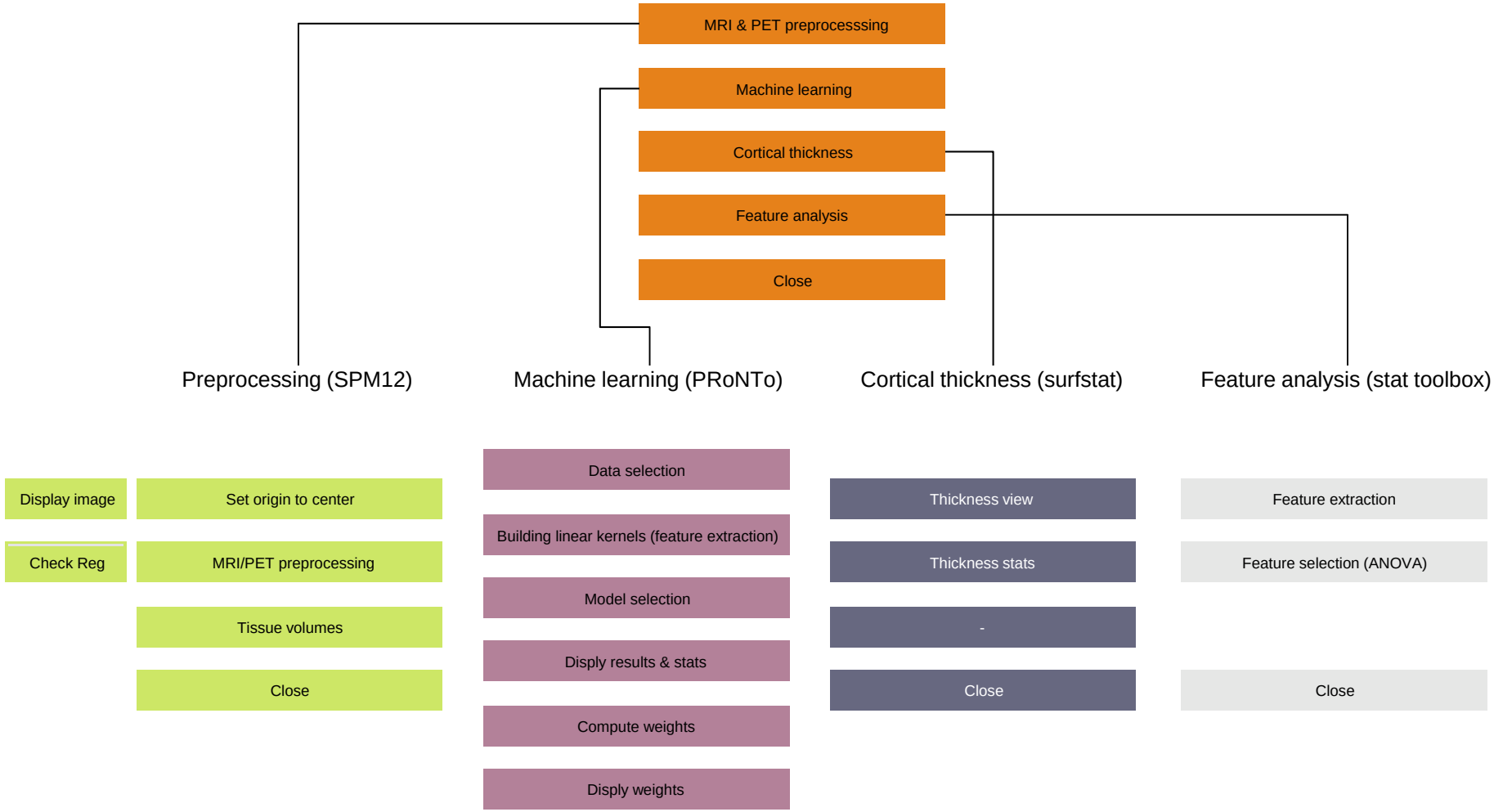
SINEAD
(Software Integrating NEuroimaging And other Data)



Wong-Lin, Kongfatt <k.wong-lin@ulster.ac.uk>, Intelligent Systems Research Centre, Ulster University
Vahab Youssofzadeh <Vahab.Youssofzadeh@cchmc.org>, Cincinnati Children's Hospital Medical Center

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SINEAD

This Matlab based software provides a GUI framework for conducting machine learning on imaging data and in particular for an AD application.

