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# Evolution in Diagnosis and Detection of Brain Tumor

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***Abstract* - Diagnosis of a Brain at an early stage has become an important topic of research in recent time. Detection of tumor at an early stage for primary treatment increases the patient's survival rate. Processing of Magnetic resonance image (MRI) for an early tumor detection face the challenge of high processing overhead due to large volume of image input to the processing system. This result to large delay and decreases in system efficiency. Hence, the need of an enhanced detection system for accurate segmentation and representation for a faster and accurate processing has evolved in recent past. This paper outlines a brief review on the developments made in the area of MRI processing for an early diagnosis and detection of brain tumor for segmentation, representation and applying new machine learning (ML) methods in the decision making. The current trends in the automation of brain tumor detection, advantages, limitations and the future perspective of existing methods for computer aided diagnosis in brain tumor detection is outlined.**

***Keywords:*** Brain Tumor Detection, Intelligent approach, diagnosis and analysis.

## I. INTRODUCTION

Various algorithms and architectures have been proposed for development of precise and more effective categorization of brain tumours for an early prediction. Cancer develops as an unrestrained and abnormal expansion of cells in certain part of the body. The growth of glaucoma cells in the brain cause brain tumors. Among different types of cancers, brain tumors are the most important. The initial tumor develop from cell tissue, metastasis cells develop at different parts of the body and expand into the body area. Chemotherapy and radiotherapy are used in the treatment of cancer detection rate. In a machine learning system, multiple-level were processed for Existing processing methods introduce distortions in MRI samples that need to be removed for precise operating. Recent research focuses on algorithms for analyzing and diagnosing the presence of brain tumor, under the supervision of MRI reading from the benchmark database and the theoretical supervision of expert radiologists. The automated system were developed for denoising, segmentation features extraction and classification subjected to process of training and classifying the sample using computer-based coding and manually-identified MRI results.

## II. BRAIN TUMOR DIAGNOSIS

Brain is a vital organ of all living beings. It is a centralized processing unit in human which sense, control and operates all part of our body. Brain constitutes of 3 main types:

1. **Fore Brain:** This part of brain is formed by cerebrum, thalamus and hypothalamus which are responsible for thought, memory and information exchange.
2. **Mid Brain:** This part of the brain is formed of tectum and tegmentum. They are responsible for long term memory forming.
3. **Hind Brain:** This is consisting of pons and medulla oblongata which helps in controlling of motions, heart movement, breathing operation etc.

Brain tumors are majorly of two types:

1. **Benign:** This type of tumor has a slow growth and defined by distinct boundaries.
2. **Malignant:** This type tumor has a rapid growth and has an irregular boundary. It spreads to nearby brain region within the brain.

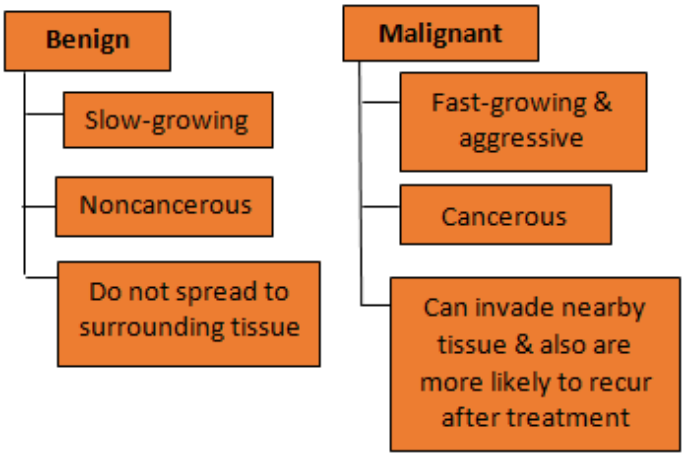


**Figure 1: Types of brain tumors**

 

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## III. METHODOLOGY

**Brain Imaging:** Various brain imaging approaches were used in diagnosis of brain tumor. Method such as position emission tomography (PET), single-photon emission computed tomography (SPECT), computed tomography (CT), magnetic resonance imaging (MRI), Functional MRI (FMRI) and magnetic resonance spectroscopy (MRS) were used for the localization of brain tumor for its size, location, shape etc. by the tumor.

**Image Acquisition:** First considered that the MRI scan images of a given patient are either colour, Gray-scale or intensity images herein are displayed with a default size of 220*220. If it is colour image, a Grey-scale converted image is defined by using a large matrix whose entries are numerical values between 0 and 255, where 0 corresponds to black and 255 white for instance. Then the brain tumor detection of a given patient consist of two main stages namely, image segmentation and edge detection.

