iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 Issue: IX Month of publication: September 2017

DOI: http://doi.org/10.22214/ijraset.2017.9175

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue IX, September 2017- Available at www.ijraset.com

Segmentation by Thresholding on Medical Imaging – A Survey

C.Malarvizhi[1]
[1]*Research Scholar, Assistant Professor, Department of Computer Science Arcot Sri Mahalakshmi Women's College, Arcot*

Abstract: Medical imaging is one of the important topics in research field. It is the visualization of body parts, tissues, or organs, for use in clinical diagnosis, treatment and disease monitoring. Imaging techniques encompass the fields of radiology, nuclear medicine and optical imaging and image-guided intervention. MRI gives the conservative treatment that does not require incision into the body or the removal of tissue of imaging the cervical spine Magnetic Resonance Imaging (MRI) is a medical imaging technology that uses radio waves and a magnetic field to create detailed images of organs and tissues. The impact of the medical image in various fields are constantly growing. Magnetic Resonance Imaging, is an advanced, state-of-the-art radiology method that produces very clear images of the human body without the use of X-rays. MRI has proven to be highly effective in diagnosing a number of conditions by showing the difference between normal and diseased soft tissues of the body. MRI a powerful diagnostic tool in the assessment of both anatomical deformity and tissue pathology. MRI has tremendous potential in the diagnosis of both intraspinal and osteo-articular disease of the cervical spine. MRI gives extremely clear, detailed images of soft-tissue structures that other imaging techniques cannot achieve. MRI has much greater soft tissue contrast than Computed Tomography, making it useful in neurological, musculoskeletal, cardiovascular, and gynecological imaging. This paper presents the survey of various thresholding techniques used in medical imaging.
Keywords: Medical Imaging, Magnetic resonance imaging,Thresholding

I. INTRODUCTION

One important problem in medical image analysis is image segmentation, which identifies the boundaries of objects such as organs or abnormal regions (e.g. tumors) in images. Having the segmentation result makes it possible for shape analysis, detecting volume change, and making a precise radiation therapy treatment plan. In the literature of image processing and computer vision, various theoretical frameworks have been proposed for segmentation. This paper deals with various segmentation by thresholding techniques applied in medical imaging. The images under MRI can evaluate post-surgical changes, detect fractures, infection and tumours. It can detect infections, fluid collections and tumours in the muscles and tissues around your cervical spine.

II. RELATED WORK

There have been a number of survey papers on thresholding. Lee, Chung and Park [1] conducted a comparative analysis of five global thresholding methods and advanced several useful criteria for thresholding performance evaluation. In an earlier paper Weszka and Rosenfeld [2] also defined several evaluation criteria. Palumbo, Swaminathan and Srihari [3] addressed the issue of document binarization comparing three methods. Sahoo et al. [4] surveyed nine thresholding algorithms and illustrated comparatively their performance. Glasbey [5] pointed out the relationships and performance differences between 11 histogram-based algorithms based on an extensive statistical study.

Images are, generally, classified into unimodal, bimodal and multimodal depending on their histogram shapes. When the histogram doesn't exhibits a clear separation between two peaks ordinary thresholding techniques might under perform. Hence there is a demand for a robust methodology to binarise all types of images. Fuzzy set theory provides better convergence when compared with non-fuzzy methods.

In case of ideal images the image histogram shows a deep valley between two distinct peaks, each one represents either an object or background and the threshold falls in the valley region. But in case of unimodal and bimodal images will not express clear separation of the pixels as two peaks, in such cases threshold selection become a difficult task[6]. To solve this difficulty Otsu [7] proposed discriminant analysis to maximize the separability of the resultant classes. Interaction among the pixels is also a reasonable feature tried in two-dimensional Otsu method [8]. In entropy based algorithms proposed by Kapur et al[10] extend the previous work of pun [9] that first uses the concept of entropy for thresholding. This method concludes that when the sum of the background and object entropies reaches its maximum, the threshold value is obtained. In Kapur et al., images which are corrupted with noise or irregular illumination produce multimodal histograms in which a gray level histogram does not guarantee for the optimum threshold selection, because no spatial correlation is considered.

Abutaleb extended Kapur's method[11] using two dimensional entropies which are calculated from a two dimensional histogram which was determined by using the gray value of the pixels and the local average of neighborhood gray values of the pixels. Then the work is simplified by A.D.Brink[12]. Entropy criterion function is applied on 2-D GLSC histogram to select optimum threshold by surpassing difficulties with 1-D histogram by Yang Xiao et al.[13,14]. This work is further extended by Seetharama Prasad et al.[15] using variable similarity measure producing improved GLSC histogram. The ordinary thresholding techniques perform poorly when non-uniform illumination corrupts object characteristics and inherent image vagueness is present.

