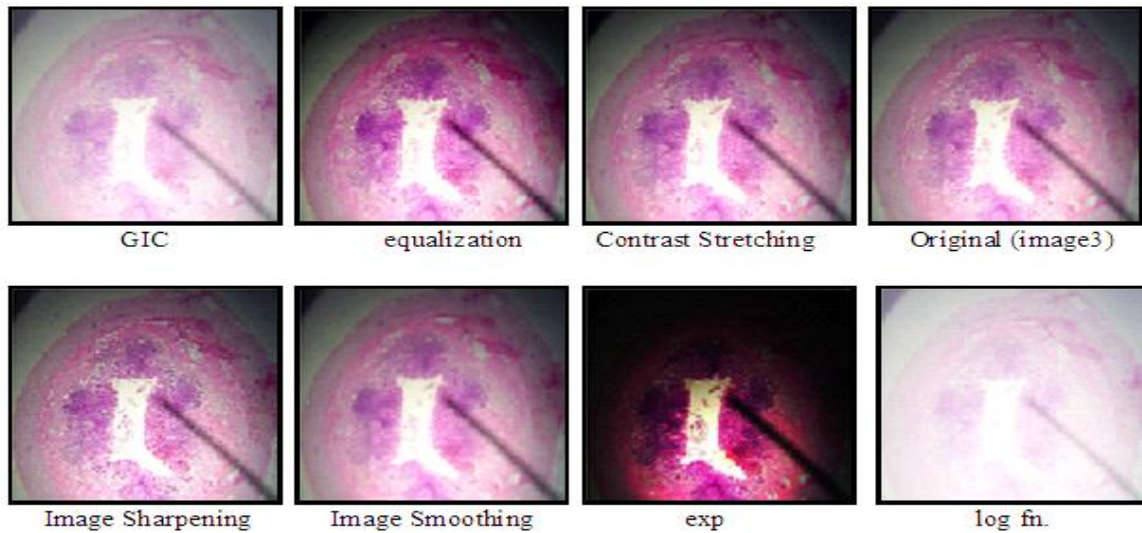


Figure (1): Display image 1, image 2 and image 3 after execution image enhancement methods

Table (1): Represent the values of Entropy and Standard Deviation of image 1, image 2 and image 3

Image Name	Enhancement Methods	Entropy	Standard Deviation
Image 1	Original	6.77	55.89
	Contrast Stretching	7.08	70.57
	Equalization	7.28	76.55
	GIC	6.35	36.44
	log fn.	5.54	17.42
	Exp	6	87.95
	Image Smoothing	6.87	55.96
	Image Sharpening	6.86	58.25
Image 2	Original	6.62	28.73
	Contrast Stretching	7.32	47.32
	Equalization	7.76	60.17
	GIC	5.78	16.93
	log fn.	4.51	7.27
	Exp	7.61	50.76
	Image Smoothing	6.43	25.12
	Image Sharpening	6.96	37.76
Image 3	Original	7.74	58.80
	Contrast Stretching	7.83	63.54
	Equalization	7.95	70.26
	GIC	7.26	41.26
	log fn.	6.30	22.10
	Exp	6.70	64.19
	Image Smoothing	7.75	58.57
	Image Sharpening	7.76	58.14

