### ROI-wise features for CTH and TBM

Both CTH and TBM analyses produce local (point-wise) information, either on cortical thickness or the volume. Thus, the number of original features is enormous, and to make the classification more efficient, the number of features has to be reduced. A ROI-based approach utilizing an anatomical atlas of 83 structures [1,2] was selected. Both the CTH nodes and the TBM voxels were mapped to a single structure, and the CTH and the Jacobian values were averaged within each ROI. However, as shown in [3], the classification results can be improved by focusing on the statistically significant nodes or voxels. Therefore, statistically significant locations were determined by applying t-test on a separate training set. The feature value of the *r*th ROI for the *i*th subject was then computed from

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where is the t-value of the t-test in the voxel/node and is a weighting function defined as

,

where is the p-value, and are user-defined parameters, and the p-values are constrained to the interval defined by and . The computation of the feature values was done separately for dilating () and shrinking () voxels/nodes so that they would not cancel each other within a ROI. The weighting was used to focus the computations on the voxels that have statistically significant group level differences. It gives a voxel a larger weight the smaller the p-value is, and no weight is given to the statistically non-significant voxels. The threshold was used to avoid situations where just a few highly significant voxels would have a too large impact on a feature value. In TBM, the final features for the classification were obtained by averaging the values of the 30 templates, i.e., ROI-wise average feature values were used. To avoid unnecessary complexity in the classification, a subset of the 83 ROIs were selected for both CTH and TBM. Tables 1 and 2 give an overview on the anatomical regions that were used to analyse TBM and CTH features respectively. All structures were selected both in the left and the right hemisphere. A detailed anatomical definition of all structures can be found in [1] and [2] (www.brain-development.org).

1. Hammers A, Allom R, Koepp MJ, Free SL, Myers R, et al. (2003) Three-dimensional maximum

 probability atlas of the human brain, with particular reference to the temporal lobe. Human Brain

 Mapping 19: 224{247.

2. Gousias IS, Rueckert D, Heckemann RA, Dyet LE, Boardman JP, et al. (2008) Automatic

 segmentation of brain mris of 2-year-olds into 83 regions of interest. NeuroImage 40: 672 - 684.

3. Koikkalainen J, Lotjonen J, Thurfjell L, Rueckert D, Waldemar G, et al. (2011) Multi-template

 tensor-based morphometry: Application to analysis of alzheimer's disease. NeuroImage 56: 1134 –

 1144.

Table 1: ROIs used in TBM analysis

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| Hippocampus |
| Amygdala |
| Anterior temporal lobe, medial part  |
| Anterior temporal lobe, lateral part  |
| Gyri parahippocampalis et ambiens  |
| Superior temporal gyrus, posterior part  |
| Medial and inferior temporal gyri  |
| Insula  |
| Posterior temporal lobe  |
| Lateral ventricle, frontal horn, central part and occipital horn  |
| Lateral ventricle, temporal horn  |

Table 2: ROIs used in CTH analysis

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| --- |
| Anterior temporal lobe, medial part  |
| Anterior temporal lobe, lateral part  |
| Gyri parahippocampalis et ambiens  |
| Superior temporal gyrus, posterior part  |
| Medial and inferior temporal gyri  |
| Lateral occipitotemporal gyrus, gyrus fusiformis  |
| Insula  |
| Occipital lobe  |
| Cingulate gyrus, anterior part  |
| Cingulate gyrus, posterior part  |
| Frontal lobe , becomes middle frontal gyrus after subdivision of frontal lobe |
| Posterior temporal lobe  |
| Parietal lobe  |
| Precentral gyrus  |
| Straight gyrus, gyrus rectus  |
| Anterior orbital gyrus  |
| Inferior frontal gyrus  |
| Superior frontal gyrus  |
| Postcentral gyrus  |
| Superior parietal gyrus  |
| Lingual gyrus  |
| Cuneus  |
| Medial orbital gyrus  |
| Lateral orbital gyrus  |
| Posterior orbital gyrus  |
| Subgenual frontal cortex  |
| Pre-subgenual frontal cortex  |
| Superior temporal gyrus, anterior part  |