

BrainSuite Statistics toolbox (bss)



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Acknowledgments:

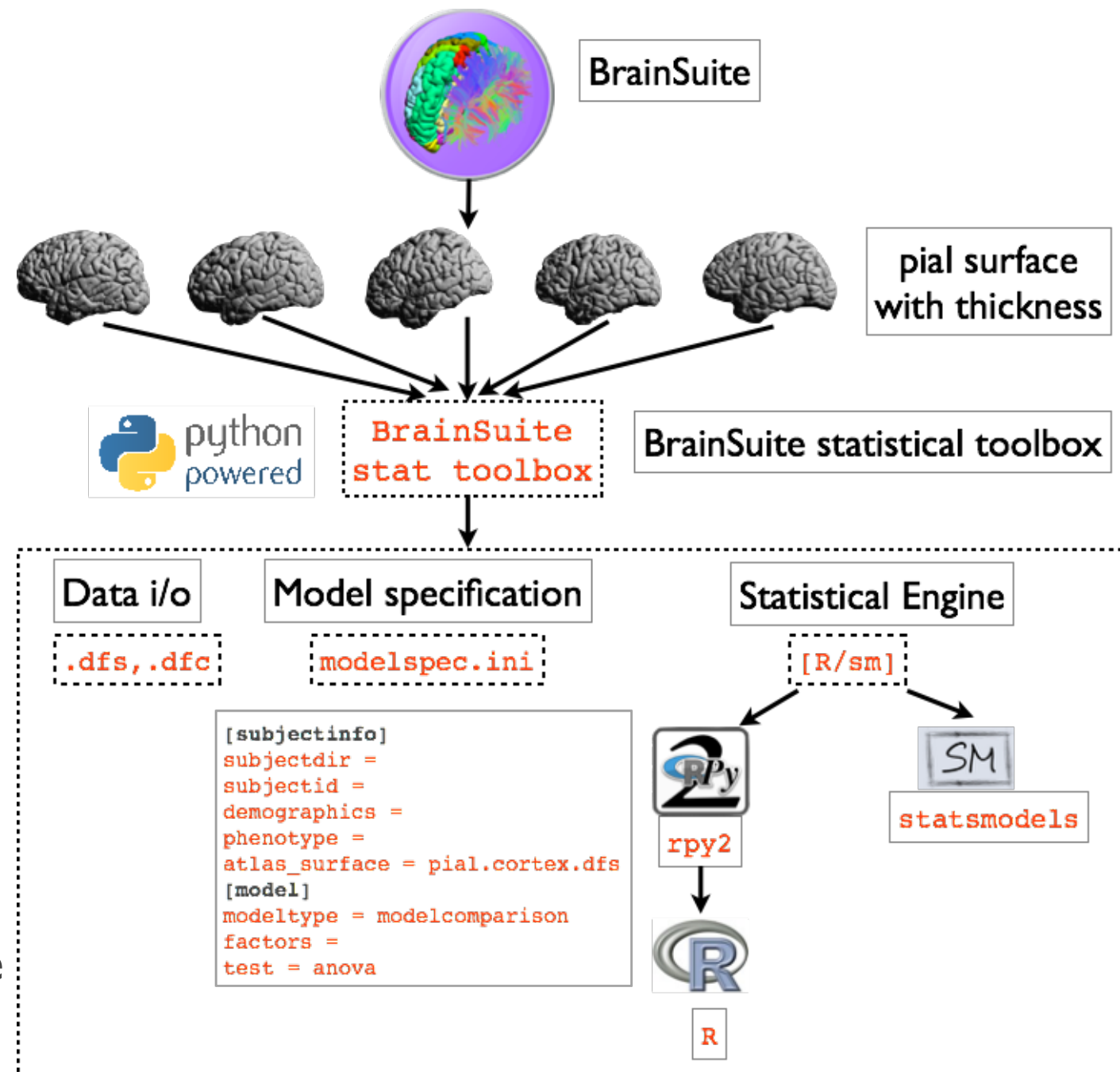
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outline

- Notes on Installation and Usage
- Before running Statistical (Group) Analysis
- Steps for running Statistical Analysis
- Outputs for Statistical Analysis

brainsuite statistical toolbox*

- Performs structural group analysis for cortical surfaces
- Implemented in Python with rpy2.
- Cross-platform - Windows, Mac, Linux
- Offers following statistical methods
 - ANOVA, GLM, correlation
 - Provision for Multiple testing - FDR
- Uses R data.table to efficiently vectorize operations



*** Open Source - Distributed under GPL v2**

notes on bss installation

BrainSuite <http://brainsuite.org/bss>

MAGNETIC RESONANCE IMAGE ANALYSIS TOOLS

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// download brainsuite statistics toolbox



Linux/Mac OSX

Installation Instructions:

1. Install [R 3.xx](#) (as a shared library for Linux. For Mac this is not required).
2. Install R package [data.table](#) as follows.
Start R in the Terminal (Type R and hit Enter).
Type `install.packages('data.table')`.
3. Exit R. Type `quit()` and hit Enter.
4. Download and run the install script in the Terminal.
`bash install.sh <Installation directory>.`

[Download the Install Script](#)

Windows

Installation Instructions:

1. Install [R 3.xx for statistics](#) for Windows.

Example path: C:\Program Files\R\R-3.1.1

2. Install R package [data.table](#) as follows.

Start R and type: `install.packages('data.table')`.