It integrates,

- SPM Toolbox (www.fil.ion.ucl.ac.uk/spm/) for preprocessing of imaging data,
- PRoNTO (www.mlnl.cs.ucl.ac.uk/pronto) for machine learning and combined analysis of imaging data,
- Surfstat (http://www.math.mcgill.ca/keith/surfstat/) and freesurfer (http://freesurfer.net/) for cortical thickness analysis.

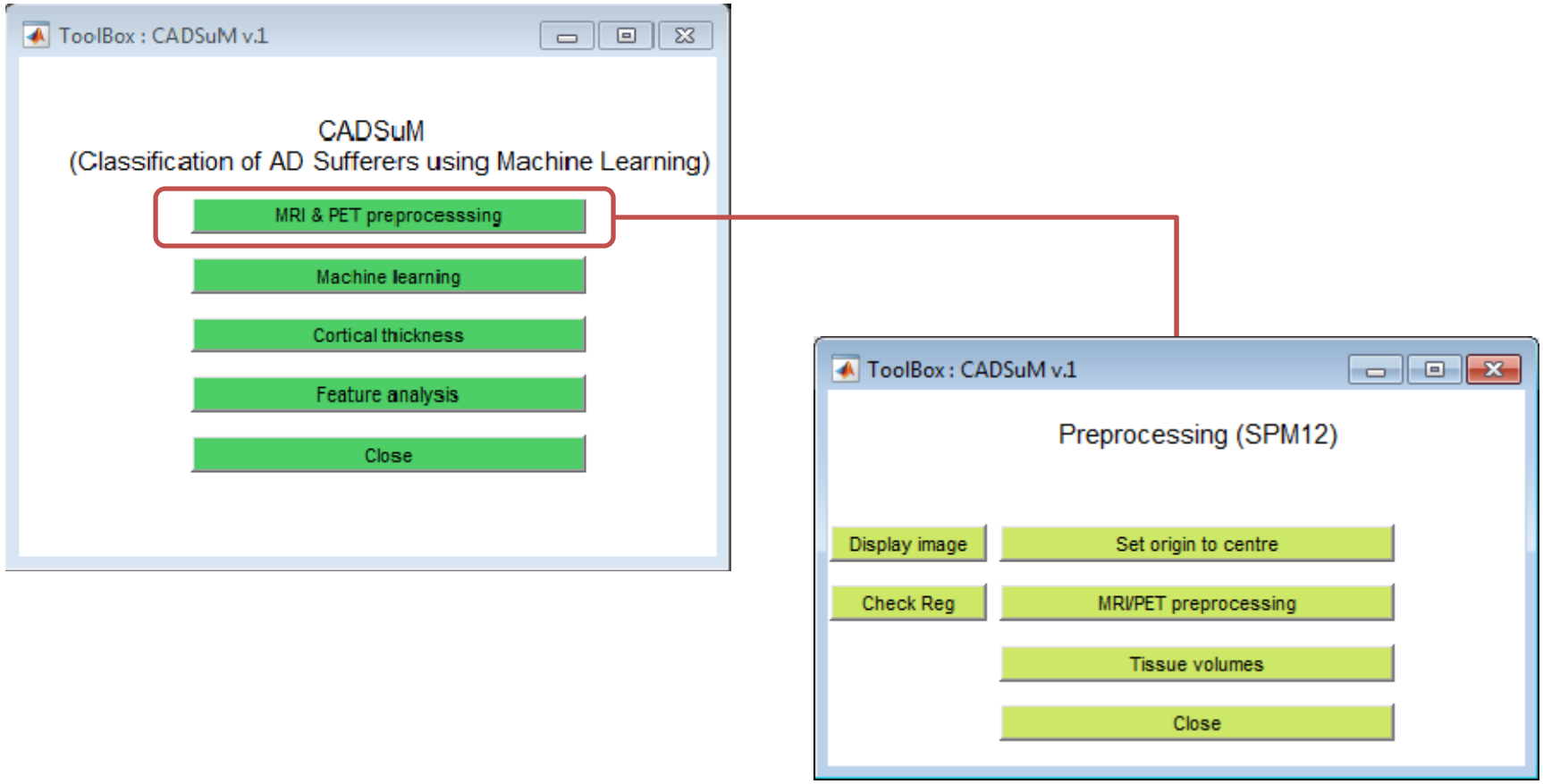
References regarding SINEAD are listed below:

