Review of Various Brain Tumor Detection Method for MRI Images using Image Processing

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Abstract— Image processing plays a vital role in the analysis of images. In the field of medical science, MRI images are widely used in brain tumor detection, breast cancer detection. Brain tumor detection and its evaluation are tough duties in scientific images processing due to the fact brain images and its shape is complex that may be analyzed handiest with the aid of professional radiologists. Image Segmentation plays an important function in the processing of clinical snapshots. MRI (also called magnetic resonance imaging) has ended up a particularly beneficial scientific diagnostic device for prognosis of the brain and other scientific pics. This paper presents a comparative study and analysis of various brain tumour detection methods for MRI images by using image processing.

Key words: Image processing, MRI images, Brain tumor, Segmentation, Clustering, SVM, K-Mean

I. INTRODUCTION

A brain tumor is an uncontrollable and abnormal growth of cells in the brain. Brain Tumors are of two types- primary or benign brain tumors and metastatic or malignant brain tumors. A primary brain tumor starts and spreads only in the brain. Metastatic brain tumors can initiate somewhere in the body as cancer and extend to the brain. Various methods, which are available in diagnosis, are an expert opinion, human inspection, biopsy, and etc [1, 5].

These methods have some drawbacks like time consumption, incorrect inspection etc. So image processing techniques can be helpful to detect brain tumor. There are various medical imaging techniques like x-ray, computed tomography (CT), positron emission tomography (PET), magnetic resonance imaging (MRI), are available for tumor detection [6]. The MRI is the most commonly used modality for brain tumor growth imaging and location detection due to its higher resolution. Magnetic Resonance Imaging (MRI) is an imaging technique which non-invasively provides high contrast images of different anatomical structures. It provides better a differentiation of tissues than other medical imaging techniques. Evaluation and analysis of

An MRI image by radiologists is error-prone and time-consuming. Hence radiologists can use an algorithmic image processing in brain tumor diagnosis in MR images, especially due to large alterations in shape and size of structures needs to be considered for brain tumor detection and segmentation. Therefore automatic analysis and classification of such medical images are essential [6, 7].

II. IMAGE PROCESSING & MRI IMAGES

A. Image Processing

In imaging science, image processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, a series of images, or a video, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image [2].Most of the image-processing techniques involve isolating the individual color planes of an image and treating them as two-dimensional signal and applying standard signal-processing techniques to them. Images are also processed as three-dimensional signals with the third dimension being time or the z-axis. Image processing usually refers to digital image processing, but optical and analog image processing also are possible [11].

1) The purpose of image processing-The main purpose of image processing is-

1) Visualization- Observe the objects that are not visible.
2) Image sharpening and restoration - To create a better image.
3) Image retrieval - Seek for the image of interest.
4) Measurement of pattern – Measures various objects in an image.
5) Image Recognition – Distinguish the objects in an image.

B. MRI images & Brain Tumour

A brain tumor is a group of abnormal cells that grow in or around the brain. Tumors can directly destroy healthy brain cells. They can also indirectly damage healthy cells by crowding other parts of the brain and causing inflammation, brain swelling and pressure within the skull [15]. Brain tumors are either malignant or benign. A malignant tumor, also called brain cancer, usually grows rapidly and often invades or crowds healthy areas of the brain. Benign brain tumors do not contain cancer cells and are usually slow growing.

Brain tumors fall into two different categories: primary or metastatic. Primary brain tumors begin within the brain. A metastatic tumor is formed when cancer cells located elsewhere in the body break away and travel to the brain. For this reason, metastatic brain tumors are almost always malignant, while primary brain tumors may be benign or malignant.

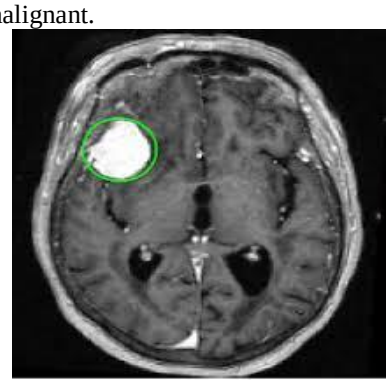

Fig. 2.2: MRI image for the tumour

III. EXISTING METHODS

Following existing techniques are suggested by various researchers, for brain tumour detection from MRI images.

