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Usage of Brain Tumor Segmentation in MRI Images Using Intelligent Water Drops Algorithm

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Abstract
The image processing is the technique which processes the input image and generates required results. In this work, the technique is been proposed which is improvement in intelligent water drops algorithm to detect brain tumor. The MRI images are taken as input which will be given to IWD algorithm for tumor detection. In this work, improvement is been proposed which is based on SVM classifier. The output of IWD algorithm is given as input to SVM classifier which will classify the cancer and non-cancer cells from the MRI images. The proposed and existing techniques is been implemented in MATLAB and it is been analyzed that accuracy of detection is increased upto 20 percent and execution time is reduced to 1.5 seconds

KEYWORDS : IWD algorithm, Classifier, SVM classifier, Segmentation, Image restoration.

Introduction

Image processing is known as the enhancement of raw images gathered from day-to-day lives that are collected from any kind of sources like satellites, cameras, internet, etc. such data can be useful either for scientific results or for the criminal investigations [1]. By definition Image processing is computer imaging where application includes an individual in the visual circle. At the end of the day the image are to be analyzed and a followed up on by individuals. The three general stages that a wide range of data need to experience while utilizing digital strategy are pre-processing, enhancement, and display, information extraction. Various techniques are involved for a proper image processing [2]. The techniques have their own functionalities that help in extraction of data from the images. Segmentation subdivides an image into its fundamental regions or objects. The level of point of interest to which the subdivision is conveyed depends on the problem being solved. The image processing techniques like image restoration, image enhancement, image segmentation etc [3].

Brain tumor segmentation intends to separate the different tumor tissues, for example, dynamic cells, necrotic core, and edema from normal brain tissues of White Matter (WM), Gray Matter (GM), and Cerebrospinal Fluid (CSF) [4]. MRI based brain tumor segmentation studies are attracting increasingly attention lately due to non-invasive imaging and good soft tissue contrast of Magnetic Resonance Imaging (MRI) images [5]. Histogram thresholding and slicing techniques are utilized to segment the image. They might be connected specifically to an image, however can likewise be joined with pre-and post-processing techniques [6]. It is done through that limit values which are gotten from the histogram of those edges of the first image. The limit values are gotten from the edge detected image. Along these lines, if the edge detections are accurate then the edge as well is detected [7]. Segmentation through thresholding has fewer computations compared to different techniques. With the edge detection technique, detected edges in an image are assumed to speak to object boundaries, and used to identify these objects. An essential clustering algorithm i.e., K-means is utilized for segmentation as a part of textured images [8]. It clusters the related pixels to segment the image. Segmentation is done through feature clustering and there it will be changed by shading components. Segmentation is likewise absolutely depending on the characteristics of the image. Features are considered for segmentation. Distinction in the power and shading values are utilized for segmentation. For segmentation of shading image they utilize Fuzzy Clustering technique, which iteratively generates shading clusters utilizing Fuzzy membership function as a part of shading space regarding to

image space. The technique is fruitful in identifying the shading region. Firstly, a brief prologue to brain tumors and imaging modalities of brain tumors is given [9]. At that point, the preprocessing operations and the cutting edge methods of MRI-based brain tumor segmentation are presented. Additionally, the evaluation and validation of the results of MRI-based brain tumor segmentation are talked about. Finally, an objective appraisal is displayed and future developments and trends are addressed for MRI-based brain tumor segmentation methods [10].

Literature Review

Poomimadevi CS et.al, 2016 proposed in this paper [11] that Tuberculosis is a serious problem and is a rapidly spreading disease everywhere throughout the world. Accurate diagnosis is the way to controlling the disease. Traditional methods like tuberculin skin test (TST) and corrosive quick staining produce results that are inaccurate or take more opportunity to distinguish. This paper exhibits an automated way to deal with identify tuberculosis utilizing chest radiographs. The proposed technique is assessed by JSRT and MC Dataset. The technique looks at the global thresholding and active contour technique for image segmentation with proposed algorithm and found that the accuracy of the proposed strategy is 60% compared with active contour and global thresholding.

Kaoru Sakai, et.al, 2016 portrays in this paper [12] an assessment technique for detecting bonding defects in interfaces of stacked wafers that have complicated patterns. The detection of defects by conventional thresholding has gotten to be troublesome as a result of the complexity of the electronic component structure and the development of the packaging procedure. A test evaluation utilizing a bonded interface image of a MEMS wafer acquired from SAT demonstrated that one-pixel defects close to the complicated patterns got to be detectable.

Zhangfeng Li, et.al, 2016 proposed in this paper [13] a rotation parameter extraction technique based on temporal differencing and image edge detection from range-Doppler images is introduced in this letter. The proposed technique first detects the motion trail of the moving pixels brought on by the rotating parts in temporal differential range-Doppler images utilizing image edge detection. A Doppler-slow-time image is then generated from the edge pixels on the motion trail. Finally, the rotation parameters are extracted from the Doppler-slow-time image. The proposed strategy is simple, rapid, and practical. Computer simulations and trial results demonstrate its effectiveness regarding calculation time compared with existing methods.

