THINK INDIA JOURNAL

ISSN:0971-1260

Vol-22-Issue-41-December-2019

Brain Tumor Detection Using Machine Learning: Review

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ABSTRACT

Cancer which can afflict brain also known as brain tumor is a superior of devastating diseases. It's needs to be recognized in early stages to counteract effectively. Segmentation of tumors in neural organ by human capability is more prone to error and distinguishing between cancer cells from MRI tomography images is a tedious and time taking process. Accuracy of these evaluations and segmentation plays an important role in detection, treatment planning and how effective these measures are.Over the last 20 years in medical field ,automatic processing of images,computer vision and leasrning algorithms for machine usage garnered wide attention of medical researchers and developers.These days in diagnosis of a disease capturing and processing of medical images plays a huge role.Distinguishing between tumors of brain is a difficult job for physicians.In this era of technological advancements,in detection of brain tumor and it's type,machine learning plays a critical role using different methods of ML(machine learning) with help of magnetic resonance imaging(MRI).This paper tried to review the existing methods,algorithms and how effective they are in detection and distinguishing the grade of tumor.This identification is carried out using various ML methods of pre-processing,segmentation,featureextraction,classification and clustering of supervised,unsupervised and deep learning methods.

INTRODUCTION

Undesired rapid reproduction of cells in human brain tissue is called brain cancer or brain tumor.which have chances to grow into an malignant because changes in environmental life style this era ,these brain tumor disease growing exponentially.To diagnose these cases effectively and speedily,we require a system called computer aided diagnosis(CAD) system,also a method which can produce the images of damaged organ and critically soft tissues.Magnetic resonance imaging(MRI) technique is mainly used to capture image of brain to provide relevant information.By using the information doctor or computer aided diagnosis system able to determine that patient is suffering from tumor in brain or not.In case brain tumor is detected,it can be further distinguish among it's severity,with help of this an effective course of action will be planned by physician such that best outcome will be derived.MRI does not cause radiation and provide us with all the required details in imaging .MRI is a flexible method used to distinguish between tissues.

Tumors in brain can be two types benign and malignant.the abnormal growth cells in brain can be cancerous or non-cancerous.the non-cancerous tumor is benign and malignant tumor has more chances to become cancerous, which are more likely used if any other part has cancer.

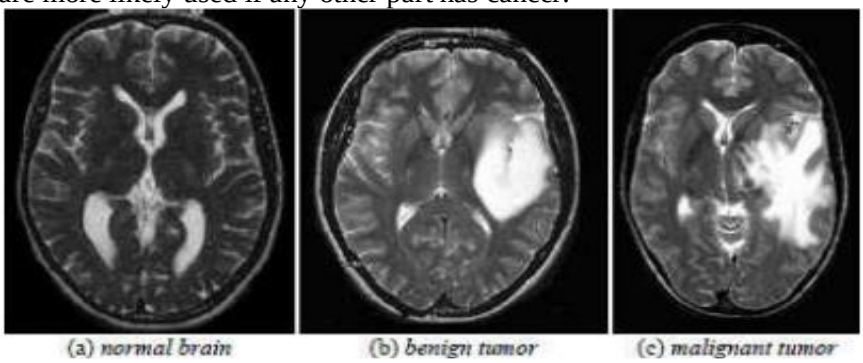

Fig1:Brain tumor MRI[10].

ISSN:0971-1260

Vol-22-Issue-41-December-2019

Survival rate of a non-cancerous type lies between 80% to 100% while cancerous(malifnant) type lies between 30% to 40%.tumor in glial cells is called gliomas. Gliomas divided into two grades low and high(LGG&HGG).On the basis of gliomas doctor decides on treatment.In CAD system there are various stages to be done to diagnose the disease .feature extrsction,selectionand image classification plays an important role.feature selection have huge responsibility which is crucial for image classification and processing time.

