



Fuzzy Logic Edge Detection (Image Processing Technique)

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ABSTRACT

The edge can be characterized as the distinction between the various degrees of variety, or all in all it is the lopsided and enormous difference between one pixel and another chromatic. The edges remember significant data for advanced pictures so they give us data about the area of the item so this matter later aides in distinguishing and following up the various articles in the picture, as in the video arrangements. Edge detection is crucial and significant in PC vision and picture handling since it is utilized to identify and follow the attributes of articles. We track down the main utilizations of edge discovery in clinical pictures, distinguishing objects in video despite everything pictures, foundation extraction, in this paper we present fuzzy logic which used to detect the edges of an image, where we studied the algorithm used in this technique and the difference between it and other techniques, as we found that this technique gives very good accuracy in identifying the edges of the image.

Keywords: edge detection, image processing, fuzzy logic technique

1. Introduction

Image processing is an actual cycle used to change over a picture signal, whether computerized or simple, into an actual picture. The genuine result itself can be a genuine actual picture or properties of a picture. The most widely recognized type is photography, where the picture is taken with the camera to make a computerized or simple picture. To create an actual picture, the picture is handled utilizing fitting innovation in view of the sort of info source.

In advanced photography, the picture is put away as a document on your PC or cell phone. This record is made an interpretation of utilizing visual programming to make a genuine picture. All tones, concealing, and subtleties are caught at the time the picture is taken, and the product makes an interpretation of this data into a picture.

While making pictures with simple photography, the picture is scorched onto film utilizing a synthetic response set off by openness to light. It is then handled in an obscured room, utilizing unique synthetics to make the real picture. This kind of picture has nearly vanished from the world, particularly as computerized cameras have become high-goal and can take pictures effectively and afterward print them with a high-goal variety printer.

1.1 Fuzzy logic

Ambiguity logic is a form of logic used in some expert systems and artificial intelligence applications. This logic arose in 1965 by the Azerbaijani scientist LutfiZadeh from the University of California, where he developed it to use it as a better way to process data, but his theory did not receive attention until 1974, when Fuzzy logic was used to organize a steam engine, and then its applications developed until it reached the manufacture of a fuzzy logic chip, which was used in many products such as cameras.

There are many motives that prompted scientists to develop the science of fuzzy logic. With the development of computers and software, the desire arose to invent or program systems that could deal with inaccurate information like a human, but this generated a problem as the computer can only deal with precise and specific data. This trend has resulted in what is known as expert systems or artificial intelligence, and fuzzy logic is one of the theories through which such systems can be built.

1.2 Fuzzy logic edge detection

Edge extraction is the main picture improving method. It is a central stage in division, object recognizable proof and movement assessment. Most edge identification calculations are carried out involving block handling strategy in the spatial space by control of the force worth of every pixel and its area inside a specific block of size $W \times W$ pixels. Edge locators find edges in a force picture by distinguishing pixels where the power values change suddenly. Utilizing calculations in view of subsidiary strategies, edge recognition is achieved by looking at the principal subordinate of the power to a limit, or by really looking at the second subsidiary for a zero intersection.

1.3 Fuzzy logic based image edge detection algorithm

The handling of caught pictures includes various methods, so it is important to remove significant highlights that will be utilized to foster an application. In the specific instance of a humanoid robot, the framework is continually getting pictures that can be utilized to convey a bunch of significant errands, in particular a) decide the place of the ball on the field, b) characterize play spaces and c) find itself and its rivals into the field. These undertakings can be completely performed by handling the caught pictures and are a critical perspective to think up procedures as indicated by the present status of every component.

$$E_n = \frac{\sum (g(j) - g_5)^2}{n(g_{\max} - g_{\min})^2} \quad g_5 = \frac{1}{n} \sum g(j)$$

$$\mu_{Egl} = \begin{cases} \frac{Eg}{T_1} & 0 < Eg \leq T_1 \\ 1 & \textit{otherwise} \end{cases} \quad \mu_{Egs} = \begin{cases} 1 - \frac{Eg}{T_1} & 0 < Eg \leq T_1 \\ 0 & \textit{otherwise} \end{cases}$$