3. Install [Miniconda](#).

4. Select and install the appropriate windows binary for r


5. Set environment variables as follows.

• • •



notes on bss installation

Linux/Mac OS X

- Need R installed 
- Need R package `data.table`
- Installs from a single script `install.sh` without explicit software download

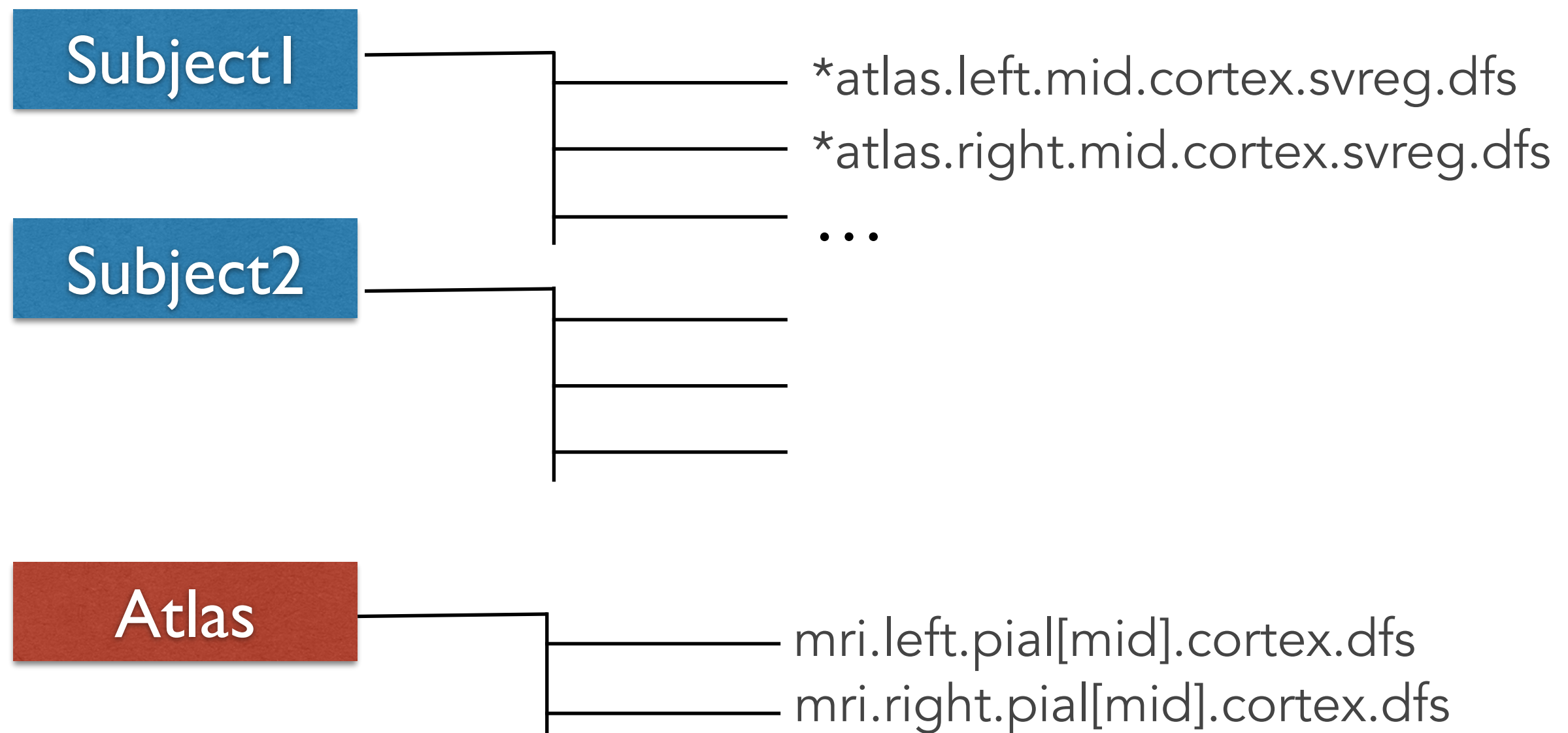
Windows

- Need R installed
- Need R package `data.table`
- Need python (Miniconda preferred)
- Need rpy2 installed
- Download `bss.zip` and install (`python setup.py install`)

before running bss

Data Requirements:

- Process Cortical Surface extraction and registration using BrainSuite
- The processed directory will have the following structure



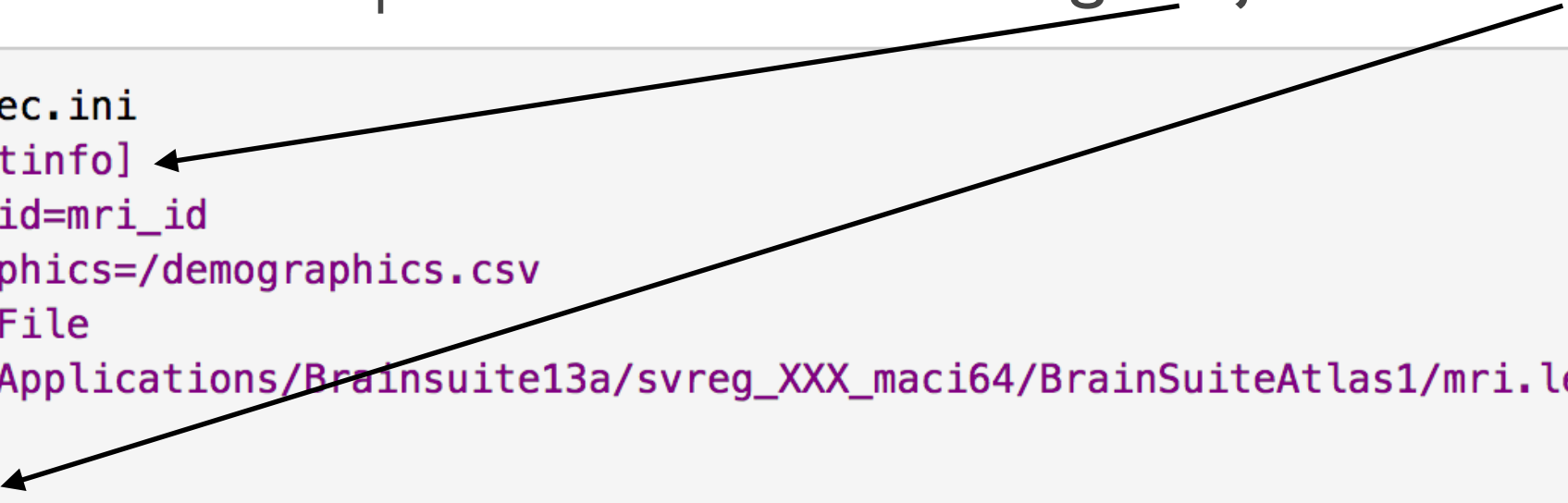
steps for running bss

Software requirements and Configuration:

- Need bss installed

<bss installation directory>/bin/bss_run.py -h

- Create modelspec.ini* file describing subject and model information



```
modelspec.ini
[subjectinfo]
subjectid=mri_id
demographics=/demographics.csv
fileid=File
atlas=/Applications/Brainsuite13a/svreg_XXX_maci64/BrainSuiteAtlas1/mri.left.pial.cortex.dfs

[model]
modeltype=glm
fullmodel=age + sex
nullmodel=sex
test=anova
```