Jigisha M. Patel, et.al, 2016 proposed in this paper [14] the Content Based Image retrieval (CBIR) is an important for retrieving the most visual relevant images from the expansive image database. The paper gives the overview of shading and texture feature extraction techniques like shading histogram, shading correlogram, shading co-occurrence matrix and tamura texture feature, steerable pyramid, wavelet transform, Gabor wavelet transform individually furthermore the comparative analysis of this techniques is appeared in the paper. From the comparison of these techniques, it can be demonstrated that the Gabor wavelet transform is utilized when there is necessity for productive discrimination of texture feature.

Yujie Liu, et.al, 2016 proposed in the paper [15] a novel calculation technique for personality based on the Chinese physiognomy. The proposed solution combines the ancient and the modem physiognomy to summarize the corresponding connection between the personality and facial feature and model the baseline to shape the face feature. The paper registers histogram of image via searching for the limit values to make a binary image in an adaptive way. The results images are divided into four areas, which are left eye area, right eye area, nose area and the mouth area. The simple line search can segment these areas effectively and search and locate the key points.

T V Sai Krishna et.al, 2016 proposed in this paper that segmenting multi-spectral remote sensor images, feature extraction and object grouping are the crucial steps that perform region-based segmentation rather than a pixel-based segmentation. In the main stage, remote sensing image is divided into spatial blocks by applying the filter technique. Test result demonstrates the proposed approach has better performance compared to the traditional segmentation techniques regarding time, noise and over segmentation. Exploratory result demonstrates the proposed approach has better performance compare to the traditional segmentation techniques regarding time, noise and over segmentation.

A.Vinothini, et.al, 2016 proposed in this paper [16], that the nucleus segmentation is the most important and tedious procedure in medical image analysis. The proposed strategy has three phases: preprocessing, h-maxima transformation based watershed segmentation and texture analysis. This can be resolved by texture analysis strategy. Where the texture demonstrates the nuclei from the non-nuclei based on the average characteristics prepared by them. In this way the non-nuclei can be recognized effectively by the texture analysis. Outputs got from the proposed strategy demonstrate that the false nucleus segmentation is identified much well than alternate nucleus identification techniques.

Intelligent Water Drops (IWD) Algorithm

Intelligent Water Drops algorithm (IWD) is inspired from natural rivers and is a population-based nature-inspired

streamlining procedure. This strategy could be connected in order to understand a vast number of improvement problems. The IWD finds good path to the rivers' destination in spite of a wide range of sorts of obstacles on their ways. A natural river frequently discovers good paths among plenty of conceivable paths in its ways from source to target. A good solution (path) could be found regarding the conditions of its surroundings to attain to its final destination which is frequently an ocean, see or a lake. The good solutions take after from actions and reactions happening among the water drops and the water drops with the riverbeds. In the path toward the final destination, several artificial water drops influence on the around environment as they travel through the river bed. This flowing toward the destination is brought on by the gravitational force of the earth. On the off chance that there are no obstacles/barriers in the water drops path, they would unmistakably take after a straight path toward the destination, which is certainly the shortest path from the source to the end. However, since in real world circumstance there are a ton of turns, twists and different sorts of obstacles in the river path, the real path might be accordingly different from the ideal one.

Each IWD algorithm is composed of two parts: a graph that assumes the part of distributed memory on which soils of different edges are preserved, and the moving part of the IWD algorithm, which is a few numbers of Intelligent Water Drops. These Intelligent Water Drops (IWDs) both compete and cooperate to discover better solutions and by changing soils of the graph, the paths to better solutions turn out to be more reachable. It is mentioned that the IWD-based algorithms need no less than two IWDs to work.

The IWD have been intended to imitate the prominent properties of the natural water drops that flow in the beds of rivers. By taking a gander at rivers in nature, we are astonished to see bunches of twists and turns along their paths. One thing that makes us believe is that why these twists have been made and is there any logic or intelligence behind them. The IWD algorithm is a step in the direction to show a few actions that happen in natural rivers and afterward to implement them in a form of an algorithm.

Proposed Work

We proposed a new problem solving algorithm called “Intelligent water drops” or IWD algorithm with MRI based brain tumor segmentation problem. One major goal of this method is to locate tumor from MRI in an efficient, accurate and reproducible way. Segmentation method has been applied according to the characteristics that allow distinguishing tumors from the normal brain tissues.

Brain tumor segmentation aims to separate the different tumor tissues such as active cells, necrotic core, and edema from normal brain tissues of White Matter (WM), Gray Matter (GM), and Cerebrospinal Fluid (CSF). MRI-based brain tumor segmentation studies are attracting more and more attention in recent years due to non-invasive imaging and good soft tissue contrast of Magnetic Resonance Imaging (MRI) images. With the development of almost two decades, the innovative approaches applying computer-aided techniques for segmenting brain tumor are becoming more and more mature and coming closer to routine clinical applications. The purpose of this is to provide a comprehensive overview for MRI-based brain tumor segmentation methods.

Experimental Results

In this work, proposed and existing techniques are implemented in MATLAB to analyze their performance. MATLAB is the tool which is used to perform complex mathematical computations and it has various inbuilt tool boxes.

