

A REVIEW PAPER ON BRAIN TUMOUR

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ABSTRACT: Brain controls all the necessary functions of body. The most complex organ in human body is brain and it is part of the central nervous system (CNS). A brain tumor is a mass or growth of abnormal cells within the brain or spinal cord. Brain tumor can be dangerous as it will disrupt the proper function of the brain. On May 9, 2016, the World Health Organization officially reclassified all of the types of brain tumor. There are 120 types of brain tumors. American Brain Tumor Association (ABTA) took a survey and declared that there were more than 79,000 new cases of brain tumors diagnosed in the United States in 2017. ABTA also estimated that there are 7,00,000 people who were suffering from brain tumors in the U.S. According to ABTA, an estimated 16,700 people died from brain and spinal cord tumors in 2017. Doctors may also refer to a tumor based on where the tumor cell originates. It can be referred to as a primary brain tumor, if the tumor began in the brain. If it began it'll spread to another part of the body and affect the brain and that can be referred to as secondary or metastatic brain tumors. In case of young age, cells divided comparatively faster, which helps in the growth of child. The uncontrolled growth of cells is known as tumor.

Keywords: Brain Tumor, Central Nervous System (CNS), Segmentation, MRI Images, Fuzzy Transform, Morphological operation.

1. INTRODUCTION

A collection of abnormal cells in your brain is called brain tumor. Your skull which closes your brain to be taken care very carefully. Any growth inside such a place can cause problem. Brain tumor can be cancerous or non cancerous. When benign or malignant tumor grows, they can cause the pressure inside your skull to increase. This will cause brain damage, and it can be hazards threatening to our life. When tumor spread in any part of brain then that is known as brain tumor. Now when brain tumor can identified number of symptoms including seizures, mood changing, difficulty in walking and hearing, vision, and muscular movement etc.

Brain tumor is classified into 5 types. They are

- Gliomas
- Medulloblastoma
- Ependymomas
- CNS lymphoma and
- Oligodendroglioma.

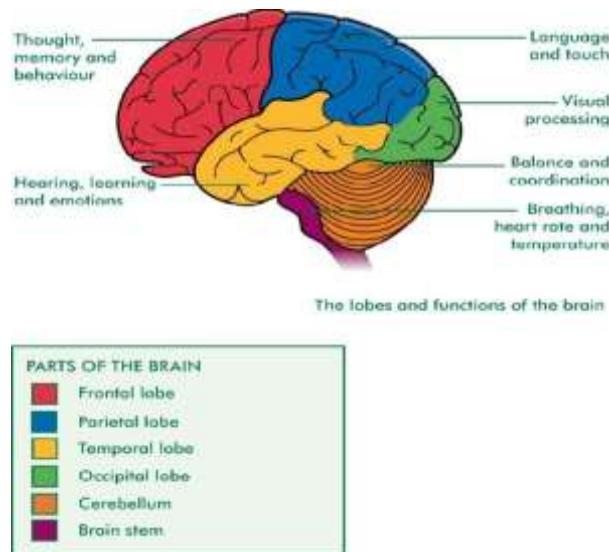
Together the brain and spinal cord (the central nervous system) control the physiological and psychological function of our body. Generally our brain includes three major parts:

- Cerebrum
- Cerebellum
- Brain Stem

Brain Anatomy

Brain controls all the necessary functions of body. The most complex organ in human body is brain and it is part of the central nervous system (CNS). Skull covers brain and provides the brain is composed of three matters—"gray matter (GM), white matter (WM) and cerebrospinal fluid (CSF)". Cerebrospinal fluid (CSF) is a transparent liquid that

encapsulates the brain and the spinal cord and many functions to CNS. It provides a barrier against shocks which consists of glucose, oxygen, and ions. It is distributed throughout the nervous tissue. CSF helps in removal of waste products away from nervous tissue. Figure shows brain anatomy with various functions.



Brain anatomy of various functions

2. MAJOR PARTS OF BRAIN

Cerebrum:

This part of the brain controls functions such as language, logic, reasoning, and creativity. Cerebrum is divided in two halves- the right hemisphere (right side), which controls the body's left side, and the left hemisphere (left side) which controls body's right side. Each hemisphere is further divided into various subparts- "frontal lobe, temporal lobe, parietal lobe and occipital lobe". The cerebrum is the place where human can think and store in memory

Frontal Lobe:

This portion of the brain helps in planning, organizing and problem solving. It controls behavior, personality and emotions of a person.