1. Youssofzadeh V, McGuinness B, Maguire L and Wong-Lin K, 2016. A kernel-based Gaussian process for combined MRI and PET in Alzheimer's disease. In: Alzheimer's Research UK (ARUK) 2016 Conference, Manchester, UK. 8-9 March 2016.
2. Youssofzadeh V, McGuinness B, Maguire L and Wong-Lin K. Multi-kernel learning with Dartel enhances MRI-PET classification and prediction of Alzheimer's disease: group and individual analyses, In preparation.

Installing SINEAD

1. Download CADSuM on your computer and add the directory path with subdirectories to your Matlab path.
2. Ensure you have the SPM12, PRoNTO directory in your Matlab path as well.

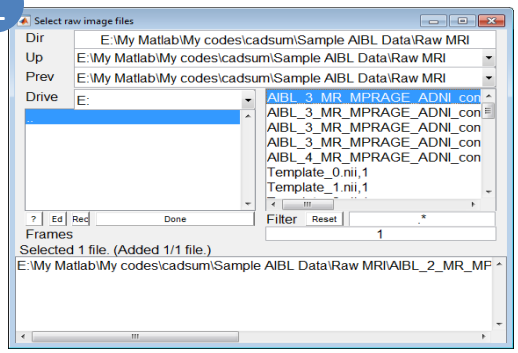
Pre-processing of scans



- SPM12 toolbox has to be added to Matlab routines

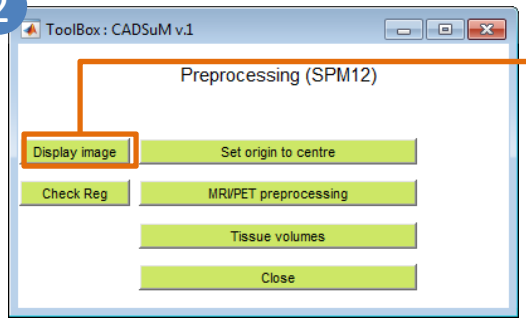
Set origin

1



Set origin to AC area was completed!

