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Brain Tumor Detection and Classification

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ABSTRACT: Brain tumors are abnormally growing cells in the brain. Early diagnosis is essential for providingappropriate therapeutic measures. Magnetic resonance imaging is one of the best techniques for detection of brain tumor. However, it can be challenging in some cases. This method aims to detect tumor easily and accurately by combining two methods, namely multi-SVM classifier and CNN. The Matlab algorithm developed along with a graphical user interface (GUI) results in an automated brain tumor detection system which can be used by physicians or other experienced medical professionals to detect and classify different types of tumors. Multi-SVM and CNN classify various types of tumors like benign, meningioma, glioma and pituitary. The result of the developed program is accurate, quick and very reliable.

KEYWORDS: GLCM, GUI, MRI, Multi-svm, Tumor.

I.INTRODUCTION

Brain tumors are abnormal cells that grow in the brain and can cause serious damage.Brain tumors can be either malignant or benign. Benign tumors cause less harm than compared to its malignant counterparts. Malignant tumors easily spread into other tissues adjacent to it or to other distant body parts. Based on the location of origin of the tumor it can be primary or metastatic. Primary brain tumors originate in the brain and may or may not spread to other body parts, whereas secondary or metastatic tumors originate in other parts of body and then spread to the brain. The symptom having of brain tumor depends on the location, size and type of the tumor. Symptoms occurs when the tumor compresses the surrounding cells and gives out pressure. Besides, it also occurs when the tumor blocks the fluid that flows throughout the brain. The common symptoms are having headache, nausea and vomiting, and having problem in balancing and walking. The automated techniques should be self-explanatory and easy to operate for the radiologists. Types of tumor are:

i) Glioma

Glioma is a type of tumor that occurs in the brain and spinal cord. Gliomas begin in the supportive cells surrounding nerve cells and help them function.

ii) Meningioma

Meningioma, also known as meningeal tumor is a slow growing tumor that forms from the meninges, a membranous layer surrounding the brain and spinal cord.

iii) Pituitary tumor

Pituitary gland is in the skull, below the brain and above the nasal passages. Pituitary tumor may or may not be cancerous.

II. RELATED WORK

In brain tumor segmentation, we find several methods that explicitly develop a parametric or non-parametric probabilistic model for the underlying data. These models usually include a likelihood function corresponding to the observations and a prior model. Being abnormalities, tumors can be segmented as outliers of normal tissue, subjected to shape and connectivity constrains. Other approaches rely on probabilistic atlases.

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Parveen and Amritpalsingh [1],proposed data mining methods for classification of MRI images. Classification is performed in four stages: pre-processing, segmentation, feature extraction, and classification. In the first stage, enhancement and skull stripping is examines the Kernel performed to improve the speed and accuracy. Segmentation was done by Fuzzy C-Mean (FCM) clustering. Grey level run length matrix (GLRLM) is used for extraction of feature from the brain image, after which SVM technique is applied to classify the brain MRI images, which provide accurate and more effective result for classification of brain MRI images.

Kailash Sinha and G.R.Sinha [2],presented a comparative study of three segmentation methods implemented for extraction of tumor in the MRI images. Proposed methods are k-means clustering with watershed segmentation algorithm, optimized k-means clustering with genetic algorithm and optimized c- means clustering with genetic algorithm. For comparison, the searching time and area of tumor region were considered as comparison parameters. Results depict that, clustering algorithm in case of optimized method perform much better segmentation than that of ordinary clustering algorithm. The problem of over segmentation has also been reduced. Also it is found that the optimized c-means perform better that optimized k-means method.

Dr.G.Padmavathi, Mr.M.Muthukumar and Mr. Suresh Kumar Thakur [3], in their paper examines the Kernel Principal Component Analysis (KPCA) feature detection and classification for underwater images.

Zhang. Y. J [4],in his paper, statistics for a number of developed algorithms is provided, the scheme for classifying different segmentation lgorithms is discussed.

