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Edge detection by combination of morphological operators with different edge detection operators

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Abstract

Edge detection plays a important role in image analysis. It is used to detect the different edges in the images. By using the combination of different morphological operators in the proposed method like erosion, dilation with the different edge operators like Robert ,prewitt, sobel, log and canny to find the edges by using the structure element. The fine edges in different direction can be detected by this process efficiently. The experimental results are showed to compare this method with other different edge detection operators.
Keywords- edge detection, morphological operators, structure elements.

1. Introduction

Edge detection is a important technique in the image analysis. Different methods are there to find the edge detection like mathematical morphology and different differential edge detection operators like Robert, prewitt, sobel etc. The symmetrical and single structure element can find the edges in one direction. Structure elements are of different shapes like disc, diamond, criss cross etc. they are find the edges in particular direction. This paper follow a algorithm on the same concept to find the edges by this method and compare with the other edge detection operators.

2. Morphological operators

Morphological operators often take a binary image or grayscale image and a structuring element as input and combine them using a operator (AND, OR) or (MAX,MIN). They process objects in the input image based on characteristics of its shape, which are encoded in the structuring element. The four basic operations are

erosion , dilation ,opening and closing.

2.1 Erosion

The erosion of a binary image *A* by a structuring element *s* (denoted $A \ominus s$) produces a new binary image $d = A \ominus s$ with ones in all locations (*x*,*y*) of a structuring element's origin at which that structuring element *s* fits the input image *f*, i.e. *d(x,y)* = 1 is *s* fits *A* and 0 otherwise, repeating for all pixel coordinates (*x*,*y*). For grayscale images the erosion of A by a flat structuring element S at any location (x, y) is defined as the minimum value of the image in the region coincident with b when the origin of S is at (x, y).

2.2 Dilation

he dilation of an image *A* by a structuring element *s* (denoted $A \oplus s$) produces a new binary image $d = A \oplus s$ with ones in all locations (*x*,*y*) of a structuring element's orogin at which that structuring element *s* hits the the input image *A*, i.e. *d(x,y)* = 1 if *s* hits *A*and 0 otherwise, repeating for all pixel coordinates (*x*,*y*).For grayscale images the dilation of A by a flat structuring element S at any location (x, y) is defined as the maximum value of the image in the region coincident with b when the origin of b is at (x, y).

2.3Opening

The **opening** of an image f by a structuring element *s* (denoted by f *s*) is an erosion followed by a dilation:

$$f \circ s = (f \ominus s) \oplus s$$

Opening is so called because it can open up a gap between objects connected by a thin bridge of pixels. Opening generally smoothes the contour of an object.

2.4Closing

The **closing** of an image f by a structuring element *s* (denoted by $f \bullet s$) is a dilation followed by an erosion.

$$f \bullet s = (f \oplus s) \ominus s$$

Closing is so called because it can fill holes in the regions while keeping the initial region sizes.

Structuring elements- the structuring element is sized n×n and has its origin at the center pixel. It is shifted over the image and at each pixel of the image and its elements are compared with the set of the underlying pixels. It is typically used in morphological operations, such as dilation, erosion, opening, and closing, as well as the hit-or-miss transform. A morphological operator is therefore defined by its structuring element and the applied set operator.

In this paper we used the erosion and dilation with the combination of different edge detection operators. The other operators that are combine with morphology are-

a) Robert operator
b) Prewitt operator

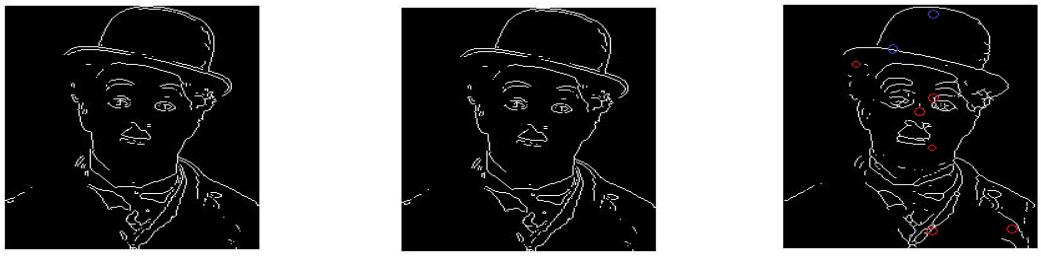
c) Sobel operator
d) Log operator
e) Canny method

