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Review on Patchmatch Based Tree-Seed Fuzzy Clustering for Ischemic Stroke Lesion Segmentation in Brain MR Images

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Abstract

Ischemic Stroke Lesion (ISL) arises when the artery of the brain gets blocked. The blood provisions nutrients and oxygen to the brain and take out carbon dioxide and other waste cells. In case an artery gets congested, the brain cells will not be able to function and will ultimately stop functioning. Nerve symptoms and symptoms of IS usually occur abruptly but can also be sometimes progressive in nature. Signs and symptoms vary based on the position of the occlusion and the flow. Atherosclerotic stroke is generally found in elders, and arises without symptoms in 80% of the cases. IS can be initiated by a variety of ailments, like contraction of the arteries head or neck region This is usually produced by atherosclerosis, deposition of cholesterol, or generation blood clots which arise as a consequence of rapid heartbeat, heart attack, damages in heart valve, or some other underlying origins, including drug overdose, severe blood vessel injury in the neck, or abnormal blood flow. MRI is extensively utilized to identify cerebral ischemia

Keywords: Patchmatch, Ischemic Stroke lesion, lesion segmentation

Introduction

Over the past few years, stroke has been among the top ten causes of death in Taiwan. Stroke symptoms belong to an emergency condition, the sooner the patient is treated, the more chance the patient recovers. However, the location of ischemic stroke in the CT image is not obvious, so the diagnosis need to rely on doctors to assess the image. The purpose of this paper is to develop an automated early ischemic stroke detection system using CNN deep learning algorithm. After entering the CT image of the brain, the system will begin image preprocessing to remove

the impossible area which is not the possible of the stroke area. Then we will select the patch images and use Data Augmentation method to increase the number of patch images. Finally, we will input the patch images into the convolutional neural network for training and testing. In this paper, we used 256 patch images to train and test a CNN module that it had the ability to recognize the ischemic stroke. From the experimental results, we can find

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that the accuracy of the proposed method is higher than 90%. It means that the method proposed in this paper can effectively assist the doctor to diagnose.

Globally, Ischemic stroke is the fore most roots of death &disability caused by blockage of the cerebro vascular system that prevents blood from reaching areas of the brain that is supplied directly from the blood vessels. Permanent brain damage can occur within minutes or hours based on the presence and nature of the collateral connections that supply with reduced flow of blood. In contrast to these dramatic changes, changes in tissues that is triggered by the secondary microbial effect last for weeks or months .

The lesion segmentation has gained high importance since the lesion size is one of the imperative factors for clinical trials. Nevertheless, the automatic classification and segmentation of lesion is not a minor task, since the lesion appearance and position depend on many important factors such as visual sites, vessel anatomy, communication and potentially possible underlying conditions due to existing stenosis. The existence of white matter (Leukoaraiosis) also affect precise segmentation.

Medical imaging procedures are used to obtain images of various regions of the human body for analyzing the condition and for further treatment. MRI is a scheme for getting comprehensive images of the interior organs, as well as the muscles of the brain &spinal cord. It is first utilized to picture body image and bodily functions.

Since the brain manages whole functions of the human body, the brain is considered to be one of the significant organs of the body. Several illnesses like infections, tumors, and strokes affect the brain. In addition, tumor brain may be a noncancerous or cancerous group or abnormal cell growth in the brain. Methods like MRI can be employed for detecting brain tumors. Lately, MRI scans have gained attention due to the requirement for a better evaluation of huge amounts of information .Obtaining brain samples and automated classification of brain cells from MRI scans is important both in medicine and in experimental studies of common and diseased brain tumors. The most significant step in the fabrication of medical imaging is segmentation, which separates the matters in the image for processing.

Medical imaging is very important in detecting brain tumors because they show different texture of the tissues and do not require surgery. Consequently, it is difficult to spot brain tumors without a medical imaging process. The two most commonly used medical imaging techniques are Computed Tomography (CT) and MRI. Both of these methods play a significant role & have an excessive impact on diagnosis .

MRI is a contemporary medical imaging system employed to identify and visualize internal details of the body. This technique utilizes central principles of Nuclear Magnetic Resonance (NMR)that was examined since the commencement of the twentieth century. MRI do not utilize X-rays, but have a great magnet that transmits radio waves to the body. Images are then displayed on a computer or on photos. MRI is very different than CT, which is very advantageous for neurological illnesses. The benefits of MRI than other imaging systems is

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the non-invasive nature, exceptional tissue contrast, flow sensitivity, versatility, and scattering.

Methodology

For the segmentation of ISL, we propose Patch Match based Tree-Seed Fuzzy Clustering (PM-TSFC). Fuzzy C-means (FCM) clustering is a typical clustering procedure in machine learning and pattern recognition. For proper segmentation of ISL, each pixel should be allotted to the nearest cluster. To do this, we employ FCM to minimize the weighted distance between pixels & cluster centers. Moreover, the inclusion of Tree Seed Optimization algorithm helps to find the nearest optimal cluster center. This makes the proposed PM-TSFC to segment ISL with greater accuracy.

Limitations

The process of segmenting an image into numerous divisions (collection of pixels) is termed as image segmentation. Typically image segmentation is utilized to detect objects within the image that produces a set of segments that completely cover the whole image. Here, the pixels within a region are identical with respect to certain characteristics such as intensity, color, and texture. Traditional image processing methods like clustering, graph cut and brain symmetry for lesion segmentation have been utilized to detect and segment ischemic injury. However, in various real situations, disputes such as overlapping intensities, poor contrast, and limited spatial resolution make segmentation a challenging task. Therefore, a robust, automated, and accurate lesion delineation is essential to segment the lesion and improve the diagnosis speed for further treatment.

Expected Outcome

The simulation will be conducted in MATLAB platform and is expected that the proposed PM-TSFC scheme outperforms the existing techniques. Evaluation metrics such as accuracy, recall, dice, precision, specificity etc. are used to relate the performance of the proposed approach with existing state-of the-art techniques. These metrics are obtained based on the number of True Positives (TP), True Negatives (TN), False Negatives (FN), and False Positives (FP).

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