International Journal of Application or Innovation in Engineering & Management (IJAIEM)
Web Site: www.ijaiem.org Email: editor@ijaiem.org
Volume 3, Issue 9, September 2014 ISSN 2319 – 4847

Object Tracking Information System Based on Statistical Measurements

Ghazi Ibrahem Raho [1], Muzhir Shaban Al-Ani [2] , Qeethara Al-Shayea[3]

[1]1Amman Arab University – Computer Information Systems Department – Amman - Jordan

[2] Anbar University – College of Computer Science – Department of Computer Science – Anbar - Iraq

[3] Al-Zaytoonah Private University, Department of MIS, Amman - Jordan

ABSTRACT

Real images may consist of many objects. These objects may be situated in different directions. Object tracking is an important process for identification of objects via the captured image. The main objective of this work is to construct an efficient information algorithm that detects the direction of objects. This algorithm is designed and implemented based on statistical measurements, histogram, entropy, moment and gradient. The obtained results indicate that this algorithm leads merging many techniques to generate an efficient and effective approach.

Keywords: Object Identification, Object Tracking, Object Recognition, Statistical Measurements, Entropy Measurements.

1. INTRODUCTION

The image can be represented as a two dimensional function of two real variables f(x,y), where x,y represent the spatial coordinates, and the function amplitude f given at any pair of coordinates is called the intensity or grey level of the image at that point. When x, y and the amplitude f are all finite and discrete quantities, we have a digital image. A digital image consists of a rectangular map of the image's pixels. The number of bits used for each pixel is called the bit depth. For monochrome image, e.g., the bit depth is 1 bit (to represent black or white), and the bit depth of the grey image is 8 bits to display 256 different shades of grey. Using entropy based methods for image processing has been a well-established approach in computer science for quite some time [1]. German et al. (2005) used entropy analysis for high dynamic range image processing. Yan et al. (2003) used entropy calculations for grey-scale image clarification required in the field of medical imagery. Basic tools for entropy based image processing are implemented in a variety of software applications. For example, Gonzalez et al. (2009) describe these tools' implementation in MATLAB [2,3] and Al-Ani et al. (2013) described a method of 3D visualization based on surface estimation techniques [4].

2. STATISTICAL MEASUREMENTS

The statistical measurements are very important especially when you have big amount of data, that is really exist in image processing. One of the important measurement is the mean (average) value in which we can see the concentration average value of pixels in which it can be measured as below [5,6]:

$$\overline{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

Where xi represents the input and i represents the indexing values and n represents the number of inputs. Another statistical measurement is the standard deviation value that is calculated as:

$$s = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(xi - \bar{x}).^2}$$

Another statistical measurement is the entropy value that is calculated expressed in terms of a discrete set of probabilities p_i:

$$\text{Entropy} = -\sum_{i=0}^{n} p(x_i)\ \log\ p(x_i)$$

3. LITERATURE REVIEWS

Many works are published in this field:

Mohamed A. El-Sayed et al. (2011), presented an approach utilizing an improvement of Baljit and Amar method which uses Shannon entropy other than the evaluation of derivates of the image in detecting edges in gray level images has been proposed. The proposed method can reduce the CPU time required for the edge detection process and the quality of the edge detector of the output images is robust [7].

M. Portes de Albuquerque et al. (2004) designed an approach uses the Shannon entropy originated from the information theory considering the gray level image histogram as a probability distribution. In this paper, Tsallis entropy is applied as general entropy formalism for information theory. For the first time image thresholding by non-extensive entropy is proposed regarding the presence of non-additive information content in some image classes [8].

Ewa Skubalska-Rafaajlowicz (2008), aimed to propose two methods of detecting defects in industrial products by an analysis of gray level images with low contrast between the defects and their background. An additional difficulty is the high non-uniformity of the background in different parts of the same image. Non-parametric estimator of local entropy is also proposed, together with its realization as a bank of RBF neural networks. The performance of both methods is done with an industrial image [9].

E.Pasha et al. (2006), implemented a new cost function is introduced by using the fuzzy entropy to choose a threshold value in image de-noising problem. Fuzzy entropy as a measure of image bullring has an important role in image processing. The best image is an image that has the lower distance of ideal image and in addition to the lower entropy. Thus fuzzy entropy cost function is a useful cost function in image processing. The results are explained with pilot this cost function on the some images [10].

Georgi Petrov et al. (2008), explained two functional models for entropy based image segmentation: using global 2D and 3D image histograms of grayscale images. We compare results obtained by both methods for different type of images such as: biomedical and micro objects, digital video records and natural photographs. Short introduction of multistage gradient 3D entropy segmentation for texture analysis is also introduced [11].

