International Journal of Engineering Research and Development
e-ISSN: 2278-067X, **p**-ISSN: 2278-800X, www.ijerd.com
Volume 7, Issue 1 (May 2013), PP. 62-66

Image Quality Measures with different Radiometric Resolution

Amel H.Abbas[1], Jamila Harbi S.[2], Lyla H. Abbas[3]
[1]Al-Mustansiriyh University, College of Science, Physics dept.
[2, 3]Al-Mustansiriyh University, College of Science, Computer Scie. Dept.

Abstract:- The resolution is define the ability of the optical system (Imaging System) to record details by distinguishing between the signals spatially or spectrally convergent or convergent in the intensity describes the details that carry image digital. The more high-resolution image was more, as can be expressed and clarity digital image with a number of different methods of radiometric resolution, recalling resolution radiometric to the number of levels used to represent the digital data representing the reference sensitized. So we devoted our work to study the effect of radiometric resolution and image quality by studying the statistical characteristics of an image Mean (μ), Standard deviation (σ) , contrast, the absolute Central moment (ACM) and the extent affected by the number of digital levels used to represent the signal recorded.

Key word:- Radiometric resolution, Image Quality, Contrast

I. INTRODUCTION

Radiometric resolution determines how finely a system can represent or distinguish differences how of intensity, and is usually expressed as a number of levels or a number of bits [1]. The human eye can only perceive 20;30 different grey levels so the additional resolution provided by images with more than about 30 levels is not visually discernible This sequence of images emphasizes the value of interpreting imagery using digital techniques to derive maximum discrimination from the available radiometric resolution [2].

Digital image statistics are very basal in digital image processing, as it describes the nature of image and the distribution of in formation inside it. The statistics measures are used to give the quality of image, and it is related to the principle of probability of grey level distribution in the image [3]. The importance of trade-offs between radiometric resolution and image quality has been examined in our work.

II. RADIOMETRIC RESOLUTION

Radiometric resolution in remotely sensed data is defined as the amount of energy requires in increase a pixel value by one quantization level or ‘count’ .the radiometric extent is the dynamic range or the maximum number of quantization levels that may be recorded by a particular sensing system. Most remotely sensed imagery is recorded with quantization levels in the range o: 255, that is, the minimum ‘detectable ‘radiation level is recorded as while the maximum radiation is recorded as 255. This range is also referred to as 8 bit resolution since all values in the range may be represented by 8 bits (binary digits) in a computer. Radiometric resolution in digital imagery is comparable to the number of tones in a photographic image p; both measures being related to image contrast. Quantization levels are frequently given in terms of the number of bits rather the number or range of levels. These values are related by: [2, 3, and 4]
Number of bits =number of Quantization levels
Table1 show the number of bit to represent the level of quantization and the range levels.

Table1: Quantization levels with the range of quantization.

Number of bits	*Number of quantization levels*	*Range of quantization*
1	*2*	*0 – 1*
2	*4*	*0 – 3*
3	*8*	*0 – 7*
4	*16*	*0 – 15*
5	*32*	*0 – 31*
6	*64*	*0 – 63*

III. IMAGE QUALITY MEASURE

The quality of an image is determined by many statistical measure can be extracted from a digital image to quantity. A number of typical measures used in the literature where computed from the image gray level value histograms [5,11].With the ages of digital imaging a simple but very powerful tool has emerged in photography, namely image histogram. An image histogram is graphical representation of the brightness in the image shown as bars corresponding to the count of the luminance value in the image ranging from 0 to 255. This basic tool can be used for the image segmentation and threshold. Image histograms can also indicate the nature of the lighting condition, the exposure of the image, and whether it is under exposed or over exposed [6].

