

Brain tumor classification and diagnosis techniques

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Abstract

One of the leading causes of increased mortality in both children and adults is a brain tumor. Tumor is a severe issue that has taken over the usual force that controls growth. On MRI pictures, there are several techniques for classification and detecting a brain tumor region. We present background reviews of many proposed techniques for detecting brain tumors in this paper. There is a lot of literature on diagnosing and improving the accuracy of this type of brain tumor.

Keywords: Brain tumor; Diagnosing MRI images; Classification; Techniques

1. Introduction

A brain tumor is caused by abnormal brain cell growth. Nowadays, diagnosing a brain tumor is important. If a brain tumor is identified early on, it is more curable and treatable. The imaging modalities computed tomography (CT) and magnetic resonance imaging (MRI) are used to diagnose and treat brain tumors [1]. MRI images are commonly utilized for high-quality imaging, especially in brain scans, because they can quickly track a brain tumor. A digital representation of tissue features can be obtained at any tissue level using MRI. The MRI scanner's images are sliced, with the extra benefit of segmentation into both horizontal and vertical planes. These MRI scans can be used to easily identify, diagnose, and classify tumor parts in the brain [2].

The type of tissue involved in the tumor, its location in the brain, whether it is benign or has spread, and other factors are used to classify it [3]. several methods for identifying a brain tumor have been proposed in the last year. Different strategies for brain cancers are examined in this study, which aids researchers in selecting the most effective methods for detecting brain.

2. Literature Survey

There have been several research on brain tumor detection systems proposed. A summary of some of these investigations is provided below:

In this paper, it is proposed that Convolutional Neural Networks (CNN) classification be used for automated brain tumor diagnosis. The suggested method consists of six main components. Signal transfers from one layer to the next are regulated by the activation layer, and smoothing the convolution filter (i.e. subsampling) reduces its sensitivity. The neurons in the preceding layer are linked to every neuron in the next layer using rectified linear units (RELU), and a loss layer is added at the end of the training to offer feedback to the neural network. The precision is great, while the complexity is modest [2].

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In this paper, a hybrid method employing a genetic algorithm (GA) and a support vector machine (SVM) for categorizing tumor tissue in magnetic resonance imaging (MRI) images is given. The feature set of a wavelet-based texture is derived. To extract appropriate texture features from normal and malignant areas, the spatial gray level dependence approach is applied (SGLDM). The SVM classifier receives these features as input. GA is used to overcome a significant challenge in classification techniques: the selection of features. These ideal characteristics are used to categorize brain tissue as normal, benign, or cancerous. A set of brain tumor images is used to evaluate the algorithm's performance [3].

In this paper, for brain tumor segmentation and classification, the fuzzy based control theory was used. The FIS (Fuzzy Inference System) is a brain segmentation system. Using supervised categorization, a membership function for a fuzzy controller is developed. Despite the excellent performance, the accuracy is poor [4].

In this paper, to distinguish between tumor and non-tumor brain regions, fuzzy C-Means (FCM) segmentation is performed. A multilevel Discrete Wavelet Transform is frequently used to extract wavelet features (DWT). Finally, to accurately classify brain tumors, a Deep Neural Network (DNN) is used. This method is compared to other classification methodologies such as KNN, Linear Discriminant Analysis (LDA), and Sequential Minimal Optimization (SMO). The accuracy rate of DNN-based brain tumor categorization was 96.97 percent in the study. The complexity, on the other hand, is high, and the performance is low [5].

In this paper, proposed that we focus on classifying mangoes based on their shape. They first extract the mango images' area of interest, then calculate the height and width of the various mango species extracted from the images. Principal component analysis, linear discriminant analysis, and nonlinear discriminant approaches are used to analyze training data using ROI [6].

In this paper, the new Cellular Automata (CA) technique is used to compare a seeded tumor segmentation method to a graph segmentation method based on graph cuts. For accurate brain tumor segmentation, seed selection and Volume of Interest (VOI) are computed. Tumor cut segmentation is also supported by this study. The degree of difficulty is little. The precision, however, is low [7].

In this paper, DWT and probabilistic neural networks were used to identify and classify brain MRI images. MRI images include a variety of imaging techniques for examining the interior cells of the human brain. They first employ morphological processes to segment the brain tumor image, then utilize DWT to extract features from the segmented tumor. The features are then input into the PNN classifier, which is a technology for rapid and accurate brain tumor diagnosis when compared to the manual detection technique used by clinical experts [8].

In this paper, the purpose of the research study is to use image processing to segment tumorous tissue from brain MRI images. Image Analysis, Correction, Sensitivity, Sensitivity, and Statistics are the different categories. The BRATS database was used to review different algorithms for brain tumor segmentation using magnetic resonance imaging (MRI) of astrocytomas. For tumor tissue segmentation, the global baseline threshold method is used. Shape-based features are extracted in the feature extraction process. The KNN classifier divides images into two categories: low score and high score. Evaluation of the system based on parameters, severity, and characteristics [9].