2



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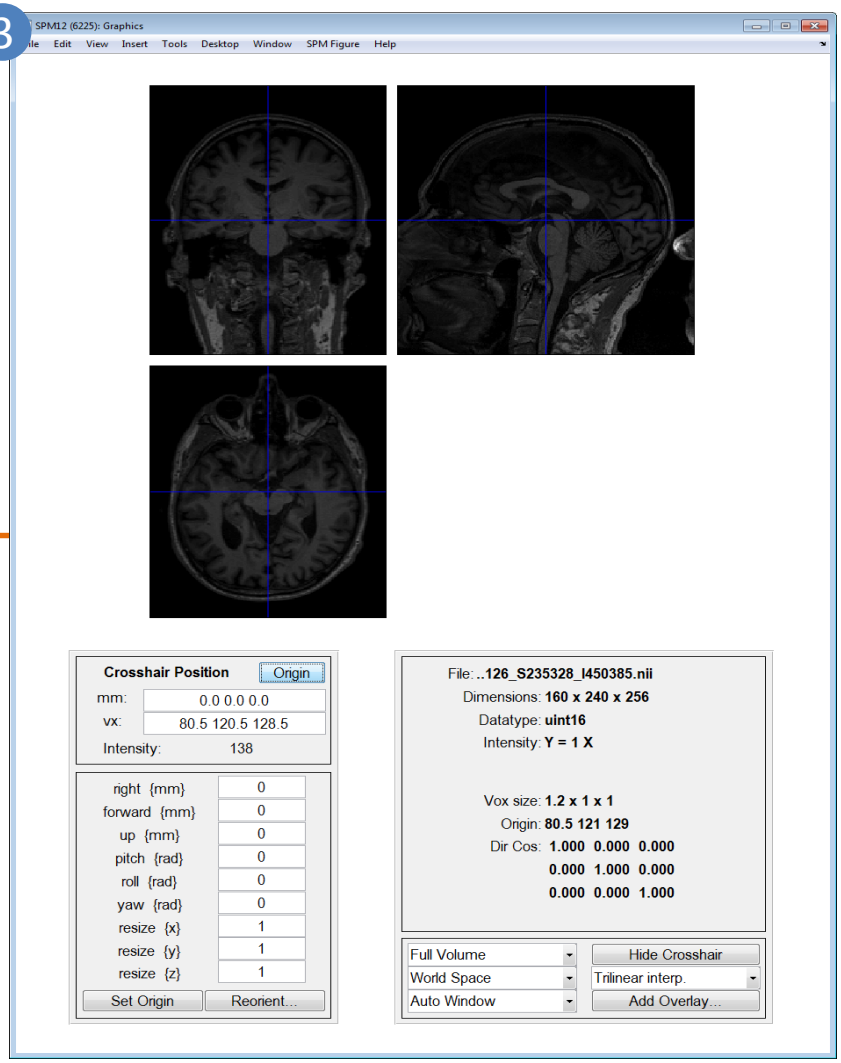
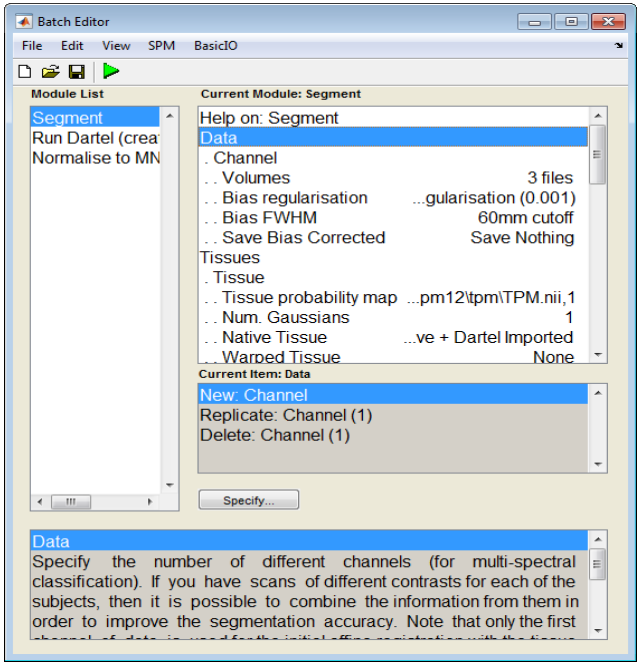


