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Detection Of Brain Tumor Through Medical Imaging

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Abstract - *Healthcare sector is totally different from other industry, it's on high priority sector and people expect highest level of care and services regardless of cost. A tumor may lead to cancer. Cancer incidence rate is growing at an alarming rate within the world. Structural Magnetic Resonance Image (MRI) maybe a useful technique to look at the interior structure of the brain. MRI is widely used for brain tumor detection because it gives a clear picture of brain soft tissues. Brain tumor identification and classification is critical and time consuming task, generally performed by radiologists. Brain tumor of different sizes and shapes can occur in a person. Extraction of tangible tumor region and analysis of minute differences is difficult for humans. Digital image processing methodologies like preprocessing, segmentation and classification are useful to clinical experts for correct diagnosis of brain tumor types. This paper focuses on current trends in brain tumor detection using MRI images. We find that computer vision based techniques can identify tumors almost at an expert level in various types of medical imagery assisting in diagnosing myriad diseases which is beneficial to radiologists for accurate brain tumor diagnosis.*

Key Words: Brain Tumor detection, Image processing, Machine learning, Feature extraction.

1. INTRODUCTION

Brain tumor maybe a growth of abnormal tissues inside the brain. It causes pressure in skull region and affects the traditional functioning of the brain. Brain tumors are classified as benign and malignant tumors. Benign tumors are non-cancerous. Malignant tumors are cancerous tumors during which brain tissues split endlessly and may spread into surrounding tissues. Identification and classification of brain tumors into benign or malignant type is vital for further treatment and survival of patients. Different medical image modalities like Computer Tomography(CT), Poisson Emission Tomography(PET), Magnetic Resonance Images(MRI) are used for brain tumor detection. MRI is non-invasive technique which uses magnetic flux and radiofrequency pulses to depict the internal structure. Three sorts of MRI sequences namely T1 weighted, T2 weighted and FLAIR(Fluid Attenuated Inversion Recovery) are used for brain tumor diagnosis (Dhanashri Joshi,2020).

2. BRAIN TUMOR DETECTION

Before As per the survey has done the highest death rate in the world is due to a brain tumor. Symptoms include changes in the hormones, blood clots, weakness, uncontrolled walking, muddled speech, mood swings, loss in vision, etc. The location of the tumor defines its type, and its proper diagnosis can save the life of the patient. Benign tumors are non-cancerous growths in the body that cannot invade neighboring tissue. They can be completely removed and are unlikely to reappear. Benign brain tumors do not spread to adjacent tissue; however, they can cause significant pain, lasting brain damage, and death. Malignant brain tumors have no distinct limits. They grow quickly, creating. increasing pressure within the brain, and can also diffuse throughout the brain or spinal cord beyond their point of origin. It is extremely rare for a malignant brain tumor to spread outside the brain (Otman Basir, 2020).

3. MACHINE LEARNING TECHNIQUES

Machine learning algorithms for brain tumor detection incorporates four main stages namely Preprocessing, Segmentation, Feature Extraction and Classification.

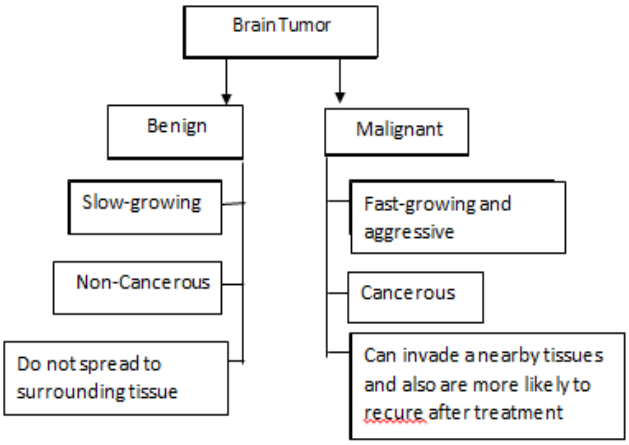

Fig. 1 Types of brain tumor

Figure.1 shows the tumor types and their brief characteristics. Techniques like MRI or CT scan gives the complete structure of a brain tumor as it directs into the intracranial cavity producing a clear image of the tumor. MRI scan scans by using strong magnetic fields and high radio frequencies to provide detailed information of soft tissues. Compounded Tomography scan scans by sending X-ray beams. Steps involved in the detection of brain tumors are pre-processing of an image, feature extraction, segmentation, and post-processing of the image (Otman Basir, 2020).

