

Report – NENS Stipends for training stay

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Training stay at Birmingham University, School of psychology, 08-01-2012/09-01-2012

with Stephane De Brito, Independent Research fellow

Object: Training in pediatric structural brain imaging: learning Voxel-based morphometry analysis

My stay at the School of Psychology of Birmingham University was devoted to a complete training in treatment and analysis of paediatric structural magnetic resonance brain (sMRI) imaging data. I received this training from Stephane De Brito, an independent fellow researcher who published important MRI studies in the past. Our work was both theoretical and practical, since I came to Birmingham with a set of data previously acquired in our laboratory in France. The analysis protocol I learnt was voxel-based morphometry (VBM): a whole brain, fully automated and unbiased technique for characterizing regional brain volume on a voxel-wise basis.

VBM represents the best available procedure to pre-process and analyze sMRI data, combining three different toolboxes: the Template-O-Matic toolbox, which produces tissue probability maps which are specific for children included in a given sample (which allows a customized normalization), the Voxel-based-morphometry (VBM8) toolbox (to segment optimally the scans and adjust data considering the size of analysed brains) and DARTEL which allows an optimal registration thanks to the inclusion of millions of parameters for each brain. First-step of the training involved learning how to evaluate the quality of scans to decide whether or not to include them in the analysis, and how to position each scan on the ac-pc line. Second step was devoted to image processing, with SPM8. Teaching included: how to create customized tissue probability maps using the TOM box, how to correct for bias-field inhomogeneities and spatially normalize (using DARTEL) T1-weighted images, how to segment these images into grey matter, white matter, and cerebrospinal fluid within the same generative model, how to account for partial volume effects and to preserve actual grey matter values locally, how to perform quality check and finally to smooth grey matter segments. Final step of the teaching were learning how to build a statistical model of the data using the full factorial design, and how to interpret the results.

We used this protocol to compare grey matter volume of noncomorbid unmedicated children with attention-deficit/hyperactive disorder (ADHD), medicated ADHD children and healthy control matched on age, gender, IQ estimate and socio-economic status. We found interesting results in regions previously involved in ADHD, and are now working together on the manuscript, which will be submitted to a high impact journal. This will be the largest pediatric VBM study of ADHD to date, and the first to include a sample of unmedicated ADHD children to compare them with healthy controls and medicated ADHD children.

My training lasted 4 weeks. Week 1 was devoted to learning quality check of scans and first steps of image processing. During Week 2 we went through the remaining steps of Image Processing. Finally, Week 3 and 4 were devoted to statistical analysis, to the interpretation of the data, and to some exploratory work using the genetic data previously collected on our sample. We are now starting new fmri studies in our laboratory in France and are therefore acquiring structural data as well. This will be the occasion for me to transfer the knowledge acquired to my phd supervisor and to another phd students, who are both willing to learn VBM. I must add that I had a great time in Birmingham and it was a great pleasure to work with and learn from Stephane De Brito, and I would therefore like to thank him and the NENS for giving me this opportunity.