Wahba Marian [5], in her paper proposed a new approach for automatic prostate segmentation of Trans-Rectal-Ultrasound(TRUS) images by dealing with the speckle not as noise but as informative signals.

III.METHODOLOGY

Detection of abnormalities are difficult because of the subtle nature of its progression and low contrast appearance. Current abnormality detection approaches uses feature extraction and classification as the major steps. The accuracy of the detection depends on the type of classifier used. Databases of known injured images are taken as the reference for the accurate detection. All the images are weighted images with different views but the same resolution.The images undergo a feature extraction process. Textural features are considered for the purpose of mild injury detection because texture features are able to identify micro structural changes that occur in the brain. The next step is the feature classification. Classifiers are used to estimate the locations of lesion and the normal appearing brain matter space. This approach performs well when there is a large amount of training data. The block diagram for mild injury detection is shown in Figure 1.

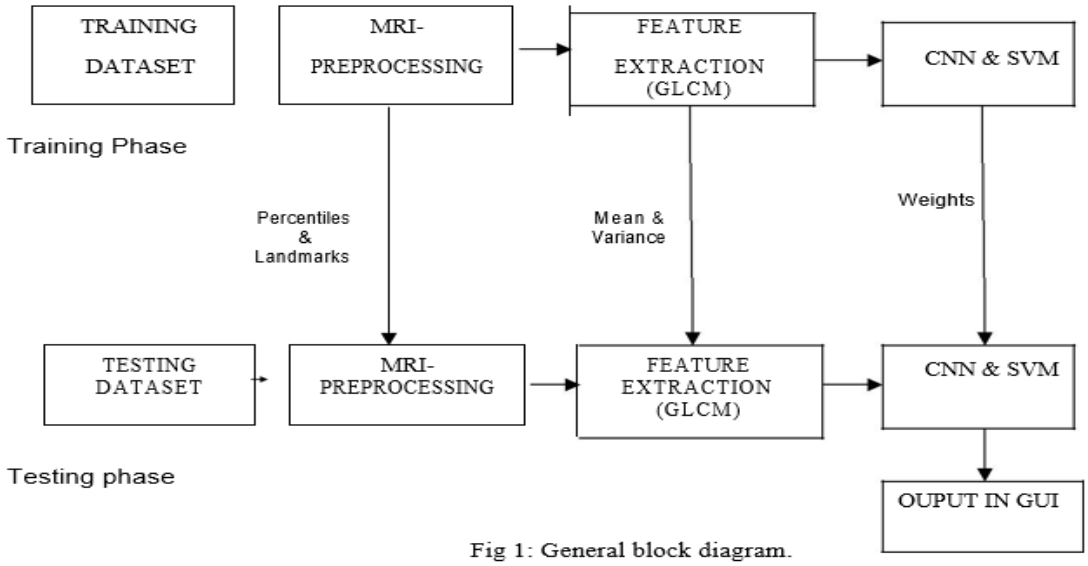

Fig 1: General block diagram.

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IMAGE ACQUISITION: Image acquisition is the first step and it is a colour image it will be converted in the form of RGB image. The MRI images are collected from online database. The original MRI brain image has dimension 256*256 pixels and after conversion to gray scale image the dimension becomes 128*128 pixels. This is done in order to increase the accuracy in both the CNN and multi- SVM classifier technique used. Out of the total images acquired some half are used for training phase and half are used for testing phase.