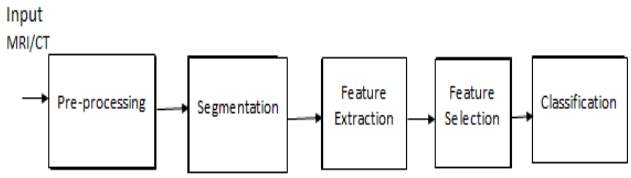

Figure 2 demonstrates the required stages for any automatic brain tumor detection.

4. IMAGE PREPROCESSING

Image Pre-processing converts the original image to gray scale to reduce the remove the unwanted noise, for image reconstruction along with the image enhancement. At every point the intensity of the gray scale image is either 1 or 0. Every pixel has value of the intensity lacking of color. Intensity values may also be in terms of fractions. It is helpful in the segmentation method by giving the precise information. After converting the image to gray scale, the noise is to be removed from by applying it to the filter. The filter can be either high pass frequency or low pass frequency. The different researchers have used several types of filters for the noise removal of the image (Manjunath s, Sanjay Pande M B, Rabeesh B N, Madhusudhan G K, 2019).

In order to obtain the quality image the primary step in the image analysis is the enhancement of the image. Afterwards it is to minimize the noise for obtaining the good quality image. The main advantage of the image enhancement ensures that the image edges of importance are highlighted with improvement in the sharpness aiding in the detection of presence of the tumor .Several types of filters are capable to reduce and remove the noise from the image. The average filters remove the noise from the image but sharpness needs to be compromised. The median filters applied to remove the noise salt and pepper. Image sharpening is done by applying the high pass filter. The object boundaries can be enhanced by the Gaussian filter. The Gaussian filter is good in the detection of edge and highlighting the tumor (Manjunath s, Sanjay Pande M B ,Rabeesh B N, Madhusudhan G K, 2019).

Pre-processing is a significant aspect of any image-based application. Pre-processing stage is required for the following reasons:

1. Pre-processing prepares the images for higher-level processing such as segmentation and feature extraction.
2. Remove the marks or labels such as name, date, and other details (film artifacts) in the image that can affect the classification task.
3. Image quality needs to be enhanced.
4. Removal of any types of noise in the image. Image Segmentation The aim of image segmentation is to divider a medical image into different regions and to extract the area of interest. In particular, it is used for separating components from the remainder of the image so that they can be observed or recognized as objects (Otman Basir, 2020).

5. FEATURE EXTRACTION AND SELECTION

The objective of feature extraction because the minimization of the first data set supported the computing of specific characteristics or attributes that classify and identify different input patterns. The dimensionality reduction is one among the goals from the feature extraction stage, which accurately identifies interesting components of a picture as a compact feature vector. This technique is useful for application with large images, for which feature representation must be reduced to enable the fast completion of tasks

such as image matching and retrieval.

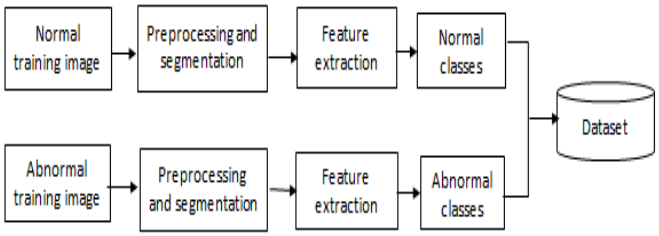

Fig. 3 Feature Extraction and Selection

The block diagram of the feature extraction phase is demonstrated in Figure 3. demonstrated that the best known feature extraction approaches are local binary pattern (LBP), grey-level co-occurrence matrix (GLCM), Canny edge detection, and a bag of words (BoW). Numerous research studies are undertaken to match the features of obtainable extraction techniques. The objective of feature selection is the elimination of unrelated and unnecessary features from input records to choose a subgroup of related features for the construction of robust classifiers. This step will probably increase the building speed and precision of the final classifier. From a theoretical perspective, it can be claimed that ideal feature selection for supervised learning tasks requires a comprehensive search of all probable feature subsections. Nevertheless, for a considerable number of features or models, conducting a complete examination of all features for the creation of an optimal feature set is impractical. For this reason, a supervised learning algorithm is employed for analyzing an appropriate approximation of the best set of features for a specific classifier rather than for determining an optimal set (Otman Basir, 2020).