Table I. 5-year relative survival rate[13]

Type of Tumor	Age		
	20-43	44-53	54-65
Low-grade astrocytoma	67%	45%	21%
Anaplastic astrocytoma	53%	31%	15%
Glioblastoma	18%	9%	4%
Oligodendroglioman	87%	80%	67%
Anaplastic oligodendroglioma	70%	60%	45%
anaplastic ependymoma	90%	85%	84%
Meningioma	86%	75%	69%

A well done image segmentation gives constructive information about tumor which is helpful in treatment,but these segmentation often done by physician and which leads to human error,slow and tough task.Toover come these obstacles various methods has been proposed to complete this task by using MRI's.

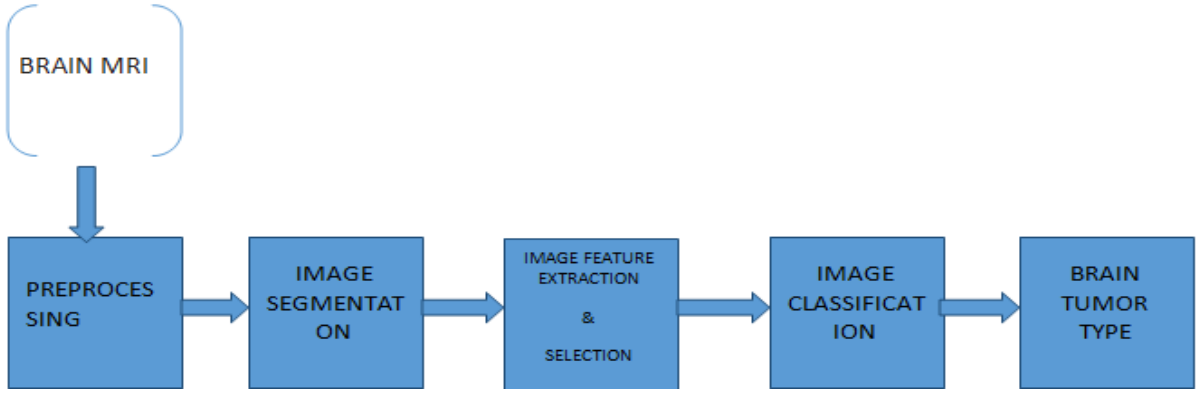

Fig 2: Generalized process of brain tumor detection

LITERATURE SURVEY

1. Hossam H. Sultan et al[4],proposed a method to classify brain tumor based on convolution neural network,a deep learning method using two types of data sets tumors classified into meningioma ,glioma and pituitary tumor from first data set which has 3064 images of 733 patients and got accuracy of 96.13%.second dataset used to distinguish among 3 glioma grades grade II,gradeIII,grade IV ,which has 516 images of 73 patients and got the accuracy of 98.7%.

2. G. Rajesh Chandra et al[1],proposed method of soft thresholding DWT used to improvisation and genetic algorithms to segmentation of imagesit is proved that these algorithms is used with grey level MRI's.By taking the advantage of GA for optimization resolving issues with a large search space.it is also includes previous knowledge to work efficiently.this method got accuracy of 82% to 97%.

3. ToktamHatami et al[8],propose a randomized segregation model—based on Random Forest (RF) algorithm—for the segmentation of the brain tumors in 3D MR images.Theproposed model in this paper has been tested on BraTS 3D MRI datasets.this method gives the performance indices including Dice SimilarityCoefficient (DSC) as well as algorithm accuracy (ACC) are calculated that are 98.38% and 97.65%, respectively.