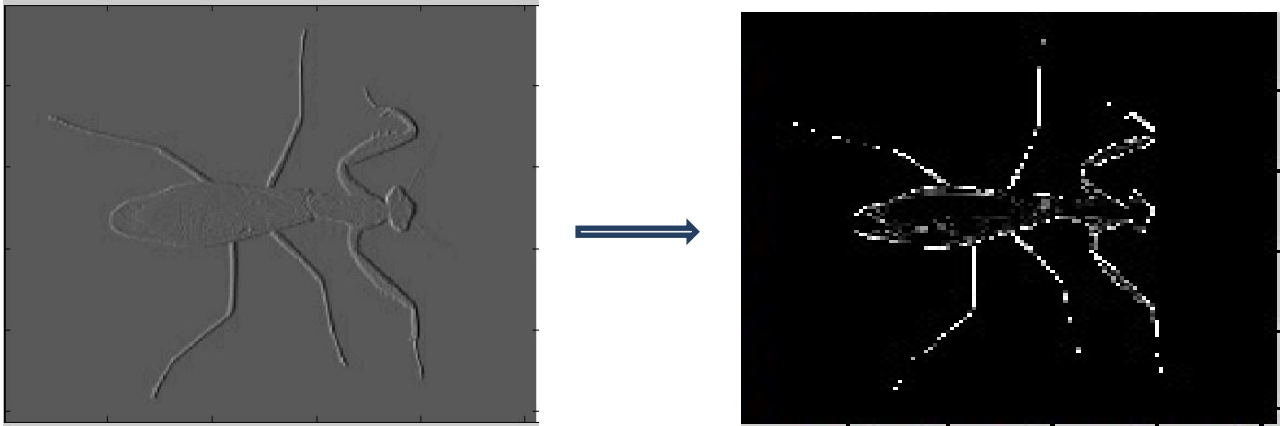
$$\mu_{Edl} = \begin{cases} \frac{Ed}{T_2} & 0 < Ed \leq T_2 \\ 1 & \textit{otherwise} \end{cases} \quad \mu_{Eds} = \begin{cases} 1 - \frac{Ed}{T_2} & 0 < Ed \leq T_2 \\ 0 & \textit{otherwise} \end{cases}$$

Figure1. fuzzy logic based image edge detection algorithm

1.3 Image Thresholding

Picture thresholding is a sub-module of picture division where certain pixel values are modified by a specific edge esteem where the pixel worth of 0 is

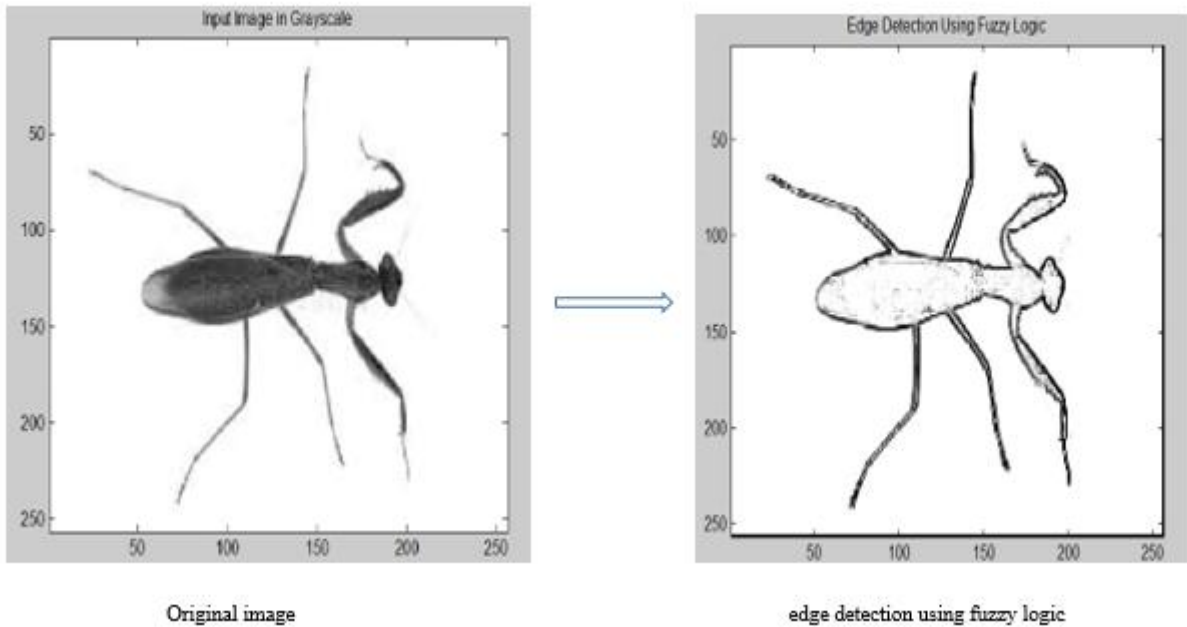
viewed as dark and the pixel worth of 255 is viewed as white. So the OpenCV module is utilized to appropriately approve the edge esteem the lower pixel worth of 0 and the upper pixel worth of 255 and correspondingly work with picture division as required. This article briefs on the various sorts of picture thresholding procedures with execution utilizing the OpenCV module..



