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Efficient detection of Brain Tumor from MRI's using K-Mean Segmentation and Normalized Histogram

[1]Soujanya Maddi, [2]G. Sudheer

[1]Research Scholar, [2]Assistant Professor, Department of Computer Science & Engineering

KODADA Institute of Technology & Science For Women, Kodad

Abstract: In this project, we are focusing on continuous and real time monitoring of water supply in IOT platform. Water supply with continuous monitoring makes a proper distribution so that, we can have a record of available amount of water in tanks, flow rate, abnormality in distribution line. Internet of things is nothing but the network of physical objects embedded with electronics, sensors, software, and network connectivity. Monitoring can be done from anywhere as central office. Using thing speak as free server data continuously pushed on cloud so we can see data in real time operation. Using different sensors with controller and raspberry pi as Minicomputer can monitor data and also control operation from cloud with efficient client server communication.

Keywords: Water Management; Cyber Infrastructures; Cloud Computing; IOT.

1. INTRODUCTION

The most important part of the central nervous system is a human brain. MRI Imaging techniques are used by researchers and doctors to study noninvasively the design and function of the brain. Human body consists of many types of cells and each has some special function. When cells divide without any order and very frequently and are there is no control on their growth, the extra cells forms a mass of tissue which is termed as tumour. IN order to diagnose and treat this disease, doctors use MRI as an assistant diagnostic tool. Images of soft tissues are produced by this imaging modality. Only Internal structures can be understood through such medical images, these images are not enough for the doctors and wants to understand more such as emphasized abnormal tissues, quantifying its sizes, depicting its shape, and so on. If the above requirements are carried out by the doctors themselves, there are lot of chances of inaccuracy, time consuming and a very heavy task.

In order to extract suspicious region from complex medical images, one important process is called segmentation.

Below are the two imaging techniques for diagnosing of brain tumor

a) Magnetic Resonance Imaging (MRI),

b) Computed Tomography (CT)

There are few advantages of MRI over CT scan such as MRI does not use ionizing radiation while CT scans do and these radiations are harmful on repeated exposure.

Tumor can be best understood as an abnormal and uncontrolled growth of cells. If this uncontrolled growth occurs in the brain cells, it is said to be brain tumor. Based on the initial location of the cells from which uncontrolled growth are initiated the tumor is broadly classified into two categories as below

a) Primary Tumor

b) Secondary Tumor

Primary Tumor are so called when the tumor are initiated in the brain tissues.

Secondary brain tumor is so called when the tumor cells are initiated in some other parts of the body and it is spread upto the brain tissues. Secondary brain tumor is also named as Metastatic brain tumor.

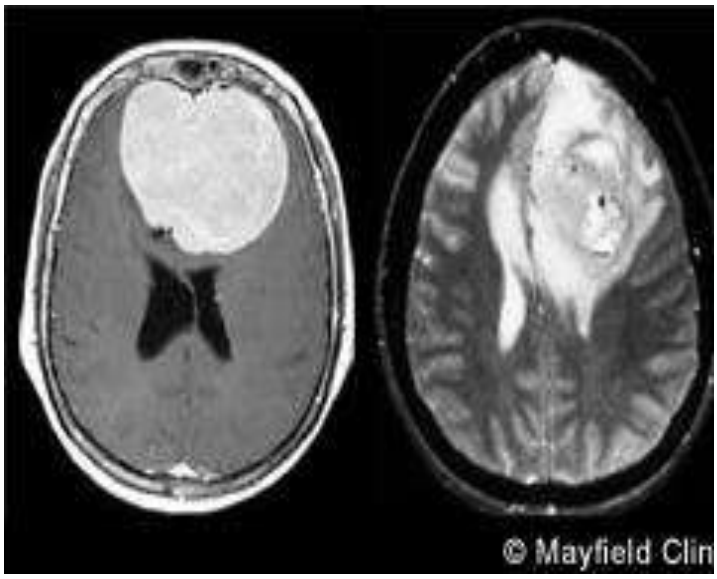

Figure 1.1: MRI Image Of Benign And Malignant Tumors.