PRE-PROCESSING: One of the major drawbacks of magnetic resonance imaging (MRI) has been the lack of a standard and quantifiable interpretation of image intensities. Unlike in other modalities, such as X-ray computerized tomography, MR images taken for the same patient on the same scanner at different times may appear different from each other due to a variety of scanner-dependent variations and, therefore, the absolute intensity values do not have a fixed meaning. So to avoid or remove this problem we are using pre-processing stage. In CNN, pre-processing consist of Gaussian filtering, using a disk function and performing closing, opening operation on the image.. In svm, the pre-processing is done to de-noise the image and smoothing the edges. After smoothening the image, the edges need to be isolated/extracted. The tumor needs to be isolated from its background. So, the best suited segmentation techniques are used for this purpose. Dilation and erosion are the most commonly used morphological operations. In Dilation pixels are added to the boundaries of objects in an image, while erosion removes pixels from object boundaries. The number of pixels added or removed in an image depends on the size and shape of the structuring element used to process the image. Repeated dilation results in further growth of the foreground regions, while further erosion results in further growth of the background, or shrinking of the foreground. Applying dilation followed by erosion using the same structuring element for both operations is defined as closing. Closing smoothes the contours of foreground objects, merges narrow breaks or gaps and eliminates small holes. The reason behind deciding to use closing instead of normalizing the image using a template is that the use of predefined anatomical templates for the measurement of healthy and diseased tissue volumes can produce ambiguous results when a small lesion is assessed with a large template. Otsu thresholding is used in CNN and Fuzzy c-means is used in SVM to get the segmented image.

FEATURE EXTRACTION: Feature Extraction is a method of capturing visual content of images for indexing & retrieval. Image features can be either general features, such as color, texture and shape of specific features. Gray level co-concurrence matrix(GLCM) is used for extraction of features. It is a method of examining texture that considers the spatial relationship of pixels and is also known as the gray-level spatial dependence matrix.The GLCM functions characterize the texture of an image by calculating how often pairs of pixel with specific values and in a specified spatial relationship occur in an image, creating a GLCM, and then extracting statistical measures from this matrix. After feature extraction, a common method of selection called sequential forward selection is used . Grey Level Co-occurrence Matrix (GLCM) approach has been used in a number of applications.

CONVOLUTIONAL NEURAL NETWORK: Convolutional Neural Network is made up of neurons which consist of learnable weights and biases. Each neuron receives some form of inputs. It performs a dot product and might follow it with a non-linearity. A Convolutional Neural Network is comprised of one or more Convolutional layers and pooling layers followed by one or more fully connected layers as in a standard multilayer neural network.The application of convolutional layers consists in convolving a signal or an image with kernels to obtain feature maps. So, a unit in a feature map is connected to the previous layer through the weights of the kernels. The weights of the kernels are adapted during the training phase by back propagation, in order to enhance certain characteristics of the input. Since the same kernel is convolved over all the image, the same feature is detected independently of the location–translation invariance. By using kernels, information of the neighbourhood is taken into account, which is an useful source of context information. Usually, a nonlinear activation function is applied on the output of each neural unit.If we stack several convolutional layers, the extracted features become more abstract with the increasing depth. The first layers enhance features such as edges, which are aggregated in the following layers as motifs, parts, or objects. A single MR image was loaded. If it is a colour image(ie, p=3), it is converted to gray scale. In the output ‘m’ is the number of rows and ‘n’ is the number of columns obtained.

Image processing is then performed which includes eroding the gray scale image, performing morphological closing, dilation and reconstruction, segmentation using otsu method etc. Finally the resultant output is obtained.

SVM CLASSIFIER: Support vector machine or the SVM is a part of machine learning that gives the computers the ability to learn. It is a method that analyse the data pattern which is used for classification. In multi-SVM classifier, more than two classes are classified. Multi-SVM is used to classify various type of tumors like Gliomas, Meningioma, pituitary etc. SVM classifier is used to determine whether the MRI lesion is normal or abnormal. SVM is a binary classification method in which two classes for input data has been fixed. For normal case, symbol ‘0’ has been taken;

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whereas, for abnormal '1' has been taken. The parameters from feature extraction are used for classification. They have their roots in Statistical Learning Theory and have gained prominence because they are robust, accurate and are effective even when using a small training sample. By their nature SVMs are binary classifiers, but, they can be modified to handle the multiple classification tasks. In addition to performing linear classification, SVMs can efficiently perform a non-linear classification using what is called the kernel trick, implicitly mapping their inputs into high-dimensional feature spaces. The clustering algorithm which provides an improvement to the support vector machines is called support vector clustering and is used in industrial applications either when data are not labelled or when only some data are labelled as a pre-processing for a classification pass.