R.Sukanesh et al. (2007), designed a novel approach of information theory based Minimum Relative Entropy (MRE) and Entropy methods for image compression are discussed. A two stage compression process is performed through homogenous MRE method, and heterogeneous MRE. The compressed images are reconstructed through Region growing techniques. The performance of image compression and restoration is analyzed by the estimation of parametric values such as Mean Square Error (MSE) and Peak Signal to Noise Ratio (PSNR) [12].

Kitara Kadhim Al-Shayeh and and Muzhir Shaban Al-Ani (2009), purposed 3D object visualization via two dimensional (2D) images that included many object. The main objective of this work is to find the contour of the given object in each slice and then merging these contours to reconstruct the 3D objects. The proposed method is easy to use as well as it can be implemented on various type of images. The obtained results indicate a good resolution of the reconstruction process [13].

Zujun Hou et al. (2010), investigated the connection between histogram and image visibility, where the concept of entropy is employed to depict the information content of the histogram. It turns out that image visibility is more dependent on the observed intensity levels with higher frequencies and the distribution of their locations in the range of intensity levels. With this in mind, the concept of visible entropy is proposed. The usefulness of the proposed visibility measure has been evaluated using a number of realistic images [14].

M.C. Padma et al. (2010), presented a novel texture-based approach is presented to identify the script type of the documents printed in three prioritized scripts - Kannada, Hindi and English, prevailed in Karnataka, an Indian state. The document images are decomposed through the Wavelet Packet Decomposition using the Haar basis function up to level two. The texture features are extracted from the sub bands of the wavelet packet decomposition [15].

Muzhir Shaban Al-Ani, Kitara Kadhim Al-Shayeh (2010), studied the effects of image compression on face recognition algorithms, in which implemented some compression algorithms then the results were evaluated via the extracted features of face images.

4. THE PROPOSED APPROACH

Depending on the fact that said Entropy refers to measure of disorder of the system, so the proposed approach are constructed via the following steps as shown in figure1. Image acquisition step in which the objects are prepared with different directions to be ready for image capturing. Four different directions are forms to be the input images for the next step of the system. Image preprocessing, in which the input images were passed to gray scale processing, resizing, filtering, etc. to be fitted with the system. Histogram calculation, in which calculates number of pixels in each gray scale that represents an indication of pixels distribution. Entropy distribution step in which indicates the average information in the entire image. Moment calculation step in which represents the central moments of all orders that is defined as the perpendicular distance from a point to a line or a surface. Gradient calculation step in which represents the variation of pixels over a steep of a straight line.