Some of the features of Benign tumor are slower growth rate, clear and distinct tumor boundaries and rarely spreading nature. Thus, benign tumordoes not have any serious side effects, however their location determines the vital role in threat to life.

Some of the features of Malignat tumor are Rapid Growth, Capricious boundaries, rapid spreading nature and affecting nearby cells.

2. LITERATURE REVIEW

The main purpose of this section is to represent the details about the image segmentation approaches [5]. Here we will explain the uses and the boundaries of these approaches. The approach which is used to process the MRI images segmentation comes under the k-means, SVM.

In this paper author [6] the proposed algorithm is a combination of SVM and c-means, this is a combine technique for the detection of brain tumor. In this section the image is polished using the contrast, mid-range stretch. Double image segmentation and binary image are used for the brain extraction. Fuzzy c-means (FCM) clustering is used for the image segmentation. Grey level run length matrix (GLRLM) generally used for the retrieving of special attributes. Then, single, double, and multi SVM technique are applied to the MRI images separation.

In this paper [7] author explained mechanical grouping approach for MRI images which is predicted by using the Adaboost machine learning algorithm. The proposed approach included three modules: engaging, attribute taking out, and analysis. The first one is engaging that removes the crude information, which transforms the RGB image into black and white metre, middle filtration minimum segmented is used. To take out the attributes by using GLCM technique 22 features were extracted from an MRI. For classification boosting technique used (Adaboost). The accuracy of the system will be increased by increasing training database images. Also the system can be implementing for different types of classes like Glioma and Meningioma.

In this paper [8] author proposed, a novel technique which includes Normalization of Histogram and K-means Segmentation. First, input image is pre-processed in order to remove the unwanted signals or noise from it. To de-noise filters such as Median filter, Adaptive filter, Averaging filter, Un-sharp masking filter and Gaussian filter is used in the MRI images. The histogram of the pre-processed image is normalized and classification of MRI is done. Finally, the image is segmented using K-means algorithm in order to take out the tumor from the MRI. Efficient classification of the MRIs is done using NB Classifier and SVM so as to provide accurate prediction and classification. The proposed method has some limitations that it could not find out the precise or accurate boundary of the tumor region.

In the future, improvement in the proposed algorithm can be done by working on the limitations, the quality of the output images can be improved by using better morphological operations.

In this paper [9] author proposed method in that MRI image of brain is de-noised using DWT by thresholding of wavelet co-efficient. Genetic algorithm is applied to detect the tumor pixels. A genetic algorithm is then used in order to determine the best combination of information extracted by the selected criterion. The present approach uses k-Means clustering methods into Genetic Algorithms for guiding this last Evolutionary Algorithm in his search for finding the optimal or sub-optimal data partition. The limitation of this work is that wavelet transform require large storage and its computational cost is high.

In this paper [10] author Proposed Methodology in which Image is processed through: Preprocessing, Segmentation, Feature extraction Classification stages. In preprocessing, Morphology technique using double thresholding is applied to remove the skull out of the MRI brain images. The present

work presents the comparison study of two techniques used for tumor detection of MRI images. One is based on the Level set method that uses the non-parametric deformable models with active contour to segment the brain tumor from the MRI brain images. The other one is the K-means segmentation algorithm. After the segmentation decision making is performed in two stages: Feature extraction using Discrete Wavelet Transform and Gray Level Co-occurrence Matrix, and classification using the Support Vector Machine. Level Set method gives better results than k-means segmentation.