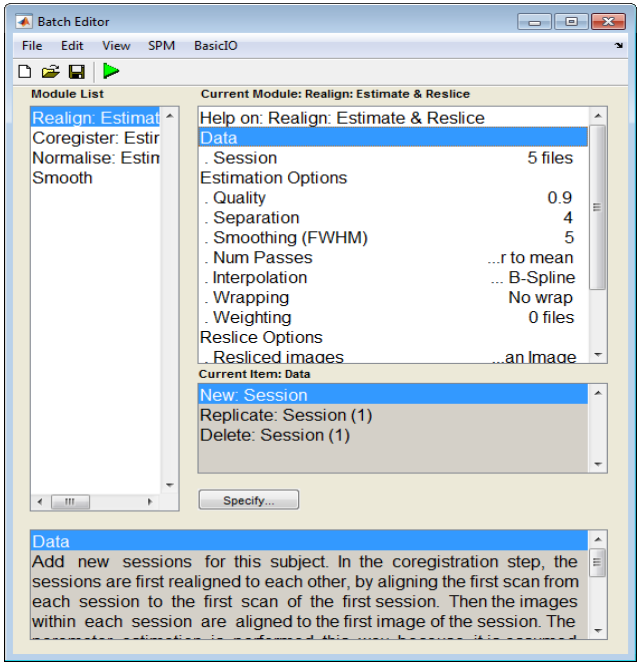
Preprocessing

- Data/scans are selected using batch interface. A sample batch is available in “SPM batch” folder.

