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Simulation of SOBEL Edge Detection Using Fuzzy Logic in MATLAB

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Abstract - With the increasing troubles of indecision, imprecision and ambiguity during the modeling of various control system, the fuzzy logic plays the vital role in it. This paper presents a detailed description of simulation of sobel edge detection using fuzzy logic, which clears that fuzzy logic is an different way to represent linguistic and subjective attributes of the real world. In order to improve the efficiency and simplicity of the design process, fuzzy logic can be applied to simulation of sobel edge detection using MATLAB. This paper is based on sobel edge detection using, which is a simulation modelling .This proves that fuzzy logic do a fairly good job than other controlling systems.

Keywords - *fuzzy logic, simulation, sobel*

1. Introduction

The control systems are generally explained by mathematical models which follow the stochastic models, law of physics or mathematical logic models.The trouble with such models is how to solve the given problem to a suitable mathematical model. No doubt all these problems are overcome by todays advanced computer techonology,but these systems are still comlex to manage.Hence ,to simplify the uncertainty,vagueness and imprecision during the modeling,the concept of fuzzy logic comes into account.In recent years,the application of fuzzy logic has been increased considerably. Fuzzy logic can deal with information that is arising from computational view, understanding and cognition. In computing problems, it provides inclusion of obscure human evolution.

The main purpose of the edge detection is to determine the frontiers of all represented objects, based on automatic dispensation of color or gray level information contained in each pixel. Edge detection has many applications in image processing computer vision and biological and robotic vision. Edge detection of real world images is a challenging task as there are a number of objects and huge variations between them which makes it difficult to approximate all objects. Most real world images possess a certain amount of ambiguity and hence their segmentation produces fuzzy regions. For such images, by detecting discontinuities in fuzzy image segmentation techniques are more adept for processing their uncertainties. Edge detection works images, by detecting discontinuities in brightness. It includes methods for acquiring, processing, analyzing, and understanding images and in general, high dimensional data from the real world in order to produce numerical and symbolic information. Edges and noise both represent a variation in intensity; usually edge has a large variation between adjacent pixels, compared to additive noise, use directional gradients to capture variations.

2. SOBEL Edges Detection of Image Using Fuzzy Approach

Fuzzy techniques can manage vagueness and ambiguity efficiently and an image can be represented as a fuzzy set. Fuzzy logic is a powerful tool to represent and process human knowledge in form of fuzzy if-then rules. Edges are extracted from the enhanced image by a two-stage edge detection operator that indentifies the edge candidates based on local characteristics of the image.

The process of classifying and placing sharp discontinuities in an image is called the edge detection. The discontinuities are immediate changes in pixel concentration which distinguish boundaries of objects in a scene. Classical methods of edge detection engage convolving the image through an operator, which is constructed to be perceptive to large gradients in the image although returning values of zero in uniform regions. There is a very large amount of edge detection techniques available, each technique designed to be perceptive to certain types of edges. Variables concerned in the selection of an edge detection operator consist of edge orientation. Edge detection based on fuzzy logic, the instructions of the image edge detection is based on fuzzy logic is as follows,
The Sobel edge detection is approximation of the gradient of the image intensity a very common first order edge

detection operator which computes an function. At each part in the image the result of the Sobel operator is the corresponding norm of this gradient vector. The Sobel operator only considers the two orientations which are 0°and 90°convolution kernels as shown in Fig.(a) and Fig.(b). The advantage of Sobel operator is its simplicity in calculation but one of the disadvantage is its accuracy which is relatively low because it only used two convolution kernels to detect the edge of image.

$$Hx=\begin{bmatrix}-1 & 0 & 1\\ -2 & 0 & 2\\ -1 & 0 & 1\end{bmatrix}.$$

Fig a

$$Hy=\begin{bmatrix}-1 & -2 & -1\\ 0 & 0 & 0\\ 1 & 2 & 1\end{bmatrix}$$

Fig b

Sobel edge detection operator is motivated by the fact that they incorporate both the edge detection as well as smoothing operator so that they have good edge detection capability in noisy conditions**.** The Sobel operator performs a *2-D* spatial gradient measurement on images. Transferring a *2D* pixel array into statistically uncorrelated data set enhances the removal of redundant data; as a result, reduction of the amount of data is required to represent a digital image. The Sobel edge detector uses a pair of *3 x 3* convolution masks, one estimating gradient in the x-direction and the other estimating gradient in *y*–direction. The Sobel detector is incredibly sensitive to noise in pictures, it effectively highlight them as edges. Hence, Sobel operator is recommended in massive data

The Sobel filter block is depicted in fig. c. It first calculates Sobel filter response in x and y direction in Sobel kernel block, then sum their absolute values to get the final Sobel filter response and quantize the response type for following display.

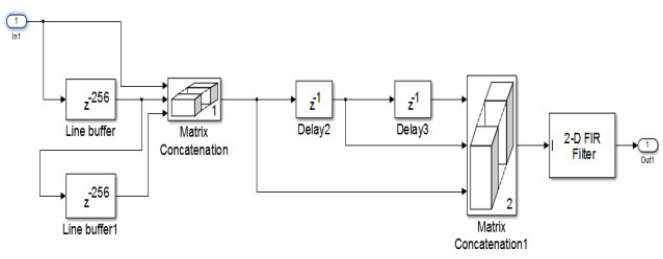

fig.c

3. Simulation Results

The output result for Sobel edge detection technique for Matlab Simulink model shown above are given bellow. Here the input image is “library.jpg” the gradient calculated image in x and y direction is done and edge detected output is shown below.

