

Edge Detection Methods: A Comparative Study

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Abstract—In this paper we have done the analysis of different types of Edge Detection Methods. Edge detection refers to the process of identifying and locating sharp discontinuities in an image. The discontinuities are abrupt changes in pixel intensity which characterize boundaries of objects in a scene. Most of them are performing well in different conditions. As the Edge Detection methods are useful in defining the boundaries of the images, it makes them useful in medical image processing, face recognition, automatic number plate recognition etc.

1. INTRODUCTION

Edge detection [6-9] is an important tool which is providing the important information related to the shape, colour, size etc. To find out the true edges to get the better results from the matching process. That's why it is necessary to take the edge detector that fit best to the application. One of the important applications of Edge Detection is in Face recognition [1, 4]. Face recognition has a wide variety of applications such as in identity authentication, access control and surveillance. There has been a lot of research on face recognition over the past few years. They have mainly dealt with different aspects of face recognition. Algorithms have been proposed to recognize faces beyond variations in viewpoint, illumination, pose and expression. This has led to increased and sophisticated techniques for face recognition. Also in Medical Image Processing [2-3] edge detection is used for detecting the boundaries. Another use of Edge Detection Method is in Automatic Number Plate Recognition (ANPR) where outer boundary of the Numbers can be easily found out.

2. VARIOUS EDGE DETECTION TECHNIQUES

1. Prewitt operators: In this method 3x3 kernels is used to convolve with the original image to calculate approximations of the derivative – one for horizontal change and one for vertical. Prewitt is relatively inexpensive in terms of computations. Moreover it is relatively easier than other edge detection techniques. The disadvantage of Prewitt operator is that the gradient approximation produced by is relatively crude particularly for high frequency variations in the image. One other drawback of this method is that it produces slightly noisy results.

2. Sobel Operators : The sobel-Feldman operators[3,5] convolves the image with a small ,separable and integer valued filter in horizontal and vertical direction. It also uses 3x3 kernels. The benefit of this method is that it detects edges and their orientation. Also it is simple method. But the Sobel operator is sensitive to noise and inaccurate as well.
3. Robert Operators: The idea behind Robert operator is to approximate the gradient of an image through discrete differentiation which is achieved by the sum of squares of differences between diagonally adjacent pixels. Robert Operators' kernel is small and contains only integers. This operation has one of the most appealing aspect that is its simplicity. Like Sobel operator it is also sensitive to noise. Moreover its response is towards some of the edges only.
4. Canny Edge Detection: The input is provided in the form of grey scale image and then it produces the output of an image which is showing the positions of tracked intensity discontinuities. The Canny operator was designed to be an optimal edge detector .It is taking an input as a grey scale image and produces the output of an image showing the positions of tracked intensity discontinuities. Canny Operator is the most widely used edge detection method in the industry. This is due to the fact that it detects edges more efficiently even in noisy images and shows road features. Thus it shows improved signal to noise ratio. The major disadvantage of this is that it is the most complicated edge detection [7-9] method. Also it is very time consuming.

3. CONCLUSION

As discussed above these techniques are widely used. Each one of the methods is having their own advantages and disadvantages. According to the suitability they can be used in various applications as an intermediate step to get the boundary of the image.

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