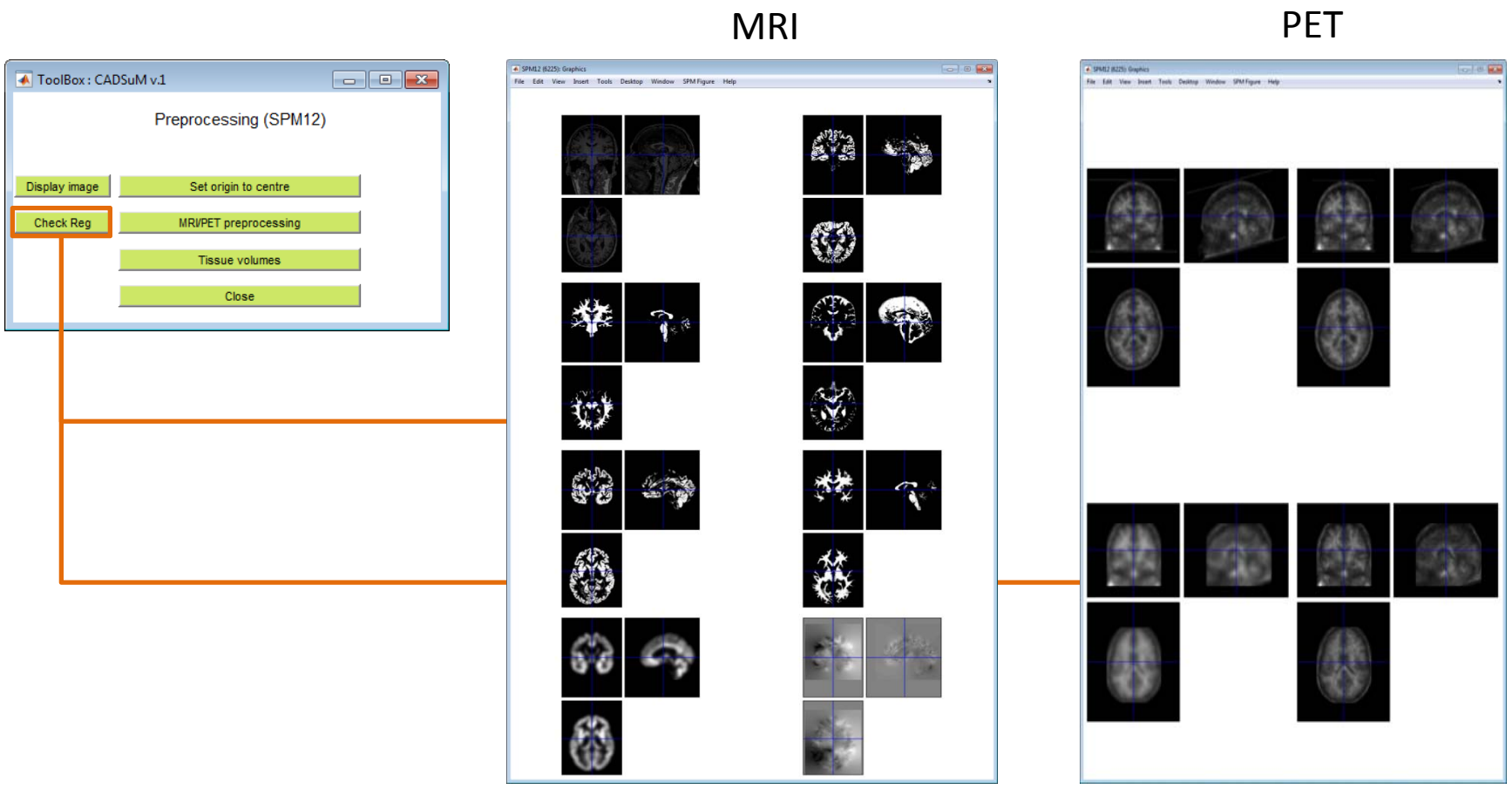
MRI preprocessing



PET preprocessing



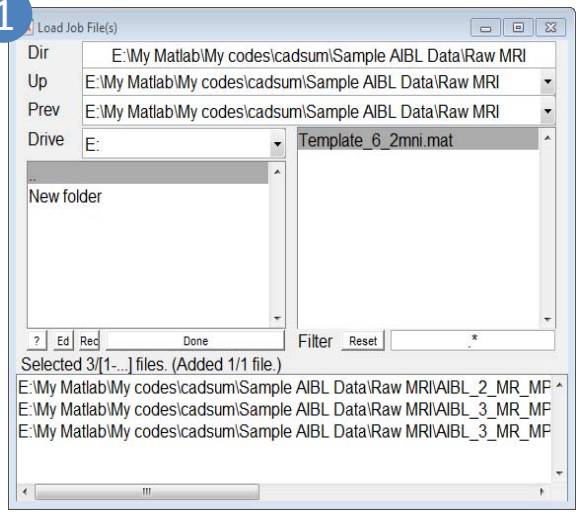
Preprocessing, checking results



Tissue volumes

- For more details about TV, please see, Ashburner 2015 VBM Tutorial that is provided in the Manual folder!