**Pre-processing stage:** Pre-processing stage consist of Noise removal this can be done by using variation spatial filters linear or nonlinear filters. Other artifacts like text removed by some morphological operations.

RGB to grey conversion and reshaping also takes place here. It includes median filter for noise removal. The possibilities of arrival of noise in modern MRI scan are very less. It may arrive due to thermal Effect.

Image Smoothing: It is the action of simplifying an image while preserving important information. The goal is to reduce noise or useless details without introducing too much distortion so as to simplify subsequent analysis.

**Image Registration:** Image registration is the process of bringing two or more images into spital correspondence. In the context of medical imaging, image registration allows for the concurrent use of images taken with different modalities (e.g. MRI & CT), at different times or with different patient position. In surgery, for example, images are acquired before (preoperative), as well as during surgery. Because of time constraints, the real-time intra operative images have lower resolution than the pre-operative images obtained before surgery.

**Image Segmentation:** The segmentation is the most important stage for analysing image properly since it affects the accuracy of the subsequent steps. However, proper segmentation is difficult because of the great varities of the lesion shapes, sizes, and colour along with different skin types and textures. In addition, some lesions have irregular boundaries and in some cases there is smooth transition between the lesion and the skin.

- Threshold segmentation
- Gradient Vector Flow (GVF)
- K-mean Clustering
- Fuzzy C-mean Clustering

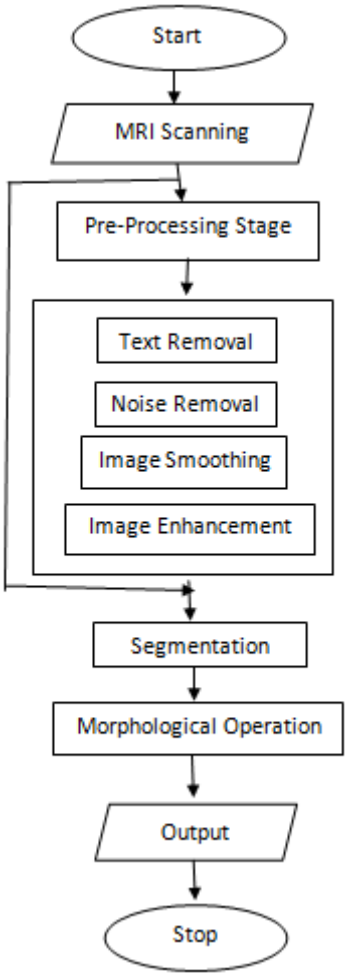


**Figure 2: Flow chart of brain tumor detection & segmentation**

Morphological Operation: After segmentation morphological processing is applied to remove unwanted part. It consists of image opening, image closing, dilation, erosion operation. At the end the decision has taken weather that MRI image consist of any tumor or not weather it normal or abnormal.

## IV. ANALYSIS

The evolution of brain tumour detection has outcome with various means of diagnosis and new technologies are evolving in improving the estimation performance more accurate. The objective of automation in brain tumor detection needs an analysis of the recent development in the brain tumor

 

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diagnosis for a region to present an accurate decision. The recent analysis developed for a past 4 years in an Indian region revealed that a majority of brain tumour cases is observed for Meningioma.

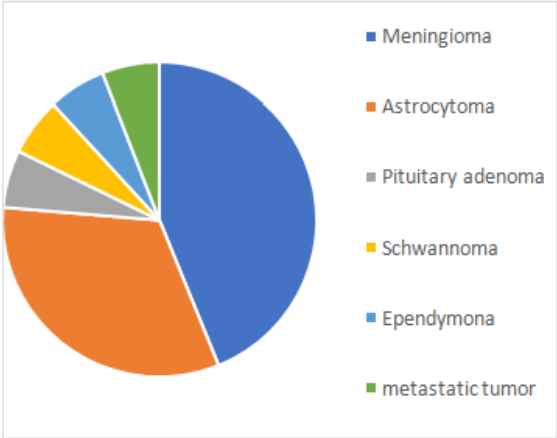


**Figure 3: Evolution of brain tumour**

**Percentage density of brain tumor cases**

The observation of Brain tumor analysis was evaluated for gender variation. The case analysis revealed a higher rate of infection for male compared to female cases. The count of brain tumor cases observed for high frequent and low frequent cases on gender base is listed in table 4 and 5 respectively. Of the total 117 observations for brain tumor cases monitored for 4 year, 65 male and 52 female cases were observed. The observation developed for varying ages for the observing period reveals a age group of 41-60 years patients were more effected.

