A spherical brain mapping of MR images for the detection of Alzheimer's disease

May 20 2016

Diagnosis, treatment and care of dementia is one of the major concerns in neurology research and associated healthcare programs. Dementia affects older age groups with a greater frequency, and as our population ages, the burden of dementia on public health is rapidly increasing. The most common cause of dementia is Alzheimer's disease (AD), which accounts for 60 to 80 per cent of total cases. Much effort has been put into understanding its causes since, although still incurable, an early diagnosis can slow the progression of the disease, improving the quality of life of patients and their families.

Neuroimaging has proven as a very useful tool in the quest for detecting ad alleviating symptoms of dementia, allowing an in vivo assessment of the structural and functional properties of the brain, providing relevant data for the diagnostic task. Currently, the use of computational techniques to analyze neuroimaging data has provided us with unprecedented insight of the process of neurodegeneration in AD.

In this article we propose a new framework for dementia diagnosis, namely Spherical Brain Mapping (SBM) that performs a projection of three-dimensional Magnetic Resonance (MR) brain images onto two-dimensional maps revealing statistical characteristics of the tissue. These maps can contain both meaningful features such as cortical thickness or surface and radial statistical features of the tissues, such as average, entropy, etc. The resulting maps perform a significant feature reduction that will allow further supervised or unsupervised processing, reducing the computational load while maintaining a large amount of the original

information. This framework achieves a performance up to 91% accuracy in a differential diagnosis involving Alzheimer-affected subjects versus controls belonging to the Alzheimer's Disease Neuroimaging Initiative (ADNI). Additionally, our maps can be visually assessed and interpreted, which can be of great help in the diagnosis of AD and other types of dementia.

More information: Martinez-Murcia, F.J. et al. (2016). A Spherical Brain Mapping of MR Images for the Detection of Alzheimer's Disease, *Curr. Alzheimer Res*., DOI: 10.2174/1567205013666160314145158

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