Comparison Of Existing Techniques

In this section below we will compare the entire previous proposed algorithm related with image segmentation. In this paper [11] author proposes an intellectual classification system to recognize normal and abnormal MRI brain images. Under these techniques, image pre-processing, image feature extraction and subsequent classification of brain cancer is successfully performed. In pre-processing MRI brain RGB images are converted in grey scale image. Median Filter is applied to remove noise from MRI image. Then Skull Masking is use to remove non-brain tissue from MRT brain image. Dilation and erosion are two elementary morphological operations used for skull masking. In feature extraction symmetrical, gray scale and texture features are extracted. When different machine learning techniques: Support Vector Machine (SVM), K- Nearest Neighbour (KNN) and Hybrid Classifier (SVM-KNN) is used to classify 50 images, it is observed from the results that the Hybrid classifier SVM-KNN demonstrated the highest classification accuracy rate.

3. PROBLEM IDENTIFICATION

Image processing help in knowledge extraction and hence the literature observed shows the multiple limitations on which the work can get performed. The current algorithm such as SVM, Genetic algorithm, Naïve Bayes work with the data processing and its classification but lacking in following aspects:

1. The approach SVM uses the limited number of feature, thus obtaining accuracy and noise processing can't be performed.
2. K-Mean approach is limited to the neighbour selection and thus accuracy in neighbour selection is dependent factor.
3. The given classification NB is also limited in finding a proper segment. The proposed method has some limitations that it could not find out the precise or accurate boundary of the tumor region.
4. Feature extraction process possess high computation time while processing individual image for tumor detection.
5. Ada boost algorithm does not provide high accuracy.
6. The algorithm named Histogram and K-Mean could not find out the precise or accurate boundary of the tumor region.
7. Finding the mid value and the value of centroid in not accurate while dealing with high dimensional data.
8. Medical hearth care data need a proper pre-processing and hence an approach for proper filtering is not applied.
9. A proper noise and trend analysis is required which is not done in current base paper work.

Thus the following limitation is discussed above which still need a proper algorithm for the computation. The current algorithm works with SVM and further more accuracy can be obtained by applying the NN neural network based classification. A better feature extraction can be used for pre-processing approach.

4. PROPOSED METHODOLOGY

In order to perform to perform the better classification with low computation and high accuracy, A proposed algorithm scenario is presented which use the ANN Layer model with enhance feature extraction approach.

The proposed algorithm ROIPropANN is presented which is an algorithm using region of interest, applying prop filtering approach for pre-processing and feature extraction. Further the data is processed with ANN model. The obtained features are trained using the NPR tool and find the advantage accuracy over SVM classification. The algorithm

ROIPropANN uses multiple layer input and output values which is able to process number of features. Thus finding a proper relevant classification is performed. The proposed methodology and its steps which is followed are presented below:

1. Finding the dataset from different resources which is extracted from the MRI units sample dataset availability.
2. Linearizing and Binaries the image. Here a binary conversion of image is perform which strength the complete MRI Image.
3. Thresholding and Smoothening the Image. Here a thinning is applied which help in finding the binary thinning to the image.
4. Finding the segmented area and feature extraction. The prop region approach is provided to extract the image features.
5. Prop Region help in extraction of feature, here 23 features are obtained. Also a ROI region of interest is extraction using the particular area selection. It help in minimizing the processing.
6. Apply the ANN approach using the NPRtool. The Neural network approach help in processing a finding the accuracy over detection.
7. Finally the computation parameters were computed and compared with the current approach to show the efficiency of proposed algorithm.

The discussed step shows the proposed mechanism followed for better segmentation and classification.

As per the discussion, proposed algorithm ROIPropANN is presented and it works with the proper brain tumor data classification. The following is the algorithm Pseudo codes which help in executing the proposed approach.

Algorithm ROIPropANN:

Input: Image parameters, Image dataset, Tool Input

Output: Segmented Image, Feature extracted, and Computational parameters.

Steps: Begin [

I=ImageRead('Image data');

G=Togray(I);

Apply thresholding;

Return segmented Image;

B=Regionprop(G);

ROI selectionRegionProp(G);

Initialize nprtool;

Apply NN nprtool (B);

Obtain Column Number Matrix;

Calculate Network Output();

Finding trained data;

Confusion matrix value;

Computation time C;

Accuracy parameter Acc;

] End;

The above pseudo code discuss about the procedure and core function which is used for processing the proposed algorithm architecture. It is feasible while working and processing the scenario of execution.