GRAPHICAL USER INTERFACE: GUIs (also known as graphical user interfaces or UIs) provide point-and-click control of software applications, eliminating the need to learn a language or type commands in order to run the application.GUIDE (GUI development environment) provides tools to design user interfaces for custom apps. GUIDE then automatically generates the MATLAB code for constructing the UI, which can be modified to program the behaviour of the developed software. This module of the GUI based automated detection and classification of the brain tumor works to differentiate between tumor and non-tumor cells. A user need to click on different buttons in sequence to process a new MRI image of brain. After processing, tumor will be detected using both Support Vector Machine and Convolutional Neural Network . It will also display the various values of GLCM features like entropy, homogeneity, contrast, cluster prominence etc.

IV. RESULTS AND DISCUSSIONS

Tumor will be detected using both SVM and CNN from the image dataset. The tumor will then be classified into glioma, meningioma or pituitary. The tumor area is segmented using Otsu thresholding and Fuzzy c-means. The percentage of accuracy of detecting the tumor will displayed finally in both the techniques.

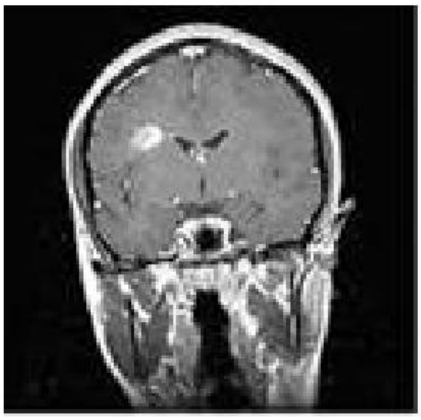

Fig 2: image from dataset

In CNN method, an image was taken from the dataset which is used for tumor detection and classification is shown in fig 2.

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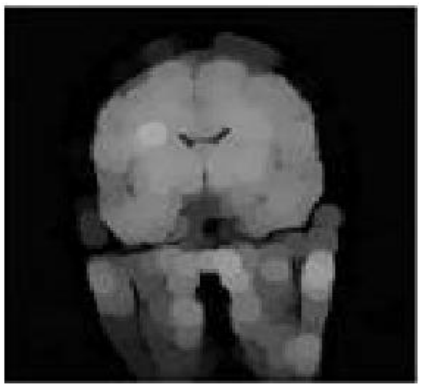

Fig 3: Image after opening operation

Morphological open operation is an erosion followed by a dilation, using the same structuring element for both operations. Here the structuring element used is that of a 'disk'. The output after performing this operation is shown in fig3.

Fig 4: Image after opening by reconstruction

For binary images, reconstruction starts from a set of starting pixels and then grows in flood-fill fashion to include complete connected components. Performing morphological reconstruction, using the eroded image as the marker and the original image as the mask, is called "opening by reconstruction. This operation is shown in fig 4.

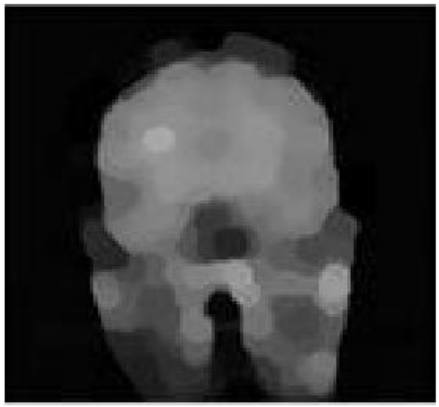

Fig 5: Image after open-close by reconstruction

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Open-close by reconstruction is done to improve the accuracy in detecting the tumor. The output is shown in fig 5.