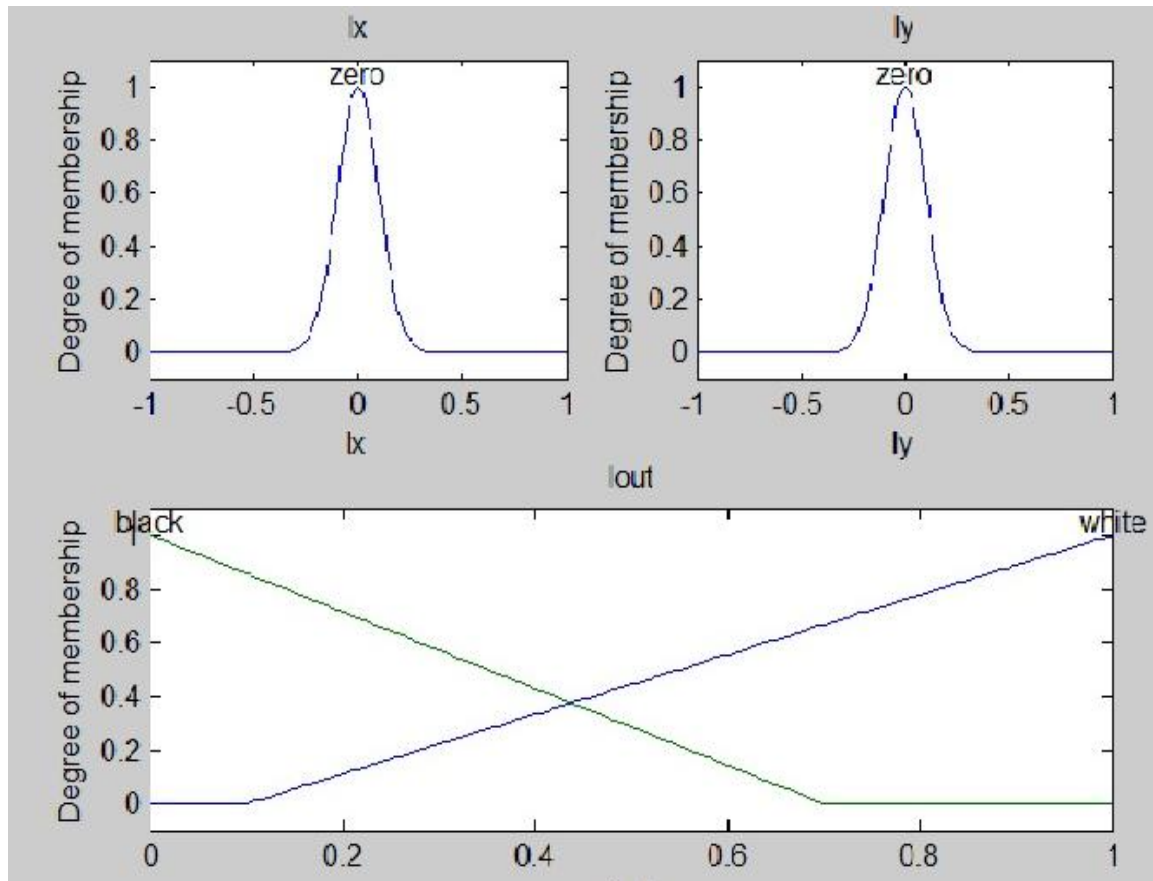
Figuer2. Image Thresholding

2. Methodology

In this paper we use Matlab program to compute an insect image , we use matlab to identify the image’s edge using fuzzy edge detection algorithm.