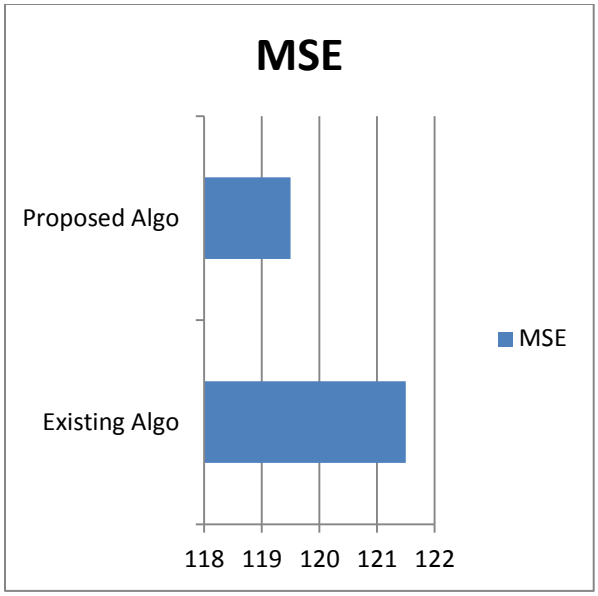

Fig 1: MSR comparison

As shown in the figure 1, proposed and existing algorithms are compared in terms of MSE values and it is been analyzed that MSE value of proposed algorithm is 121.5 and existing algorithm has 119.5.

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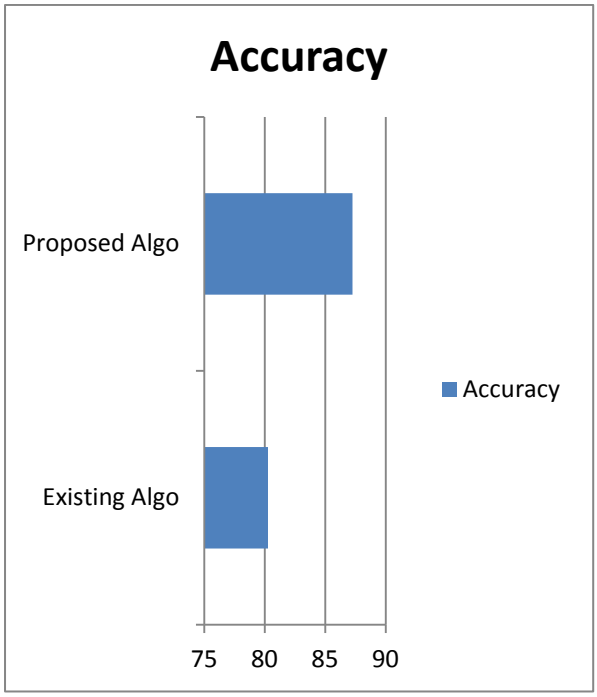

Fig 2: Accuracy Comparison

As shown in figure 2, the comparison is made between proposed and existing algorithms in terms of accuracy and it is been analyzed that accuracy of proposed algorithm is 87.26 percent and 80.67 percent accuracy is of existing algorithm.

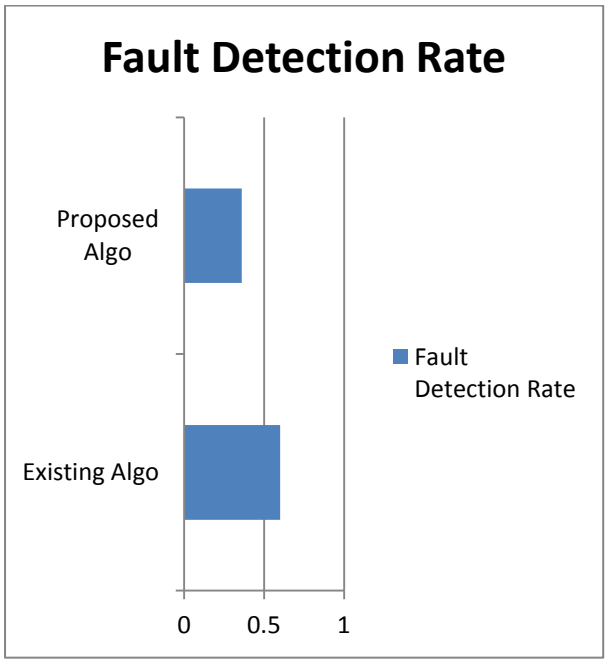

Fig 3: Fault Detection rate comparison

As shown in figure 3, the existing and proposed algorithm are compared in terms of fault detection rate and it is been analyzed that fault detection rate of existing algorithm is 0.60 and 0.36 is of proposed algorithm.

Conclusion

The brain tumor detection is the technique which detects cancer and non cancer cells from the MRI image which is given as input. In the existing IWD algorithm the whole input image is scanned and image which is dissimilar features are segmented differently according to their similarity. In this work, improvement is been proposed which is based on SVM classifier which is applied to classify the data of MRI images. The simulation is performed in MATLAB and it is been analyzed that accuracy is increased and execution time is reduced

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