Fuzzy set theory is used to handle grayness ambiguity or inherent image vagueness during the process of threshold selection. Fuzzy C-partitions were used on entropic criteria to achieve optimum threshold value by Seetharama Prasad et al.[16]. Type-II fuzzy is used with GLSC histogram with human visual nonlinearity characteristics to identify the optimal similarity measure. Type-II fuzzy sets and a new fuzzyness measure called Ultrafuzziness are introduced by H.R.Tizhoosh [17] and Type-II fuzzy probability partitions methods are applied on GLSC histogram to obtain the threshold by Seetharama Prasad et al.[18].Ch.V.Narayana et al.[19] used ultra fuzziness and type-II fuzzy sets for automatic image segmentation.

Nuno Vieira Lopes et al[20]. introduced fuzzy measures to threshold gray level images with no entropy criterion function to reduce the time complexity for computation and this technique is further automated by Seetharama Prasad et al.[21].concludes that when the sum of the background and object entropies reaches its maximum, the threshold value is obtained. histogram with human visual nonlinearity characteristics to identify the optimal similarity measure.

The histogram based thresholding method is based on the shape properties of the histogram. Two major peaks and an intervening valley is searched for using such tools as the convex hull of the histogram, or its curvature and zero crossings of the wavelet components. Shape_ Rosenfeld[22] is based on obtaining the convex hull. Other variations on the theme are in Weszka [30] , [23]. We found that the deepest concavity point works best as a threshold irrespective of object smoothness. Halada and Osokov [24] have also considered histogram concavity analysis.

Sahasrabudhe and Gupta [25] have addressed the histogram valley-seeking problem. More recently Whatmough [26] has improved on this method by considering the exponential hull of the histogram. Shape-based thresholding of Sezan [27] scheme is based on the peak analysis of the smoothed histogram. Shape-based thresholding of Carlotto [28] and Olivo [29] consider the multiscale analysis of the probability mass function and interpret its fingerprints, that is the course of its zero crossings and extrema over the scales. In [29] using a discrete dyadic wavelet transform, one obtains a sequence of smoothed signals describing the multiresolution analysis of the histogram. The threshold is defined as the valley (minimum) point following a peak in the smoothed histogram. This threshold position is first estimated at the coarsest resolution, but later refined using finer resolution representations and establishing correspondences between extrema at different resolution levels.

Shape-based thresholding of Ramesh [30] use a functional approximation to the pmf. It is approximated by two-step functions, that is, a bi-level function,in such a way that either the sum of squares or the variance of the approximation is minimized. Shape-based thresholding by an all-pole model Guo [31], Cai [32]. In Cai [32] the authors have approximated the spectrum as the power spectrum of multi-complex exponential signals in Prony's spectral analysis method. A similar all-pole model was assumed in Guo [31], where the threshold is selected by maximizing the between-class variance. In a modified approach, the autoregressive (AR) model is used to smooth the histogram and the valley is found by the pole analysis.

III. CONCLUSION

In this paper, various segmentation by thresholding techniques used in medical imaging is discussed. This paper analysis the survey of segmentation by thresholding work of the medical images into anatomical components of interest, including anatomical landmarks for variousl location, identification of individual part. These types of thresholding method removes the ramdom noise of data. Image thresholding has one of the finest method in medical imaging field. Medical Image Segmentation is the process of automatic or semi-automatic detection of boundaries within a 2D or 3D image. A major difficulty of medical image segmentation is the high variability in medical images and this becomes minimized in future.

REFERENCES

[1] S.U. Le, S.Y. Chung, R.H. Park, A Comparative Performance Study of Several Global Thresholding Techniques for Segmentation, Graphical Models and Image Processing, 52 (1990) 171-190.

[2] J.S. Weszka, A. Rosenfeld, Threshold evaluation techniques, IEEE Trans. Systems, Man and Cybernetics, SMC-8(8) (1978) 627-629.

[3] P.W. Palumbo, P. Swaminathan, S.N. Srihari, Document image binarization: Evaluation of algorithms, Proc. SPIE Applications of Digital Image Proc., SPIE Vol. 697, (1986), pp:278-286.

[4] P.K. Sahoo, S. Soltani, A.K.C. Wong , Y. Chen., A Survey of Thresholding Techniques, Computer Graphics and Image Process., 41 (1988) 233-260.

[5] C.A. Glasbey, An analysis of histogram-based thresholding algorithms, Graphical Models and Image Processing, 55 (1993) 532-537.