6. CLASSIFICATION OF ALGORITHMS

The last stage is the classification stage. The classification of medical images is the most challenging task for automatic detection of brain tumor from the images. Classification might provide the answer whether the image contain brain tumor or not. For classification purpose many classes will be used. Some commonly used classification methods and concepts are Artificial neural networks, support vector machine (svm), supervised machine learning. These approaches are used for classification of images. Their work indicates the development of particular learning techniques for enhancing the achievement of a standard based on the use of model data or prior events . During supervised learning, the approval of the training is dependent on patterns that carry output labels.

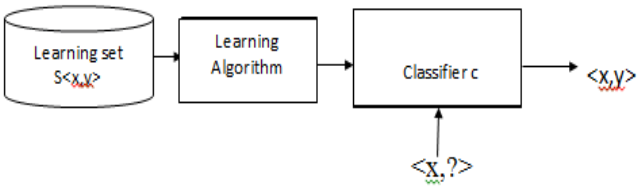

Fig. 4 supervised learning model

Figure 4 shows the supervised learning model. When the output values identify the various classes to which the samples relate, the training assignment is called “classification.” The classifier factors have described the training data consistently because they have been collected from the model data. The training data set to be fed to the classification algorithm for constructing the classifier consists of N data points that can be formally denoted as {xi,yi} N n=1, with xi €R^d being an input example of dimension d and yi€ {−1, +1}, the corresponding class label for a two-class classification task (Otman Basir, 2020).

7. DISADVANTAGES

1) MRI scans may contain a lot of unwanted and irrelevant parts in its actual images and it is difficult to remove it.
2) The identification and detection of tumor infected area from brain MRI is critical task. Clinical experts examine medical images to identify signs and location of tumor. Due to complex nature of MRI, there is limitation for human eye to analyze the minute differences.
3) Mostly the interpretations of medical data is being done by medical expert. In terms of image interpretation by human expert, it is quite difficult because Great knowledge and experience on radiology are required for accurate tumor detection in medical imaging.
4) Less accuracy, More time consuming and More human interaction is required.

8. ADVANTAGES

1) Automation of tumor detection is required because there might be a shortage of skilled radiologists at a time of great need.
2) Image preprocessing techniques are used to retain original image properties.

3) It is reliable and accurate. It will take very less time to show result of disease.
4) Once system is train and ready to implement then it will shows result without any human interaction and it is easy to detect diagnoses.

9. COMPARISON

1) In medical field it is essential to get precise images for accurate observations of disease. Quality of medical images depend upon the sources of artifact acquisition such as MRI, PET, CT etc. MRI scans may contain a lot of unwanted and irrelevant parts in its actual images. MRI are influenced by Rician noise. Rician noise is signal dependent and it is difficult to remove it for removing unwanted parts different filters are used.
2) The identification and detection of tumor infected area from brain MRI is critical task. Clinical experts examine medical images to identify signs and location of tumor. Due to complex nature of MRI, there is limitation for human eye to analyze the minute differences. Mostly the interpretations of medical data is being done by medical expert. In terms of image interpretation by human expert, it is quite difficult because Great knowledge and experience on radiology are required for accurate tumor detection in medical imaging for accurate detection of diasease automation system of detection of diagnose is developed.

10. CONCLUSIONS

The study has identified main processes in determining the existence of tumor. In summary, in this paper we have discussed the different types of brain tumor. Machine learning as well as the current practice of radiology to elucidate how these new algorithms can be incorporated into radiology workflow. We have discussed the different stages in brain tumor which are used to develop CAD(computer aided detection) systems for brain tumor detection through MRI images detection system. Finally, we have discussed some advantages and limitations related to implementation of deep learning in the current practice of medicine. It can be generally concluded that the program will be interested in detecting damaged tissue with a certain intensity of brightness to its grayscale image. The thresholding will detect the damaged tissues. Through the image segmentation process, this research intends to use grayscale converted images of MRIs or CT scans to showing accurate result whether the patient is suffering from the tumor disease or not.

AI based application provided positive feedback, however, but due to the sensitivity of healthcare data and challenges, we should look more sophisticated machine learning methods that can deal complex healthcare data efficiently. All signs show that AI will play a significant role in radiology. The next 5 years will be a very exciting time in the field of machine learning scientists and radiologists. Lastly we conclude that there are unlimited opportunities to improve healthcare system.

11. ACKNOWLEDGEMENT

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