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**Shape versus size: Improved understanding of the morphology of brain structures.**

Niessen, Wiro J. (ed.) et al., Medical image computing and computer-assisted intervention - MICCAI 2001. 4th international conference, Utrecht, the Netherlands, October 14–17, 2001. Proceedings. Berlin: Springer (ISBN 3-540-42697-3). Lect. Notes Comput. Sci. 2208, 24-32 (2001).

Summary: Standard practice in quantitative structural neuroimaging is a segmentation into brain tissue, subcortical structures, fluid space and lesions followed by volume calculations of gross structures. On the other hand, it is evident that object characterization by size does only capture one of multiple aspects of a full structural characterization. Desirable parameters are local and global parameters like length, elongation, bending, width, complexity, bumpiness and many more. In neuroimaging research there is increasing evidence that shape analysis of brain structures provides new information which is not available by conventional volumetric measurements. This motivates development of novel morphometric analysis techniques answering clinical research questions which have been asked for a long time but which remained unanswered due to the lack of appropriate measurement tools. Challenges are the choice of biologically meaningful shape representations, robustness to noise and small perturbations, and the ability to capture the shape properties of populations that represent natural biological shape variation. This paper describes experiments with two different shape representation schemes, a fine-scale, global surface characterization using spherical harmonics, and a coarsely sampled medial representation (3D skeleton). Driving applications are the detection of group differences of amygdala-hippocampal shapes in schizophrenia and the analysis of ventricular shape similarity in a mono/dizygotic twin study. The results clearly demonstrate that shape captures information on structural similarity or difference which is not accessible by volume analysis. Improved global and local structure characterization as proposed herein might help to explain pathological changes in neurodevelopment/neurodegeneration in terms of their biological meaning.

<http://link.springer.de/link/service/series/0558/bibs/2208/22080024.htm>