The statistical measure is:

a. Mean

All the pixels in each group will take and find the average grey level by summing the values and dividing by the number of pixel in the group [7, 8].

$$\mu = \frac{1}{N}\sum_{i=0}^{N-1} P_i(i) \ldots . (1)$$

Where, i: the value of intensity, P(i): pixel values in the group, and N: number of gray level

b. Variance

Play a minor role in statistical computing. A key problem in design of good algorithm for this problem is that formals for the variance may in value some of square, which can lead to numerical instability as well as to arithmetic overflow when dealing with large values. The formal for calculating the variance of an entire population of size n is n is [7, 8]:

$$\sigma = \sqrt{\frac{1}{MN}\sum_{x=1}^{M}\sum_{y=1}^{N}(f(x,y)-\mu)^2} \ldots . . (2)$$

c. Entropy

The entropy is a measure that tells us how many bits we need to code the image data and given by [7]:-

$$entropy = -\sum_{g=0}^{L-1} p(g) Log_2[p(g)+1] \ldots \ldots (3)$$

Where p_i = the probability of the i^{th} gray level.

As the pixel value in the image are distributed among gray levels the entropy increases and this measure tends to vary is the distribution is concentrated in only a small number of different inversely with the energy.

The energy measure has a maximum value of 1 for an image with a constant value and gets increasingly small as the pixel values are distributed a cross more gray level values (remember that all p(g) values are less than or equal to 1). the larger this value is, the easier it to compress the image data, if the energy is high it tells us that the number of gray levels in the image is few [11].

d. Contrast

The difference in luminance is created the amount of reflected light, reflected from two adjacent surfaces. It can be defined is slightly different ways. The contrast can be compute from [9, 10]:

$$contrast = \frac{L_{max} - L_{min}}{L_{max} + L_{min}} \ldots \ldots (4)$$

Where: L_{max} and L_{min} luminance on the lighter surface and on the darker surface respectively.

When the darker surface is black and reflects no light, the ratio is high contrast, image has large region of dark and light. Image with good contrast have a good representation of all luminance intensities.

As the contrast of an image increase, the viewer perceives is increase in detail. This is purely apperception as the amount of information in the image does not increase [9].

e. Absolute Central Moment (ACM)

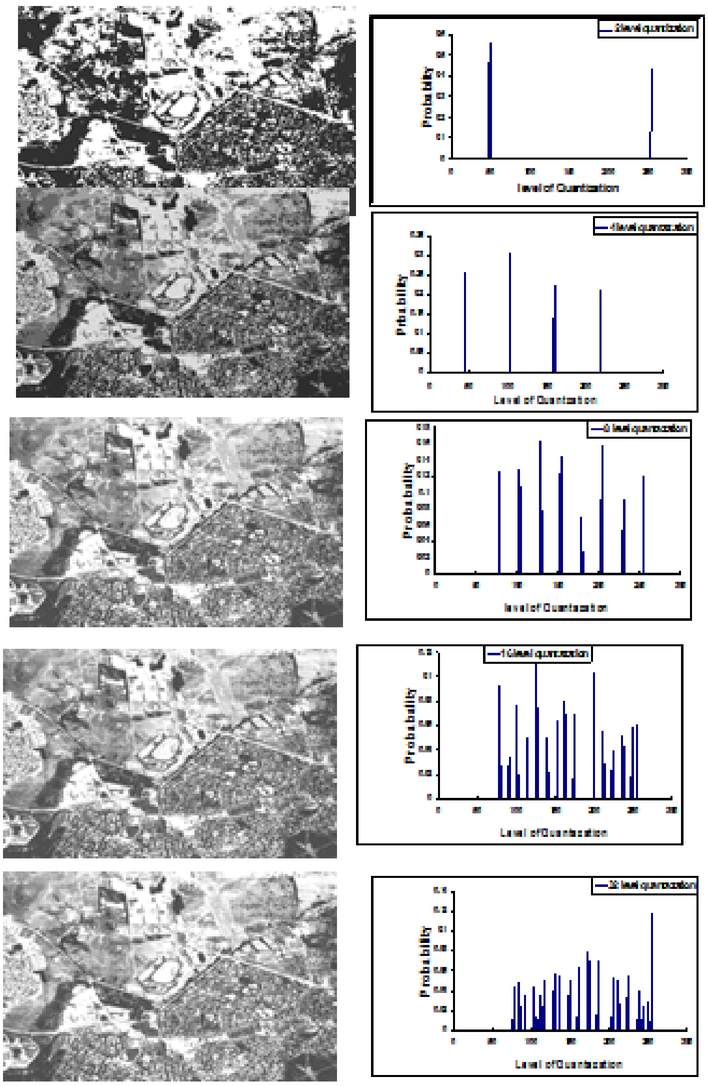
The gray level moments are usually, used in image processing literature to describe how the gray – levels of a finite domain of the image are distributed with respect to the mean level. However the gray – level central and absolute central moment can provide zero – crossing and ridges the ACM is computed using the following equation [7].

