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Brain Tumor Region Detection Using Machine Learning Techniques: A Review

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Abstract: ***A tumor is also called neoplasm is a development in the irregular tissue which can be separated from the encompassing tissue by its structure. A tumor may prompt cancer, which is a noteworthy leading cause of death and in charge of around 13% of all deaths around the world. Cancer incidence rate is developing at an alarming rate on all over the world. Incredible information and experience in radiology are required for accurate tumor detection in medical imaging. Automation of tumor detection is required because there may be a shortage of skilled radiologists during an era of incredible need. This paper surveys the processes and techniques utilized as a part of detecting tumor in view of medical imaging results of magnetic resonance imaging (MRI). We find that computer vision based techniques can distinguish tumors nearly at a specialist level in different sorts of medical imagery helping with diagnosing myriad diseases.***

Keywords: Tumor Detection, Medical Imaging, Computer Vision, Machine Learning, segmentation, MRI.

I. INTRODUCTION

Tumors are the undesirable development of brain tissues in the skull. Tumors are of various kind and behave distinctively according to their size, shape and location. Tumors can be classified as: - 1. Benign 2. Pre Malignant 3. Malignant. Benign means non-progressive. So these kinds of tumors cannot be spread and are noncancerous. In any case, these can have negative effect such some may press against nerves of blood vessels and can cause pain. Pre-Malignant tumors are the precancerous stage of the tumor that isn't yet malignant yet is going to become so malignant brain tumors are cancerous and these become progressively more regrettable and can cause death.

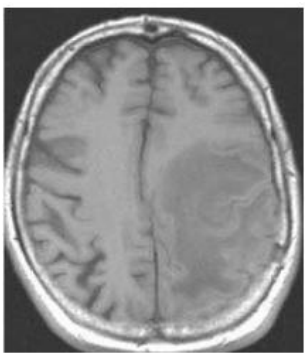

Fig. 1. MRI Report – when tumor absent

Fig. 2. MRI Report when tumor present

In addition, Brain tumor is the irregular development of cells inside the brain. Brain tumors can be partitioned into two categories. 1. Primary brain tumor 2. Secondary brain tumor. Primary brain tumors are what begins inside the brain and don't spread anyplace. These can be classified by the sort of the tissue in which they emerge. Secondary brain tumors are those which

start from another piece of the body such as lung, breast, skin and kidney etc. also, develop towards the brain. These can cause the death of the patient.

According to WHO, there are 120 kinds of brain tumor. They separated it into from least progressive (Benign) to more progressive (Malignant). It classifies brain tumors into grade I to IV under the microscope. As a rule, grade I and grade II are benign brain tumor (second rate); grade III and grade IV are malignant brain tumor (high-grade). On the off chance that second rate brain tumor isn't dealt with, it is probably going to weaken to a high-grade brain tumor. In Southern Asia i.e. in India, the incidence rate of brain tumor is around 2 patients for each 1, 00,000 population, while the molarity rate is under 2 patients for every 1,00,000 population. In 2006, at TATA Memorial Hospital in Mumbai 372 individuals determined to have brain and central nervous system issues. Among which 250(67%) were male and 122(33%) were female. In 2015, evaluated deaths became 15,320 i.e. 67% among this 4000 were teenagers. In the United States, 13,000 deaths are noticed every year.

II. SEGMENTATION

Segmentation is the process of apportioning a digital image into portions i.e. into modest number of pixels to improve the portrayal of the image. There are a few segmentation techniques [8].

Thresholding technique in which input gray scale image is converted into a twofold image in light of some threshold value. Thersholding is of two sorts a) Global b) Local In watershed transformation pixels of an image are assembled based on their intensities. Morphological operations are non-linear operations which are identified with the shape and morphology of features in an image.

K-means clustering [9] is an algorithm which is utilized to cluster pixels in view of properties into k number of clustering where k is a positive integer. Fuzzy c-means is a method for processing the information by giving the partial membership value to each pixel in the image. A genetic algorithm depends on heuristic strategy. It works in five stages i.e. 1. Instatement of populace 2. Assessment of fitness function 3. Selection 4. Crossover 5. Mutation and termination. In neutrosophic hypothesis, each occasion has not just a certain level of reality, and additionally a lie degree and an indeterminacy degree that must be considered self-sufficiently from each other. Region developing technique is pixel-based image segmentation.

In normal region developing strategy, just the force constraint is considered. Here, initial a threshold value is set and a seed bring up discovered. The neighboring pixels, whose force difference between the seed point and corresponding neighbor pixel is underneath the particular threshold value, are developed to the region.

III. MAGNETIC RESONANCE IMAGING (MRI)

MRI is commonly utilized as a part of the medical field for detection and perception of details in the internal structure of the body. It is basically used to detect the differences in the body tissues which have a considerably better technique as compared to computed tomography [6]. Along these lines, this technique become a special technique especially for the brain tumor detection and cancer imaging [7]. Basically, for comparison, CT utilizes ionizing radiation while MRI utilizes strong magnetic field to adjust the nuclear magnetization that takes after by changes the arrangement of the magnetization by radio frequencies that can be detected by the scanner. The signal produced can be additionally processed later to increase additional data of the body [6].

