

## INTRODUCTION

Brain is the most important organ of our human body. Therefore, there is a constant search for tools that can analyse the brain that can reveal its idiosyncrasies. There is an acute need for tools that can help to increase the efficiency of the diagnosis.

Clinical Imaging using MR is one of the potent tools for diagnosis. Among the magnetic resonance (MR) images, brain MR images are extensively studied due to their importance in inpatient treatment, such as detection of disease, therapy planning, post-therapy observation, etc.

The magnetic resonance imaging (MRI) technique is usually used for the production of pictures of anatomy for clinical purposes and diagnosis. However, due to noise, intensity inhomogeneity (IIH), or radiofrequency (RF) inhomogeneity and partial volume effect, the intensity of a particular structural tissue varies across the image domain. The imaging is further affected by the structural nature of the organ and the patient's movement at the time of image capturing.

This results in an image of low resolution and blurred tissue boundaries and have an detrimental effect in diagnosis.

As a direct result of this, the segmentation process becomes cumbersome and challenging. Although manual segmentation by trained experts is reliable, the process is time-consuming, susceptible to human errors, and heavily dependent on expertise.

Thus, there is a strong need for a computer-aided segmentation method, which may yield accurate and robust results in the minimum time.

### ***Overview***

Segmentation of brain MR images into different tissue types usually helps to investigate the brain structure. It also helps the radiologists to detect any deformation in the brain, helping them for better treatment planning and diagnosis.

But due to noise and IIH, the intensity distribution of a specific tissue is irregular across the 3D brain MR image volume, resulting in an irregular visual texture. For these inherited artifacts, uncertainty arises in the process of predicting the class of each voxel.

Literature review suggests that brain MR images are usually segmented into three main structural tissues regions, Cerebrospinal Fluid (CSF), Grey Matter (GM), and White Matter (WM).

This thesis presents an efficient and robust computer aided method for segmenting a brain MR image into the Background (BG), the Cerebrospinal Fluid (CSF), Grey matter (GM), and White matter (WM) using type-2 fuzzy system.

The model aims to segment a 3D brain MR image volume as a whole in the presence of high noise and IIH.

This algorithm tries to exploit two membership functions, global and local membership functions. These two functions are calculated independently using global entropy and spatially constrained likelihood-based local entropy. Then these two membership values are then used to compute a Type-2 Fuzzy interval set of membership values for each of the voxels. Then this Type-2 Fuzzy interval set is defuzzified and then normalized to get the Type-2 membership value.

The Final Membership value is then calculated by finding the weighted sum of global membership value, local membership value and type-2 membership value using three regularizing parameters which are selected empirically.

The rest of the thesis is organized as follows:

**Chapter 2:** Describes a brief review of the literature related to segmentation of Brain MR Images.

**Chapter 3:** Provides a brief introduction of the concepts and technologies used in this thesis.

**Chapter 4:** Describes the proposed system.

**Chapter 5:** Describes the implementation details and reports the performance of the implemented system following the proposed approach.

**Chapter 6:** Draws the summary of the proposed system and shows the directions for future work,