

Eight Direction Sobel Edge's Brain Tumor Detection

Article Review

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Abstract

The hereby document aims to summarize the work done by (Remya Ajai A Sa, 2022), a research conducted on a novel method to detect brain tumors in MRI images and to propose a prototype that reproduces the said method.

1 Introduction

The article starts by defining a brain tumor, its main causes, and the categories under which it can be classified. The tumor can be classified into four grades I,II,III, and IV (Cf. Figure 1).

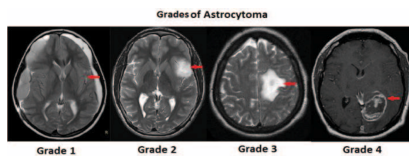


Figure 1: Brain Tumor Grades (Priya, 2016).

This highlights the necessity of implementing highly precise algorithm to distinguish between the aforementioned grades, not only that, the algorithm should manage to detect tumors at a very early stage, to start the treatment of the tumor. Which brings to as why this paper (Remya Ajai A Sa, 2022) has been written.

Indeed, the paper introduces their emphasis on edge detection techniques, the authors describe the basic principle of the algorithm and states that the 8-Sobel algorithm "has been shown to improve the hardware performance better than the other techniques" (Remya Ajai A Sa, 2022), page 488. The article pursues its analysis of methods used to detect tumors by review the literature on that topic.

2 Algorithm

The Sobel operator as described by (Remya Ajai A Sa, 2022) is a "discrete first-order difference operator. It is used to calculate the image luminance function.", this operator takes into consideration both the X and Y directions to detect edges.

However, the 8-Sobel edge detector takes into consideration eight different directions. It is deemed as an improvement since it takes into account several axes of variations. and its Kernel is defined by Figure 2.

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Figure 2: 8-Sobel Edge Detection Matrices (Remya Ajai A Sa, 2022).

3 Prototype

The work has been implemented on a Jupiter notebook. The code will :

- Retrieve the MRI images from a given folder in a dataset found on Kaggle (Kag)
- Create an output folder in which it will store the processed images
- Go through each image via a for loop

- Filter each image using a Gaussian blurring effect (Kernel's size=3, standard deviation=1)
- Convolve each image with each kernel producing eight gradients that will be stored in an array
- Compute the norm of the gradients by calculating a cumulative sum of squared gradient values

References

- Brain tumor MRI dataset. Available on <https://www.kaggle.com/datasets/masoudnickparvar/brain-tumor-mri-dataset>.
- Mohana Priya. 2016. [Brain tumor types and grades classification based on statistical feature set using support vector machine](#). *2016 10th International Conference on Intelligent Systems and Control (ISCO)*, pages 1–8.
- Sundararaman Gopalan Remya Ajai A Sa. 2022. Comparative Analysis of Eight Direction Sobel Edge Detection Algorithm for Brain Tumor MRI Images. *ScienceDirect*, pages 487–'494'.