Benign and Malignant Brain Tumor Pre-processing and Segmentation Techniques: A Survey

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Abstract *- The lump inside the brain is considered a brain tumor, due to cells divide and grow in an uncontrolled way the lump formed inside the brain. At present-day, processing of medical images is a developing and important field. It includes many different types of imaging methods, they are Computed Tomography scans (CT scans), X-rays and Magnetic Resonance Imaging (MRI) etc. The technologies like MRI and CT allow us to separate even the smallest imperfections in the human body. Brain tissues abnormal growth affect functions of the brain are considered as a tumor. The medical image processing is a tool to classify and groups perfect and significant information in Magnetic Resonance Images with the acceptable error rate. Brain tumor identifications through MRI images are a difficult task because of the complexity of the brain. These tumors can be segmented using various image segmentation with pre-processing techniques. Pre-processing and Enhancement of an image is the first step of image processing it is used to enhance the chances of detecting the suspicious region. Image segmentation is the method of partitioning a digital image into superpixels. The objective of segmentation is to convert the MRI into meaningful and easier to scrutiny. In this paper, various image processing methods for the detection and segmentation of brain tumors are discussed in detail with their simulation results.*

Keywords *- Magnetic Resonance Imaging, Medical Image Processing, Pre-processing and Enhancement, Segmentation.*

I. INTRODUCTION

The abnormal growth of cells inside the skull which leads to a brain tumor and it also damages the other functioning cells in the brain. Estimation of the World Health Organization (WHO) pieces of evidence, the most common brain diseases is a tumor and there are more than 120 types of brain and Central Nervous System (CNS) tumors. The brain tumor detection is a thought-provoking task due to the complex structure of the human brain. Basically, tumor in the human brain is classified in to benign or malignant. The objective of this survey is to elaborate different pre-processing and segmentation techniques available to determine benign or malignant cells inside the brain.

MRI helps identify tumors by magnifying the differences in water content and blood flow between tissues. The growth of malignant tumors creates their own network of blood vessels via angiogenesis; because of this a huge supply of blood to the surrounding tissues. Contrast material points out the blood vessels with high concentration, helps locate growth of malignant. Computer programs have defeated humans in Jeopardy. Pre-processing is the first step, performed to extract the Region Of Interest (ROI) using manual skull stripping and noise effects are removed by filters. Segmentation is the second step, dividing the image to its essential parts sharing identical properties such as color, texture, contrast and boundaries.

Processing and analyzing of Magnetic Resonance brain tumor images are the most upcoming and challenging field. MRI is an advanced medical imaging technique used to characterize and discriminate among tissues using their physical and biochemical properties (water, iron, fat, and extravascular blood and its breakdown products) and it is very important process for determining the correct treatment at right stage for tumor-infected individual.

II. MAGNETIC RESONANCE IMAGE PRE-PROCESSING

Most of the real-life data (MRI) is noisy, inconsistent and incomplete, so pre-processing becomes necessary. The aim of digital image pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image features important for further processing.

The CT and MRI cardiac images normally consist of some artifacts; patient specific and image processing and equipment based artifacts. Patient specific artifacts includes motion beam hardening, metal artifact. Others include partial volume effect, ring and staircase artifacts. So, it is needed to be removed by pre-processing procedures before any analyzing. The enhancement activities also used to remove the film artifacts, labels and filtering the images. Several denoising approaches have been surveyed and analysed in this section.

The incorporated noise during Magnetic Resonance Image acquisition however degrades the human interpretation or computer-aided analysis of the features in MRI images. Time averaging of image sequences aimed at improving the Signal to Noise Ratio (SNR) would leads to additional acquisition time and reduces the temporal resolution. Therefore, denoising instead should be performed to enhance the image quality for more accurate diagnosis [1].

1. Artifacts Removal from Magnetic Resonance Image:

Magnetic Resonance Imaging may contain artifacts or label. Different types of artifacts in brain MRI: (i) Chemical Shift, (ii) Aliasing, (iii) Black Boundary, (iv) Gibbs Ringing, (v) Zipper, (vi) Motion, (vii) Field (B0) inhomogeneity, (viii) Slice-overlap, (ix) RF Overflow, (x) Central Point, (xi) Quadrature Ghost, (xii) Susceptibility, (xiii) Eddy Current, (xiv) RF inhomogeneity, (xv) Partial Volume, (xvii) Flow, (xviii) Entry Slice, (xix) Moire Fringes and (xx) Gradient failure (B1inhomogenity). Brain imaging artefacts may occur at any stage of image preparation, ranging from acquisition to the post-processing period. Artifacts may also result from hardware problems