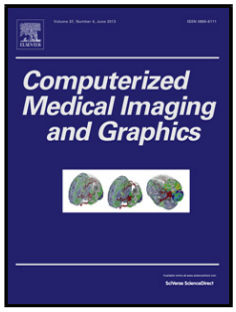

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MULTI-CHANNEL NEURODEGENERATIVE PATTERN ANALYSIS AND ITS APPLICATION IN ALZHEIMER'S DISEASE CHARACTERIZATION

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ABSTACT

Neuroimaging has played an important role in non-invasive diagnosis and differentiation of neurodegenerative disorders, such as Alzheimer's disease and Mild Cognitive Impairment. Various types of features have been extracted from the neuroimaging data to characterize the disorders, and these features can be roughly divided into global and local features. Recent studies show a tendency of using the local features in disease characterization, since they are capable of identifying the subtle disease-specific patterns associated with the effects of the disease on human brain. However, problems arise if the neuroimaging database involved multiple disorders or progressive disorders, for disorders of different types or at different progressive stages might exhibit different degenerative patterns. It is difficult for the researchers to reach consensus on what brain regions could best distinguish multiple disorders or multiple progression stages. In this study we proposed a Multi-Channel pattern analysis approach to identify the most discriminative local brain metabolism features for neurodegenerative disorder characterization. We compared our method to the global methods and other pattern analysis methods based on clinical expertise or test statistics. The preliminary results suggested that the proposed Multi-Channel pattern analysis method outperformed other approaches in Alzheimer's disease characterization, and meanwhile provided important insights of underlying pathology of Alzheimer's disease and Mild Cognitive Impairment.

Key words: pattern analysis, Alzheimer's disease, mild cognitive impairment

1. INTRODUCTION

Neuroimaging data are a rich source of information on brain anatomy and physiology. Neuroimaging has been a fundamental component of the neurological disorder diagnosis, and also plays an important role in the assessment of therapy and monitoring disease progression. Due to the large size of volumetric neuroimaging data, it is difficult to quantitatively analyze the brain images for computer-aided-diagnosis (CAD) and clinical-decision-support (CDS) [1-3]. Therefore, researchers usually extract features from the neuroimaging data to efficiently represent them without losing important information.

Various studies focusing on finding the most discriminative disease-related brain features have been reported. A thorough review of all these studies is beyond the scope of this paper. For interested readers these domain-specific studies could be found in [4-12]. These features can be roughly divided into two groups, global and local features. Global features that treat all of the brain regions with no distinction were commonly used. For example, Qian *et al.* [4] designed a neuroimaging retrieval system with four 3D feature descriptors based on 100 brain Magnetic Resonance Imaging (MRI) studies. Unay *et al.* [5] proposed a retrieval system for MRI data based on local binary patterns incorporating spatial context information. Ramírez *et al.* [6] employed Support Vector Machine (SVM) combined with pasting votes technique in their study specifically for early diagnosis of Alzheimer's disease (AD)

[*] Data used in preparation of this article were obtained from th Alzheimer's Disease Neuroimaging Initiative (ADNI) databas (adni.loni.ucla.edu). As such, the investigators within the ADN contributed to the design and implementation of ADNI and/or provide data but did not participate in analysis or writing of this report. A complet listing of ADNI investigators can be found at: http://adni.loni.ucla.edu/wp content/uploads/how_to_apply/ADNI_Acknowledgement_List.pdf