Figuer.3Fuzzy logic edge detection



Figuer.4 image dimension x,y

3. Result

The proposed method was simulated by an insects image, the result shows that the output of the image can detect the edges clearly and more easier than other methods.

4. Conclusion

Fuzzy logic edge detection It is considered one of the most important and best techniques in identifying the edges of images. There is a large group of techniques used to identify the edges of images. In this paper, the method of working of this technique and the algorithm used in this technique were identified, and using Matlab tools, the process of identifying the edges of an image was performed. (Insect image) The edge recognition rate of the image was large and the edges were clear.

REFERENCES

Fuzzy Mathematical Approach to Pattern Recognition, S.K. Pal, D.K. Dutta Majumder.

Fundamentals of Digital Image Processing, Anil K. Jain, Prentice Hall, 1989.

Fuzzy Techniques in Pattern Recognition, A. Kandel, Addison Wesley, 1989.

Using Fuzzy Logic, Jun Yan, Michael Ryan, James Power, Prentice Hall, 1992.

Y.W.Lim and S.U.Lee, on the Color Image Segmentation Algorithm Based on the Thresholding and Fuzzy c-means Techniques, Pattern Recognition,

Vol.23, pp935-952, 1990.

[T.Peli and D. Malah, A Study of Edge Detection Algorithms, Computer Graphics and Image Processing, Vol.20, pp1 -21, 1982.

Image Processing and Understanding Based on the Fuzzy Inference Approach, Chen, Chen & Hsu, the Third IEEE Conference on fuzzy Systems, pp254-259, 1994.

Effective Fuzzy Logic Approach to Image Enhancement, Xhao Li, Cheng, The International Society for Optical Engineering, Vol.2094, No.I, pp244-251, 1993.

Fuzzy Rule Based Approach for Edge Detection of Color Image, N.

Kamekura, R. Tashiro, H. Yokoyama, International Conference on Fuzzy Theory and Technology , Vol.2, pp67-69, 1993.

Image Processing Using Fuzzy Clustering Algorithms, Maged S. Riad, The university of Wisconsin-Milwaukee Master thesis, 1995

Image Processing Analysis and Machine Vision, M. Sonka, V. Hlavac and R. Boyle, Chapman & Hall, Cambridge, UK, 1993.

Edge Detection and Image Enhancement Using Neuron-like Networks and Fuzzy Rules, Woon-Tack Woo, International Neural Network Society AnnualMeeting, Vol.1, pp 1-738-1-742, 1994.156

C.C. Leung, F.H.Y. Chan, K.Y. Zee, P.C.K. Kwok, "Compensation of bending errors in Intra-oral Radiographs using Block-by-Block Image Scaling", IEEE Trans. On Biomedical Engineering. (In manuscript).

C.C. Leung, P.C.K. Kwok, K.Y. Zee, F.H.Y. Chan, and S.T.F. Lo, "Minimizing the bending error in Intra-oral Radiographs using Point-byPoint Interpolation with image scaling", Proceedings of the EMBEC'99, Part II, pp.1050-1051, Nov. 1999. Vienna.

W.F. Chen, X.Q. Lu, J.J. Chen, and G.X. Wu, "A new algorithm of edge detection for color image: Generalized fuzzy operator", Science in China (Series A), Vol.38, No.3, pp.468-473, 1998.

C.C. Leung, F.H.Y. Chan, W.F. Chen, P.C.K. Kwok and K.Y. Lam, "Thyroid Cancer Cells Boundary Location by a Fuzzy Edge Detection Method" ICPR'2000, Sept. 2000.

Kuo, R. J.: A robotic die polishing system through fuzzy neural networks, Comput. Industry 32(3) (1997), 273–280.

Tizhoosh H.R., "Fast fuzzy edge detection", Proceedings of Fuzzy Information Processing Society, 2002, pp. 239-242.

Lin, C. T. and Lee, S. G.: Reinforcement structure/parameter learning for neural network based fuzzy logic systems, IEEE Trans. Fuzzy Systems 2(1) (1994), 46–63.

Ayman A. Aly, H. Ohuchi and A. Abo-Ismael, "Fuzzy Model Reference Learning Control of 6-Axis Motion Base Manipulator", 7th IEEE International

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