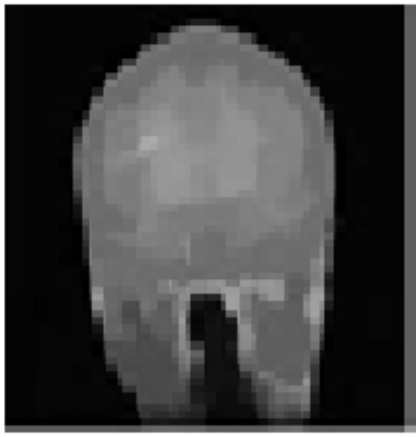

Fig 6: Image after erosion

Erosion operation is performed using the structuring element 'disk'.Erosion operation erodes the input image producing the eroded image as shown in fig 6.

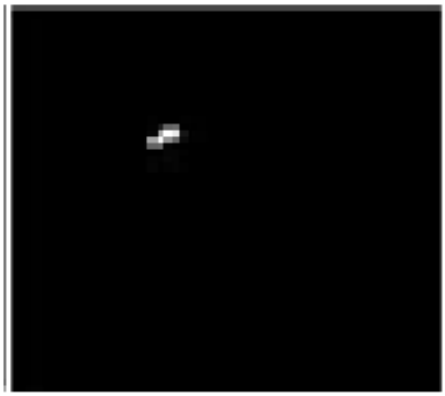

Fig 7: Segmented tumor

The tumor segmented from the input image from the dataset is shown in fig 7.

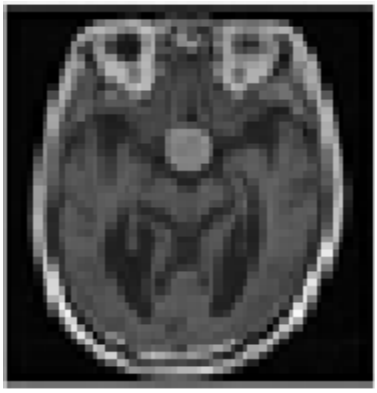

Fig 8: Image from dataset

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Fig 8 shows an input image from the dataset where the tumor is to be detected and classified using svm method.

Fig 9: FCM segmented image

Image after performing Fuzzy C Means segmentation method is shown in fig 9. This technique is used to get 'n' segments from an image.

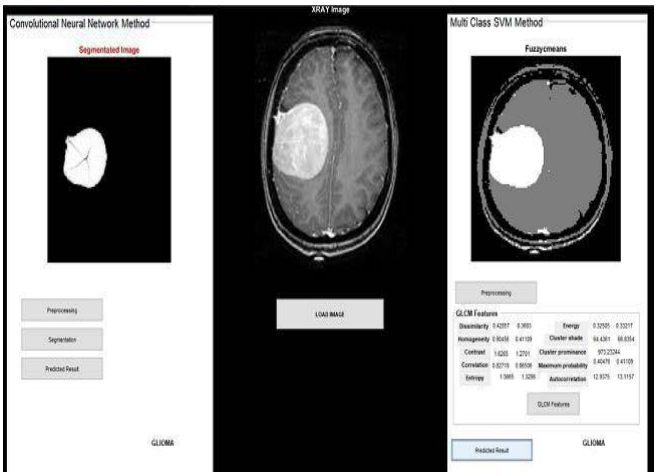

Fig 10: GUI output

In fig 10, an image is given as input and both CNN and SVM mthods are performed and tumor detectected area and the type of tumor is detected.

IV.CONCLUSION

The developed software will help in detection of tumor very easily which in turn will saves the precious time of doctors and pathologists to diagnose the tumor. Moreover, the tumors will be classified in a short span of time depending upon their characteristics and growth pattern. The CNN is observed to be more accurate and reliable than the multi-SVM classifier method.

