AN EDGE DETECTION METHOD DEVELOPED FOR OBJECT RECOGNITION

İbrahim TÜRKOĞLU, Ahmet ARSLAN*, Muammer GÖKBULUT

E.mail : iturkoglu@firat.edu.tr

Fırat University Engineering Faculty Computer Department,
** Fırat University Technical Education Faculty Electronics-Computer Department, 23119 Elazığ/TURKEY

Abstract- What is desired in the detection of edges of an object is to evaluate the information included in the image of the object, and to eliminate the unnecessary information causing time loses. Edge detecting is one of the most fundamental subject of image analysis. In image analysis and classification of objects the edge detecting has become very interesting and popular.

In this study, using a new developed method the lines resembling boundaries of an object can be obtained as single lines. This algorithm will facilitate the object recognition processes.

Keywords- Object recognition, characteristic vector, edge detection, feature determination.

1. INTRODUCTION

Edge detecting plays an important role in the object recognition, we can explain it as follows : Human seeing system looks at the objects first, during the recognition period. When we apply this approach to the artificial seeing systems, it is essential to trace the edge of the object effectively to reach a good definition. In another word the edge detecting plays an important role in defining the edge too. Many images do not include concrete objects and to understand these objects depends on their structural features. The detection of these features depends on edge detecting [1].

The definition of the edge point has an important place in the interpretation of edge detection. The edge of an object is related to the change in the surface density of the object. An edge can be defined as the intersection between two homogenous area with different contrasts. This definition can be considered as the local variation of the contrast level of an edge on the screen. The performance of the edge detectors depends on their distinguish on the edge point [2].

Edge detecting algorithms are expected to achieve a very high success rate besides realising a rapid, two dimensional seeing process in automation systems. The most important thing is to be independent of the changes in the dimensions, brightness, place and posture. In addition there must not be any information loss during image processing. On the other hand, whole image processing takes a very long time. There fore by detecting only the edge of the objects, desired quickness and performance can be achieved [3].

We had stated above that the most important information was the edges of the object in object recognition process. The desired result in edge detection algorithms is to find the thinner edge track in the width of a point, which occupies the least area in the memory without any information loss. Thus object recognition can be done faster and also the data base for the recognition can be created easier [4].

There are other edge detection algorithms used in image analysis [5,6,7]. Two of then are Prewitt Edge Detection and Sobel Edge Detection Methods[8]. In none of them the width of the edges is not as thick as a point. Therefore, the detection is more time consuming since the definition is done by more than one point. In this study, the algorithm developed by us provides the recognition to be completed in shorter times.

2. EDGE DETECTING METHOD

In the new developed method, the lines resembling boundaries of an object can be obtained as single lines. The boundaries of the objects can be determined by applying the following edge detecting algorithm to the image of the numerical and two-coloured object, (for instance the base is white and the object is black) just as desired.

The algorithm determines whether the edge belongs to the object by interpreting all the points of the object comparing with the adjacent points. In fig.1.a. a point n_5 of the object and the adjacent points;

$n_1, n_2, n_3, n_4, n_5, n_6, n_7, n_8, n_9$

are shown.

n_1	n_2	n_3
n_4	n_5	n_6
n_7	n_8	n_9

(a)

0	1	0
1	n_5	1
0	1	0

(b)

Fig.1. a) The neighbours of n_5 point,
b) The edge detection template developed.

In numerical image, if the point belongs to the object considered, it is given a "1" value if not "0". In doing so, the template in fig.1.b. is applied to all points and neighbouring points. For determining whether the point belongs to the edge of the object. We can obtain this edge detection template with the classical yes/no logic as following.

$$O = n_2 \wedge n_4 \wedge n_6 \wedge n_8 \quad \text{..... (1)}$$

If the result of the statement above is "0". It is understood that n_5 remains as "1". If the result is "1" then n_5 is not the point of the edge and its value is "0".

The objects in fig.2.a. have been entered into the algorithm developed as input and the objects the edge of which is defined in single points or dots have been obtained as output in fig.2.b.

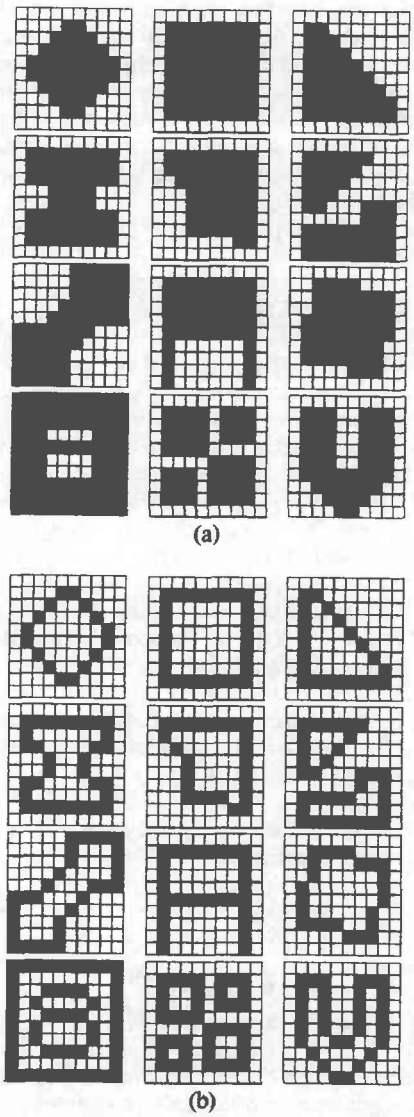

Fig.2. Edge detection processing.

3. CONCLUSION

There must be two important properties in edge detection algorithms according to the researchers [9]. These are;

- The result of edge detection must be direction independent. In another word, the edge information obtained must remain same even if the object changes direction.
- The width of the line detected must be as the same of a point's.

In the edge detection process developed, the process was based on the numerical image of the object and the algorithm was depended on this bases. A real-time solution can be obtained by adding our algorithm into the numerical image inputted to the system as a numerical filter. In addition the new algorithm has the two properties mentioned above, provide a great deal time saving in object recognition.

4. REFERENCES

[1] F., ve C.H. Bağcıoğulları, A Edge detection algorithm developed for object recognition system, *The Symposium of 2. Signal Processing and Applications*, s.47-52, 1994.

[2] S. Banks, *Signal Processing, Image Processing and Pattern Recognition.* Sheffield University, 1990.

[3] H. Uzunalioğlu, *Model-Based Recognition of Polyhedral Objects*, Master Thesis, ODTÜ *Science Institute*, 1992.

[4] R.O. Duda and P.E. Hart, *Pattern Classification and Scene Analysis.* Stanford Research Institute, 1989.

[5] D. H. Ballard, C. M. Brown, *Computer Vision*, Prentice Hall, 1982.

[6] R. C. Gonzalez, P. Wintz, *Digital Image Processing*, Addison-Wesley, 1987.

[7] A. K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall, 1989.

[8] P. Ioannis, Digital Image Processing Algorithms, Prentice hall international series in signal processing, 1993.

[9] K. Marefat, Geometric reasoning for recognition of 3-D object feature, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, vol.12, pp.950-964, 1990.