International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.07, April 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

DETECTION OF EDGES USING FUZZY LOGIC TECHNIQUE FOR MICROARRAY IMAGES

Sunitha R[1] ,Dr.H.B.Phaniraju[2]

1(PHD Research Scholar, Dept. of ECE, Rajarajeswari College of Engineering, Bangalore-74, India)

2(Principal, Sridevi Institute of Technology, Thumkur, India)

ABSTRACT

The applications and development of microarray technology have been growing exponentially in the past few years. There are numerous applications of this technology, including clinical diagnosis and treatment, drug design and discovery, tumour detection, and in the environmental health research. One of the key issues in the experimental approaches that utilize microarrays is to extract quantitative information from the spots, which represent genes in a given experiment. For this process, the initial stages are quite important and influential in future steps of the analysis. Edge detection is the most common approach used segmentation. An edge is a boundary between two uniform regions. You can detect an edge by comparing the intensity of neighbouring pixels. However, b uniform regions are not crisply defined, small intensity differences between two neighbouring pixels do not always represent an edge. Instead, the intensity difference might represent a shading effect. The fuzzy logic approach for image processing allows using membership functions to define the degree to which a pixel belongs to an edge or a uniform region. Various fuzzy based methods have been developed for image enhancement. Fuzzy IF THEN rules, Fuzzy based reasoning and Fuzzy inference system etc have been utilized in different ways to enhance the quality of images, remove the noise and improve the contrast of the images.

Keywords- *Microarray image, fuzzy logic, fuzzy inference system(FIS)*

I. INTRODUCTION

DNA microarray technology [1] has a large impact in many application areas, such as diagnosis of human diseases and treatments (determination of risk factors, monitoring disease stage and treatment progress, etc.), agricultural development (plant biotechnology), and quantification of genetically modified organisms, drug discovery, and design. In cDNA microarrays, a set of genetic DNA probes (from several hundreds to some thousands) are spotted on a slide. Two populations of mRNA, tagged with fluorescent dyes, are then hybridized with the slide spots, and finally the slide is read with a scanner. The outlined process produces two images, one for each mRNA population, each of which varies in intensity according to the level of hybridization represented as the quantity of fluorescent dye contained in each spot.

Microarray image processing consists of the following sequence of three stages 1. Gridding, separation of spots by assignment of image coordinates to the spots [2]. 2. Segmentation, separation between the foreground and

background pixels and 3. Intensity extraction, computation of the average foreground and background intensities of each spot of the array [3]. Microarray image may contain different sources of errors. Such as electronic noise, dust on slide, photon noise and other sources causes high level of noise which may propagate through higher image analysis leading to difficulty in identifying the genes that each type of cells is expressing to draw accurate biological conclusions. Spot recognition is complicated task as microarray image gets corrupted by noise sources during image acquisition also bright artifacts may be detected incorrectly as spots of microarray image. Hence it is very much essential to remove the noise present in the image .The image enhancement is necessary to improve the interpretability of information in images to provide better input for the higher image processing applications. Low quality images are thus to be enhanced by appropriate methods to interpret the accurate expression levels.

The goal of edge detection is to locate the pixels in the image that correspond to the edges of the objects seen in the image. This is usually done with a first and/or second derivative measurement following by a comparison with threshold which marks the pixel as either belonging to an edge or not. The result is a binary image which contains only the detected edge pixels. The purpose of detecting sharp changes in image brightness is to capture important events and changes in properties of the world. Discontinuities in image brightness are likely to correspond to discontinuities in depth, discontinuities in surface orientation and changes in material properties or variations in scene illumination