This paper give a reviews of image-based tumor detection. The author at that point review image based tumor detection, commenting on techniques connected for color detection and shape detection. They give their insight and perspectives on future research directions in image-based tumor detection.

IV. LITERATURE SURVEY

In this section we presents existing work done in the field of MRI brain tumor detection.

In this paper [1], a computer based method for characterizing tumor region in the MRI brain images is exhibited. The algorithm consolidates steps for preprocessing, feature extraction and classification utilizing neural network methods. The extraction of texture features in the detected tumor has been accomplished by utilizing Gabor filter. These features are utilized to prepare and classify the brain tumor utilizing Artificial Neural Network Classifier. The framework essentially enhances the classification accuracy of brain tumor detection.

In this paper [2], automated recognition of brain tumors in magnetic resonance images (MRI) is a troublesome technique attributable to the inconstancy and complexity of the location, size, shape, and texture of these lesions are discussed. Due to intensity similarities between brain lesions and normal tissues, some methodologies make utilization of multi-spectral anatomical MRI scans. On the other hand, the time and cost restrictions for gathering multi-spectral MRI scans and some different challenges require building up an approach that can distinguish tumor tissues utilizing a single-spectral anatomical MRI images.

In this paper [3], brain tumor diagnosis, clinicians coordinate their medical knowledge and brain magnetic resonance imaging (MRI) scans to get the nature and pathological attributes of brain tumors and to settle on treatment choices are used. On the other hand, manually recognizing and segmenting brain tumors in the present brain MRI, where countless scans taken for every patient, is monotonous and subjected to bury and intra eyewitness identification and segmentation changeability. As result various methods have been proposed as of late to fill this gap, yet at the same time there is no generally acknowledged automated procedure by clinicians to be utilized as a part of clinical floor because of accuracy and strength issues. In our approach, a programmed brain tumor location and segmentation system that comprises of methods from skull stripping to identification and segmentation of brain tumors is proposed with fuzzy Hopfield neural network as its final tumor segmentation procedure. Through preprocessing, image fusion and starting tumorous slice classification, the final hybrid intelligent fuzzy Hopfield neural network algorithm based tumor segmentation, and tumor region recognition and extraction is accomplished.

In this paper [4], author proposes adaptive brain tumor detection, Image processing is utilized as a part of the medical tools for location of tumor, just MRI images are not ready to identify the tumorous region in this paper authors are utilizing K-Means segmentation with preprocessing of image. Which contains denoising by Median filter and skull masking is utilized. Likewise we are utilizing object labeling for more point by point information on tumor region. To make this framework an adaptive we are utilizing SVM (Support Vector Machine), SVM is utilized as a part of an unsupervised manner which will use to make and keep up the example for some time later.

Bbridging the gap amongst mathematical and biological models and clinical applications could be considered as one of the new difficulties of medical image investigation over the ten a years ago. In this paper [5], exhibits a progressed and jovial algorithm for brain glioblastomas tumor growth modelization. The brain glioblastomas tumor region would be separated utilizing a fast conveyance matching created algorithm based on global pixel wise information. Another model to reenact the tumor growth based on two noteworthy elements: cellular automata and fast marching method (CFMM) has been produced and used to appraise the brain tumor development amid the time. Based on this model, tests were done on twenty neurotic MRI chose cases that were precisely examined with the clinical part. The acquired reenacted comes about were validated with ground truth references (real tumor growth measure) utilizing dice metric parameter.

TABLE I. Shows comparison between various existing approaches

Ref.	Image Dataset	Detection	Image Processing Steps	Disease Segmentation Technique	Extracted Features	Classifier: Accuracy
[1]	24 brain MRI	Brain tumor detection	Image is de-noised using a median filter	Gabor Filter, Artificial Neural Network	Intensity, Shape	89.9%
[2]	Real databases	Brain tumor detection	Post processing method is applied to remove the false positives/negatives	Gabor wavelet,	Texture, Statistical	-
[3]	PDC datasets	Tumor region extraction and visualization	Skull stripping, image enhancement	C-means based Fuzzy Hopfield Neural Network based Segmentation	Region	93.33%
[4]	Brain MRI	the texture feature and color feature are extracted	brightness, threshold, Filtering, Brightness	K-Means based segmentation	color, intensity, texture	Proposed technique in successfully segmenting brain tumor tissues with high accuracy
[5]	thirty five pathological cases with various cerebral MRI	brain glioblastoma s tumor growth detection	Extract the tumor mass from the MR images.	a fast distribution matching developed algorithm based on global pixel wise information	region	-

V. CONCLUSION

Image processing has become a very important task in today' s world. Today applications of image processing can be originate in number of areas like medical, remote sensing, electronics and so on. If we focus on medical applications, and image segmentation is widely used for diagnosis purpose. In this paper, we have surveyed different papers on segmentation of brain MR Images for Detection and identification of brain tumor.

Various techniques are proposed by various authors all around the world. They have some merits and also some demerits. Among all the technologies used clustering and neural network techniques are superior because they produces efficient and high accuracy of results.

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