# A Novel method of exploring Human reasoning power in image Analysis

<sup>1</sup>S. Nagendram, <sup>2</sup>G. Divya, <sup>3</sup>K. Avinash Bharadwaj, <sup>4</sup>P. Dharanija

<sup>1</sup>Assistant Professor, Dept of Electronics & Computers Engg (ECM) <sup>234</sup> reena1286@gmail.com,guggilamdivya@gmail.com,Koppavibh.4@gmail.com, dewdrops.dharani291@gmail.com Students, Dept of ECM, KL University, Vaddeswaram, Guntur, Andhra Pradesh, India

### Abstract

Soft computing is an emerging field that consists of complementary elements of fuzzy logic, neural computing and evolutionary computation. Soft computing techniques have found wide applications. One of the most important applications is edge detection for image segmentation. The process of partitioning a digital image into multiple regions or sets of pixels is called image segmentation. Edge is a boundary between two homogeneous regions. Edge detection refers to the process of identifying and locating sharp discontinuities in an image. In this paper, the main aim is to survey the theory of edge detection for image segmentation using soft computing approach based on the Fuzzy logic. Fuzzy Logic (FL) explores human reasoning power using linguistic terms. Since, domain knowledge of real life problems are often uncertain, imprecise and inexact, therefore create difficulty in decision making while solving by conventional approaches like image processing. Among various methods of handling uncertainties, fuzzy logic has been most intensively studied.

Keywords- Fuzzy logic, Edge detection, Image processing, pixel, segmentation

## Introduction

OVER the last few decades the volume of interest, research, and development of computer vision systems has increased enormously. Nowadays they appear to be present in almost every sphere of life, from surveillance systems in car parks, streets, and shopping centers, to sorting and quality control systems in the majority of food production. Thus, introducing automated visual inspection and measurement systems are necessary, specially for the two dimensional mechanical objects. In part due to the substantial increase in digital images that are produced on a daily basis (e.g., from radiographs to images from satellites) there is an increased need for the automatic

processing of such images. Thus, there are currently many applications such as diagnosis computer-aided of medical images, segmentation and classification of remote sensing images into land classes (e.g., identification of wheat fields, and estimation of crop growth), optical character recognition, content-based retrieval for multimedia applications, image manipulation for the film industry, identification of registration details from car number plates etc.

Historically much data has been generated as images to facilitate human analysis (it is much easier to understand an image than a comparable table of numbers). And so this has encouraged the use of

### CLEAR IJRET

image analysis techniques over other possible methods of data processing. In addition, since humans are so adept at understanding images, image based analysis provides some aid in algorithm development (e.g., it encourages geometric analysis) and also helps informally validate results. While the role of computer vision can be summarized as a system for the automated (or semiautomated) analysis of images, many variations are possible. The images can come from different modalities beyond normal gray-scale and colour photographs, such as infrared, X-ray, as well as the new generation of hyper-spectral satellite data sets. Second, many diverse computational techniques have been employed within computer vision systems such as standard optimization methods, AI search strategies, simulated annealing, genetic algorithms.

The fuzzy technique is an operator introduced in order to simulate at a mathematical level the compensatory behaviour in process of decision making or subjective evaluation. Digital image processing is a subset of the electronic domain wherein the image is converted to an array of small integers, called pixels, representing a physical quantity such as scene radiance, stored in a digital memory, and processed by computer or other digital hardware. Edges characterize boundaries and edge detection is one of the most difficult tasks in image processing hence it is a problem of fundamental importance in image processing. Edges in images are areas with strong intensity contrasts and a jump in intensity from one pixel to the next can create major variation in the picture quality. Edge detection of an image significantly reduces the amount of data and filters out useless information, while preserving the important structural properties in an image. Fuzzy logic reasoning strategy is proposed for edge detection in images with fuzzy logic and first order edge detection method.

A very important role is played in image analysis by what are termed feature points,

pixels that are identified as having a special property. Feature points include edge pixels as determined by the well-known classic edge detectors of PreWitt, Sobel, Marr, and Canny. Recently there has been much revived interest in feature points determined by "corner" operators such as the Plessey, and interesting point operators such as that introduced by Moravec. Classical operators identify a pixel as a particular class of feature point by carrying out some series of operations within a window centered on the pixel under scrutiny. The classic operators work well in circumstances where the area of the image under study is of high contrast. In fact, classic operators work very well within regions of an image that can be simply converted into a binary image by simple thresholding as shown in Fig.1.Feature points are characterized by their relationship to pixels values within some local window.



