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# A Survey on the deep learning architectures in the field of bio-medical engineering

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**Abstract**
Now a day's tumor is second leading cause of cancer. Due to cancer, large no. of patients are in danger. The medical field needs fast, automated, efficient and reliable techniques to detect tumors like brain tumors. Detection plays a very important role in treatment. If proper detection of tumor is possible then doctors keep a patient out of danger. Various image processing techniques are used in this application. Using this application doctors provide proper treatment and save a number of tumor patients. A tumor is nothing but excess cells growing in an uncontrolled manner. Brain tumor cells grow in a way that they eventually take up all the nutrients meant for the healthy cells and tissues, which results in brain failure. Currently, doctors locate the position and the area of brain tumor by looking at the MR Images of the brain of the patient manually. This results in inaccurate detection of the tumor and is considered very time consuming. A tumor is a mass of tissue it grows out of control. We can use a Deep Learning architectures CNN (Convolution Neural Network) generally known as NN (Neural Network) and VGG 16(visual geometry group) Transfer learning for detecting brain tumors. The performance of the model is predicting image tumor is present or not in image. If the tumor is present, it returns yes otherwise return no. The work done is the third semester project phase-1 & 2 as a part of the M.Tech. project work in the 2nd year.
**Keywords:**Medical, Bio, Cancer, Tumor

## 1. Brain Tumor Detection System

The human body is made up of many organs and brain is the most critical and vital organ of them all. One of the common reasons for dysfunction of brain is brain tumor. A tumor is nothing but excess cells growing in an uncontrolled manner. Brain tumor cells grow in a way that they eventually take up all the nutrients meant for the healthy cells and tissues, which results in brain failure. Currently, doctors locate the position and the area of brain tumor by looking at the MR Images of the brain of the patient manually. This results in inaccurate detection of the tumor and is considered very time consuming [1].

A Brain Cancer is very critical disease which causes deaths of many individuals. The brain tumor detection and classification system is available so that it can be diagnosed at early stages. Cancer classification is the most challenging tasks in clinical diagnosis. This project deals with such a system, which uses computer, based procedures to detect tumor blocks and classify the type of tumor using Convolution Neural Network Algorithm for MRI images of different patients. Different types of image processing techniques like image segmentation, image enhancement and feature extraction are used for the brain tumor detection in the MRI images of the cancer-affected patients [2].

Detecting Brain tumor using Image Processing techniques its involves the four stages is Image Pre-Processing, Image segmentation, Feature Extraction, and Classification. Image processing and neural network techniques are used for improve the performance of detecting and classifying brain tumor in MRI images [3].

## 2. Overview of brain and brain tumor

Main part in human nervous system is human brain. It is located in human head and it is covered by the skull. The function of human brain is to control all the parts of human body. It is one kind of organ that allows human to accept and endure all type of environmental condition. The human brain enables

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humans to do the action and share the thoughts and feeling. In this section we describe the structure of the brain for understanding the basic things as seen in the Fig. 1 [4].

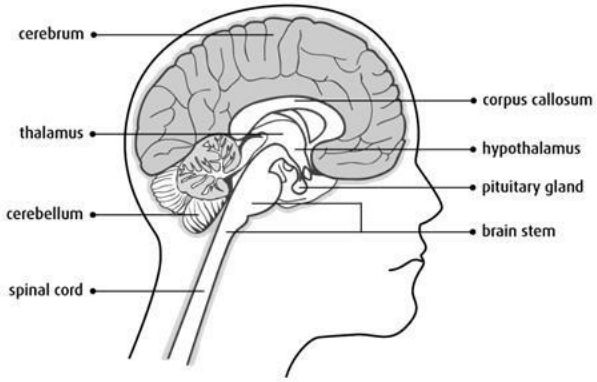


Fig 1: Basic structure of human brain

The brain tumors are classified into mainly two types: Primary brain tumor (benign tumor) and secondary brain tumor (malignant tumor).The benign tumor is one type of cell grows slowly in the brain and type of brain tumor is gliomas. It originates from non neuronal brain cells called astrocytes. Basically primary tumors are less aggressive but these tumors have much pressure on the brain and because of that, brain stops working properly. The secondary tumors are more aggressive and more quick to spread into other tissue. Secondary brain tumor originates through other part of the body. These type of tumor have a cancer cell in the body that is metastatic which spread into different areas of the body like brain, lungs etc. Secondary brain tumor is very malignant. The reason of secondary brain tumor cause is mainly due to lungs cancer, kidney cancer, bladder cancer etc [5].

