

Chapter 4

Brain Tumor and Its Segmentation From Brain MRI Sequences

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ABSTRACT

Automated segmentation of tumorous region from the brain magnetic resonance image (MRI) is the procedure of extrication anomalous tissues from regular tissues, such as white matter (WM), gray matter (GM), and cerebrospinal fluid (CSF). The process of accurate and efficient segmentation is still exigent because of the diversity of location, size, and shape of the tumorous region. Brain MRI provides metabolic process, psychological process, and descriptive information of the brain. Brain tumor segmentation using MRI is drawing the attention of the researchers due to its non-invasive nature and good soft tissue contrast of MRI sequences. The main motive of this chapter is to provide a broad overview of the methods of brain tumor segmentation based on MRI. This chapter provides the information of the brain tumor, its types, brief introduction of the MRI, and its diverse types, and lastly, this chapter gives the brief overview with benefits and limitations about diverse techniques used for brain tumor segmentation by different researchers and scientists.

1. INTRODUCTION

Human brain is the most vital part in human body. It is a complex composition that exhibits neural activity on numerous spatial scales. It is the main and only reason of our each and every emotion, thought, memory and action in the world. If any situation arises of brain getting affected then, whole human body system gets affected. Out of many such scenarios, brain tumor is the worst case scenario. Among all life threatening diseases which are increasing in quick rate, Brain tumor is one of the most serious life threatening disease. It is basically a mass of tissue which is generally formed due to unstructured growth of abnormal cells in brain at any random location. The prevalence of research on human brain imaging focuses on the covered structure of the cerebral cortex gray matter.

A tumor (sometimes it is called lesion or neoplasm) is anomalous tissue that grows by irrepressible division of cells. Standard cell grows in controlled approach as old or damaged cells are replaced by new cells. Taking into consideration about the brain tumor, it can be separated into two types' primary tumor and metastatic or secondary tumor.

A primary brain tumor is an anomalous growth that initiates in the brain and generally does not spread to another part of the body. It may be malignant or benign. The benign tumor grows gradually, is having discrete boundaries, and hardly ever spread. While a malignant tumor grows rapidly and having asymmetrical boundaries. Secondary (metastatic) brain tumor begins as cancer somewhere else in the body and spread to the brain. They form where the cancer cells are conceded in the blood stream of the brain. There are almost 120 different types of brain tumor. Ordinary brain tumor includes glioma, lymphoma, craniopharyngioma, schwannoma, epidermoid, meningioma, pituitary adenoma, medulloblastoma, pinealoma, and many more. This chapter will give the brief introduction of the different types of commonly brain tumor as per WHO (World Health Organization). American Brain Tumour Association (ABTA) presented that in the year 2015, nearly 78,000 new human cases of primary brain tumours have been diagnosed. That includes just about 53,000 nonmalignant and 25,000 primary malignant brain tumours. The growth of brain tumour amongst the people and people expire out of brain tumour are increasing in every year amid the developed countries and that is approximated by National Brain Tumour Foundation (NBTF) (El-Dahshan, Mohsen, Revett & Salem, 2014). Grading for brain tumours is issued by the World Health Organization (WHO) (Louis, Ohgaki, Wiestler, Burger, Jouve & Kleihues, 2007) in which Grade I (pilocytic astrocytoma) are least violent and cultivate gradually and Some Grade II (low-grade astrocytoma) replicate and affect close by tissues. Grade III (anaplastic astrocytoma) are the malignant tumour that replicate cells and impinge on tissues. Grade IV (glioblastoma) are the mainly malignant tumours that usually imitate quickly and affect close by normal brain tissue.

Further, identification of exact brain tumor is also an essential and critical task. One of the most significant ways of diagnosing brain tumor is MRI. It is a non invasive medical test that uses radio frequency waves and magnetic field to give a descriptive view of the soft tissue of the brain. It views the brain 3 dimensionally in slices which can be taken from the side or can be taken from the top as a cross section. A contrast agent may be inserted into the patient's blood stream. MRI is one of the important tools for analyzing brain tumor. There are several types of brain MRI sequences available such as T1-weighted MRI, T2-weighted MRI, Diffusion weighted MRI, Fluid attenuation Inversion Recovery (FLAIR) MRI, Diffusion Tensor Imaging, Gradient Record MRI, functional MRI. This chapter provides the detailed information of the different kinds of MRI. How they are useful and what are the uses and significance. Though, MRI gives the detailed information of the brain such as structure and shape of the tumor, if it is there. However, it is very difficult task for a medical practitioner for analyzing brain tumor manually

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