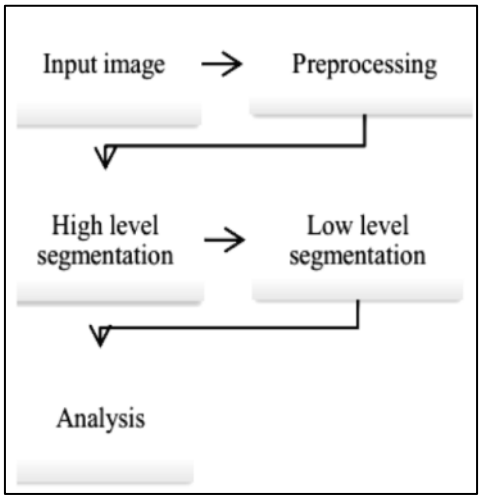

Fig. 3: Stages in tumour detection[4]

A. Knowledge-based Method

In this paper [2] a system that can automatically segment and uses the labels glioblastoma-multiforme tumors in magnetic resonance images (MRI's) of the human brain is presented. Along with cluster, the segmented images find outs the centers for each class that is provided to a rule-based expert system which extracts the region of intracranial. It uses the technique of Multispectral histogram analysis separates suspected tumor from the rest of the region of intracranial, with region analysis used in performing the final tumor labeling. Many efforts have exploited MRI's multidimensional data capability through multispectral analysis.

B. Component Labeling Method

In this paper [3, 7] image segmentation scheme to segment 3-D brain tumor from MRI images through the clustering process [11]. The clustering is achieved using K-mean algorithm in conjunction with the connected component labeling algorithm to link the similar clustered objects in all 2-D slices and then obtain 3-D segmented tissue using the patch object rendering process. It is allowing a diagnostics automation and assists the expert in the qualitative and quantitative analysis. It is very important for the surgical planning and quantitative analysis such as volume measurements. In the existing system, it uses K-mean 2-D Slice Clustering. It consists in applying to each slice the k-mean clustering algorithm in 2-D and to propagate the result by labeling or relabeling the clustered contours of the preceding slice.

C. Content-based Retrieval Method

In this paper the Content-based medical image retrieval allows exploring same images appear with a different kind of diagnosis. It also allows the searching through large collections of disease-related illustrations using the visual attributes. It provides a convenient environment for the retrieved images [8]. All the approaches which are based on one-to-one regions of image matching for shifting and scaling. The existing system uses the MR images using discrete wavelet transformation (DWT).Following that, principles component analyses (PCA) that were used to reduce the features of MR image.

D. Fuzzy C-Means Method

This paper deals with the implementation of Simple Algorithm for detection of range and shape of the tumor in brain MRI. The tumor is uncontrolled growths of tissues in any part of the body [6].Tumors are of different types and they have different Characteristics and different treatment. The advantage is that in the existing method is based on the thresholding.

The thresholding technique was ignored the spatial characteristics. These techniques consist of segmentation, pre-processing, Feature extraction, and approximate reasoning. This project uses computer-aided method for segmentation and detection of brain tumor based on the combination of two algorithms. This method mostly uses the segmentation of tumor tissue with high accuracy and reproducibility comparable to manual segmentation.

E. PNN Techniques

In this paper [6] they modified image segmentation techniques were applied on MRI scan images in order to detect brain tumors. In this paper, they Modified Probabilistic Neural Network (PNN) model that is based on learning vector quantization (LVQ) with image and data analysis and manipulation techniques are proposed to carry out an automated brain tumor classification using MRI-scans. The simulation results showed that the modified PNN gives rapid and accurate classification compared with the image processing and published conventional PNN techniques.

