Brain Tumor Detection using Image Processing, ML & NLP

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Abstract - *It is very difficult for doctors to detect brain tumors at its earlier stages because they are more directed to noise and other environmental interference. This system is designed make things easy and the brain tumor detection process more efficient. To proceed with the implementation of the system filtering is applied to eliminate irrelevant and image is converted into a grayscale image. Machine learning and image processing algorithms will be applied on the image by the system to get required output. One of the issues with MRI images is that the edges of the MRI images are not sharp during the early stage of brain tumor. So, we can use Image segmentation on MRI images to detect edges. To improve accuracy and efficiency of the system other filtering techniques could be applied*

Key Words: **Image Processing, Filtering, MRI, Machine Learning.**

1. INTRODUCTION

In the recent times, due to the technological improvements in the field of medical sciences, patients are getting better healthcare facilities. This research or study addresses the problems of detection of brain tumors using MRI images and converts the manual process into an automatic one.

When cancerous cells grow unmanageably in brain it is known as Brain Tumor. A brain tumor can be either benign or malignant. The benign brain tumor is uniform in structure and does not contain active i.e. cancer cells, whereas malignant brain tumors are non-uniform (heterogeneous) in structure and contain active cells. The gliomas and meningiomas are the examples of low-grade tumors, classified as benign tumors and glioblastoma and astrocytoma are a class of high-grade tumors, classified as malignant tumors.

World Health Organization (WHO) and ABT Association [1] use grades (I to IV) to classify tumors as benign tumors or malignant tumors. Using the above-mentioned grading scale, grade [I, II] gliomas are classified as benign tumors or low-grade tumor types that possess a slow growth rate and grade [III, IV] gliomas as malignant tumors also known as high-grade tumors that possess rapid growth rate. If someone has

In order to remove tumor accurately, information has to be precisely extracted from MRI. Using this system, we will get accurate features of the tumor from the MRI and that will help the patients and the doctors during treatment.

2. LITERATURE SURVEY

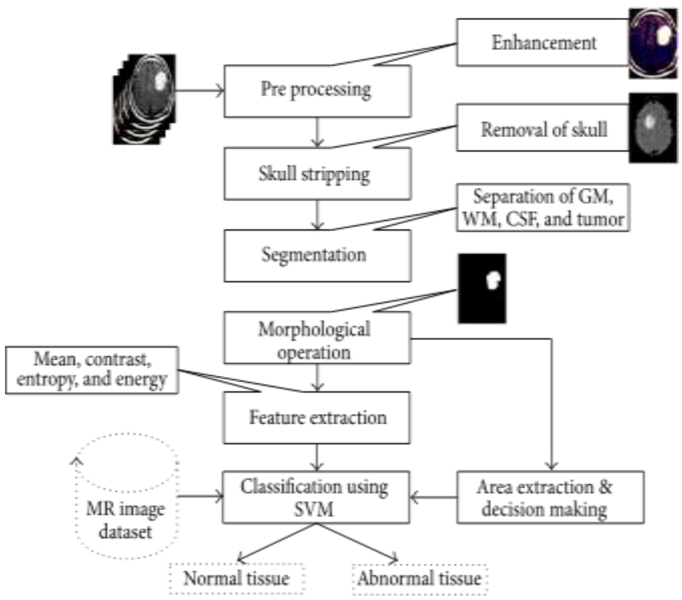
Alfonse and Salem [2] have done automatic classification of MR images of brain tumor using SVM-based classifier. In order to improve the efficiency of the classifier, FFT (Fast-Fourier-Transform) is used for feature extraction and MRMR (Minimal-Redundancy-Maximal-Relevance) is used for feature reduction to decrease complexity. They achieved an accuracy of 98.9% using this method.

Kong al. [3] used autonomous segmentation of tissues and brain parts from MRI using future selection discriminative clustering method. Demirhan et al. [4] introduced an algorithm for tissue segmentation using neural networks and wavelets, which gives effective division of brain Magnetic Resonance Images into the tumor, White and Grey Matter, etc.

Kumar and Vijayakumar [5] have introduced brain tumor classification and segmentation grounded on radial basis function and PCA and has likeness index of 96.20%, overlap fraction is equal to 95%, and an extra fraction of 0.025%.

3. ARCHITECTURE

Steps used in proposed algorithm are.



3.1 Preprocessing: The main function of preprocessing is to boost the quality of MR images and to fabricate it appropriately for further processing by human and machine systems. Also, preprocessing helps to enhance specific parameters of MR images like the Signal-Noise ratio. By improving the visual appearance of MR images and by withdrawing the unnecessary noise and undesired parts and further making inner region smoother and preserving its edges for enhancement of SNR and for raw MR images clarity, we approach the adaptive improvements.