3. Results and its analysis

The result of different combination of edge detection operators with dilation and erosion are shown below-

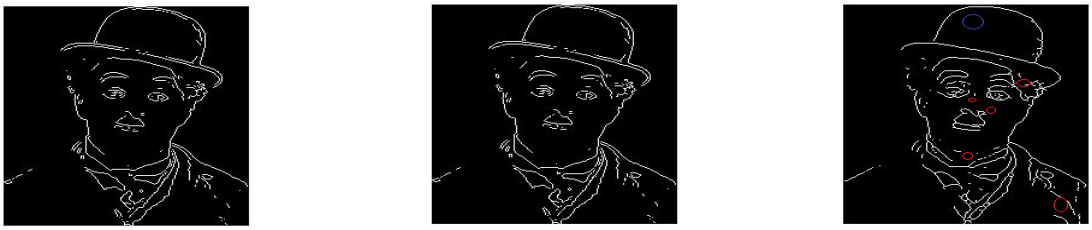
(a) (b) (c)

Fig 1) a) Edge detected by Robert b)Edge detected by Robert with dilation c)Edge detected by Robert with erosion



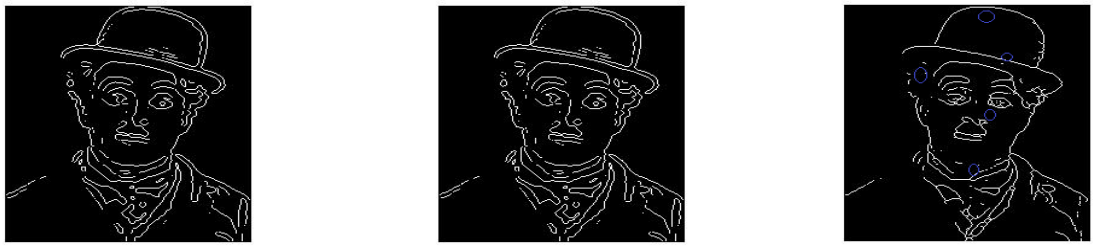
(a) (b) (c)

Fig 2) a) Edge detected by Prewitt b)Edge detected by Prewitt with dilation c)Edge detected by Prewitt with erosion



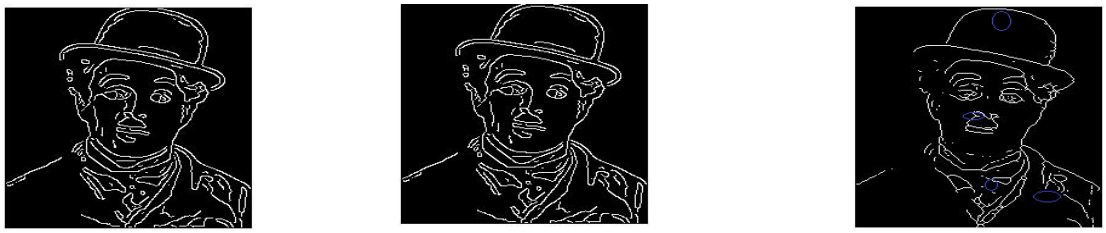
(a) (b) (c)

Fig 3) a) Edge detected by Sobel b)Edge detected by Sobel with dilation c)Edge detected by Sobel with erosion



(a) (b) (c)

Fig 4) a) Edge detected by Log b)Edge detected by Log with dilation c)Edge detected by Log with erosion



(a) (b) (c)

Fig 5) a) Edge detected by canny b)Edge detected by canny with dilation c)Edge detected by canny with erosion

In fig 1 sobel operator with erosion gives the better result than other two it find the different other edges that are missing in sobel operator and sobel with dilation. Similarly in fig 2 and fig 3 operator with erosion gives the better result but we can see in fig 4 and fig 5 that different edges are absent in result of operator with erosion but result of operator with dilation have the same edges like edge detected by log and canny respectively.

4. Conclusion

This method implies that the first derivative operator of edge detection like Robert, Prewitt , Sobel gives the better resultant edges with the combination of morphology. So the morphological operators like erosion and dilation are used efficiently with edge detection operator to find the different edges.

5. References

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