In this paper, every voxel in the brain is classified using the local independent, projection-based classification (LIPC) approach. Using this way, you can also get the path feature. As a result, LIPC eliminates the need for explicit regularization. The accuracy is low [10].

In this paper. Magnetic resonance imaging (MRI) was used to detect and retrieve a brain tumor. Images are gathered from the Internet, and samples from the radiologist are taken. The radiologists' images are converted into regular RGB images before being sent to a DICOM converter. The method is divided into three stages, with the first stage preprocessing the input image, the second stage threshold segmentation with further morphological processes, and the third stage tumor detection and extraction, with the image presented as an output. It uses a binarized image for automatic area splitting based on a region-growing technique, similar to how the automated classified sel works [11].

In this paper, a new brain tumor segmentation system has been implemented, also known as a multimodal brain tumor segmentation scheme. Furthermore, different segmentation algorithms are being combined to provide higher performance than currently available methods. The level of complexity, on the other hand, is high [12].

In this paper, the suggested work is referred to as the process of segmenting an image in order to extract different objects is known as image segmentation. This work uses a Gabor filter and contour level set segmentation to create a unique two-stage MRI brain tumor segmentation approach. To detect different regions in an image, the contour level

set approach is utilized. This method allows us to extract only the tumor part, which is useful for determining tumor size, shape, and density. Tumor tissue has higher pixel values than normal tissue. The tumor's area and shape matrix were calculated. The tumor is benign if the metric value is 1; the tumor is malignant if the metric value is more than 1 [13].

In this paper, the proposed method incorporates data acquisition, preprocessing, segmentation using the Expectation Maximization (EM) algorithm and adaptive thresholding, feature extraction from an MRI data set using the Fast Fourier Transform (FFT), feature selection using the Minimal-Redundancy-Maximal-Relevance (MRMR) criterion to select the most valuable features, and classification [14].

In this paper, the step-by-step tumor growth of patients is studied using a novel bio-physio mechanical tumor growth model. To avoid the significant tumor mass effect, it will be used with individual margins for gliomas and solid tumors. Combining discrete and continuous approaches, a tumor growth model is developed. The proposed scheme, which is based on atlas-based registration, offers for the tacit segmentation of tumor-bearing brain images. This method is commonly used to segment brain tissue. The computation time, on the other hand, is high [15].

In this paper, to detect and segment the brain tumor, researchers applied a novel multi-fractal (MultiFD) feature extraction approach and enhanced AdaBoost classification algorithms. The MultiFD feature extraction technology is used to acquire the texture of brain tumor tissue. To determine if a certain brain tissue is a tumor or non-neoplastic tissue, improved AdaBoost classification algorithms are used. The level of difficulty is really high [16].

In this paper, the results of a survey and segmentation of brain tumors are provided. Margo Random Field (MRF) segmentation, region-based segmentation, threshold-based segmentation, fuzzy C Means segmentation, Atlas-based segmentation, deformable model, and geometric deformable model are all discussed. Each method is evaluated for precision, robustness, and validity [17].

In this paper, the image's contrast is improved via adaptive histogram equalization. The tumor is then separated from the rest of the brain image using Fuzzy CMeans (FCM). After that, the Gabor feature is used to filter out any aberrant brain cells. Finally, the anomaly in the brain MRI image is located using the fuzzy with K Nearest Neighbor (KNN) classification. The level of difficulty is high. The precision, on the other hand, is low [18].

In this paper, brain tumors are diagnosed using hybrid feature selection and ensemble classification. The decision rules are obtained using the GANNIGMAC decision Tree, Bagging C based wrapper technique. To make decision rules more understandable, use hybrid feature selection [19].

In this paper, they presented a hybrid method that uses statistical characteristics and a Fuzzy Support Vector Machine classifier to detect brain tumors. There are four steps to the proposed approach. An anisotropic filter was used to minimize noise in the first step. The second stage makes use of texture features collected from MR images. The features of MR Images were minimized. To the most fundamental aspects in the third phase, which used principal component analysis. Finally, a Supervisor classifier-based Fuzzy Support Vector Machine was employed to determine whether or not the tumor was normal or abnormal. The classification was accurate 95.80% of the time [20].

3. Conclusion

The major purpose of this study is to discover a technology for automatically classifying brain tumors that is effective, accurate, fast, and easy to use. In this research article, reviewed various techniques for Brain Tumor Detection. These techniques are studied wholly to find out which of these techniques is more efficient, accurate and less complicated. According to the research, a hybrid method that uses statistical characteristics and a Fuzzy Support Vector Machine classifier to detect brain tumors. Is high accuracy and low complexity.

Compliance with ethical standards

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