**3. Magnetic Resonance Imaging (MRI)**

Raymond V. Damadian invented the first magnetic image in 1969. In 1977 the first MRI image were invented for human body and the most perfect technique. Because of MRI we are able to visualize the details of internal structure of brain and from that we can observe the different types of tissues of human body. MRI images have a better quality as compared to other medical imaging techniques like X-ray and computer tomography.[8]. MRI is good technique for knowing the brain tumor in human body. There are different images of MRI for mapping tumor induced Change including T1 weighted, T2 weighted and FLAIR (Fluid attenuated inversion recovery) weighted shown in Fig. 2 [6].

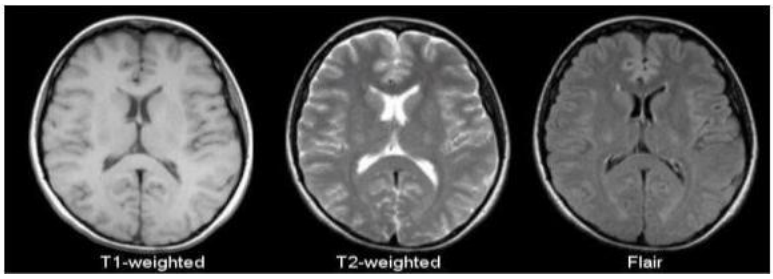


Fig. 2 : T1, T2 and Flair image

The most common MRI sequence is T1 weighted and T2 weighted. In T1 weighted only one tissue type is bright FAT and in T2 weighted two tissue types are Bright FAT and Water both. In T1 weighted the repetition time (TR) is short in T2 weighted the TE and TR is long. The TE an TR are the pulse sequence parameter and stand for repetition time and time to echo and it can be measured in millisecond(ms)[9]. The echo time represented time from the centre of the RF pulse to the centre of the echo and TR is the length of time between the TE repeating series of pulse and echo is shown in Fig. 3 [7].

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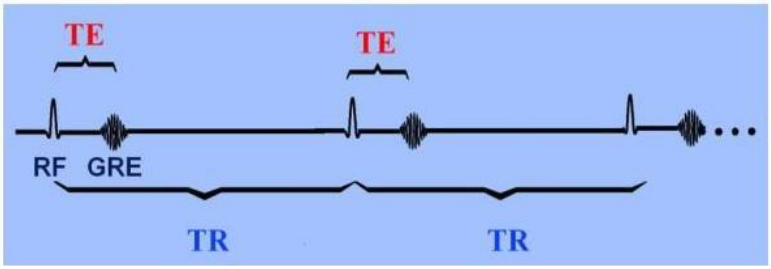


Fig. 3 : Graph of TE and TR

The third commonly used sequence in the FLAIR. The Flair sequence is almost same as T2-weighted image. The only difference is TE and TR time are very long. Their approximate TR and TE times are shown in table 1 [8].

| | TR (msec) | TE (msec) |
|---|---|---|
| **T1-Weighted** (short TR and TE) | 500 | 14 |
| **T2-Weighted** (long TR and TE) | 4000 | 90 |
| **Flair** (very long TR and TE | 9000 | 114 |

Table 1 : Table of TR and TE time

**4. Applications of project**

Based on the study so far regarding to the identification of tumor cells using CNN, it is now necessary to know a few applications towards this technology. Below listed are a few applications that can be expected from the project [8]:

- The main aim of the applications is tumor identification.
- The main reason behind the development of this application is to provide proper treatment as soon as possible and protect the human life which is in danger.
- This application is helpful to doctors as well as patient.
- The manual identification is not so fast, more accurate and efficient for user.

To overcome those problem this application is design. To all the above mentioned applications, this performance analysis would throw light on how best the system model can be used [9].

**5. Conclusions**

In conclusion, this survey provides a comprehensive overview of the deep learning architectures used in the field of biomedical engineering. Deep learning has emerged as a powerful tool for analyzing and interpreting complex biomedical data, offering significant advancements in various areas such as medical imaging, genomics, drug discovery, and disease diagnosis. The survey highlights the diverse range of deep learning architectures employed in biomedical engineering, including convolutional neural networks (CNNs), recurrent neural networks (RNNs), generative adversarial networks (GANs), and transformer models [10].

The survey emphasizes the potential of deep learning in improving the accuracy and efficiency of biomedical analysis, enabling more precise diagnoses, personalized treatment plans, and advancements in medical research. It discusses the specific applications of deep learning architectures in tasks such as medical image segmentation, disease classification, prediction of treatment outcomes, and biomarker discovery. Additionally, the survey explores the challenges and limitations associated with deep learning techniques in the biomedical field, such as the need for large labeled datasets, interpretability issues, and ethical considerations.

Overall, this survey underscores the significant progress made in applying deep learning architectures to biomedical engineering and highlights the potential for future advancements. With ongoing

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research and development, it is expected that deep learning will continue to revolutionize the field, leading to improved healthcare outcomes, enhanced understanding of diseases, and the development of innovative medical technologies.

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