# Machine learning base brain tumor detection and classification using image toolbox.

Anandi Rajyaguru[1], Mitesh Patel[2]

[1]*Research Scholar,Information & Technology Department, Silver oak college of Engineering & Technology, Gujarat, India*
[2] *professor, silver oak college of Engineering & Technology, Gujarat, India*

**ABSTRACT**

*This paper presents a novel framework for braintumor diagnosis and its grade classification based on higherorder statistical texture features namely kurtosis and skewnessalong with selected morphological features. These features wereextracted from segmented tumorous T2-weighted brain MRimages, in order to distinguish high grade (HG) tumor from lowgrade (LG) tumor. Tumor classification is carried out usingSupport vector machine (SVM) classifier with k-fold cross-validation. This work also compares the performance of the SVMwith linear discriminant analysis (LDA) and Naives Bayesclassifiers. Our proposed feature set achieved sensitivity,specificity and accuracy of 100% with SVM (linear kernel) whileclassifying brain tumor MR images as LG/HG. Magnetic resonance imaging (MRI) is a techniquewhich is used for the evaluation of the brain tumor in medicalscience. In this report, a methodology to study and classify theimage de-noising filters such as Median filter, Adaptive filter, Averaging filter, Un-sharp masking filter and Gaussian filter isused to remove the additive noises present in the MRI images i.e. Gaussian, Salt & pepper noise and speckle noise. A novel idea is proposed for successful identification of the brain tumor using SVM (linear kernal). Efficient classification of the MRIs is done using Naïve Bayes Classifier and Support Vector Machine (SVM) so as to provide accurate prediction and classification.*

**Keywords:-** *MRI Images,Brain tumor detection, Segmentation, Brain tumor extraction, SVM,*

---

**1. INTRODUCTION:**

Brain Tumor is a life threatening neurological disorder in which a mass of unwanted cells grows inside the brain or around it. Brain Tumors are broadly categorized as either noncancerous or cancerous. The grade of a tumor indicates its degree of malignancy. Low grade(LG) tumors has long survival rates and are the least malignant, whereas high grade (HG) tumors are most malignant, grow more quickly, can cause more damage and have less survival rates. Brain tumor is one of the prime reasons for growing death rate among children and adults.

According to American Brain Tumor Association (ABTA), approximately 78,000 more brain tumors cases will be detected by end of 2016.Diagnosis Brain Tumor is a very challenging job as tumors are largely diverse in shape and appearances.

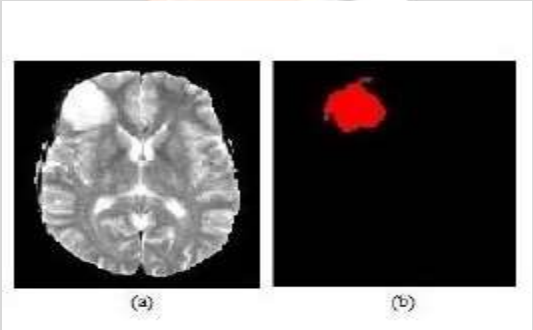
Processing a medical image involves two main steps. The first is the pre-processing of the image. This involves performing operations like noise reduction and filtering so that the image is suitable for the next step.

1) **Input dataset**
The MR images considered for this work are typically T2-weighted image volumes, as they provide better contrast difference between normal and tumorous tissue. The dataset includes cases of high grade and low grade gliomas on which proposed model is tested.

2) **Pre-processing**
The MR images are usually corrupted by a smooth signal intensity variation called intensity non-uniformity also called as RF inhomogeneity or bias field. This results in decreasing high frequency contents of image such as its edges and contours and also blurs it.Before applying the algorithm to image it is necessary to process the data in order to remove the undesirable parts from the MRI.

3) **Segmentation**

Tumor segmentation is achieved by integrating symmetry property of brain with region growing method. In this section, we have briefly described the segmentation technique, The tumorous regions in the brain were located by using bilateral symmetry property of brain.This is based on the hypothesis that there is a very less possibility of tumor being present symmetrically in both hemispheres of the brain. The method involves dividing the brain in symmetric halves and then comparing them voxel-wise by applying subtraction operation. Output images have higher intensity for non symmetric regions, as their intensities will be different. To further differentiate the tumorous regions from remaining areas contrast stretching operation is applied.




**Segmented tumor region[1]**

## 2. LITERATURE REVIEW:

### 2.1 Brain Tumor detection in conventional MR Images based on statistical texture and Morphological features.

Support vector machine (SVM) analysis is carried out to obtain tumor classification as low grade(non malignant) or high grade(malignant) with extracted feature vector as input.This work also compares classification efficiency achieved from SVM with linear discriminant analysis (LDA) and Naïves Bayes classifier, in order to identify optimum classifier for tumor grade identification with chosen feature set.

### 2.2 Efficient Detection of Brain Tumor from MRIs using K-means segmentation and normalized Histogram.

Brain tumor identification using Magnetic resonance imaging(MRI) is a widely used technique for diagnosis. MRI provides significant information about the anatomy of the brain which is important for the detection of the tumor.

### 2.3Alternate machine validation of early brain tumor detection.

This methods are used for process and support vector machine(SVM) and neural network classifier to checking early stage. To detect the cancerous areas, There exist numerous techniques for the diagnosis of cancer, like Magnetic Resonance Technique(MRI), Computed Tomography(CT), Chest Radiography(X-ray) and sputum Cytology.