## V. COMPUTER AIDED DIAGNOSIS (CAD) SYSTEM

The process of MRI diagnosis based on technicians is a slow process, and has manual errors. Computer based automation processing is an appropriate technique to automate tumor detection for brain cancer detection and classification. Analysis of various medical images in the diagnosis such as computed tomography (CT). Single-photon emission computed tomography (SP), magnetic resonance spectroscopy (MRS), positron emission tomography (PET), and SP Predictors were used in the analysis of early detection of brain tumors. Various computer-aided diagnostic (CAD) methods were introduced for the automatic processing of such scan images.

Distortion Minimization and Effect in MRI Processing Wherein efforts on noise elimination are resolved through in-depth filtration methods, descriptive features are highly susceptible to interference observed in the computation process. Wherein the test sample image is processed for the entire region, feature in large count to achieve high-quality accuracy, the complexity in image filtration for representation and classification needs to be reduced. In the early stage of processing, Captured MRI sample are pre-processed to remove the distortions acquired by processing system in improving the quality of image content for processing.

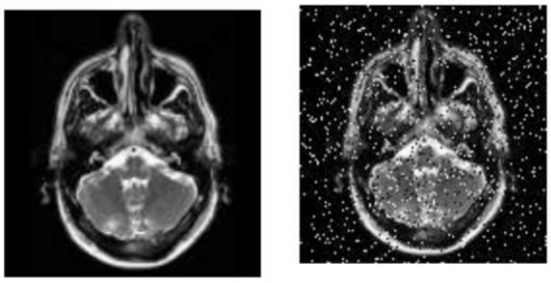

**Figure 4: Original and Noise effected sample in MRI processing**

## VI. ARTIFICIAL INTELLIGENCE EXPEDITES BRAIN TUMOR DIAGNOSIS DURING SURGERY

For patients with a brain tumor, the first step in treatment is often surgency to remove as much of the mass as possible. A tumor sample obtained and analysed during surgery can help to precisely diagnosis the tumor and define the margins between tumor and healthy brain tissue.

However, such intra operative pathology analysis takes time- the sample must be processed, stained, and analysed by a pathologist while the surgeon and patient wait for the results. Now, a advanced imaging technology and artificial intelligence (AI) can accurately diagnose brain tumors in fewer than 3 minutes during surgery. The approach was also able to accurately distinguish tumor tissue from healthy tissue.

**Applying Imaging and AI Technology**

In the study, combine an imaging technology called stimulated Raman histology (SRH) with the predictive power of AI to improve current intraoperative pathology practice.

SRH, a specialized form of microscopy, can be used to visualize fresh tissue samples directly in the operating room, even producing the same sort of “staining” that pathologists apply to frozen tissue sample to analyse cellular structure.

AI involves using powerful computers to perform tasks that are typically associated with human intelligence. A type of AI known as deep learning uses complex mathematical algorithms, sometimes called convolutional neutral networks, to extract features from data that it is then “trained” on. This training allows the algorithm to recognize patterns and perform tasks such as analyzing images. In medicine, for example, such algorithms are being studied to see cancerous moles more accurately.

 

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To combine the power of the SRH imager with AI, the researchers began by training an algorithm on SRH-produced images of brain tumor tissue. For the training, they used more than 2.5 millions tumour tissue images from 415 patients. The images covered three nontumor-tissue classifications, including healthy grey or white matter, and the 10 most diagnosis in the United States.

**The Future of AI in Brain Tumors**

Before the new technology can be expanded to other centers and institutions, "robust testing with more patients and expanding the technology to include rare brain tumors are greatly needed.

The SRH imager is being used a several major cancer centre across the United States today. Both AI and SRH imaging are emerging technologies, so there will be challenges to integrating them into care. Even so, the use of the SRH-AI technology will expand in the future, including at centre wait limited pathology resources and for potential use in a number of different cancer types.

## VII. CONCLUSION

A comprehensive literature survey is conducted on the developed methods for the proposed work of brain tumor detection. The automation of the brain tumor is important task became of its volumetric data presentation, fine-grained features, and complexity indecision-making. The processing speed, complexity in calculation is also important in system performance. Improving operational efficiency, recent developments has include new machine learning systems that have expanded the use of machine learning methods in MRI diagnosis. This paper described recent advances in the process to automated brain tumor detection, Segmentation, feature presentation, and classification models. Intelligent approach to machine learning methods such as the neural network (NN) provided an advantage in processing and classification of tumors and non-tumorous methods have given an opportunity to develop new approaches to improve automated performance with faster speeds and better accuracy. In future to improve the performance of brain tumor detection, an improvement in segmentation based on multiple scaling with advanced feature extraction and classification is focused. The learning overhead and classification limitation in terms of accuracy and processing time will be addressed.

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