

Brain Tumor Detection and Classification in Magnetic Resonance Imaging (MRI) using Region Growing, Fuzzy Symmetric Measure, and Artificial Neural Network Backpropagation

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Abstract

Brain tumor is one type of malignant tumors that occurs because there is an abnormal and uncontrolled cell division activity. There are several ways to diagnose brain tumors, for example use MRI images. Through the MRI images, the radiologist can see the brain anatomy without performing surgery. However, this process is still done manually and could lead to misdiagnose. In addition, the different characteristics of brain tumor makes the diagnose more difficult. Therefore, we need a system of Computer-Aided Diagnostic (CAD) that will help radiologist in identifying brain tumors.

In general, the CAD system consists of two major processes, namely image segmentation and feature extraction and classification. One example of segmentation is Region Growing that will classify the pixels based on certain criteria. However, the manual selection of seed point is a drawback of this method. The examples of feature extraction methods are Fuzzy Symmetric Measure (FSM), and First and Second Order Statistics. FSM values can be used to calculate the symmetry of the image brain, while the first and second order to represent feature in the image. As for the classification process, Artificial Neural Network Backpropagation method is widely used for its ability to resolve nonlinear dan complex problems.

This research implements CAD system that uses Region Growing, Symmetric Fuzzy Measure, and Backpropagation Neural Network for detecting and classifying the brain tumors. In addition, the modification of converging square is conducted to select a seed point automatically. After testing, the system generates a 100% accuracy and BER is 0 in the case of distinguishing between normal and tumor brain. Besides, the average accuracy in classifying the types of brain tumors achieved 89.72% , the BER 0.1 for training data, and the average accuracy of 84.44%, BER 0.16 for the testing data.

Index Terms

e-commerce, Collaborative Analysis of Requirement and Design, User Centered Design, Information

I. INTRODUCTION

A. Background

The development of technology in processing digital image and artificial intelligence hold an important role in medical field. The use of Magnetic Resonance Imaging (MRI) by radiologist for identifying anatomy structure and diagnosing brain tumor is one of the examples [2]. Brain tumor is one type of malignant tumors that occurs because there is an abnormal and uncontrolled cell division activity.

Through this MRI image, radiologist can diagnose brain tumor without doing surgery. However, the diagnosis is conducted manually based on the radiologist interpretation. Besides, this process is also considered as a tough work for its complex characteristic of brain tumor [3]. That is why; Computer Aided Diagnosis (CAD) is needed to assist the radiologist in diagnosing the MRI image of the brain.

Generally, CAD system consists of two large processes; image segmentation and image feature extraction and classification. Region growing is an example of the image segmentation method which is classifying the pixels based on certain criteria. However, the manual selection of seed point is considered as a drawback of this method.

Furthermore, the sample methods from the feature extraction are Fuzzy Symmetric Measure (FSM) and First and Second Order Statistics. FSM values can be used to calculate the symmetry of the image brain [4]. While the First and Second Order to represent feature image. As for the classification process, Artificial Neural Network Backpropagation (ANN) method is widely used for its ability to resolve nonlinear dan complex problems. However, ANN has a weakness in the problem of determining the values of the optimal parameters. There is no definitive guide to determine the best parameter values.