**2.4Brain Tumor detection based on watershed transformation.**

In this paper a watershed transformation technique is used with **gradient magnitude** with morphological open image and two important features is used as **foreground** and **background** to identify the tumor.

**2.5An efficient Brain tumor detection from MRI images using Entropy Measures.**

This technique is highly useful for early detection of brain tumor.Entropy methods like Shannon, Renvi, vajda, Havrda-Charvat and Kapur are applied to the MRI images. After comparing and analysing through simulation results, we observed that havrda-charvat entropy performs better than any other entropy algorithms.

**3. COMPARATIVE TABLE:**

**Table -1:**Comparative Table

| SR NO. | TITLE | YEAR OF PUBLICATION | TECHNIQUE | ADVANTAGES | DISADVANTAGES |
|---|---|---|---|---|---|
| 1. | Brain Tumor Detection in conventional MR Images based on statistical Texture and Morphological | 2016 | SVM (Support Vector Machine) | To identify the best classifier for tumor grade identification as low grade or high grade. | The proposed feature set is extracted from all MRI slices of particular tumor patient, individual slices does not give proper Information about tumor grade. |
| 2. | Efficient Detection of Brain Tumor from MRIs Using K-means segmentation and normalized Histogram | 2016 | Magnetic Resonance imaging(MRI) | Recognition and segmentation of the tumor is imperative in medical analysis. | the detection of tumor was not accurate and the algorithm could not find out the precious and accurate boundary of the tumor region |

| | | | | | |
|---|---|---|---|---|---|
| 3. | Alternative machine validation of early brain tumor detection. | 2016 | Digital Image processing technique using SVM neural network class | With the help of ANN(Artificial Neural Network) we can detect the tumor at the early stage in quite less time | It is costly and cannot afforded by everyone. |
| 4. | Brain Tumor Detection based on Watershed Transformation | 2016 | Watershed Transformation technique. | This technique is elaborate the pixel along with morphological operation to open the image very clearly. | It will be highly complex for the post treatment of Tumors. |
| 5. | An efficient Brian tumor detection from MRI Images using Entropy measure**.** | 2016 | Various entropy methods like Shannon, Renvi, Vajda, Havrda-Charvat and kapur | Highly effective in diagnosis of brain tumor. | Havrda-charvat entropy performs better than any other entropy algorithm**.** |

**4. CONCLUSION:**

This paper mainly focuses on many related works of MRI image segmentation, detection of brain tumor and comparison between various methods of segmentation. Some methods focuses on better tumor region representation while in some techniques focus is on shape of tumor and some methods focuses on brain tumor size and area. As brain tumor is very sensitive problem related to health, main focus of MRI segmentation is on Accuracy. Every methods have it's own advantages and limitations though hybrid method for brain tumor segmentation is needed which can able to focus on more brain tumor parameters for giving more accurate information related to shape, size, region and texture of brain tumor.

**5. REFERENCES:**

[1]. S.U.Aswathy,Dr G.Glan Deva Dhas,dr. S.S.Kumar, "A Survey on Detection of Brain Tumor From MRI Brain Images", International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT),IEEE 2014, DOI:10.1109/ICCICCT.2014.6993081, Pages:871-877.

[2]. Luxit Kapoor, Sanjeev Thakur, " A Survey on Brain Tumor Detection Using Image Processing Techniques ", 7th International Conference on Cloud Computing, Data Science & Engineering - Confluence, IEEE 2017, DOI: 10.1109/CONFLUENCE.2017.7943218, Pages:582-585.

[3]. S. Réjichi and F. Chaabane, " Brain Tumor Extraction Using Graph Based Classification Of MRI Time Series For Diagnostic Assistance ", International Symposium on Signal, Image, Video and Communications (ISIVC), IEEE 2016, DOI:10.1109/ISIVC.2016.7894008, Pages:320-324.

[4].Asit Subudhi,Jitendra Jena, Sukanta Sabut, " Extraction of Brain from MRI Images by Skull Stripping using Histogram Partitioning with Maximum Entropy Divergence", International Conference on Communication and Signal Processing, April 6-8, IEEE 2016,DOI:10.1109/ICCSP.2016.7754284, Pages:931-935.

[5].Prakash Tunga P, Vipula Singh, " Extraction and Description of Tumour Region from the Brain MRI Image using Segmentation Techniques", IEEE International Conference On Recent Trends In Electronics Information Communication Technology, May 20-21, IEEE 2016, DOI:10.1109/RTEICT.2016.7808097,Pages:1571-1576.

[6].Seyed Sadegh Mohseni, Salehi Deniz Erdogmus and Ali Gholipour, "Auto-context Convolutional Neural Network (Auto-Net) for Brain Extraction in Magnetic Resonance Imaging", IEEE Transactions on Medical Imaging, IEEE 2016,DOI:10.1109/TMI.2017.2721362, Pages:1-12.

[7].Asra Aslama,Ekram Khanb,M.M. Sufyan Bega, "Improved Edge Detection Algorithm for Brain Tumor Segmentation", Second International Symposium on Computer Vision and the Internet (VisionNet'15),Elsevier 2015, DOI:10.1016/j.procs.2015.08.057,Pages: 430-437.