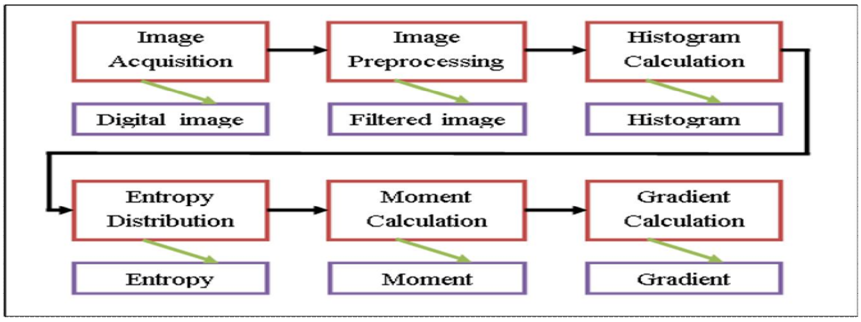


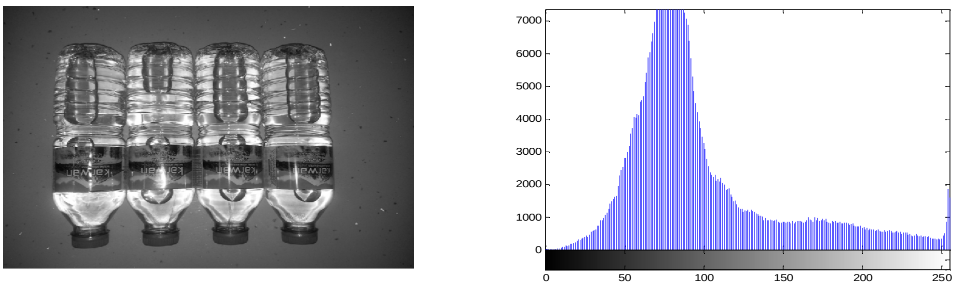
Figure1 The proposed approach

5. RESULTS AND ANALYSIS

The system is implemented to track the variation of the bottles direction via the acquisition of many images in different positions. The obtained results of entropy, standard deviation and mean values are demonstrated in table1, In which we can mentioned that there are clear difference between the four tested images. Figure2 shows the image of four bottles at the same direction and its histogram, moment of the entropy and gradient of the moment, in figure (d) you can find that there are four peaks referred to four bottles. Figure3 shows the image of three bottles at the same direction and one bottle perpendicular in which you can indicate three peaks referred to three bottles. Figure4 shows the image of two bottles at the same direction and two bottles perpendicular in which you can indicate two peaks referred to two bottles. Figure5 shows the image of one bottle at the same direction and three bottles perpendicular in which you can indicate one peak referred to one bottle.

Table1 statistical measurements

Images	Entropy		Std. Dev.		Mean	
	Before entropy	After entropy	Before entropy	After entropy	Before entropy	After entropy
four bottles at the same direction	7.1908	0.0007	48.3470	3.8127	98.6526	3.8127
three bottles at the same direction and one bottle perpendicular	7.1308	0.0010	42.2151	1.3516	9.9893	3.6205
two bottles at the same direction and two bottles perpendicular	7.0856	0.0	45.3245	1.3746	76.9788	3.6526
one bottle at the same direction and three bottles perpendicular	7.1418	0.0029	48.3572	1.3534	73.5535	3.7523



(a) gray scale image (b) histogram of the gray scale image

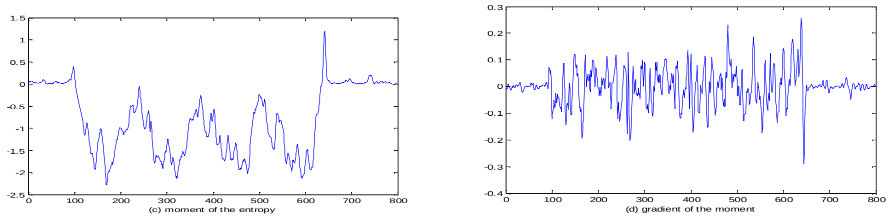


Figure 2 Four bottles at the same direction

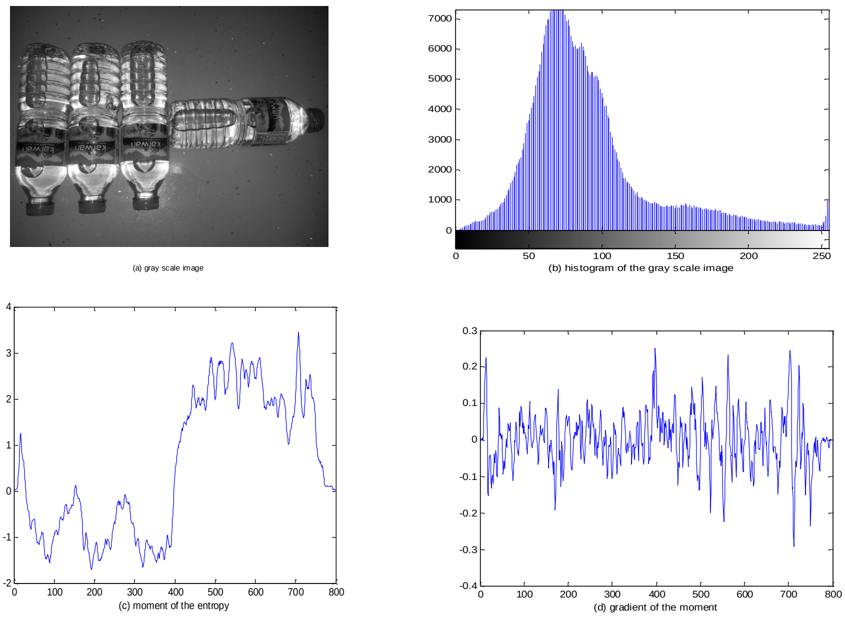


Figure 3 Three bottles at the same direction and one bottle perpendicular

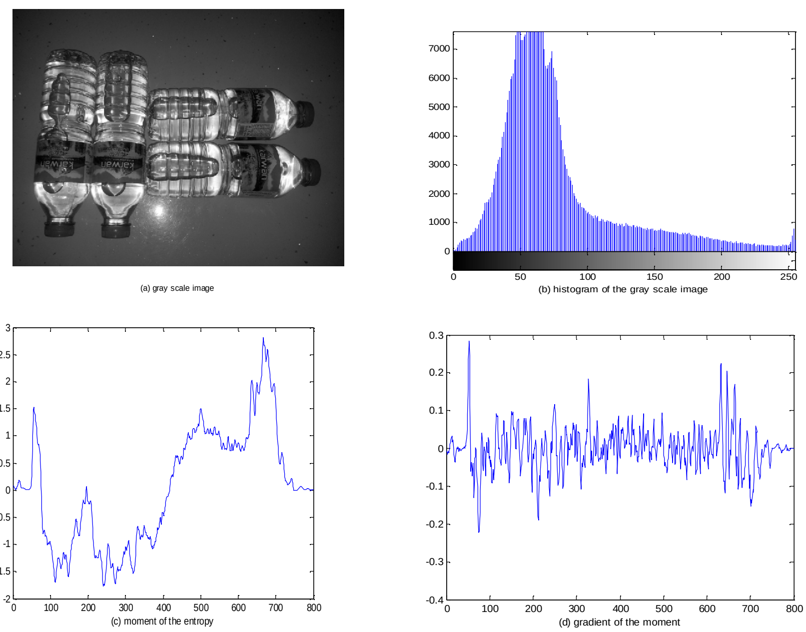


Figure 4 Two bottles at the same direction and two bottles perpendicular

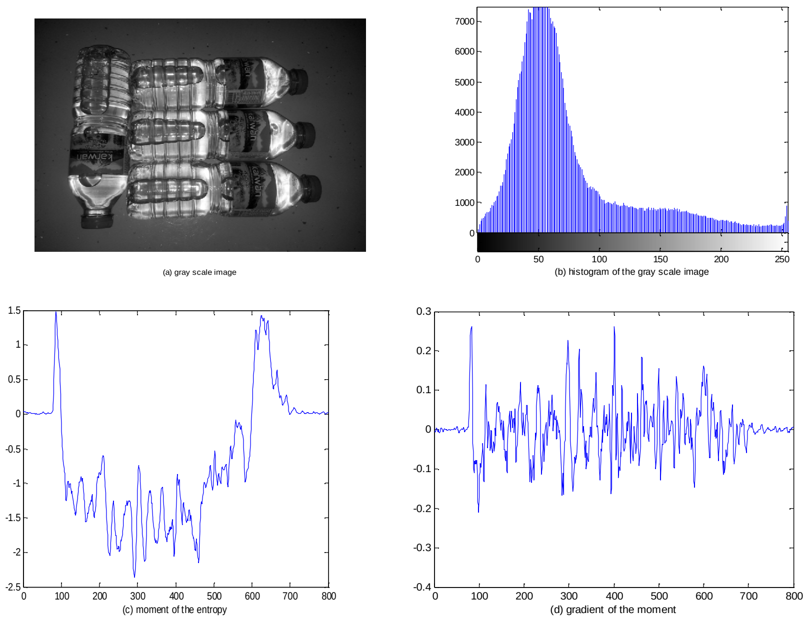


Figure 5 One bottle at the same direction and three bottles perpendicular

6. CONCLUSIONS

Object tracking and direction finding are concern an important part of digital image processing field. In this paper we designed and implemented an efficient information system approach to identify the directions of the objects in images that approach based on statistical measurements, histogram, entropy, moment and gradient. The implementation of this system indicated good results for object tracking and identification. Different directions of object are tested to improve the accuracy of this system.

References

[1] C. Yan, N. Sang, and T. Zhang (2003), "Local Entropy-Based Transition Region Extraction and Thresholding", Pattern Recognition Letters 24, p. 2935ff.

[2] A. German, M.R. Jenkin, and Y. Lesperance (2005), "Entropy-based Image Merging", Technical report, CRV '05Proceedings of the 2nd Canadian conference on Computer and Robot Vision.

[3] R.C. Gonzalez, R.E. Woods, and S.L. Eddins (2009), "Digital Image Processing Using MATLAB", Prentice Hall, New Jersey.

[4] Muzhir Shaban Al-Ani and Shokhan Mahmoud H (2013), "3D visualization based on surface estimation techniques", International Journal of Advances in Engineering & Technology, May 2013, Vol. 6, Issue 2, pp. 606-612.

[5] Robert M. Gray (2013), "Entropy and Information Theory" First Edition, Springer-Verlag, New York, 2013.

[6] Jean-Bernard Brissaud (2005), "The meanings of entropy", Entropy 2005, 7,1, 68-96, Feb 2005.

[7] Mohamed A. El-Sayed and Tarek Abd-El Hafeez (2011), "New Edge Detection Technique based on the Shannon Entropy in Gray Level Images", International Journal on Computer Science and Engineering (IJCSE), Vol. 3 No. 6 June 2011

[8] M. Portes de Albuquerque, I.A. Esquef, A.R. Gesualdi Mello a, M. Portes de Albuquerque (2004), " Image thresholding using Tsallis entropy", Pattern Recognition Letters 25 (2004) 1059–1065

[9] EWA SKUBALSKA-RAFAJŁOWICZ (2008), "LOCAL CORRELATION AND ENTROPY MAPS AS TOOLS FOR DETECTING DEFECTS IN INDUSTRIAL IMAGES", Int. J. Appl. Math. Comput. Sci., 2008, Vol. 18, No. 1, 41–47

[10] E.Pasha, R. Farnoosh, A.Fatemi (2006), "Fuzzy Entropy as Cost Function in Image Processing", Proceedings of the 2nd IMT-GT Regional Conference on Mathematics, Statistics, and Applications Universiti Sains Malaysia, Penang, June 13-15 2006.

[11] Georgi Petrov, Panayotiliev, Plamen Tzvetkov (2008), "Comparison of Global Histogram Methods for 2D and 3D

[12] R.Sukanesh, R.Harikumar, N.S.Balaji and S.R.Balasubramaniam (2007) , "Analysis of Image Compression by Minimum Relative Entropy (MRE) and Restoration through Weighted Region Growing Techniques for Medical Images", Engineering Letters, 14:1, EL_14_1_16 (Advance online publication: 12 February 2007)
[13] Kitara Kadhim Al-Shayeh, Muzhir Shaban Al-Ani (2009), "Efficient 3D Object Visualization via 2D Images", International Journal of Computer Science and Network Security (IJCSNS), November 2009, Vol. 9 No. 11 pp. 234-239
[14] Zujun Hou and Wei-Yun Yau (2010), Visible Entropy: A Measure for Image Visibility 2010 International Conference on Pattern Recognition, IEEE computer Society
[15] M.C. Padma and P.A.Vijaya (2010), Entropy Based Texture Features Useful for Automatic Script Identification, (IJCSE) International Journal on Computer Science and Engineering, Vol. 02, No. 02, 2010, 115-120
[16] Muzhir Shaban Al-Ani, Kitara Kadhim Al-Shayeh (2010), "The Effect of Image Compression on Face Recognition Algorithms", Journal of Computer and Network Security, Vol. 2, No. 8, August 2010, Korea

AUTHORS

Ghazi Ibrahem Raho, Associated professor at Computer Information System& Information Technology at Amman Arab University – Amman - Jordan. Doctoral Fellowship(1988)- Research & Computer – University of Marseilles-France. Ph.D. (1981), in Computer Information System& Information Technology, College of Planning &Cybernetics - ASE – Romania. M.Sc. (1979), in Computer Information System& System Analysis College Of Planning & Cybernetics – Romania. Postgraduate Diploma(1980), in Information &Applied mathematics UNESCO , Bucharest. B .Sc.(1976) Statistics Almustanseriy university Baghdad – Iraq.

Muzhir Shaban Al-Ani has received Ph. D. in Computer & Communication Engineering Technology, ETSII, Valladolid University, Spain, 1994. Assistant of Dean at Al-Anbar Technical Institute (1985). Head of Electrical Department at Al-Anbar Technical Institute, Iraq (1985-1988), Head of Computer and Software Engineering Department at Al-Mustansyria University, Iraq (1997-2001), Dean of Computer Science (CS) & Information System (IS) faculty at University of Technology, Iraq (2001-2003). He joined in 15 September 2003 Electrical and Computer Engineering Department, College of Engineering, Applied Science University, Amman, Jordan, as Associated Professor. He joined in 15 September 2005 Management Information System Department, Amman Arab University, Amman, Jordan, as Associated Professor, then he joined computer science department in 15 September 2008 at the same university. He joined in August 2009 College of Computer Science, Al-Anbar University, Al-Anbar, Iraq, as Professor.

Qeethara Kadhim Abdul Rahman Al-Shayea, has received Ph. D. in Computer Science, Computer Science Department, University of Technology, Iraq, 2005.She received her M.Sc. degree in Computer Science, Computer Science Department from University of Technology, Iraq, 2000. She has received her High Diploma degree in Information Security from Computer Science Department, University of Technology, Iraq, 1997. She has received B. Sc. Degree in Computer Science Department from University of Technology, Iraq, 1992. She joined in September (2001-2006), Computer Science Department, University of Technology, Iraq as assistant professor. She joined in September 2006, Department of Management Information Systems Faculty of Economics & Administrative Sciences Al-Zaytoonah University of Jordan as Associate Professor. She is interested in Artificial intelligent, image processing, computer vision, coding theory and information security.