1



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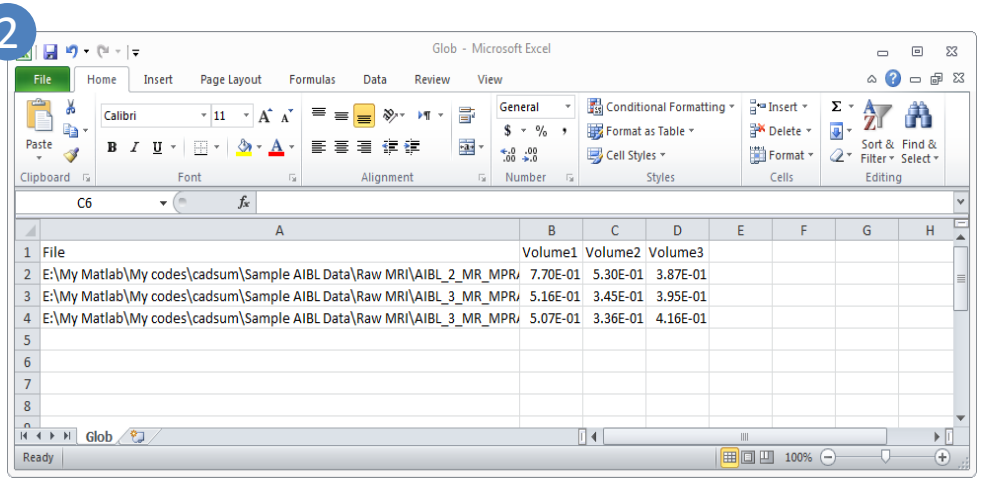
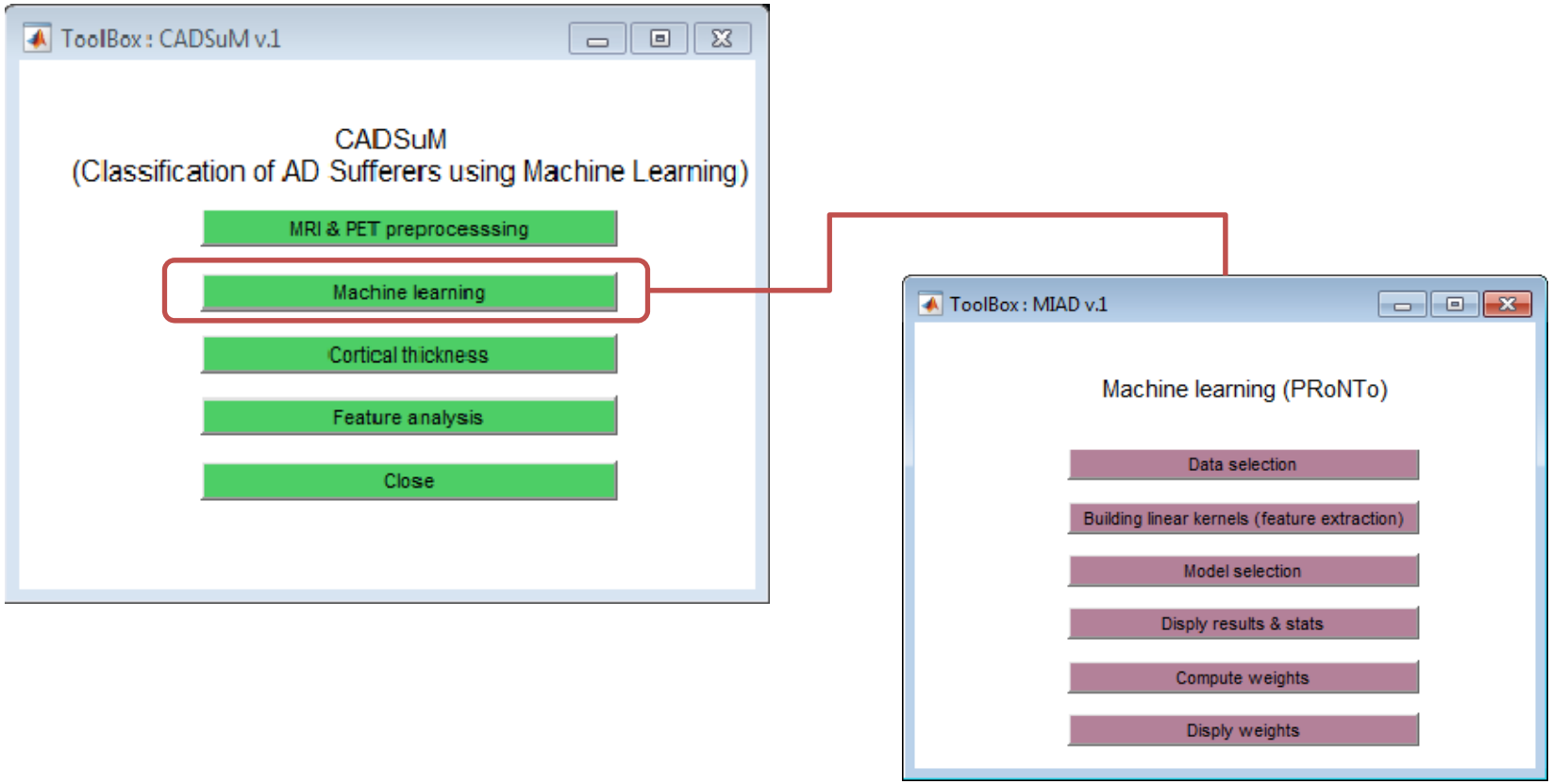