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REFERENCES

1.Parveen and Amritpal singh , "Detection of brain tumor in MRI images, using fuzzy-c means segmented images and artificial neural network" ,International conference on recent cognizance in wireless communication and image processing , 2014.
2.Kailash sinha & G.R Sinha, "Efficient Segmentation Methods for Tumor Detection in MRI Images", IEEconference ,2015
3. Dr.G.Padmavathi, Mr.M.Muthukumar and Mr. Suresh Kumar Thakur,"Non linear Image segmentation using fuzzy c means clustering methodwith thresholding for underwater images", IJCSI International Journal of Computer Science Issues, Vol. 7,May2010
4. Zhang, Y. J, "An Overview Of Image And Video Segmentation In The Last 40 Years", Proceedings Of The 6th International Symposium On Signal Processing And Its Applications, Pp. 144-151, 2001.
5.Wahba Marian, "An Automated Modified Region Growing Technique For ProstateSegmentation In Trans-Rectal Ultrasound Images, Master"s Thesis, Department Of Electrical And Computer Engineering, University Of Waterloo, Waterloo, Ontario, Canada, 2008.
6.. W. X. Kang, Q. Q. Yang, R. R. Liang,"The Comparative Research On Image Segmentation Algorithms", Ieee Conference On Etcs, Pp. 703-707, 2009. [5]. N. R. Pal, S. K. Pal,"A Review On Image Segmentation Techniques", Pattern Recognition, Vol. 26, No. 9,Pp.1277- 1294, 1993.
7. H. Zhang, J. E. Fritts, S. A. Goldman,"Image Segmentation Evaluation: A Survey Of Unsupervised Methods", Computer Vision And Image Understanding, Pp. 260-280, 2008.
8. Y. Chang, X. Li,"Adaptive Image Region Growing", Ieee Trans. On Image Processing, Vol. 3, No. 6, 1994.
9. K. Dehariya, S. K. Shrivastava, R. C. Jain,"Clustering Of Image Data Set Using K-Means And Fuzzy Kmeans Algorithms", International Conference On Cicn, Pp.386- 391, 2010.
10. Z. B. Chen, Q. H. Zheng, T. S. Qiu, Y. Liu. A New Method For Medical Ultrasonic Image Segmentation.Chinese Journal Of Biomedical Engineering.2006, 25(6),Pp.650-655.
11. A.Sivaramakrishnan And Dr.M.Karnan "A Novel Based Approach For Extraction Of Brain Tumor In Mri Images Using Soft Computing Techniques", International Journal Of Advanced Research In Computer And Communication Engineering, Vol. 2, Issue 4, April 2013.
12. K.Selvanayaki, Dr.P.Kalugasalam Intelligent Brain Tumor Tissue Segmentation From Magnetic Resonance Image (Mri) Using Meta Heuristic Algorithms Journal Of Global Research In Computer Science Volume 4, No. 2, February 2013
13. Kshitij Bhagwat, Dhanshri More, Sayali Shinde, Akshay Daga, Assistant Prof. Rupali Tornekar, " Comparative Study Of Brain Tumor Detection Using K Means ,Fuzzy C Means And Hierarchical Clustering Algorithms " International Journal Of Scientific & Engineering Research , Volume 2,Issue 6,June 2013,Pp 626-632.
14. S.Roy And S.K.Bandoyopadhyay, "Detection And Qualification Of Brain Tumor From Mri Of Brain And Symmetric Analysis", International Journal Of Information And Communication Technology Research, Volume 2 No.6, June 2012, Pp584-588
15. Tahir Sag Mehmet Cunkas, "Development Of Image Segmantation Techniques Using Swarm Intelligence",Iccit 2012
16. Mohammed Sabbih Hamoud Al-Tamimi Ghazali Sulong, "Tumor Brain Detection Through Mr Images: A Review Of Literature", Journal Of Theoretical And Applied Information Technology 20th April 2014. Vol. 62 No.2
17. Sayali D. Gahukar et al Int. Journal of Engineering Research and Applications Vol. 4, Issue 4(Version 5), April 2014, pp.107-111.