Occipital Lobe:

It is the region which lies in the back of the brain and processes visual information. It helps in visual recognition of different shapes and colors and finds association between them. Any damage to this lobe can cause failure of visual capability.

Cerebellum:

This is situated behind and below the cerebrum. Its main purpose is to maintain muscle coordination. If any problem occurs in this area, person can have problem in walking, talking and eating.

Brain Stem:

Brain is connected with spinal cord with the help of brain stem. This is very useful in controlling our body functions- "heart rate, digestion, breathing, blood pressure, and alertness".

Temporal Lobe:

There are two types of temporal lobes: Left lobe and Right Lobe. Left lobe maintains verbal memory e.g. words and names. Right lobe maintains visual memory e.g. pictures and faces.

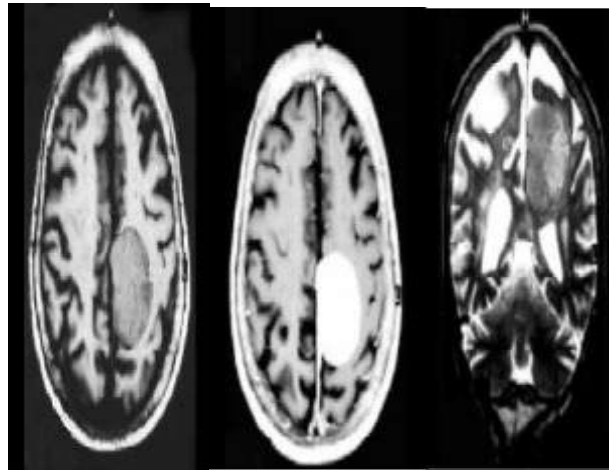
Parietal Lobe:

It helps in judgment of texture, weight, shape and size. A brain tumor occurs due to abnormal growth of unnecessary cells. The American cancer society has surveyed that a total number of 21,000 Americans suffer from brain tumor each year [1]. Our body is made up of many cells. Generally, cells grow, divide into new cells, and then die off continuously. In case of young age, cells divide comparatively faster, which helps in the growth of child. But after some age, new cells are not formed. Instead most of the cells are divided just to replace died cells or to repair any injury. When this process gets disturbed, cells continuously grow and new cells are formed without dying old cells. This increases number of cells in that body part. This uncontrolled growth of cells is known as tumor.

3. TYPES OF BRAIN TUMORS:

According to World Health Organization (WHO), there are 120 types of brain tumor. WHO classification is based on cell's origin.

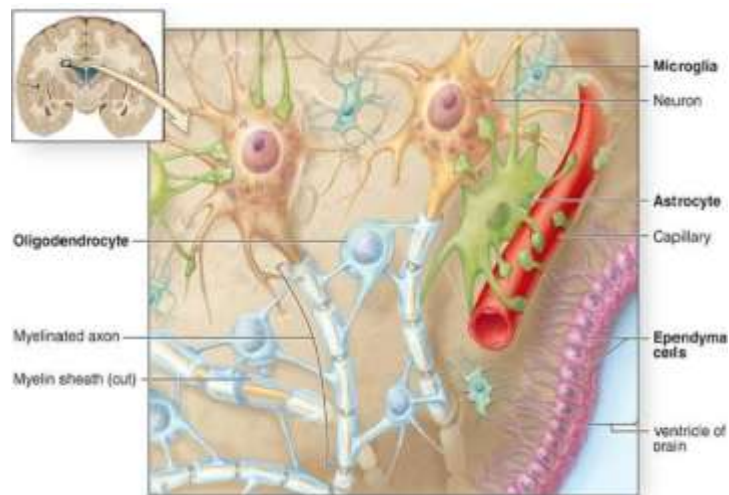
Broadly, brain tumors are categorized in two types:



- **Primary brain tumor**
- **Secondary brain tumor**

Primary Brain Tumors are originated in the brain. Name of tumor can be determined by seeing their origination. Tumors of two types-benign and malignant. Benign brain tumor is also known as non-cancerous and it does not affect other parts of our body, while malignant brain tumor is originated in the brain and spreads in other parts of our body like spine. Growth rate of malignant tumor is fast. Benign brain tumor is easy to treat than malignant tumor because it is not deep buried in brain and has defined boundary. Benign tumor if removed successfully then there is very less chance of its coming back. But that is not true in case of malignant tumor. If this is removed then also there is some probability of coming back. Most common type of primary tumor is 'Glioma' which occurs due to glial cells. Glial cells are supportive tissues of brain as shown in Figure 2. Glial cells are of three types:

- Astrocytes – These are blood brain barriers.
- Oligodendrocytes – These provide covering (myelin) to neurons.
- Ependymal cells – These align the ventricles and secrete cerebrospinal fluid.



