BRAIN TUMOR DETECTION BY USING SEGMENTATION

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ABSTRACT

In brain is one of the most serious infections in human creatures. Tumor discovery in brain is crucial for its treatment. The right area of tumor and its spread locale is identified. Tumor is identified by utilizing the property that the tumor has the more escalated in its locale. In this usage, MRI filter picture is considered as the input to the framework. Here the tumor location is executed in two major steps image pre-processing, post-processing. Preprocessing uses image enhancement techniques like noise removal, high-pass filtering, median filtering and de-blurring. In post-processing, the operations like thresholding , segmentation using watershed technique and morphological operations are implemented. The implemented system is applied on different images at various angles and the accurate the actualized framework gives the quick and effective result [1].

Keyword - *Brain Tumor, malignant, benign*

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1. INTRODUCTION

There are different imaging methods like MRI, computed tomography (CT), ultrasound, and division. Its detection and treatment are done by the manual method [2]. Brain tumor is one of the foremost common causes of increased mortality among children and grown-ups around the world. A brain tumor may be a bunch of unusual cells that grow inside or around the brain. There are numerous distinctive sorts of brain tumors. A few brain tumors are non-cancerous (benign), and some brain tumors are cancerous.

The standard MRI strategy could be a non-invasive imaging interior the body that employments radio recurrence signal. MRI method provides high-quality pictures of different tissues of the body, so it has a important structure of data and permits the detection and division of tumors along with their sub-regions. Since manual division of the tumor range is time consuming thus, a method for segmenting tumor area with high quality and accuracy is a necessity [3]. Automated analysis of brain tumors is Detection and subsequent segmentation. Brain tumor detection is commonly a more complex task than recognizing other images object. Pattern recognition is usually shape of the desired object or on the object Motion in video sequences. Each tumor has a different shape and different characteristics must be used.

2. LITERATURE REVIEW

Various analyses were performed using deep learning techniques. In this section we are discussing various methods and techniques of brain tumor detection.

Michael Agung et al. [4] presented fully automatic generation (FAG)Brain tumor excision technology using multi-model MRI image. Generative models are routinely used for healthy brain tissue Here the tissue is represented by a Gaussian Mixture Model (GMM). Previously connected to spatial organization using a further extended base model Tumor Prior with Machine Learning Based Modified Boltzmann Convolution to modify the contour of the tumor.

they conducted an experiment the model is Performance was comparable to today's state-of-the-art. but, It can be easily extended to any number of input differences, but it's not. Attached to a specific imaging protocol. However GMM has also limit. There is no measure of uncertainty.

[4] Mikael Agn, Ian Law, Brain Tumor Segmentation by a Generative Model with a Prior on TumorShape, IEEE, 2014. For brain tumor segmentation, Ramdas Vankdothu et al. [5] suggested the classification was divided into training and testing sets, and the testing set consisted of 394 MR images and a training set with 2870 various MR images from 233 patients. The Kaggle dataset also includes synthetic data with low variance in the energy values of a similar class that is relatively easy to classify. Hence, only accurate patient data were used to estimate the proposed model. The evaluation metrics are defined for four tumor regions: a) glioma tumor, b) meningioma tumor, c) no-tumor d) pituitary tumor the graph shows a comparison between various algorithms of the BP, U-Net, and RCNN classification techniques. The proposed RCNN achieved a higher accuracy of 95.17% compared to previous classification techniques.

For brain tumor detection D. N. Louis, et al. [6]on the basis of the fourth edition of the World Health Organization (WHO) classification of tumors of the central nervous system, published in 2007, lists several new entities, including angiocentric glioma, papillary glioneuronal tumor, rosette-forming glioneuronal tumor of the fourth ventricle, papillary tumour of the pineal region, pituicytoma and spindle cell oncocytoma of the adeno hypophysis. Histological variants were added if there was evidence of a different age distribution, location, genetic profile or clinical behaviour; these included pilomyxoid astro cytoma, anaplastic medulloblastoma and medulloblastoma. The WHO grading scheme and the sections on genetic profiles were updated and the rhabdoid tumour predisposition syndrome was added to the list of familial tumour syndromes typically involving the nervous system. As in the previous, 2000 edition of the WHO 'Blue Book', the classification is accompanied by a concise commentary on clinico-pathological characteristics of each tumour type. The 2007 WHO classification is based on the consensus of an international Working Group of 25 pathologists and geneticists, as well as contributions from more than 70 international experts overall, and is presented as the standard for the definition of brain tumours to the clinical oncology and cancer research communities world-wide[6].

In brain is one of the most serious infections in human creatures Tumor discovery in brain is crucial for its treatment, et. al. G. Mahesh Kumar [7] suggested the right area of tumor and tumor is identified by utilizing the property that the tumor has the more escalated in its locale. In this usage, MRI filter picture is considered as the input to the framework. Here the tumor location is executed in two major steps image pre-processing, post-processing. Preprocessing uses image enhancement techniques like noise removal, high-pass filtering, median filtering and de-blurring. In post-processing, the operations like thresholding, segmentation using watershed technique and morphological operations are implemented. The implemented system is applied on different images at various angles and the accurate location of tumor is identified. The actualized framework gives the quick and effective result [1].