FIG:1 Measuring the object elongatedness in gray-level and binary images

Recent research has concerned using neural Fuzzy Feature to develop edge detectors, after training on a relatively small set of proto-type edges, in sample images classifiable by classic edge detectors. This work was pioneered by Bezdek etal, who trained a neural net to give the same fuzzy output as a normalized Sobel Operator. The advantage of the *neural fuzzy* edge detector over even the traditional edge detector on which the *neural fuzzy* form was based is

A Novel Method of Exploring Human Reasoning Power in Image Analysis

23

## CLEAR IJRET

Vol-01: No- 01

very apparent. In the system described in all inputs to the fuzzy inference systems (FIS) system are obtained by applying to the original image a high-pass filter, a first-order edge detector filter (Sobel operator) and a low-pass (mean) filter. The whole structure is then tuned to function as a contrast enhancing filter and, in another problem, to segment images in a specified number of input classes. The adopted fuzzy rules and fuzzy membership functions the are specified according to the kind of filtering to be executed.



Fig. 2 The general structure of fuzzy image processing

In this paper a novel FIS method based on fuzzy logic reasoning strategy is proposed for edge detection in digital images without determining the threshold value or need training algorithm. The proposed approach begins by segmenting the images into regions using floating 3x3 binary matrix. A direct fuzzy inference system mapped a range of values distinct from each other in the floating matrix to detect the edge.

## **Fuzzy Image Processing:**

Fuzzy image processing is the collection of all approaches that understand, represent and process the images, their segments and features as fuzzy sets. The representation and processing depend on the selected fuzzy technique and on the problem to be solved. Fuzzy image processing has three main stages: image fuzzification, modification of membership values, and, if

necessary, image defuzzification as shown inFig.2.The fuzzification and defuzzification steps are due to the fact that we do not possess fuzzy hardware. Therefore, the coding of image data (fuzzification) and decoding of the results (defuzzification) are steps that make possible to process images with fuzzy techniques. The main power of fuzzy image processing is in the middle step (modification of membership values). After the image data are transformed from gravlevel plane to the membership plane (fuzzification), appropriate fuzzy techniques modify the membership values. This can be a fuzzy clustering, a fuzzy rule-based approach, a fuzzy integration approach and so on.

# Fuzzy Sets and Fuzzy Membership Functions:

The system implementation was carried out considering that the input image and the output image obtained after defuzzification are both 8-bit quantized; this way, their gray levels are always between 0 and 255. The fuzzy sets were created to represent each variable's intensities; these sets were associated to the linguistic variables "Black", Edge and "white". The adopted membership functions for the fuzzy sets associated to the input and to the output were triangles as:

B-Back W-White



White

Fig. 3 Membership functions of the fuzzy sets associated to the input and to the output

## **Proposed Method:**

The basic rules for fuzzy logic in edge detection depends on the weights of the eight neighbors gray level pixels, if the neighbours' weights are degree of blacks or degree of whites. The powerful of these rules is the ability of extract all edges in the processed image directly. This study is assaying all the pixels of the processed image by studying the situation of each neighbour of each pixel. The condition of each pixel is decided by using the 3x3 mask which can be scanning the all grays. The first four rules are dealing with adjacent pixels of the desired

checked or center pixel of the mask, if the grays represented in one line are black and the remains grays are white then the checked pixel is edge and under remaining cases the checked pixel will be black. The introduced rules and another group of rules are detecting the edges, the white and the black pixels.

3x3 matrix representation

[i-1, j-1]	[i-1, j]	[i-1, j+1]
[i, j-1]	[i, j]	[i, j+1]
[i+1, j-1]	[i+1, j]	[i+1, j+1]

The result images contribute for the contour, the black and the white areas. From the side of the fuzzy construction, the input grays is ranged from 0-255 gray intensity, and according to the desired rules the gray level is converted to the values of the membership functions. The output of the FIS according to the defuzzification is presented again to the values from 0- 255. And then the black, white and edge are detected. From the experience of the tested images in this study, it is found that the best result to be achieved at the range black from zero to 80 gray values and from 80 to 255 meaning that the weight is white. 3x3 matrix representation The four basic rules for finding the edges with white and black pixels of an image are:



Basic rules of fuzzy logic

The resultant matrix is formed with the white and black pixels. Now apply the any first order edge detection technique to the obtained matrix form the basic fuzzy rules. This will give a better form of edges when compared to that of the method that has been given by a sobel operator. This is method helps to increase the possibility of getting curved and corner edges better when compared to that of the solution obtained from the sobel operator and any other first order edge detection technique.

#### **Experiments:**

The proposed system was tested with different images, its performance being compared to that of the Sobel operator and the proposed FIS method. The firing order associated with each fuzzy rule were tuned to obtain good results while extracting edges of the image shown in fig., where we used this image as comparative model for the classical Sobel operator and the FIS method. The original image is shown in part a of fig. The edge detection based on Sobel operator using the image processing toolbox in MATLAB is illustrated at the part b. The white pixels on the map indicate there are edges. thus will be preserved from smoothing. There is obviously some noise left on the edge map and some of thevedges are corrupted. By applying the new FIS on the image to detect its edges, it is found that

Vol-01: No- 01

the modified version of edge map has less noise and less edge corruption as shown on the image of Fig. For the segmentation task, a thin edge is better because we only want to preserve the edge rather than the details in the neighborhood. The values of the edge map are normalized to the interval of 0 and 1 to represent the edginess membership values.