$$ACM = \sum_{i=0}^{N-1} |i - \mu| p(i) \;\ldots\ldots (5)$$

IV. Experimental Results

In our work we examine the characteristics of images that have different levels in quantization by charting the relationship between the levels quantization and Probability have been studying the properties of these images by calculating the average, standard deviation, entropy and absolute value, contrast, and the impact of these properties the level of quantization.Fig.1shown the histogram for images with different levels of quantization, Fig.2 shows the relationship between level quantization and contrast, and Figs.3,4,and 5 are explain the relationship between level quantization and entropy , standard deviation and absolute central moment. Also, Table2 show the resultant values of mean, standard deviation, absolute moment, contrast, and entropy with different quantization

.



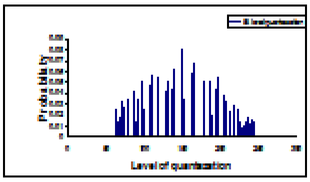
A

B

C

D

E



F

Fig.1: Histogram of image with different quantization levels, A) used 2 quantization levels, B) used 4 quantization levels, C) used 8 quantization levels, D) used 16 quantization levels, E) used 32 quantization levels, and F) used 64 quantization levels

Table 2: The results of our proposed parameters

STD	Mean	Entropy	Contrast	ACM	gray level
102.23	139	0.989317	0.38	101.4718	2
62.59	126	1.985108	0.34	54.98006	4
57.31	162	2.955022	0.25	50.06807	8
55.68	164	3.831097	0.24	47.82701	16
57.03	171	4.146937	0.24	46.8	32
53.08	149	4.586157	0.25	45.67902	64

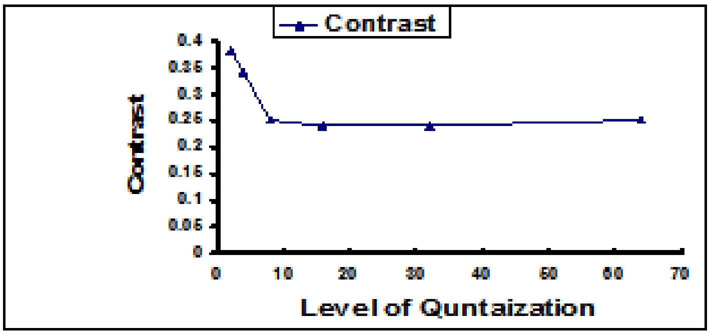


Fig.2: The relationship between level quantization and contrast.

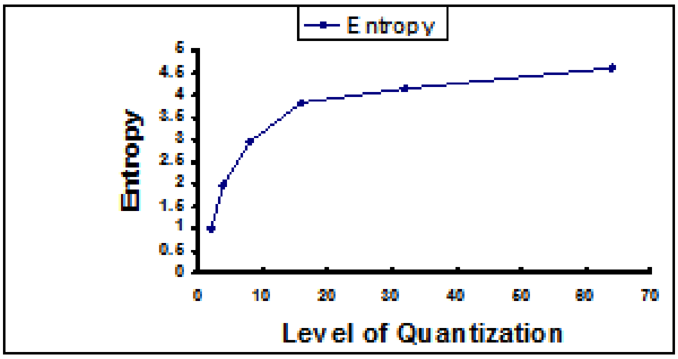


Fig.3: Explain the relationship between level quantization and entropy.