II. RELATED WORK

Shashank Mathur and Anil Ahlawat, presented a fuzzy relative pixel value algorithm for edge detection by checking the relative pixel values in 3*3 pixels mask for scanning of image using the windowing technique, which is subjected to a set of fuzzy conditions for the comparison of pixel values with adjacent pixels to check the pixel magnitude gradient in the window. However their technique was not rule base [3]. Yinghua Li, Bingqi Liu, and Bin Zhou of Ordnance Engineering College (China), presented Fuzzy technology as a newly rising technology used in many fields, especially in the image domain, and fuzzy enhancing technique as one important portion of the fuzzy technology. Based on this technology, they firstly set the image fuzzy characteristic plane of original image, secondly preceded the fuzzy enhancement, and then detected the edge by Sobel differential arithmetic[4]. Yasar Becerikli1 and Tayfun of Kocaeli University, Computer Engineering Department, Izmit, Turkey proposed that an edge detection is one of the most important tasks in image processing. They studied that imagesegmentation; registration and identification are based on edge detection. They proposed that fuzzy rules based algorithm is more flexible in handling thickness of edges in the final image [5].

Cristiano Jacques Miosso, Adolfo Bauchspiess presented that First-order linear filters constitute the algorithms most widely applied to edge detection in digital images but they don't allow good results to be obtained from images where the contrast varies a lot, due to non-uniform lighting, as it happens during acquisition of most part of natural images[6]. Dong-Su Kim, Wang-Heon Lee, In-So Kweon, Department of

Electrical Engineering and Computer Science, KAIST, South Korea, presented an edge magnitude and direction scheme that uses 3 x3 ideal binary pixel patterns and described a lookup table. They concluded that their algorithm didn't require any manual online threshold adjustment and was more suitable to the dynamic environment[7] The work of this paper is concerned with the development of a fuzzy logic rules based algorithm for the detection of image edges. Scanning mask used is smallest possible i.e. 2*2 pixels window.

Fuzzy Inference based system in MATLAB environment has been developed, which is capable of detecting edges of an image. The rule-base of 16 rules has been designed to mark the pixel under consideration as Black, White or Edge. The noise removal algorithm has been implemented at intermediate and final levels of processing. The result has been compared with the standard algorithms.

III. FUZZY LOGIC TECHNIQUE

Fuzzy image processing is the collection of all approaches that understand, represent and process the images, there segments and features are fuzzy sets. Fuzzy set theory is thus useful in handling various uncertainties in computer vision and image processing applications [3].

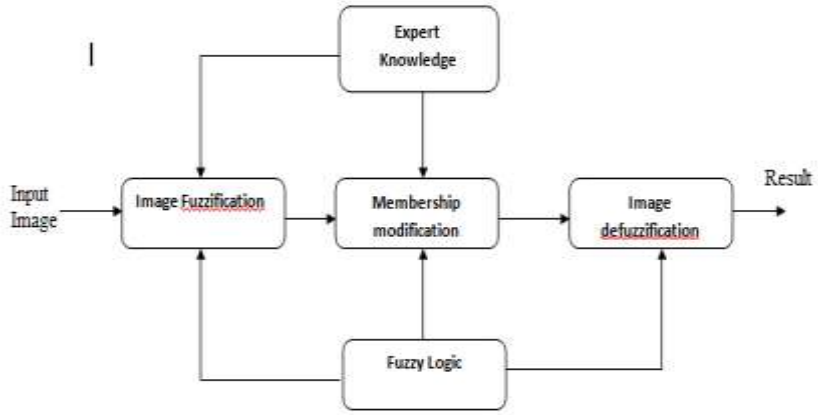

Fig. 1 Fuzzy Image Processing

The representation and processing depend on the selected fuzzy technique and on the problem to be solved. It has three main stages that are image fuzzification, modification of membership function values, and defuzzification. Fuzzy image enhancement is based on gray level mapping into membership function with fuzzy intensification factors. The aim is to generate an image of higher contrast than the original image by giving a larger weight to the gray levels that are closer to the mean gray level of the image that is farther from the mean. Fig. 1

This method uses the intensification operator to reduce thefuzziness of the image which results in an increase of image contrast. Steps for algorithm:

1. Read the input image.

International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.07, April 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

2. If the image is RGB then converts the image into gray scale.
3. Identify image fuzzification.
4. The fuzzy logic edge-detection algorithm.
5. Identify image defuzzification.

