Chapter 4
A Study on Evaluation and Analysis of Edge Detection Operators

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ABSTRACT

One of the key stages in both image processing and computer vision is edge detection. For analysis and measurement of several fundamental attributes of an object or set of objects in an image, such as area, perimeter, and form, correct identification of the edges of the objects in the image is crucial. The edge detection operators employed in image processing must therefore be thoroughly understood. In this chapter, fundamental theories and comparative assessments of several edge detection operators are discussed along with a proposed improved contour detection scheme for better performance measurement. The technique has been used to process a number of digital photos, and improved performance in terms of contour detection has been attained.

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INTRODUCTION

Digital images are a two dimensional light intensity function obtained by a sampling procedure, which is usually referred to as discretization, which transforms the two-dimensional (2-D) continuous spatial signal $f(x,y)$ into the two-dimensional (2-D) discrete, digital image $f(m,n)$. This image represents the response of some sensor (or simply a value of some interest) at a series of fixed positions ($m = 1, 2,..., M;$ $n = 1, 2,..., N$) . The indices m and n, respectively, represent the image's rows and columns. The individual picture elements, or pixels, of the image. $f(m, n)$ denotes the response of the pixel located at the *mth* row and *nth* column starting from a top-left picture origin. There are several imaging systems that allow the use of different image sources and the column-row convention. The size of the 2-D pixel grid and the amount of data saved for each individual picture pixel affect the image's spatial resolution and colour quantization. The resolution of an image determines how large or representational it can be. The following three measures can be used to gauge the sharpness of a camera.

Dimensional Resolution

The row column dimensions (m by n) of the image determine the amount of pixels required to fill the visual space that the image captures. The sampling of the visual signal is related to what is commonly known as the pixel or digital resolution of the image. It is commonly referred to by the acronym m n (A. Mahmoud, et al., 2016).

Temporal Resolution

This is the total number of images that were collected over a predetermined amount of time in a continuous capture system like video. A typical unit of measurement is frames per second (fps), which describes a single image in a video frame (El Shair, et al., 2022).

Bit Resolution

It relates to the quantization of the image data and indicates the range of intensity/ color values that a pixel may have. For example, a binary image only has the two colours black or white. In contrast, a grey-scale image typically has 256 discrete grey levels, ranging from black to white, and a colour image can have any number of hues, depending on the colour space used. In this context, the term "bit resolution" refers to the number of binary bits that are used to store data at a certain quantization level, such as "binary," which is defined as 2 bits, "grayscale," which is defined as 8

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