Arun kumar et al. [8] suggested a novel segmentation study for brain tissues using MR images. Their methods consist of three computer vision fiction steps: enhancing images, segmenting images, and filtering out non-ROI based on the texture and HOG features. A fully automated MRI-based brain tumor segmentation and classification method is based on a model that uses artificial neural networks to locate an ROI accurately. Therefore, the non-ROI filtering process was used for histogram examination to avoid non-ROI and identify the correct object in brain MRI. However, histological features are used to determine the type of tumor. Two hundred MRI cases were used to compare the automatic and manual segmentation processes. The results show that fully automated trainable model-based segmentation is superior to manual methods and brain recognition using ROI texture features. Their model achieved a precision of 92.14%, with 89% sensitivity and 94% specificity.

Odisama et al. [9] proposed a deep learning model that can predict mild cognitive impairment (MCI), early MCI (EMCI), late MCI (LMCI), and AD Alzheimer's disease neuroimaging project. (ADNI) An fMRI data set consisting of 138 subjects was used for the assessment. Their fine-tuned ResNet18 network model achieved an accuracy of 99.99%, 99.95%, and 99.95% on EMCI vs. AD, LMCI vs. AD, and MCI vs. EMCI classification scenarios, respectively.

Mekhmoukh et al. [10] proposed a novel segmentation approach based on Particle Swarm Optimization (PSO) and outlier rejection combined with the level set. The traditional brain tumor segmentation algorithm in the MR database is the fuzzy c-means (FCM) algorithm. The membership function of this traditional algorithm is sensitive to external factors and does not include spatial information in the image. The algorithm is very sensitive to noise and image irregularities and is based on centroid reset. To improve the external damping and reduce noise sensitivity of traditional FCM aggregation algorithms, the authors presented a new extended FCM algorithm for image segmentation. Usually, in the FCM algorithm, the initial cluster centers are chosen randomly; The cluster centers are

optimally selected using the PSO algorithm. Their algorithm also takes into account the spatial information of the neighborhood. Their model achieved excellent performance.

Han [11] proposed an unsupervised medical anomaly network model to detect unsupervised medical anomalies .A new two-step method that uses multiple contiguous MRI slice reconstruction to detect brain abnormalities at different stages on multi-structured MRI: (reconstruction).

III. PROPOSED METHODOLOGY

The proposed work mainly focuses on classifying brain tumors to decrease the human death rate and improve human lifetime. The proposed work aims to classify brain tumors with low complexity and high accuracy rates compared with previous developments. The proposed methodology consists of four stages, as described below. The first stage is preprocessing using an adaptive filtering algorithm, and the second stage is the clustering algorithm for segmentation. The third process is feature extraction, performed using a gray-level co-occurrence matrix (GLCM). The fourth stage of the work is classification.

The following figure shows the proposed methodology for feature extraction of brain tumor.

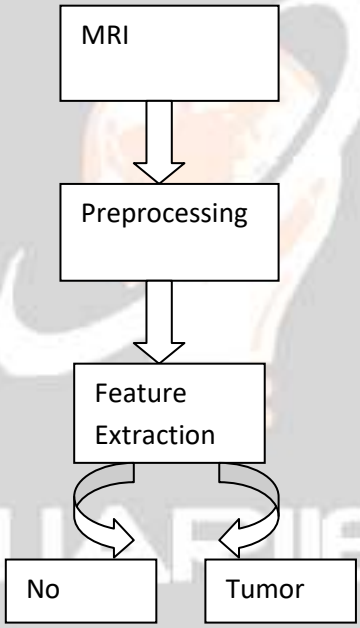

Figure 1. Proposed methodology

3.1 MRI Images:

The suggested system's initial phase is represented by this. The quality of the generated MRI images for analysis might not be particularly good. There can be low contrast, noise, and hazy images. Extracting the area of interest might be challenging [12]. In this case, the system receives input in the form of grayscale MRI pictures.

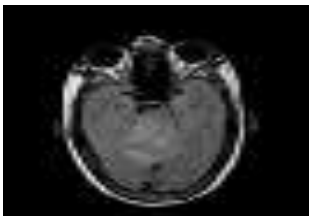

Figure 2. Original Image

3.2 Pre processing:

The activities that are typically required before to the target analysis, the extraction of the required data, and typically geometric corrections of the original image are all included in the preprocessing phase. These enhancements consist of deleting an image of a non-brain component, changing the data so that it reflects accurately in the original image, and correcting the information for jaggedness and undesired noise in an area. The initial preprocessing step is to change this raw MRI picture into a format that will allow for further processing[13].