The original captured image is Edge Checked Pishown in Fig.6.a. We observe, in part b, that the Sobel operator with threshold automatically estimated from image's binary value does not allow edges to be detected in the regions of low contrast. So which results in two edges being detected (double edges) at the left side of part b. The FIS system, in turn, allows edges to be detected even in the low contrast regions as illustrated in part c. This is due to the different treatment given by the fuzzy rules to the regions with different contrast levels, and to the rule established to avoid including in the output image pixels not belonging to continuous lines.

#### INPUT IMAGE



USING LINEAR SOBEL OPERATOR

26



Vol-01: No- 01

Sep-Nov 2011





AFTER APPLYNG SOBEL METHOD

AFTER APPLYING PROPOSED METHOD



INPUTIMAGE



AFTER APPLYING METHOD

PROPOSED

Sep-Nov 2011



INPUT-IMAGE



#### BY SOBEL METHOD



# BY PROPOSED METHOD



#### **V FUTURE WORK**

#### **ADVANCED FUZZY LOGIC**

The ability of fuzzy systems to provide shades of gray between "on or off" and "yes or no" is ideally suited to many of today's complex industrial control systems. The static fuzzy systems usually discussed in this context fail to take account of inputs outside a pre-set range and their off-line nature makes tuning complicated. Advanced Fuzzy Logic Technologies addresses the problem by introducing a dynamic, on-line fuzzy inference system. In this system membership functions and control rules are not determined until the system is applied and each output of its lookup table is calculated based on current inputs. In fact, the proposed technique is to find more fine edges using advanced fuzzy logic technique.

In future, modification of fuzzy rules can produce better result. Further tuning of the weights associated to the fuzzy inference

rules is still necessary to reduce even more inclusion in the output image of pixels not belonging to edges.

#### VI CONCLUSION

Because of uncertainities that exist in many aspects of image processing, fuzzy processing is desirable. These uncertainties include additive and non-additive noise in low-level image processing, imprecision in the assumptions underlying the algorithms, and ambiguities in interpretation during high level image processing. For the common process of edge detection usually models edges as intensity ridges. Nevertheless, in practice this assumption only holds approximately, leading to some of the deficiencies of these algorithms. Fuzzy image processing is a powerful tool form formulation of expert knowledge edge and the combination of imprecise information from different sources. The designed fuzzy rules are an attractive solution to improve the quality of edges as much as possible. One past drawback of this type of algorithm that they required extensive was computation. These results allow us to conclude that:

- The implemented FIS system presents greater robustness to contrast and lighting variations, besides avoiding obtaining double edges.
- It is gave a permanent effect in the lines smoothness and straightness for the straight lines and for the curved lines it gave good roundness. In the same time the corners get sharper and can be defined easily.

In fact, the proposed technique is to find more fine edges using fuzzy logic technique and first order edge detection technique.In future, modification of fuzzy rules can produce better result.

Further tuning of the weights associated to the fuzzy inference rules is still necessary to reduce even more inclusion in the output image of pixels not belonging to edges.

## **VII REFERENCES**

- I.M. Elewa, H.H Soliman, A.A. Alshennawy. "Computer vision Methodology for measurement and Inspection: Metrology in Production area ". Mansoura Eng. First conf. Faculty of Eng. Mansoura Univ., March 28-30,1995,pp. 473-444.
- A. A. Alshennawy, "Measurement and Inspection of Three Dimensional Objects Using Computer Vision System", Ph.D thesis, Mansoura University, Egypt, 2003.

R.T. Chin, C.A. Harlow, "Automated Visual Inspection: A survey ", IEEE Trans. Pattern Anal. Machine Intell., Vol.

PAMI-4, pp. 557-573, November 1982.

- A. M. Darwish, A. K. Jain, "A Rule Based Approach for Visual Pattern Inspection", IEEE Trans. on Pattern Analysis and Machine Intelligence, Vol. 10, No. 1, pp. 56-68, 1988.
- [5] G. Maitre, H. Hugli, F. Tieche, J. P. Amann, "Range Image Segmentation Based on Function Approximation", published at ISPRS90, Zurich, Sept. 1990.
- Md. Shoiab Bhuiyan, Yuiji Iwahori, Akira Iwata, "Optimal edge detection under difficult imaging conditions". Technical report, Educational Center for Information Processing and

29

Dept. of Electrical and Computer Engineering, Nagoya Institute of Technology, Showa, Nagoya, pp. 466-8555,Japan.