[6] CH.V.Narayana, E. Sreenivasa Reddy & M. Seetharama Prasad," A New Method for Gray Level Image Thresholding Using Spatial Correlation Features and Ultrafuzzy Measure ",Global Journal of Computer Science and Technology Graphics & Vision ,Volume 12 Issue 15 Version 1.0 Year 2012.

[7] N. Otsu, "A threshold selection method from gray level histograms," IEEE Trans. Syst., Man, Cybern. Vol. SMC-9, pp. 62–66, 1979.

[8] Liu Jianzhuang, Li Wenqing and Tian Yupeng, "Automatic Threshoding of Gray-level pictures using Two- dimensional Otsu method", IEEE Intnl. Conf.On Circuits and systems, pp.325-327, 1991.

[9] T. Pun, "A new method for gray-level picture thresholding using the entropy of the histogram," Signal Process. vol. 2, no. 3, pp. 223–237, 1980.

[10] J. N. Kapur, P. K. Sahoo, and A. K. C.Wong, "A new method for graylevel picture thresholding using the entropy of the histogram," Graph.Models Image Process., vol. 29, pp. 273–285, 1985.

[11] A.S. Abutaleb, "Automatic thresholding of grey-level pictures using two-dimensional entropy", Computer vision, Graphics and Image processing. No.47pp.22-32, 1989.

[12] A.D. Brink "Thresholding of digital images using two dimensional entropies", pattern recognition, vol.25, no.8, pp. 803-808, 1992.

[13] Yang Xiao, Zhiguo Cao, Tianxu Zhang "Entropic thresholding based on gray level spatial correlation histogram", IEEE trans. 19th international conf., pp.1-4, ICPR-2008.

[14] Y.Xiao, Z.G.Cao, and S.Zhong, "New entropic thresholding approach using gray-level spatial correlation histogram", Optics Engineering, 49,127007, 2010.

[15] M Seetharama Prasad, T Divakar, L S S Reddy, "Improved Entropic Thresholding based on GLSC histogram with varying similarity measure", International Journal of Computer Applications, vol.23 no.1, pp. 25-32, June 2011.

[16] M Seetharama Prasad, C Naga Raju, LSS Reddy, "Fuzzy Entropic thresholding using Gray level spatial correlation histogram", i-manager's Journal on Software Engineering, Vol. 6 l No. 2 l pp. 21-30, October - December 2011.

[17] H. R. Tizhoosh, "Image thresholding using type II fuzzy sets," Pattern Recognit., vol. 38, pp. 2363–2372, 2005.

[18] M Seetharama Prasad, Venkata Narayana, R SatyaPrasad, "Type-II Fuzzy Entropic Thresholding Using GLSC Histogram Based On Probability Partition", Asian Journal of Computer Science And Information Technology, vol.2, no.1, pp. 4-9, 2012.

[19] CH. V. Narayana, E. Sreenivasa Reddy, M.Seetharama Prasad, "Automatic Image Segmentation using Ultrafuzziness", International Journal of Computer Applications, Vol.49, No.12, July 2012.

[20] Nuno Vieira Lopes et al. "Automatic Histogram Threshold using Fuzzy Measures" IEEE Trans.Image Process., vol. 19, no. 1, Jan. 2010.

[21] M Seetharama Prasad et al. "Unsupervised Image thresholding using Fuzzy Measures", International Journal of Computer Applications, vol.27 no.2, pp.32-41, August 2011.

[22] A. Rosenfeld, P. De la Torre, Histogram Concavity Analysis as an Aid in Threshold Selection, IEEE Trans System, Man and Cybernetics, SMC-13 (1983) 231-235.

[23] J. Weszka, A. Rosenfeld, Histogram Modification for Threshold Selection, IEEE Trans. System, Man and Cybernetics, SMC- 9 (1979) 38-52.

[24] L. Halada, G.A. Osokov, Histogram Concavity Analysis by Quasicurvature, Comp. Artif. Intell., 6 (1987) 523-533.

[25] S.C. Sahasrabudhe, K.S.D. Gupta, A Valley-seeking Threshold Selection Technique, Computer Vision and Image Processing, (A. Rosenfeld, L. Shapiro, Eds), Academic Press, 1992, pp:55-65.

[26] R.J. Whatmough, Automatic threshold selection from a histogram using the exponential hull, Graphical Models and Image Processing, 53 (1991) 592-600.

[27] M.I. Sezan, A Peak Detection Algorithm and its Application to Histogram-Based Image Data Reduction, Graphical Models and Image Processing, 29 (1985) 47-59.