Figure 3. After preprocessing

3.3 Feature Extraction:

It is the method by which certain visual features of interest are found and supplied for additional processing. In most cases, this is an essential step solution for computer vision and imaging. The tumor is categorized based on the outcomes of the sign extraction. Size, shape, composition, and image placement are among the criteria that are taken into consideration during extraction. The features of the input image are extracted in this step. These characteristics are used to assess the image and pinpoint the tumor's location. The output of the MRI picture before the project's feature extraction phase. Segmentation is a process of breaking up an image into smaller pieces so that it can be analyzed more easily. Segmentation in this project refers to the method of dividing an image into many segments, however, the greatest difficulties in segmentation arise from the degree of the image and images are not inherited in a continuous area, as on X-ray , or in a separate house, as in MRI. In 2D individual images, the placement of each action is called an element. When the restriction that regions connect is removed, the defining sets are called pixel classifications, and therefore the sets themselves are called classes. To address this problem, we used the foremost reliable segmentation techniques, which are helper vector machines and self-organizing maps, to see if there was a tumor on the input MRI image.

3.4 Classification:

The support vector machine (SVM) approach is considered a good candidate because of its high generalization performance, especially when the size of the function space is very large. Those training points for which the equality of the dividing plane is satisfied, those that lie on one of the hyper planes (H1, H2) and the removal of which will change the found solution, are called support vectors (SV).

IV. EXPERIMENTAL METHOD/PROCEDURE/DESIGN

4.1 Performances Metrics

To evaluate the proposed efficiency, we compare the proposed model overall performance using accuracy, sensitivity, specificity, DSC, Precision, JSI, FPR, and FNR values.

4.2 Accuracy (ACC)

Accuracy (ACC) is utilized to compute the degree of correct tumor classification rate, and is calculated using the following Equation (1):

$$\text{Accuracy}=(TP+TN)(TP+TN)+(FP+FN)\times 100 \quad (1)$$

4.3 Sensitivity (SE)

Sensitivity (SE) is utilized to calculate the degree of how much approach is sensitive to measure the tumor identification rate, and is calculated using the following Equation (2):

$$\text{Sensitivity}=(TP)(TP+FN)\times 100 \quad (2)$$

4.4 Specificity (SP)

Specificity (SP) is the rate between true negative (TN) and true positive (TP), and is calculated using the following Equation (3):

$$\text{Specificity}=(TN)(TN+FP)\times 100 \quad (3)$$

4.4 Dice Similarity Coefficient (DSC)

Dice similarity coefficient (DSC) is utilized to compute the ratio between the actual tumor and non-tumor, which are compared with predicted tumor and non-tumor pixels, and is calculated using the following Equation (4):

$$DSC=2TPFP+2TP+FN\times 100 \quad (4)$$

4.6 PRECISION (PRE)

PRECISION (PRE) describes the number of digits that are used to express a value, and is calculated using the following Equation (5):

$$\text{Precision}=(TP)(TP+FP)\times 100 \quad (5)$$

4.7 JACCARD Similarity Index (JSI)

JACCARD similarity index (JSI) is utilized to compute the similarity between the actual tumor pixels and predicted tumor pixels and is calculated using the following Equation (6):

$$JSI=TPTP+FN+FP\times 100 \quad (6)$$

4.8 FALSE Positive Rate (FPR)

FALSE positive rate (FPR) is utilized to compute the ratio of wrongly identified pixels, corrected identified pixels, and is calculated using the following Equation (7):

$$FPR=1-\text{Specificity} \quad (7)$$

4.9 FALSE Negative Rate (FNR)

FALSE negative rate (FNR) is utilized to compute the positive proportion, but the approach-identified negative and is calculated using the following Equation (8).

$$FNR=1-Sensitivity \quad (8)$$

where true positive (TP), true negative (TN), false positive (FP), and false negative (FN)[14].

V. RESULTS AND DISCUSSION

Using image processing, we have automated the process for identifying a brain tumor. Our effort has shown to deliver an overall accuracy of up to 92.12% in addition to numerous existing approaches for segmentation and detection of brain malignancies for MRI images of the brain. Operations like wavelet-based approaches have already been explored as part of the preprocessing. Enhancement and filtering are crucial because they increase picture quality and detection by sharpening edges, improving, eliminating noise, and removing undesirable background. In comparison to other filtering methods, one filtering technique decreases noise, enhances image quality, and increases computational efficiency. The brain tumor segmentation approach based on MRI scans of the brain was applied after the increased picture quality and noise reduction explained here. Classification-based segmentation accurately .segments the tumor and yields reasonable results for a large set of information, however, unwanted behavior can occur if the category is not represented in the training data. These classification methods can first determine if a tumor is present or not, and if there is one, they can determine if a tumor is present or not.

VI. CONCLUSION

The categorization of a brain tumor is critical to determining the best course of action. For the first time, researchers have developed an automated method for recognizing and categorizing brain cancers using MRI scans. The suggested study was separated into four categories: preprocessing, segmentation, MR image feature extraction, and final image classification. The brain tumor pictures were segmented MRI brain pictures may now be used to detect malignancies using a method that outperforms prior algorithms, according to the results of the research. Using MR images, the suggested approach accurately classified normal and pathological tissues with a precision of 92.12%.

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