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4. Arun Kumar et al[10],used particle swarm optimization based method for selection of features .To classification of tumor MRI's used support vector machine classifier.considering of best features only can be resulted in effective output and time delay's are decreased.online data base BRATS-2015 is used which consisted of brain tumors MRI's of different people ,this paper consider 354 images.classification accuracy is 95.23% by using PSO-SVM.
5. Muhammad Imran Razzak et al[12],proposed a model for segmentation of brain tumor that is two path way group CNN architecture which takes advantage of both local and global features.instabilities and over fitting parameters sharing is brought down because of equivarience in model.data sets BRAT 2013and BRAT 2015 were used for validation and got promising results.
6. I. Ram´ırez et al[21],variational model used for saliency identification in images.this can also apply for segmentation with help of this ,it is easy to determine which part is relevant from image.this idea is validated by testing on data base of MRI of brain and got results of dice similarity coefficient of 85%.
7. T. Chithambaram et Al[2],used genetic algorithm and ann to classification.first infected area are marked with help of active contour model.from these areas features were ectracted and selected which is done by GA .freatures are classified by SVM model and got accuracy of 91.7% and by ANN got 94%.
8. F. P. Polly et al[14],DWT is used for feature extraction while PCA used for feature reduction and k-means for clustering.MRI images which are used all T2-weighted. LGG AND HGG types are classified by SVM.Data set contains 440 images and all are classified successfully with accuracy 98%.

COMPARATIVE ANALYSIS OF EXISTING TECHNIQUES

Table2: comparison and future scope

Sr.no	Author	Summary	Future scope
1	ToktamHatami et al[8]	• Randomized segregation model—based on Random Forest (RF) algorithm. • Validated on BraTS 3DMRI datasets. • Algorithm accuracy 97.65%.	• By incorporating a method to distinguish grade of the tumor will make it more effective.
2	G. Rajesh Chandra et.al[1]	• Segmentation accuracy from 82% to 97%.	• We can try to find growth rate of the tumor. • Can be improve to identify type of tumors also.
3	Hossam H. Sultan et al[4]	• a method to classify brain tumor based on convolution neural network • first data set which has 3064 images of 733 patients and got accuracy of 96.13%. • second dataset used to distinguish among 3 glioma grades grade II,gradeIII,grade IV ,which has 516 images of 73 patients and got the accuracy of 98.7%.	• If the dataset is large, how effective proposed method works to be seen.
4	Arun Kumar et al[10]	• used particle swarm optimization based method for selection of features and for classification SVM. • Data set BRATS-2015 is used	• By testing on a large data set this method may show good results. • By extracting and selecting

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		which consisted of brain tumors MRI's of different people ,this paper consider 354 images. • Classification accuracy is 95.23% by using PSO-SVM.	principle features can improve this method.
5	Muhammad Imran Razzak et al[12]	• segmentation of brain tumor that is two path way group CNN architecture • data sets BRAT 2013and BRAT 2015 were used for validation and got promising results.	• By testing on a large data set this method may show good results. • By extracting and selecting principle features can improve this method.
6	I. Ram´ırez et al[21]	• variational model used for saliency identification in images. • this idea is validated by testing on data base of MRI of brain and got results of dice similarity coefficient of 85%.	• This method can be improved by finding growth rate of the tumor.
7	T. Chithambaram et Al[2]	• genetic algorithm and ann to classification.first infected area are marked with help of active contour model. • freatures are classified by SVM model and got accuracy of 91.7% and by ANN got 94%.	• By integrating several methods in one will make good prediction(detection)of brain tumor.
8	F. P. Polly et al[14]	• DWT is used for feature extraction while PCA used for feature reduction and k- means for clustering. • Data set contains 440 images and all are classified successfully with accuracy 98%.	• Different MRI shoud have been used other than T2 weighted MRI's. • By testing on a large data set this method may show good results. • By extracting and selecting principle features can improve this method.

CONCLUSION

Brain tumor is devastating disease which can be detected by CAD system for precise results and to form effective treatment.thispaper,reviews some existing techniques like svm,genetic algorithm and convolution neural networks etc.some methods are good at feature extraction while some good at classification.By combining best possible methods can be results in an effective method with all the possible advantages.similar to combination of deep learning and best feature extraction method.these new ideas can be yield in best resultswhich can be implemented in real time.

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