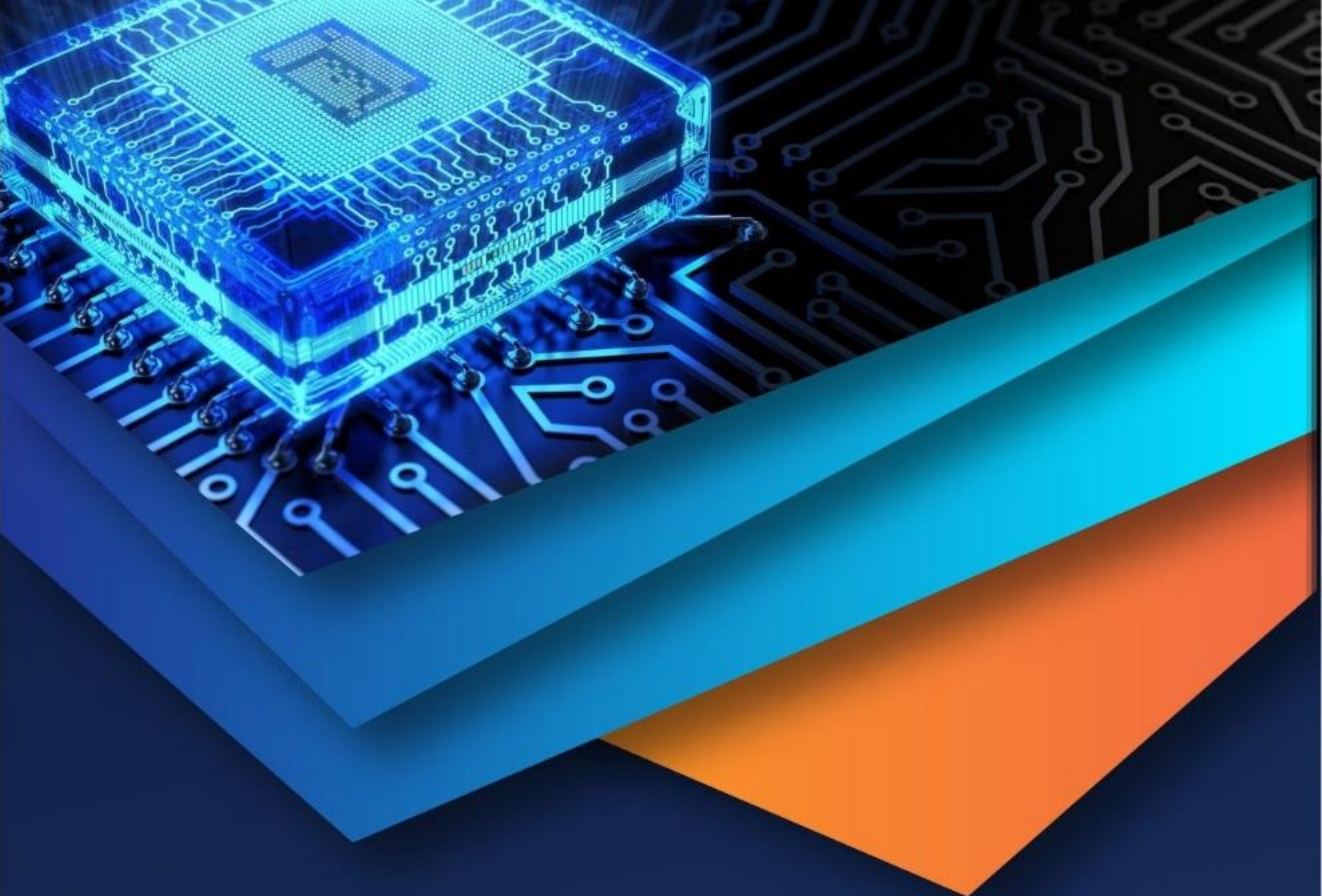
[28] M.J. Carlotto, Histogram Analysis Using a Scale-Space Approach, IEEE Trans. Pattern Analysis and Machine Intelligence, PAMI-9, (1997) 121-129.

[29] J.C. Olivo, Automatic threshold selection using the wavelet transform, Graphical Models and Image Processing, 56 (1994) 205-218.

[30] N. Ramesh, J.H. Yoo, I.K. Sethi, Thresholding Based on Histogram Approximation, IEE Proc. Vis. Image, Signal Proc., 142(5) (1995) 271-27

[31] R. Guo, S.M. Pandit, Automatic threshold selection based on histogram modes and a discriminant criterion, Machine Vision and Applications, 10 (1998) 331-338.

[32] J. Cai, Z.Q. Liu, A New Thresholding Algorithm Based on All-Pole Model, ICPR'98, Int. Conf. on Pattern Recognition, Australia, 1998, pp:34-36.



10.22214/IJRASET

INDEX COPERNICUS

45.98

ISRA JIF

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY