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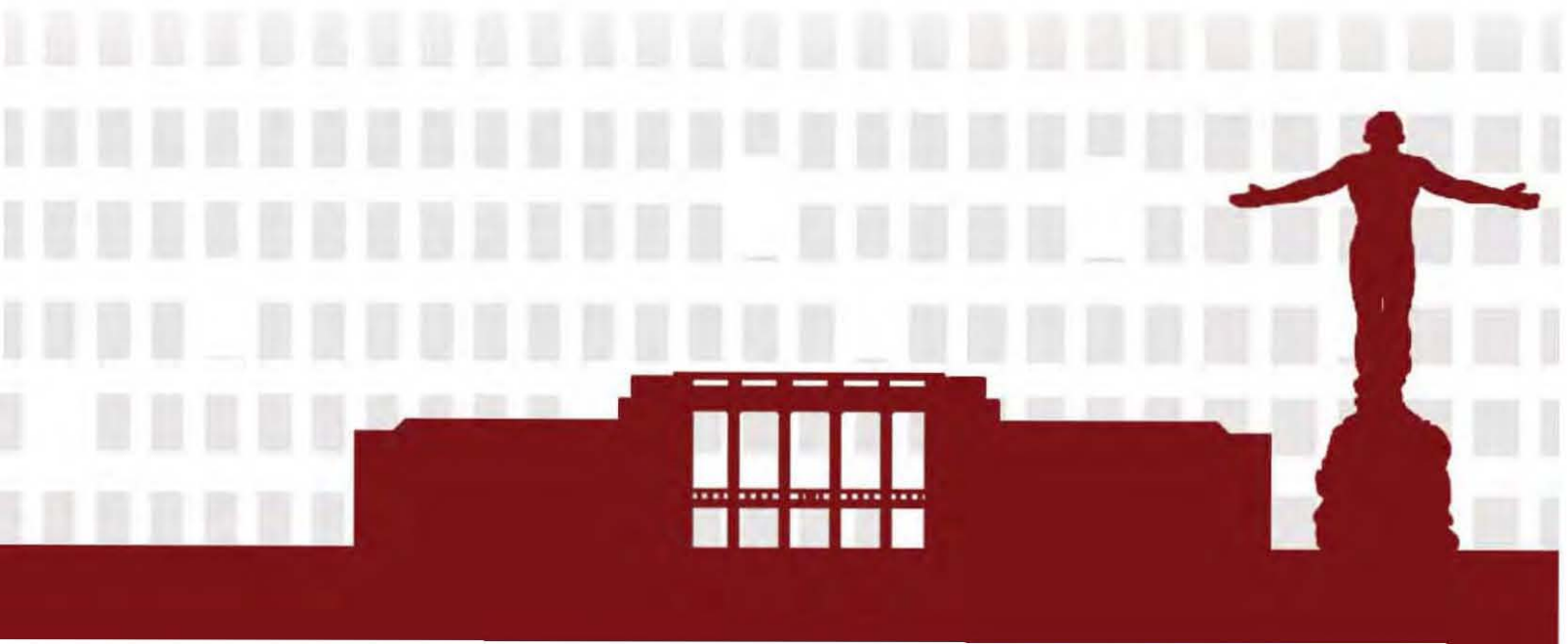

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ASSESSMENT OF ROBUST MRI BRAIN SEGMENTATION METHODS TOWARD DIAGNOSING OF ALZHEIMER'S DISEASE

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ABSTRACT
Whole brain segmentation from MR image is a key process toward higher level processing required by computerized Alzheimer's diagnosis. Delineated structures serve as the domain for subsequent hippocampus and other tissue segmentation. This paper proposed a robust method which involves less intervention from the user, compared to the conventional 2D geometric figure, based on a Level Set. Both methods were benchmarked on the T1 MR images obtained from the Alzheimer's disease Neuroimaging Initiative (ADNI) database. The experimental results reported herein indicated that the proposed method can extract the whole brain structure more accurately than its counterpart.

Keywords: MRI; ADNI; Level Set; Segmentation

1. Introduction

Alzheimer's disease (AD) is a degenerative disease which causes the brain to gradually shrink and later incapacitated. AD affects almost 50% of those over the age of 85 and as such is a top ten leading cause of death. Current diagnosis of Alzheimer's disease is carried out by clinical, neuropsychological, and/ or neuroimaging assessments. Magnetic Resonance (MR) has been considered a preferred neuroimaging modality for examining the AD as it enables accurate assessment of relevant organs such as hippocampus and related peripherals [1].

More recently, some previous researches have been successfully determining the prognostic outcomes of AD from MR images. Their methods involve interpreting spatial information derived from pixels intensities [2-3]. [2], for example, proposed an ad-hoc scheme for segmenting the whole brain structure based on mathematical morphology. In their work, assumptions on the geometric figures and their gross dimensions needed to be specified based on anatomical a priori. These assumptions are highly view dependent and maybe unable to remove spurious objects completely. Another pixel based method was proposed in [3], which segmented the brain structure by an adaptive thresholding. Alternatively, without extracting any object, [4] transformed the entire axial images using 2D Gabor Wavelet whose coefficient were used to classify the disease.

Similar to [1], this paper focus on extracting anatomical domain, i.e., the whole brain based on a Level Set method [5]. Unlike the "2D geometric method", the Level Set (LS) method did not require exact anatomical geometry of the brain except that on its connectivity. Moreover, it is more robust against noise and tonal variations, compared to a generic pixel based threholding [3] and against subjects and scans variability, compared to global brain classification [4].

This paper is organized as follows. The segmentation methods are presented in Section 2. Section 3 reports the analytical results of segmented whole brain structure. Conclusions and future works are given in Section 4.

2. Segmentation Methods

2.1 2D Geometric Method

Following [1], a set of geometric object were estimated from a sagital brain scan using gross anatomical data [1]. Once the rough brain outlines (Fig. 1(a)) were extracted the double thresholding followed by morphological opening were applied (Fig 1(b)). The binary mask was then overlaid on the original image from which a disk filter was applied to further remove noise and spurious structures (Fig. 1(c)).