Edge Detection in Images Using Sobel and Canny Filters

Authors: Ian Amoedo, Maria Mello, Larissa Nobrega, Carolina Cruz,
Fernanda Moyses, Bruno Pilão and Giovanna Amaral

Abstract

This work proposes a study on edge detection in images using classical Computer Vision filters. The Sobel and Canny filters were applied to an image of a soccer ball after a smoothing step with a Gaussian filter. The comparative analysis between the methods made it possible to observe differences in the precision of the extracted edges, contributing to the understanding of the characteristics of each approach.

1   Introduction

Edge detection is an essential step in various computer vision systems, as it enables object segmentation and pattern recognition. Among the most widely used techniques are the Sobel and Canny filters, each with its own advantages and limitations. This study aims to compare the results obtained by these filters on a real image.

2   System Description and Problem Addressed

The developed system takes a grayscale image as input and outputs the extracted edge representation. The addressed problem is to effectively identify the image edges, eliminating noise and preserving relevant information.

3   Proposed Method (Solution)

Initially, the image was loaded in grayscale. To reduce noise, a Gaussian filter was applied. Then, the following edge detection methods were used:

- **Sobel**: applied on the X and Y axes, followed by the calculation of the gradient magnitude.

- **Canny**: using thresholds 30 and 100, followed by binary thresholding to better highlight the edges.

The implementation was done in Python using the OpenCV and Matplotlib libraries.

4   Results

The resulting figures showed that the Sobel filter extracted smoother and more detailed edges, especially in regions with gradual intensity variation. On the other hand, the Canny filter demonstrated greater precision and less noise, being effective in highlighting main contours. Both methods proved to be suitable depending on the application goal.
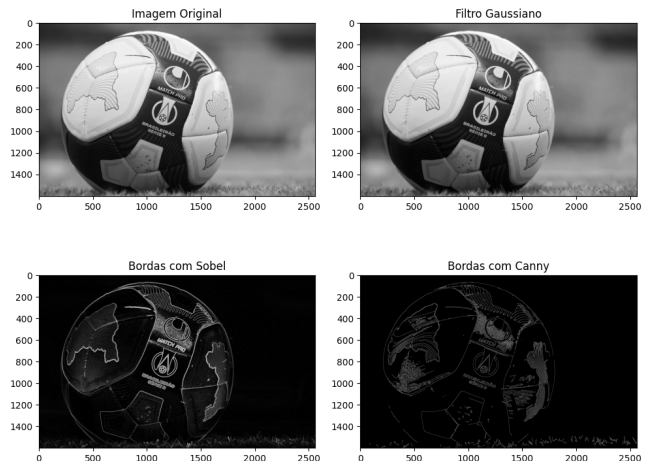

Figure 1: Top: Original Image and Gaussian Filter. Bottom: Edges detected using Sobel and Canny filters.

5   Conclusion

It is concluded that both Sobel and Canny are effective for edge detection, with complementary characteristics. Sobel may be more appropriate when a richer representation of contours is desired, while Canny excels in applications requiring greater precision and noise removal.

References

[1] GONZALEZ, R. C.; WOODS, R. E. *Digital Image Processing*. Pearson, 2018.

[2] OpenCV Documentation. Available at: `https://docs.opencv.org`

[3] Wikipedia. Edge Detection. Available at: `https://en.wikipedia.org/wiki/Edge_detection`