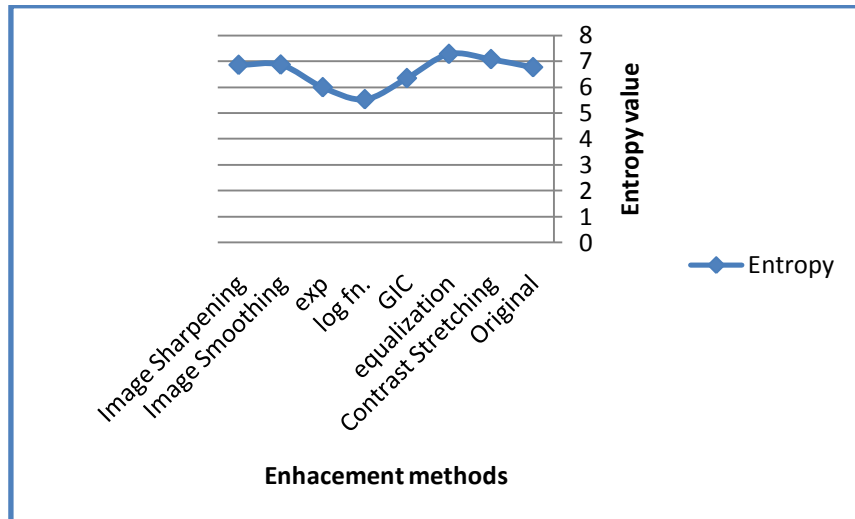


Figure (2): Entropy values of Image 1

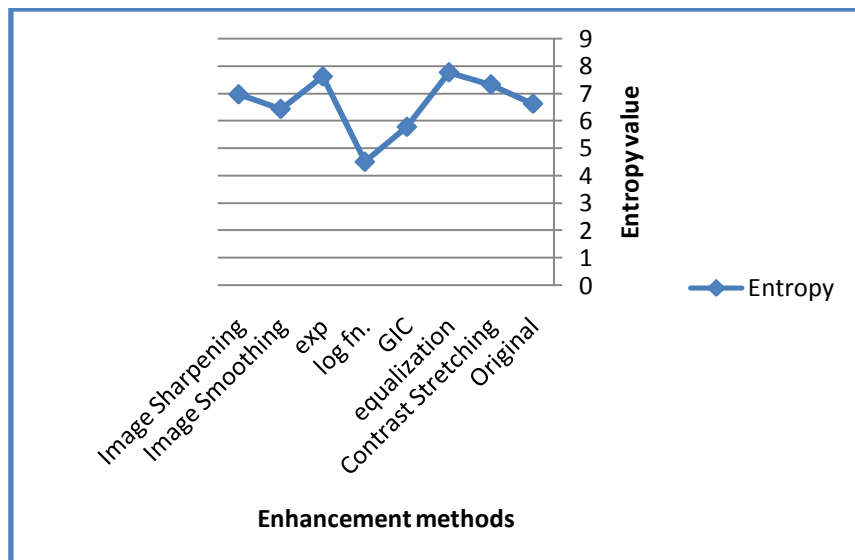


Figure (3): Entropy values of Image 2

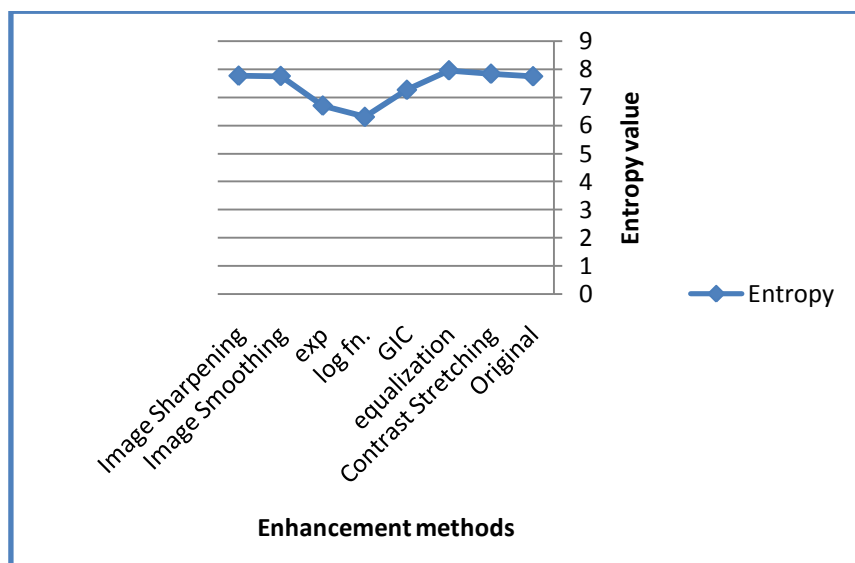


Figure (4): Entropy values of Image 3

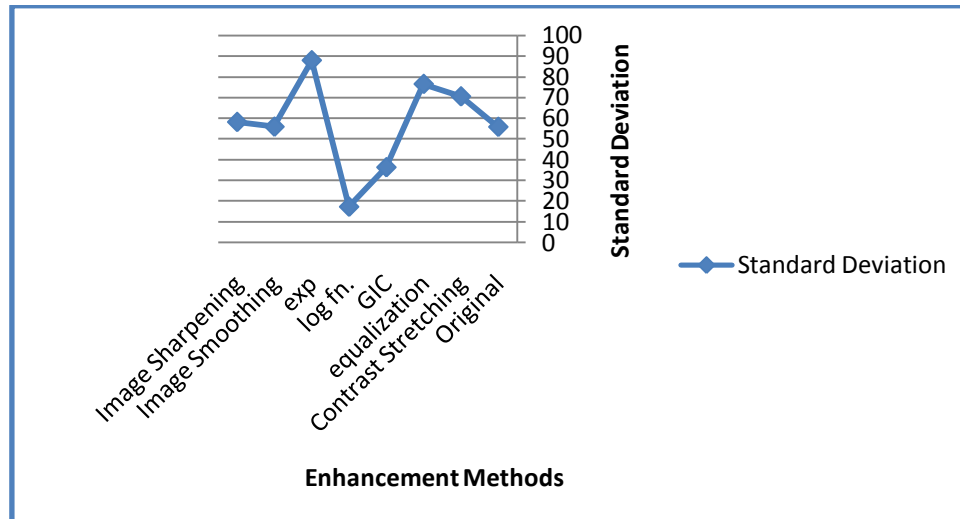


Figure (5): Standard Deviation values of Image 1

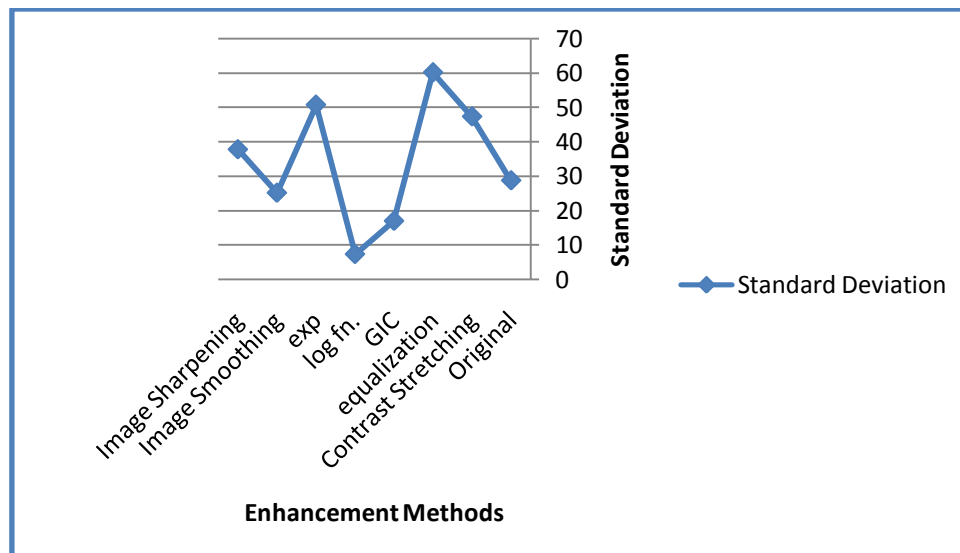


Figure (6): Standard Deviation values of Image 2

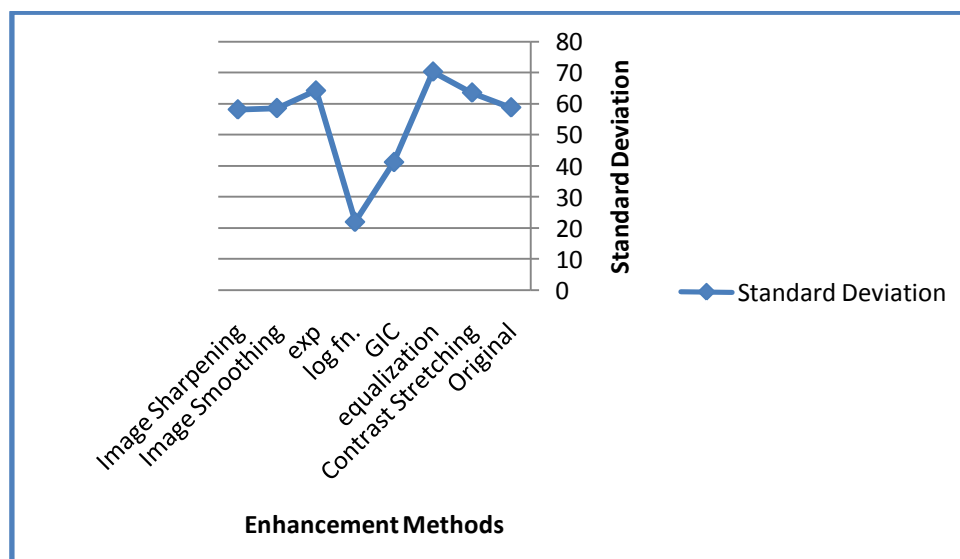


Figure (7): Standard Deviation values of Image 3

CONCLUSION

Image enhancement is an important branch of image processing, it is the process an image to make the result more suitable than the original image for a specific application.

Seven methods were used to enhancement images , these methods are: (Contrast Stretching, Histogram equalization, Gamma Intensity Correction, Logarithmic Function , Exponential function, Image Smoothing and Image Sharpening). The entropy and the standard deviation of the original image and images after execution are calculated.

This research produced a set of conclusions that can be summarized as follows:

1. The methods of Contrast stretching and Histogram equalization gave good results in enhancement the images as observed by displaying images.
2. The method Exponential function gave acceptable result in image enhancement.
3. Image smoothness has been achieved by applying Image Smoothing method.
4. If we want to see a new specification in the image and sharpen the image, it requires the application of the method Image sharpening.
5. The results obtained showed that (Gamma intensity correction, Logarithmic function) give unacceptable results in images enhancement.

Through the overall operations carried out on all methods, the research revealed that each of these methods was characterized by a special mechanism to activate its procedures.

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