

Coupled Shape Modeling of the Medial Temporal Lobe

Bjørn Skovlund Dissing, Rasmus Larsen, Arnold Skimminge and Thomas Ramsøy

Informatics and Mathematical Modelling
Technical University of Denmark, Building 321
DK-2800 Kgs. Lyngby, Denmark

Abstract. Here we investigate how regions in the Medial Temporal Lobe(MTL) in a dataset consisting of 13 different people changes using a Principal Component Analysis(PCA). The regions investigated are the Temporopolar, Parahippocampal, Entorhinal, Hippocampal, Perirhinal and Amygdalar regions. The MTL is located fairly deep in the brain where the contrast is quite low, and region-boundaries can be difficult to find, which is why a shape guiding term would be helpful for a segmentation algorithm.

An expert used an interactive tool to draw binary(1 inside and 0 outside) Volumes Of Interests(VOI) for each of the 13 subjects. As the brain is symmetric, 12 VOIs has been drawn for each subject. A simultaneous multi-shape rigid registration scheme, similar to the one used in [Tsai et al., 2004] was used on the training shapes to remove linearities. As these are binary shapes, a set-difference cost function is minimized between all shapes. To represent shapes in the coupled shape model, signed distance maps(SDM) was used, [Tsai et al., 2004]. The eigen-problem was solved on the covariance matrix using svd, to find the eigenshapes and their magnitude. Seven modes of variation was extracted, representing 75% of the total variance which each represents different modes of variations. An interactive program was developed to investigate how the first seven modes changes the shapes. In figures 1 to 3 the most significant mode is seen varying with $\pm 2\sigma$ from the meanshape.

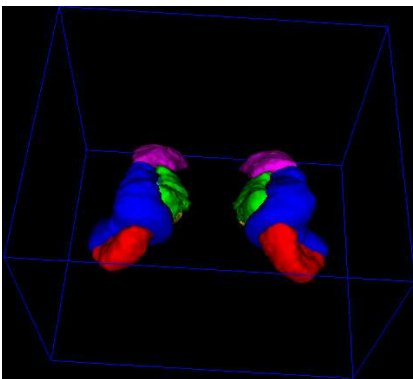


Fig. 1. *meanshape + 2σ*

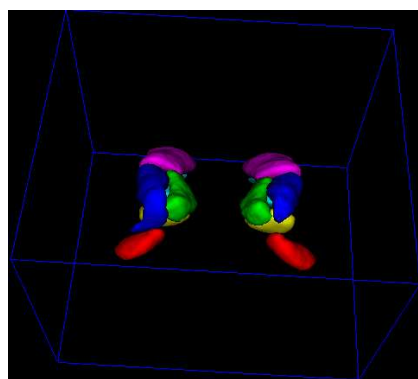


Fig. 2. *meanshape*

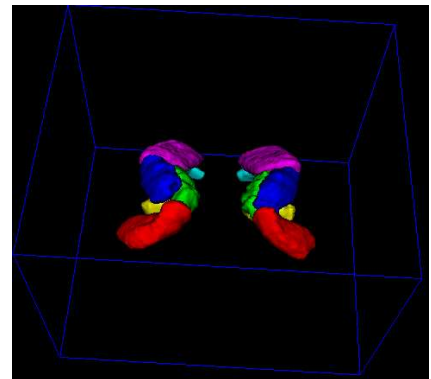


Fig. 3. *meanshape - 2σ*

References

- [Tsai et al., 2004] Tsai, A., Wells, W., Tempany, C., Grimson, E. og Willsky, A. (2004). Mutual information in coupled multi-shape model for medical image segmentation. Elsevier Science.