Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 93 (2016) 431 – 438

Procedia Computer Science

6th International Conference On Advances In Computing & Communications, ICACC 2016, 6-8 September 2016, Cochin, India

A Novel Approach To Improve Sobel Edge Detector

Neha Mathur[a,*] *,Shruti Mathur*[b] *,Divya Mathur*[c]

[a]*Assistant Professor, Poornima College of Engineering,Jaipur - 303905, Rajasthan, India*
[b]*Assistant Professor, JECRC University, Jaipur - 303905, Rajasthan, India*
[c]*Assistant Professor, JECRC University, Jaipur - 303905, Rajasthan, India*

Abstract

An improved edge detection algorithm based on k-means clustering approach. Being a fundamental tool in image processing, edge detection aims to identify the points in an image at which image brightness changes sharply or regularly. In Medical Science, edge detection is very useful, such as in segmentation of MRI image. Magnetic resonance imaging (MRI) produces a detailed image of any human body part, by using the natural magnetic properties of the body tissues. Since body tissues contain hydrogen atoms, which made to emit radio signals. These radio signals are then detected by a scanner. Magnetic Resonance imaging is a medical test used to diagnose tumors of the brain on the basis of high quality images produced by it. In this paper edge detection is made to determine the location of a tumor. The edge detection technique presented in this paper uses k-means clustering approach to generate the initial groups. These groups are then input to the mamdani fuzzy inference system, which generates different threshold parameters. When these parameters are fed into the classical sobel edge detector, it is found that images obtained are more enhanced and provide exact location of a tumor in a brain.

Peer-review under responsibility of the Organizing Committee of ICACC 2016

Keywords: Fuzzy Inference system (FIS), Magnetic Resonance Imaging (MRI).

1. Introduction

In the field of medical image processing, edge detection is an important technique useful for extracting images of part of human body. The edge detected image of any body part help radiologist in diagnoses and treatment. Medical imaging consists of techniques which are used in generating images of any part of human body to either diagnosing the diseases or to study normal anatomy and function [1]. Medical Resonance Imaging (MRI) used in radiology, is one of the medical imaging technique which uses the magnetic field generated from the hydrogen atoms of the

Peer-review under responsibility of the Organizing Committee of ICACC 2016
doi:10.1016/j.procs.2016.07.230

body tissues [2]. This magnetic field emits radio signals which are then detected by the scanner used to create high quality images of the organs and tissues inside human body. The examination of images produced by MRI scan is made by various edge detectors [3].

The performance enhancement of different edge detectors based on retrieval of correct information is a key research issue in most of the countries of the world due to development in medical equipment generating digital images. It has been observed that the choice of input parameters [4] like threshold parameter greatly decided the performance of most of the edge detectors [5], [6] such as Canny, Rothwell, Iverson et.al.

* Corresponding author: Tel.: +91-9460553722;
*E-mail address:*nmdoll@gmail.com

In this paper, we are enhancing the edge detection capability of the Sobel edge detector by using a fuzzy edge detection approach with k-means clustering algorithm. MRI images of a human brain are taken as an input image. Previous approaches involve the use of convex hull algorithm [7], [8], [9]. These algorithms in order to find out the next valley point in the image histogram [4], [10] depends on the different sections of the image histogram [6], which makes them restricted to some specific type of images.

The paper is organized as follows: Section II describes the Sobel edge detector. Section III describes the mamdani fuzzy inference system. Section IV is about threshold detection using k-means clustering approach using fuzzy logic. These threshold values then made input to the Sobel edge detector. Section V shows simulation results and section VI is conclusions.

2. THE SOBEL EDGE DETECTOR

The Sobel edge detection method is proposed by Sobel in 1970 [11]. The Sobel operator is the magnitude of the gradient computed by

$$M = \sqrt{s_x^2 + s_y^2}, \tag{1}$$

Where the partial derivative is computed by

$$s_x = (a_2 + ca_3 + a_4) - (a_0 + ca_7 + a_6) \tag{2}$$

$$s_y = (a_0 + ca_1 + a_2) - (a_6 + ca_5 + a_4) \tag{3}$$

With a constant C=2

Like the other gradient operators, S_x and S_y can be implemented using convolution masks:

$$s_x = \begin{array}{|c|c|c|}\hline -1 & 0 & 1 \\ \hline -2 & 0 & 2 \\ \hline -1 & 0 & 1 \\ \hline \end{array} \quad s_y = \begin{array}{|c|c|c|}\hline 1 & 2 & 1 \\ \hline 0 & 0 & 0 \\ \hline -1 & -2 & -1 \\ \hline \end{array} \tag{4}$$

The Sobel edge detector gives more emphasis on the image pixels that are closer to the center of the mask. This operatorprecedes the edges where the gradient is highest in grayscale images, this method also used in finding the