V. RESULTS

The microarray image with Dimension 256×256 of the format JPEG (Joint Picture Expert Group) is taken as the original image which is in color are converted to gray scale for further analysis

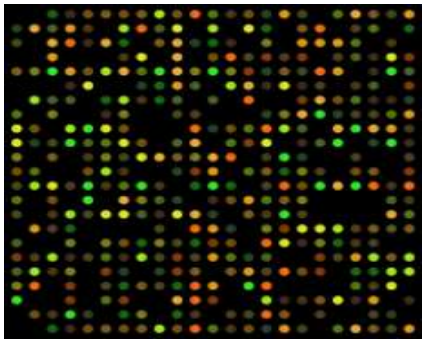

Fig.2(a) Microarray Image

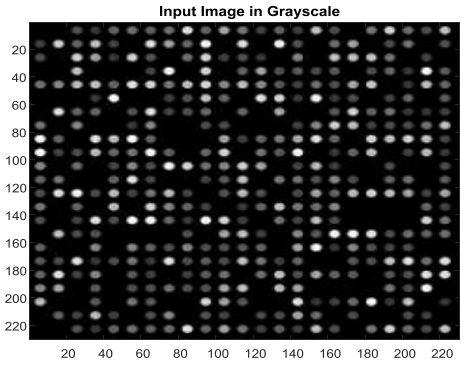

Fig.2(b) Input Image in Grayscale

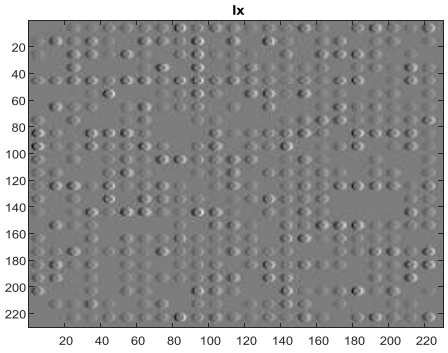

Fig.2(c). Image Gradient along x-axis

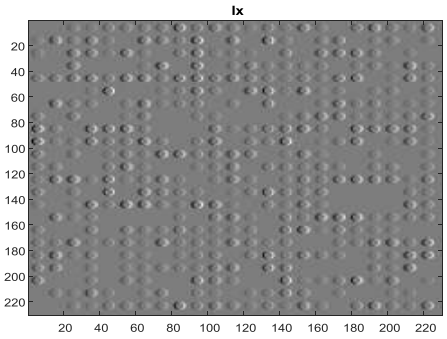

Fig.2(d). Image Gradient along y-axis

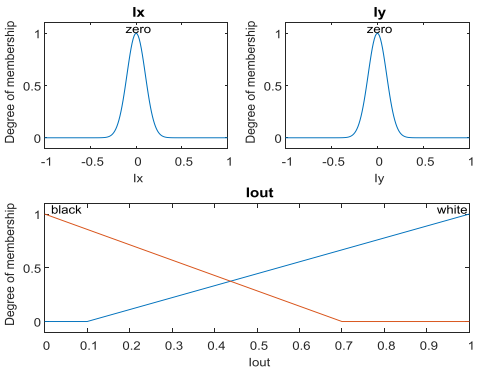

Fig.2(e). Fuzzy Inference System

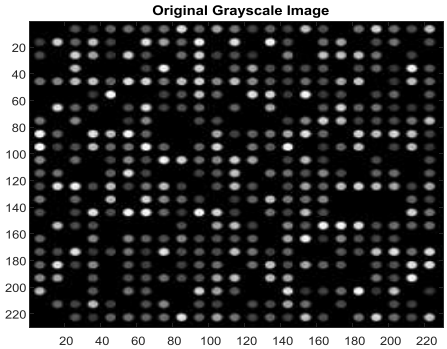

Fig.2(f) Image Defuzzification

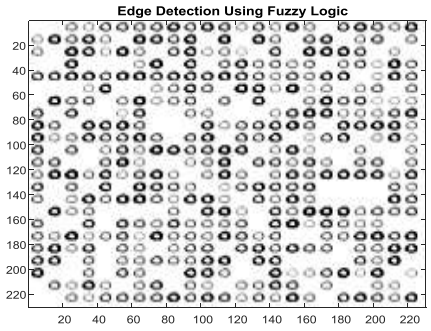

Fig.2(g). Edge Detection using Fuzzy Logic

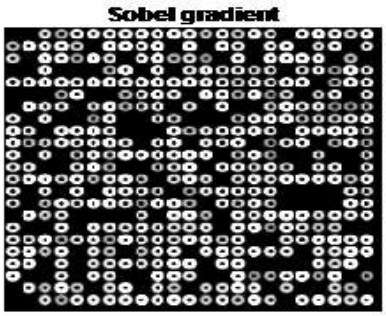

Fig.2(h). Edge Detection using sobel operator

VI. CONCLUSION

This paper presents a new Edge detection method for Microarray images using fuzzy logic. Detected the edges in an image using a FIS, comparing the gradient of every pixel in the x and y directions. If the gradient for a pixel is not zero, then the pixel belongs to an edge (black). It is defined the gradient as zero using Gaussian membership functions for your FIS inputs. Edge detection using sobel operator is also performed. It shows that proposed method gives more contrast images.

REFERENCES

[1] Y. F. Leung and D. Cavalieri, "Fundamentals of cDNA microarray data analysis," TRENDS in Genetics , vol. 19, no. 11, pp. 649-659, 2003.

[2]M. Steinfath, W. Wruck, H. Seidel, H. Lehrach, U. Radelof, and J. O'Brien, "Automated image analysis for array hybridization experiments," Bioinformatics, vol. 17, no. 7, pp. 634–641, Jul. 1, 2001

[3] Shashank Mathur, Anil Ahlawat, "Application Of Fuzzy

Logic In Image Detection", International Conferenc "Intelligent Information and Engineering Systems" INFOS 2008, Varna, Bulgaria, June-July 2008