It provides the smooth processing with low computation time and also persist high accuracy while dealing with different images.

5. RESULT ANALYSIS

SIMULATION SETUP

To evaluate the performance of existing method local and global image segmentation use MATLAB software 17 with a variety of dataset used for experimental task. This research uses the various tools and functions from MATLAB 2017b. Script generation for thresholding and feature extraction is also get performed using the MATLAB scripting tool.

Execution Time

The execution time is computed which is taken by algorithm to process the input image. The time difference between the initial and completed time is shown.

Syntax:-

Computation Time:

```
TIC
{
        Algorithm;
}
toc;
```

***Accuracy*:**

$$\text{Accuracy} = \frac{\text{TP} + \text{TN}}{TP + TN + FP + FN}$$

TPR:

$$\text{TPR} = \frac{\text{TP}}{TP + FN}$$

Comparative Performance Graph

This section discuss about the observed result graphically, an analysis using the bar graph shows the outcome comparison and efficiency of proposed algorithm.

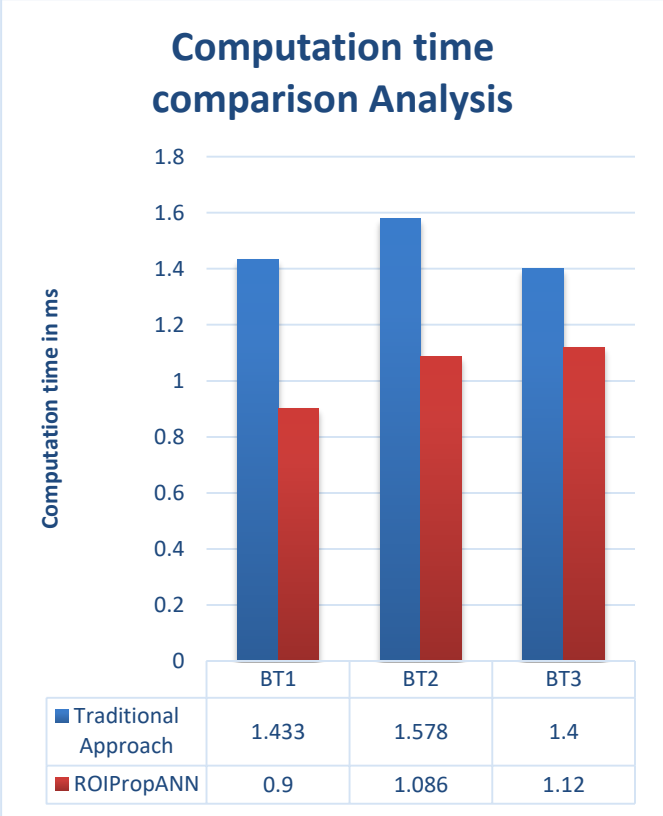

Figure 1.2: Comparative Result Graph For The Value Of Execution Time In Seconds.

Table 5.1: Comparative performance evaluation for the traditional and ROIPropANN techniques with the various images.

Name Of Image	Name of Method	Execution Time in milliseconds
BT1	Traditional	1.433
	ROIPropANN	0.900
BT2	Traditional	1.578
	ROIPropANN	1.086
BT3	Traditional	1.40
	ROIPropANN	1.12

An execution with the given dataset and processing with the proposed algorithm shows the advantage in computation while comparing with traditional approach. The execution shows the low computation time.