F. Computer Aided System

In this paper [2,8] they propose a method for automatic brain tumor diagnostic system from MRI images. The system consists of three steps to detect and segment a brain tumor. In the first stage, MR image of the brain is acquired and pre-processing is done to remove the noise and too sharp the image. In the second step, global threshold segmentation is done on the sharpened image to segment the brain tumor. In the third step, the segmented image is post processed by morphological operations and tumor masking in order to remove the false segmented pixels. Results show that our proposed technique accurately identifies and segments the brain tumor in MR images.

G. Image Segmentation Methods

In paper [13] author presented image segmentation. Image segmentation is the primary step and the most critical tasks of image analysis. Its purpose is that of extracting from an image by means of image segmentation. The mechanization of medical image segmentation has established wide application in diverse areas such as verdict for patients, treatment management planning, and computer-integrated surgery. There are three broad approaches to segmentation, termed, Boundary approach (thresholding), Edge based approach, Region-based Approach.

H. The K-Means Algorithm

In paper [4, 7] author presented K-Mean clustering. K-means algorithm is the most well-known and widely-used unsupervised clustering technique in partitioned clustering

algorithms. The purpose of this algorithm is to minimize the distances of all the elements to their cluster centers. Most of the algorithms in this field are developed by inspiring or improving k-means. The algorithm upgrades the clusters iteratively and runs in a loop until it reaches to the optimal solution. The performance of K-means algorithm depends on initial values of cluster centers. Therefore the algorithm should be tested for different outcomes with different initial cluster centers by multi-running.[15]

I. PSO

Based Clustering Algorithm-The algorithm based on swarm intelligence has been developed by adapting the collective behavior which is shown for searching food sources. Each solution in PSO algorithm is a bird in the search space and it is called as a "particle". All particles have a fitness value evaluated by a fitness function and a velocity data that orients their fights. In the problem space, the particles move by following the existing most favorable solutions [12].

PSO algorithm starts with a group of randomly generated solutions (particles) and the optimal solution is investigated iteratively. In each iteration, all particles are updated according to two best values. The first of these best values is that a particle found so far and is called "gbest". The other one is the best value found so far by any particles in the population. This value is the global best value for the population and called as "gbest". PSO is a numeric optimization algorithm in nature [15]. However, Omran proposed a PSO-based clustering algorithm in 2004 and he applied this method for image segmentation. In this approach, optimal cluster centers are determined by PSO which is a population-based search technique. Thus the effects of initial conditions are reduced, compared with classic methods (K-MEANS, FCM).

IV. PROBLEM STATEMENT & OBJECTIVE OF THE WORK

Besides investigating suitable frameworks for image mining, early image miners have attempted to use existing techniques to mine for image information. There are some medical image segmentation systems which use K-means algorithm for detecting a mass tumor in the brain.
The following problems are faced by the existing system.

- Slow Detection time
- Less Accurate
- The Volume of MRI Images cannot be calculated in existing system
- In the Existing system, the growth rate is not calculated.

The main objective of this work is to present a study and analysis of various tumour detection methods for MRI images based on various image processing methods. We have also compared and reviewed different existing work of various researchers in the field of MRI image processing. The main objective of this work is to develop an efficient tumour detection method by improving existing methods.

A. Proposed method will achieve-

- Better PSNR value
- More accurate
- Tumour area and growth rate
- More efficient

V. CONCLUSION & FUTURE WORK

In medical images, the image segmentation plays an important role. Today's many extensive methodologies are available for medical diagnoses like CT scan and MRI. From that, the MRI is the significant techniques for detecting brain tumor because of it a batter and accurate tools comparative to CT scan. The brain tumor detection is a complicated and sensitive task; therefore, accuracy and reliability are always assigned much importance. Many brain MRI image segmentation methods and classifiers have been developed in the past several decades for segmenting MRI brain images and classifying it as normal or abnormal. In the future work, we will develop an efficient tumour detection method for MRI images and will compare this method with various existing clustering and segmentation method. Proposed method will achieve better results.

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