

Template-O-Matic Toolbox

<http://irc.cchmc.org/software/pedbrain.php>
<http://dbm.neuro.uni-jena.de/software/tom/>

Christian Gaser
Structural Brain Mapping Group, Department of Psychiatry
University of Jena, Germany

Marko Wilke
Department of Pediatric Neurology and Developmental Medicine
University of Tuebingen, Germany

Scott Holland, Mekibib Altaye
Imaging Research Center
Cincinnati Children's Hospital Medical Center, USA

Installation

First, unpack the zip-file and copy or link the TOM8 folder to the spm8/toolbox directory. You can start the toolbox by choosing "TOM8" in the "Toolboxes" selector. Alternatively you can use the "TASKS" button (right in the Graphics window): select TASKS | Tools | Template-O-Matic.

Description

The TOM toolbox takes a radically new approach towards providing reference data, based on imaging data from the NIH study of normal brain development (<http://www.bic.mni.mcgill.ca/nihpd/info/>). Using the general linear model, we statistically isolate the influence of external variables of interest on brain structure, allowing us to generate high-quality matched templates for any given group of subjects. The toolbox offers two options:

1. to create pediatric templates (T1) and tissue maps (GM, WM, and CSF) based on the objective 1 NIH data (n = 394), in the age range of 5-18 years, or
2. to assess a new reference population with regard to your variables of interest.

Of note, this approach is generally applicable and in no way restricted to analyzing pediatric imaging data: for example, if you aim at investigating the effects of aging in elderly subjects, the toolbox will also allow you to create more appropriate reference (if your group is large enough to isolate such effects).

This toolbox is the result of a joint effort by the Department of Pediatric Neurology and Developmental Medicine (Marko Wilke, Tuebingen, Germany), the Imaging

Research Center (Scott Holland and Mekibib Altaye, Cincinnati, OH, USA), and the Structural Brain Mapping Group (Christian Gaser, Jena, Germany).

The rationale, approach and further details are available in a recent NeuroImage paper (Wilke et al. 2008).

We make the software available free of charge on the Imaging Research Center's website at <http://irc.cchmc.org/software/pedbrain.php>. We will ask you to complete a registration form before downloading.

Template creation method

Two general approaches seem feasible to construct appropriate reference data. First, the average age, gender, etc. is calculated based on the supplied input information (i.e., the demographic variables of the sample under study), and a fitting average template is created accordingly. Here, we term this the average approach. Alternatively, the input sample could be completely matched such that one reference tissue map is generated for each input subject, and these matched reference maps would only be averaged at the end. We term this the matched pairs approach.

File Output Options

This version allows to generate customized priors for "classical" unified segmentation (GM, WM, CSF, and T1) as well as for SPM8's "new segment" (GM, WM, CSF, T1 plus 3 non-brain tissue classes in a single .nii-file). Depending on the approach you want to take, choose the appropriate option.

For all template files we also save the according mat-file. Although this is non-standard for nifti-images, it will offer backwards compatibility to older SPM versions. SPM5/8 (and all other nifti-based software) will simply ignore the mat-file.

Order of polynomial regression

Age can be modeled as polynomial regression with up to third order terms. The simplest model is a linear regression (which is not recommended). Either third or second order regression is appropriate for modeling aging effects. The different age terms will be orthogonalized with regard to its preceding column.

Check for Updates

The new version also includes an integrated update algorithm that allows easy access to possible updates and fixes. Go via Toolbox => TOM8, then click on TOM8 in the interactive window and click on "check for updates".