Cell structure of brain

Secondary Brain Tumors are not originated in brain but come in brain through other body parts. This process of spreading tumor is known as metastasis. This type of tumor is named according to body parts from where they originally spread. If brain tumor is developed from lung then called metastatic lung tumor

Shown in figure. This is due to abnormal growth of lung cells.

4. BRAINTUMOR CLASSIFICATION ACCORDING TO GRADE:

In medical field, brain tumors are characterized by their GRADE. The GRADE of a tumor can be decided according to their behavior under microscopic observation:

GRADE I: These tumors are known as benign. Their look is nearly same as normal brain cells and their growth rate is slow as compared to other grades. This is the first stage of tumor.

GRADE II: These tumors are known as malignant. GRADE I and GRADE II are known as low grade tumors.

GRADE III: GRADE III and GRADE IV are known as high grade tumors. Their behavior is much different from normal cells and requires urgent treatment to cure.

GRADE IV: These types of tumors show fastest growth rate and have worst abnormal behavior than other grade.

5. BRAIN TUMOR DETECTION METHODS:

Brain imaging techniques help radiologists and researchers to detect problems in the human brain, without need of neurosurgery. There are number of techniques available in hospitals throughout the world that are proved to be safe.

CT scan:

Computed Tomography (CT) is used to construct brain images through a series of X-rays scan. In the process of CT scan the patient lies on a table which can slide in to center of CT scanner. Machine X-ray beam rotates around the patient. Scan usually only takes 30 minutes. It shows structural view of brain not the functional.

PET scan:

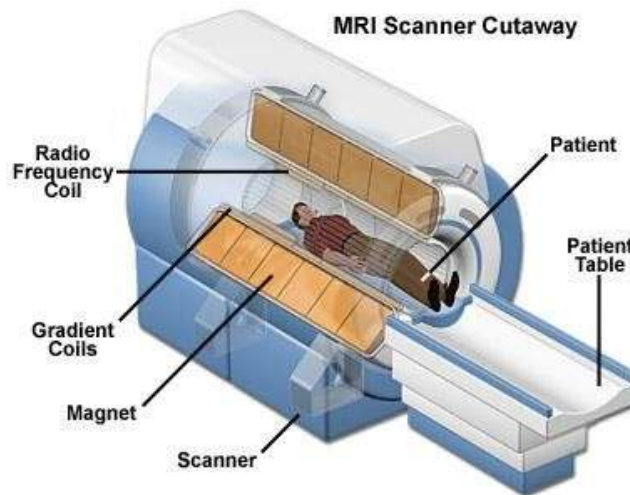
A Positron Emission Tomography (PET) scan is used to get functional view of brain. A small amount of radioactive material is injected in the body and scanner detects material when this material breaks down. A PET scan is able to show how different areas of the brain behave during various tasks. PET is able to detect following brain abnormalities:

- Tumors
- Memory disorders

- Seizures

MRI Scan:

In the last few years, the uses of Magnetic Resonance Imaging (MRI) scanners in medical field have grown superbly [9]. Doctors may use MRI scans in diagnosing brain tumor and cancer.



6. CAUSES:

According to American Brain Tumor Association (ABTA), primary causes for brain tumor are:

- Genetic conditions.
- Medical radiation (previous X-rays).
- Previous cancers.
- Mobile phones.
- Hair dye.
- Working in synthetic rubber manufacturing or petroleum refining/production
- Smoking and alcohol.
- Use of medicine like birth control pills, sleeping pills, headache remedies.
- Due to cured foods (for curing foods Nitrite is used which contributes in number of cancers).
- Being exposed to air pollution, power lines, chemicals used in agriculture and industrial formaldehyde (vinyl chloride).

6. SYMPTOMS OF BRAIN TUMOR:

Symptoms of brain tumors depend on the type of tumors, growth rates and their locations. Headaches are often a symptom of brain tumor. But it is not necessary that headache always occur due to brain tumor. There can be some other reasons too (like migraine, tension etc.)

Common Symptoms

- Common initial symptom of brain tumor is headache which is worse in the morning, and gradually improves

during the day.