3.2. Skull Stripping: For biomedical analysis, skull stripping is the fundamental process and it is significant for the effective testing of brain tumor from Magnetic Resonance Images. Brain skull stripping is basically the procedure of eliminating tissue other than brain tissues from the brain images. With the help of brain skull stripping, additional cerebral tissues like fat, skin and skull can be removed in the brain images. There are various methods available for brain skull stripping such as automatic skull stripping, skull stripping based on segmentation, brain skull stripping using histogram analysis. This project uses threshold operation-based brain skull stripping to remove tissues.

3.3. Segmentation: The fragments of the brain MRI regions can be attained through the following stages: At first, binary image is formed by converting the preprocessed MR image with threshold of 128 is selected. The pixel values are selected which are greater than the threshold and are further mapped to white and others marked as black; because of this, various regions are formed near the tumor tissues, which can be cropped out. In further step, an erosion operation of morphology is employed to eliminate white pixel. Finally, the division is made into two parts mainly of the eroded region and the original image. The rest black region extracted from erode operation is named as a brain MRI mask.

3.4 Feature Extraction Using feature extraction technique, we can get important information about the tumor like shape, size, texture and contrast. The analysis of texture is important for visual perception of humans and also for the machine learning system. It is used effectively to improve the accuracy of this system by selecting some features.

(1) Mean (M): When we add all the values of pixels and then divide it by total pixels present in that image, we get the mean value.

(2) Standard-Deviation: It describes the distribution of values from the mean and measures inhomogeneity. Higher Standard Deviation means good contrast on the edges of an MR image.

(3) Entropy (E): The randomness of any textual image can be characterized by Entropy.

(4) Skewness: To know if either symmetry exists or not, we can use Skewness.

(5) Kurtosis: A random variable's shape of probability distribution can be explained with an attribute known as Kurtosis.

(6) Energy: The amount that can be quantified as the magnitude of PPR(Pixel-Pair-Repetitions) is known as Energy. It is a parameter to measure similarity present in an image.

(7) Contrast- Contrast is a testing of intensity pixels over the MRI image.

(8) Inverse Difference Moment: It is testing or measuring of the local homogeneity of an image. It may have one or many values that are used to know whether the MRI image is textured or not.

(9) Directional Moment: It considers the orientation of the image as a measure in terms of the angle.

(10) Correlation: To know about the spatial dependencies between the pixels, correlation is used.

(11) Coarseness: Coarseness is testing or measure of roughness in the texture of image analysis of an image. A texture with a smaller number of texture elements is coarser as compared to the one with a larger number.

4. CONCLUSION

In this research, we used ML algorithms and image processing methods to extract data from the MRI. We used preprocessing to upgrade the signal to noise(S/N) ratio and to get rid of the effect of unwanted noise. Based on threshold technique we used a skull stripping algorithm to enhance the skull stripping performance. During this study, we analyzed texture-based characteristic with a recognized classifier for classifying brain tumor from MR Images. From the outcomes, it's clear that the brain tumor identification is quick and precise when put next with the manual identification performed by clinical experts. The varied execution factors also show that the suggested algorithm gives effective result by improving certain parameters like mean, MSE (Mean Square Error), PSNR, accuracy, sensitivity, specificity, and dice coefficient. Our outcomes show that the planned approach can help within the timely and precise detection of brain tumor together with the recognition of its precise location. Therefore, using ML and NLP the proposed system is significant for brain tumor identification from MRI images.

REFERENCES

[1] American Brain Tumor Association, http://www.abta.org.

[2] M. Alfonse and A.-B. M. Salem, "An automatic classification of brain tumors through MRI using support vector machine," Egyptian Computer Science Journal, vol. 40, pp. 11–21, 2016.

[3] Y. Kong, Y. Deng, and Q. Dai, "Discriminative clustering and feature selection for brain MRI segmentation," IEEE Signal Processing Letters, vol. 22, no. 5, pp. 573–577, 2015.

[4] A. Demirhan, M. Toru, and I. Guler, "Segmentation of tumor and edema along with healthy tissues of brain using wavelets and neural networks," IEEE Journal of Biomedical and Health Informatics, vol. 19, no. 4, pp. 1451–1458, 2015.

[5] P. Kumar and B. Vijayakumar, "Brain tumour Mr image segmentation and classification using by PCA and RBF kernel based support vector machine," *Middle-East Journal of Scientific Research*, vol. 23, no. 9, pp. 2106–2116, 2015.

[6] www.google.com