

Details of FAPESP Research Grant

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Title: Image, Statistics, and Data-Mining: Computational Methods to Analyse the Human Brain

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Abstract:

The link between brain structure and function has been of interest since the beginning of brain research and has motivated several research studies all over the world. Advances in neuroscience and neuroimaging have led to an increasing recognition that certain neuroanatomical structures may be affected preferentially by particular diseases. The development of computational methods for morphological analysis of the human brain has enabled the automatic characterization and quantification of neuroanatomical differences between a reference group of images and the population under investigation. In the recent years, multivariate pattern recognition methods that analyse all voxels simultaneously have been proposed to classify and analyse morphological and anatomical structures of 3D magnetic resonance (MR) brain images. Most of these techniques have overcome the difficulty of dealing with the inherent high dimensionality of 3D MR brain image data by using pre-processed segmented images or a small number of specific features. However, an intuitive way of mapping the classification results back into the original image domain for further interpretation remains challenging. The aim of this project is to develop an integrated framework for classifying and analysing patterns of disorders from medical images using a combination of image registration, multivariate statistics, and data mining. Our goal is to analyse all the data simultaneously rather than feature by feature. The first part of this project consists basically of studying and evaluating multivariate statistical methodologies to identify the most discriminating hyper-plane separating two populations. In the second part of this project we are going to develop an intelligent agent aimed at assimilation and exploration of the knowledge contained in the results of the previous statistical methods. Automated knowledge discovery from the visual observation of images is the key motivation for the methods to be investigated in this research. We believe that such investigation provides a suitable framework for characterising the high complexity of MR images in schizophrenia, Alzheimer, and epilepsy.

Keywords: Human Brain Images, Statistical Pattern Recognition, Data Mining

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