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DETAILED ANALYSIS OF VOXEL BASED MORPHOMETRY

Abstract

Voxel Based Morphometry, VBM, is one of the most widely used brain morphometry methods which aims to reveal the structural differences between the brain MR images of different populations. It is a whole brain and fully automatic approach in which all the images are registered onto a common template and then segmented into grey matter, white matter and cerebrospinal fluid. After an optional modulation step (regaining the original volume which is shrunk or enlarged during the registration), smoothing takes place in order to make the data more normally distributed and to diminish the inexact nature of the nonlinear registration. Finally, voxel-wise statistical operations are performed between the groups of the images. As revealed in several studies, changes in these steps and changes in their parameters might influence the resulting statistics. Although some short guidelines exist for conducting the processing stages, this thesis tries to explain each main step and gathers the discussions in the literature to make the VBM users aware of some pitfalls and limitations of VBM; and also gives brief descriptions about the other brain morphometry methods to give a view for where VBM stands at. In this thesis, the effect of modulation and masking strategy at the statistical stage were studied and concluded that not using the modulation and using average-based masking for the statistical part increased the detection power of VBM. Additionally, within the scope of this thesis, three clinical applications of VBM are performed and presented: Comparisons of the brain images of mathematicians, SSPE patients, and solvent abusers vs healthy controls.

PUBLICATIONS

Journals

1. Effects of Unmodulation and Thresholding by Average-Based Masking on Voxel-based Morphometry: O. Ozmen Okur, C. Ozturk, Journal of Medical Imaging and Health Informatics, 2016. (submitted) (SCI-E)
2. Reduced Gray Matter Volume in the Frontotemporal Cortex of Patients with Early Subacute Sclerosing Panencephalitis: K. Aydin, O. Ozmen Okur, B. Tatli, SG. Sarwar, C. Ozturk, C. Dilber, American Journal of Neuroradiology, vol.30(2), pp.271-75, 2009. (SCI)
3. Smaller Gray Matter Volumes in Frontal and Parietal Cortices of Solvent Abusers Correlate with Cognitive Deficits: K. Aydin, S. Kircan, S. Sarwar, O. Ozmen Okur, E. Balaban, American Journal of Neuroradiology, vol.30(10), pp.1922-1928, 2009. (SCI)
4. Increased Gray Matter Density in the Parietal Cortex of Mathematicians: K. Aydin, A. Ucar, K.K. Oguz, O. Ozmen Okur, A. Agayev, Z. Unal, S. Yilmaz, C. Ozturk, American Journal of Neuroradiology, vol.28, pp. 1859-1900, 2007. (SCI)

Conferences

1. Effects of the Modulation in the White Matter Voxel Based Morphometry: O. Ozmen Okur, C. Ozturk, K. Aydin, Proceedings, International Society for Magnetic Resonance in Medicine, 17, 4685, Honolulu, USA, 2009.
2. Evaluation of non-rigid registration of SPM5 in normal children: O. Ozmen Okur, K. Aydin, C. Ozturk, Proceedings of 25th Annual Meeting of ESMRMB, Valencia, Spain, 2008.
3. Morphological Differences in the Grey Matters of Mathematicians: A Voxel-Based Morphometry Study: O. Ozmen Okur, A. Agayev, C. Ozturk, K. Aydin Proceedings,

International Society for Magnetic Resonance in Medicine, Berlin, Germany, May 2007.

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