***Interactive tool to create modelspec.ini — bss_create_modelspec.py**

steps for running bss

- Run bss as

`bss_run.py -h <modelspec.ini> <output directory>`

outputs from bss

- .dfs files
 - contain statistical measures and p-values mapped to the atlas

- For correlation analysis

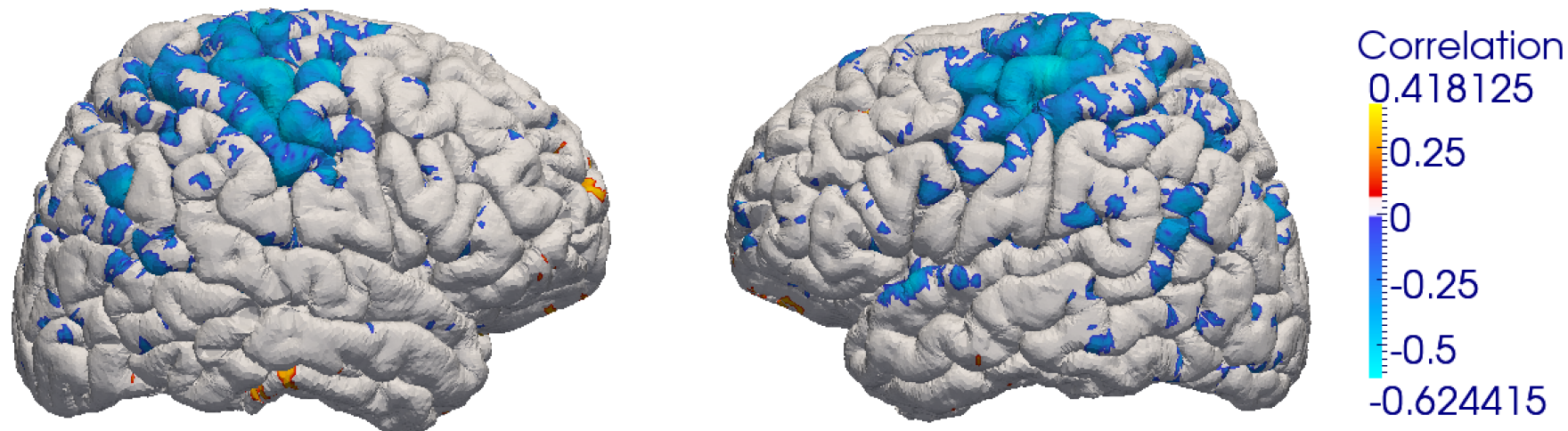
1. Pearson correlation coefficient mapped on atlas
2. masked correlation coefficient after FDR
3. p-values denoting significance of correlation
4. adjusted (after FDR) p-values

- For ANOVA

1. p-values for main effect
2. adjusted (FDR) p-values for main effect

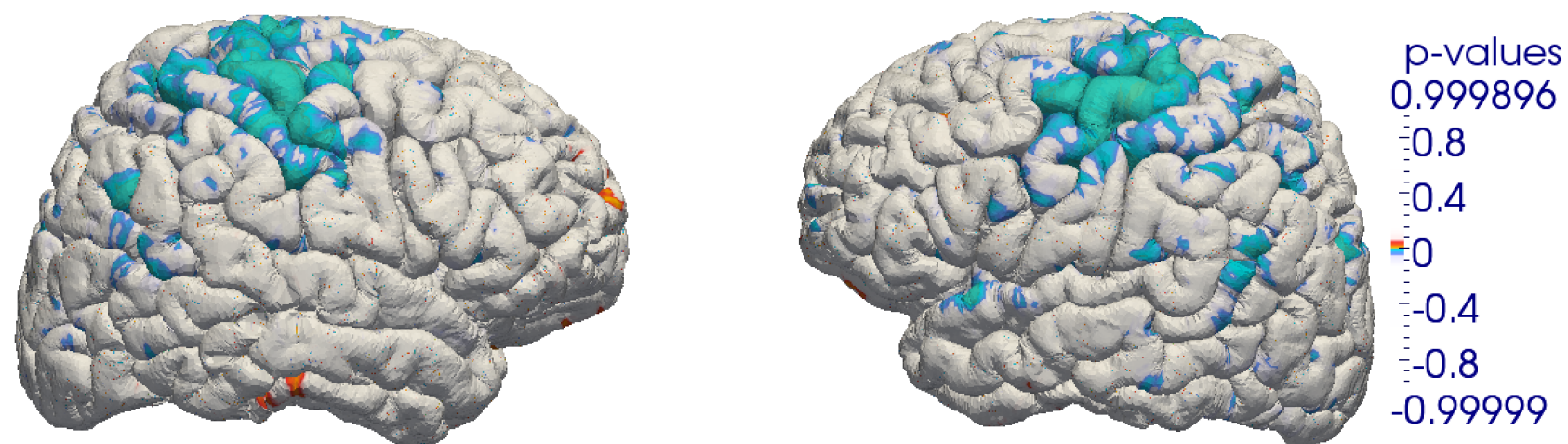
outputs from bss ... examples

- For correlation analysis



Significant Correlation with Age (FDR corrected)

- For ANOVA



Significant p-values for Age
when controlled for Sex (FDR corrected)

N=91 healthy controls from the ICBM dataset, 43 F/ 48 M, Age: 21 ~ 63 years

bss demo

- Data downloaded from:

<http://sjoshi.bmap.ucla.edu/ICBM100.zip>

- Find the vertex-wise correlation of thickness with age

```
modelspec.ini
[subjectinfo]
subjectid=mri_id
demographics=/demographics.csv
fileid=File
atlas=/Applications/Brainsuite13a/svreg_XXX_maci64/BrainSuiteAtlas1/mri.right.pial.cortex.dfs

[measure]
coeff=corr
variable=age
```

ideas for the future

- Use new R constructs dplyr, etc..
- Mixed Models
- (Non)/Linear regression
- New data types
 - Diffusion Tensors
 - Fiber Tracts (Curves)
 - Images (VBM)
- GUI Interface
- Provide alternatives implementations using statsmodels