Fig d: Input image in grayscale

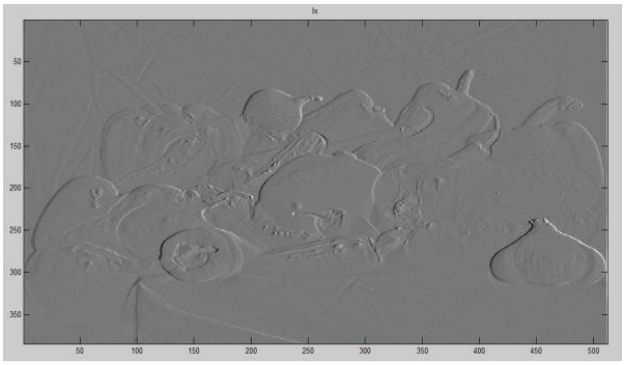

Fig e: Gradient image in the x direction

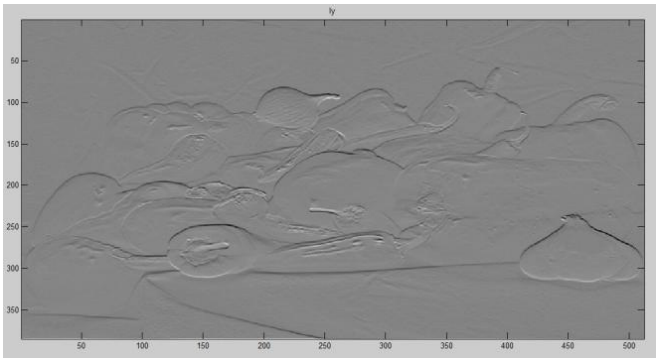

Fig f: Gradient image in the y direction

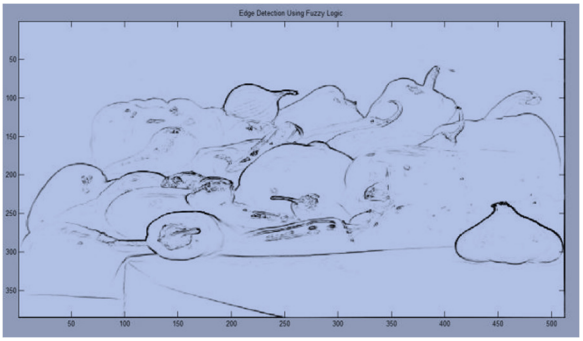

Fig g: SOBEL Edge detection of image using fuzzy logic

4. Conclusion

The various operation performed on the image can be applied for various applications like Image filtering, medical imaging, image compression, computer vision, etc. Some of the most common operations on an image that comes under image processing which are Image scaling, image rotation, filtering, edge detection, color. This paper presents a detailed description of fuzzy logic which clears that fuzzy logic is an alternative way to represent linguistic and subjective attributes of the real world. In order to improve the efficiency and simplicity of the design process, fuzzy logic can be applied to various applications. The various applications of fuzzy logic which is simulated using the MATLAB prove that fuzzy logic systems do a fairly good job than other controlling systems.

Future Scope:

As the Sobel edge detection is approximation of the gradient of the image intensity a very common firstorder edge detection operator which computes an function. At each part in the image the result of the Sobel operator is the corresponding norm of this gradient vector. The Sobel operator only considers the two orientations which are 0°and 90°convolution and there must be more work on ,more than two convolution kernels to detect the edge of image so that higher accuracy can be gained.

References

[1] Fuzzy Logic Toolbox, for use with MATLAB, "The Math Works", user's guide, version 2.

[2] Kiran Pal, Surendra Tyagi, "Selection of Candidate by Political Parties Using Fuzzy Logic", International Conference of Advance Research and Innovation (ICARI-2004).

[3] Fuzzy logic, https://en.m.wikipedia.org/wiki/Fuzzy_logic

[4] Fuzzysetoperations,https://en.m.wikipedia.org/wiki/Fuzzy_set_operations No.1, 2015.

[5] "A Classified and Comparative Study of EdgeDetection Algorithms" by Mohsen Sharifi,Mahmoud Fathy, Maryam Tayefeh Mahmoudi Department of Computer Engineering, Iran University of Science and Technology. Proceedings of the International Conference on Information Technology: Coding and Computing (ITCC.02) 2002 IEEE

[6] "A Simple and Efficient Edge Detection Algorithm" Guangyu Luan and Rensheng Che Department of Automatic Measurement and Control Harbin Institute of Technology, Harbin, China. 2008 International Symposium onComputer Science and Computational Technology.

[7] "An efficient architecture for hardware implementations of image processingalgorithms" Farzad Khalvati and Hamid R.Tizhoosh Department of Systems DesignEngineering University of Waterloo, Waterloo,Ontario, Canada. 2009 IEEE

[8] Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing. 3nd. ed. New Jersey: Pearson Prentice Hall. 2008

[9] The MathWorks, Simulink-Model-Based and System-Base Design. The MathWorks, September 2003. Writing S-Functions—Version 5.

[10] Raman Maini, Dr. Himanshu Aggarwal, ―Study and Comparison of Various Image Edge Detection Techniques‖, International Journal of Image Processing (IJIP), Volume (3)

[11] Zhang Jin-Yu; Chen Yan; Huang Xian-Xiang, ―Edge detection of images based on improved Sobel operator and genetic algorithms‖, International conference on Image Analysis and Signal Processing, pp. 31 – 35, 2009.