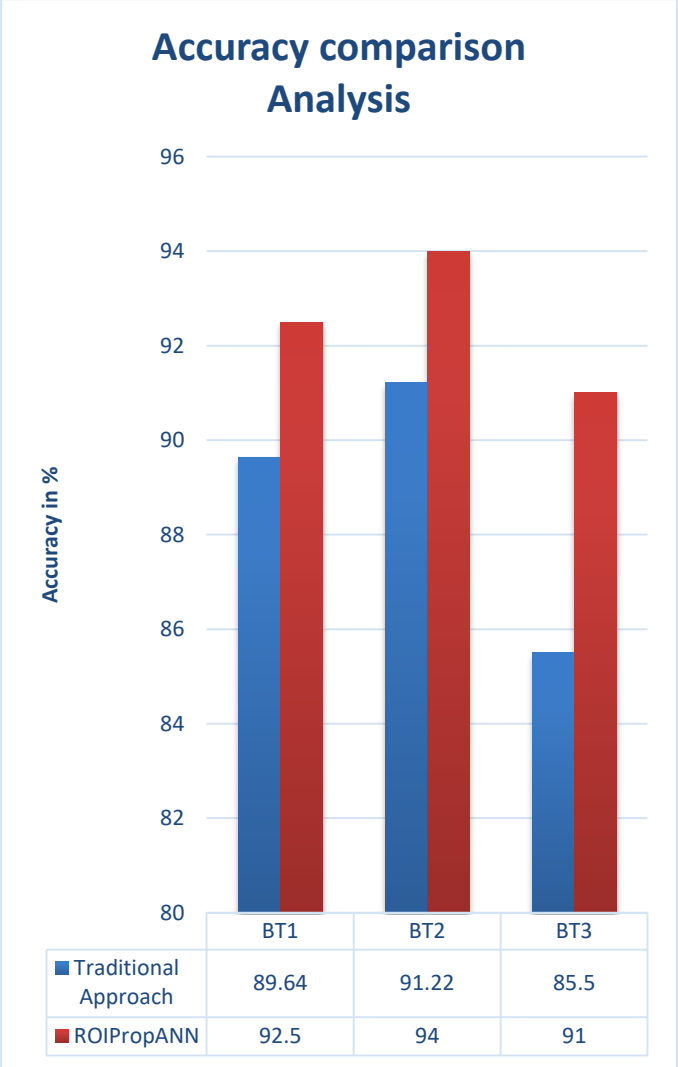

Figure 1.3: Comparative Result Graph Finds The Value Of Accuracy In % Age .

Name Of Image	Name of Method	Accuracy
BT1	Traditional	89.64
	ROIPropANN	92.5
BT2	Traditional	91.22
	ROIPropANN	94
BT3	Traditional	85.5
	ROIPropANN	91

Table 1.2: Comparative Performance Evaluation For The Traditional And ROIPropANN Techniques With The Various Images.

As per the above discussed statically and graphically analysis with different images and different computed parameters. It is observed that the proposed approach ROIPropANN has obtained the improved performance in processing the tumor image and finding proper segmentation in it with high accuracy and low computation time.

Thus the proposed algorithm ROIPropANN can be used for refine level of image processing for Brain tumor prediction.

As per the experiment performed and the processing of image is executed, the following are the observed computation. The comparison analysis is presented statically and graphically which shows the efficiency of Proposed ROIPropANN Algorithm over traditional scenario for brain tumor detection.

An execution with the given dataset and processing with the proposed algorithm shows the advantage in computation while comparing with traditional approach. The execution shows the low computation time.

5. CONCLUSION

Bio Medical Imaging Technologies are an important segment of Healthcare which deals in important aspect of life. Medical healthcare data analysis required a proper access and skillset. Previously given algorithm discussed with different classification and other data mining approaches which help in reducing the effort. MRI images are the source of tumor images through which a brain tumor/cancer and some other diseases such as Alzheimer's syndrome can also be predicted. Here we have proposed a methodology for automatic segmentation and classification of MRI brain image with tumor. Thus again finding an accuracy and detection using the machine learning is a challenging task. Many algorithms such as KNN, Genetic approach and other classification is presented by previous research. This paper discussed the introduction towards the MRI images and its classification approaches using SVM Classifier. Further we are going to present a new approach to present high accuracy, precision, recall and detection rate over the existing solutions.

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