- Another common symptom is seizures. A seizure is a physical change in the behavior that occurs due to abnormal flow of electricity in the brain. Seizure results evolutionary changes in human behavior.
- Nausea is due to uneasiness in the stomach that results in vomiting. Nausea and vomiting may be one of the symptoms of brain tumor.
- 25% patients of brain tumor reported about hearing problem like hearing loss, buzzing sounds etc.
- There can be problems with memory like concentration changes, confusion etc.

7. PROBLEM STATEMENT

In medical field most of the classifications are reproducible. Images may contain different types of noise which can lead to inaccurate results. Accuracy is very important in case of medical image classification. There is a need to develop a computer based system which can assist radiologists. Although final decision is of radiologist but such type of computer based types of problems.

- Explore new possibilities for brain tumor segmentation algorithm.
- Make system enable to differentiate between tumor and non-tumor images.
- Able to find out type and grade of tumor.
- Comparative study between different algorithms at each stage and finally uses the algorithm which one is best.
- Calculate area and volume of tumor.
- Since artificial techniques show a great potential in medical fields. The proposed research work uses Neuron - Fuzzy, FCM and Snake model.

8. MOTIVATION

Brain tumor represents an important group of diseases which has higher mortality rate (18.8%) and low survival rate (less than five years) than other common type of cancer reported by New Philanthropy Capital (NPC). Figure below shows proportion of death due to cancer and other diseases reported by Canadian cancer society and figure shows comparison graph of various cancers in terms of survival rate.

Comparison in terms of survival rate

Main motivation for this proposed work can be summarized as follows:

- Segmentation of Brain tumor demands high accuracy. So, a robust segmentation model must be proposed which increases segmentation accuracy.
- The another motivation is to minimize human errors as it can possibly help physicians and radiologists with some segmenting software that will produce more accurate and fast results. Error minimization is necessary because it have to deal with human lives.
- In these days, CAD (Computer Aided Diagnosis) software is being used by radiologists for early detection so that treatment can start earlier. CAD helps medical expert in making final decision by providing second opinion.
- Automatic segmentation also encourages new application to be developed e.g. Content Based Image Retrieval (CBIR). In large medical databases, it is very easy to find out particular record for knowing medical history of patient and patient's family. Also, same type of tumor if treated by a doctor then previous record can help this time.

In this thesis, we proposed a Fuzzy c-means, ANFIS framework to detect and segment brain tumor types and boundaries. The MR images are combined with other image processing techniques in order to enhance accuracy of brain tumor segmentation.

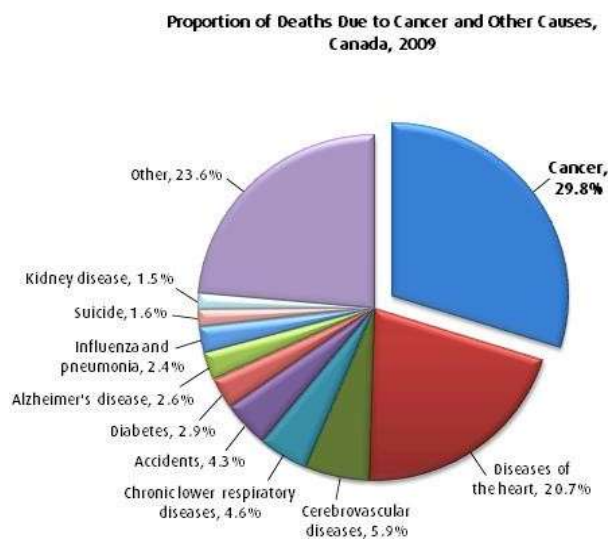
9. OBJECTIVE

The proposed work has been carried out to find new computerized methods to improve computer-based methods to improve computer-based brain tumor segmentation. Main objectives of thesis are:

- Improving accuracy of brain tumor classification system by diagnosing and implementing a pattern recognition system.
- Develop a system that can differentiate between different types of tumor with their grades using Neuron-Fuzzy technique.
- To further extend and improve the proposed classification system by using boundary- based methods i.e. Snake model to highlight boundaries of tumor.

10. CONCLUSIONS

Image segmentation is extensively used in numerous biomedical imaging application .In this paper we have proposed different techniques to detect and segment brain tumor from MRI image .Now a day's speed of computation is no longer an issues for researchers. We present the image segmentation of MRI image to get an accurate segmentation picture of the brain tumor cell.



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