[4] Yinghua Li, Bingqi Liu, and Bin Zhou, "The Application Of Image Edge Detection by using Fuzzy Technique", in Conference " Electronic Imaging and Multimedia Technology", November 2004

[5] Yasar Becerikli1 and Tayfun M. Karan, "A New Fuzzy Approach for Edge Detection", Computational Intelligence and Bio inspired Systems" , June 2005.

[6] Cristiano Jacques Miosso, Adolfo Bauchspiess, "Fuzzy Inference System Applied to Edge Detection in Digital Images", in the proceedings of the V Brazilian Conference on Neural Networks pp. 481–486, April , 2001

[7] Dong-Su Kim, Wang-Heon Lee , In-So Kweon, "Automatic edge detection using 3x3 ideal binary pixel patterns and fuzzy-based edge thresholding," in Pattern Recognition Letters in 2004

[8] Kundra M.H, Aashima and Verma E.M. (2009), "Image Enhancement Based On Fuzzy Logic", International Journal of Computer Science and Network Security, Vol.9, No. 10, pp. 141-145.

[9] Liang, Zang and Qui B. (2008), "An Improved Fuzzy Image Enhancement Algorithm", proceedings the Fifth International Conference on Fuzzy Systems and Knowledge Di

[10] M. Ki Kerr M. K, Martin M, and Churchill G. A.", Analysis of variance for gene expression Microarray data", Journal of Computational Biology, vol No. 7, pp No. 819–837, 2001.

[11] Schena M, Shalon D, Davis RW, Brown PO, "Quantitative monitoring of gene expression patterns with a complementary DNA microarray", Science, Vol No 270, pp. 467 – 470, 1995.

[12] Robert S. H, "Microarray Image Processing: Current Status and Future Directions", IEEE Transactions Nano bioscience, Vol No 2, pp No. 173-175, 2003.

[13] Yuk Fai Leung and Duccio Cavalieri, "Fundamentals of cDNA microarray", Data Analysis and trends in Genetics, Vol.19, Issue No.11, pp No. 649-659, 2003.