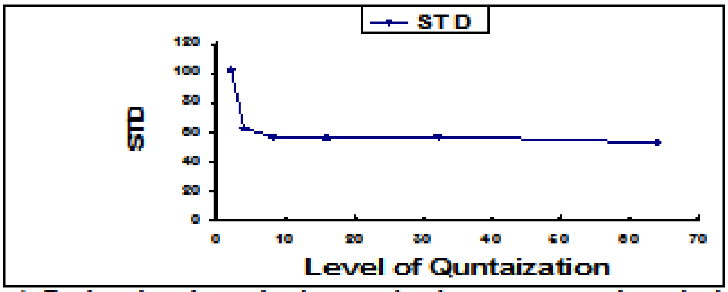


Fig.4: Explain the relationship between level quantization and standard deviation.

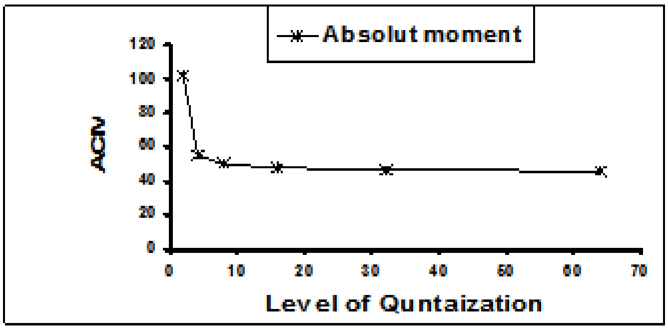


Fig.5: Explain the relationship between level quantization and absolute moment.

V. CONCLUSION

From earlier Figs. was observed the properties of entropy and the absolute central moment the best standards in determining the quality of image with different levels quantization, the relationship between entropy and the levels of quantization a direct correlation to the extent of the level of quantization 20, we note the stability of the value of the entropy of the high levels quantization.

The relationship between the value of absolute central moment and levels of quantization inversely at the lower level of quantization when the level of quantization lower the value of absolute central moment is greater signifies the presence of noise in image, but when you reach the level of quantization is greater than 20 we note the stability of the values to the absolute central moment

REFERENCES

[1]. B. Jahne, “Digital Image Processing”, Springer-Verlag, Berlin, 1997.
[2]. BA Harrison and Dlb Jupp, “Introduction to Remotely Sensed Data”, (2004).
[3]. Smith W., “Modern Optical Engineering”, 3rd edition, MC Graw Hill Profession, ISBNO-07-136360-2, (2000).
[4]. Roggemann, Michael and Welsh, Byron, “Imaging through Turbulence” CRC press ISBNO - 8493 - 3787 - 9, (1996).
[5]. Fisher R. and Tadic Galeb B., “Optical System Design”, MC-Graw-Hill, (2000).
[6]. William K, Pratt, Digital Image Processing (2nd ed.), John Wiley &Sons, Inc., New York, NY, 1991.
[7]. Mukul V. “An Optimal measure for camera focus and exposure “, electrical engineering department of texas at tyler proceeding of IEEE (2004).
[8]. H .Haubecker, H.Tizhoosh, “computer vision and application” academic press, 2000.
[9]. J.R. Jenson, “Introductory Digital Image Processing”, prentice hall, 2005.
[10]. Young I.Gerbrands J. and van vlieil, “Fundamental of image processing “, prinked in Netherlands of the delft University of Technology ISBN 90–75691-10-7.
[11]. L.F.V. Scharff and A.J.Ahumada ,”Computational image Quality “ ,Austin state University , Nacogdoches.