Volume 1: gray matter
Volume 2: white matter
Volume 3: CSF
Total intracranial volume = Volume 1 + Volume 2 + Volume 3

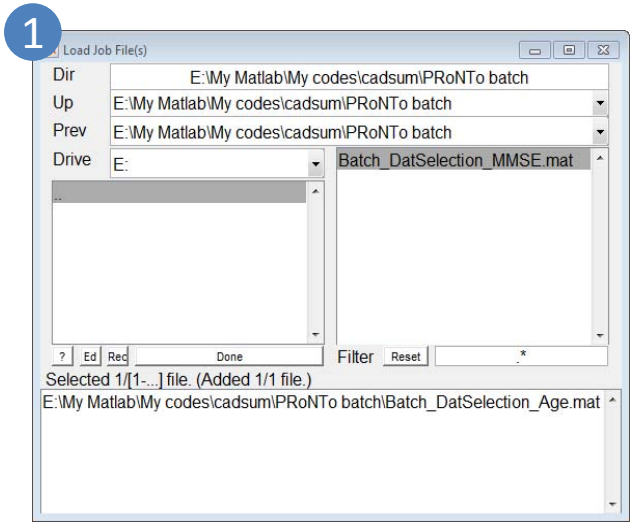
Machine learning

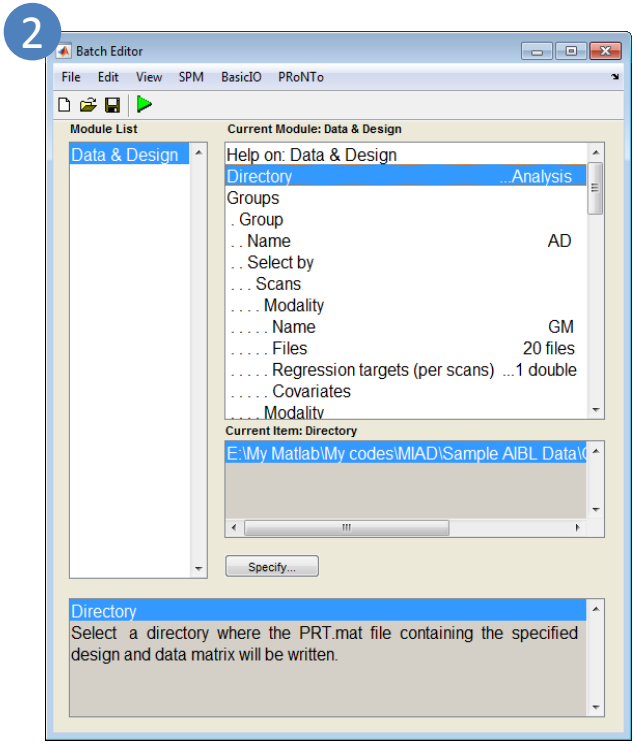


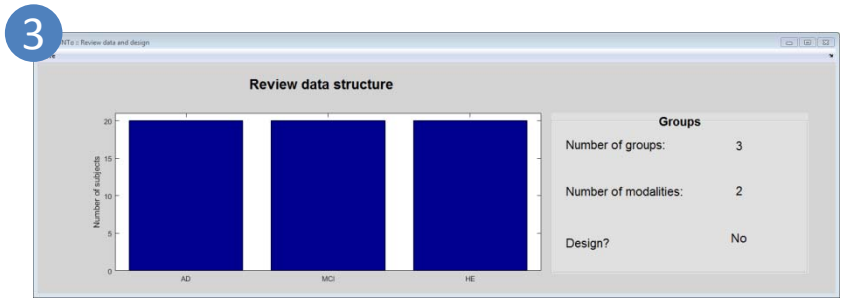
- PRoNTo toolbox is utilized for the machine learning process.

Data Selection

- Data/scans are selected using batch interface.





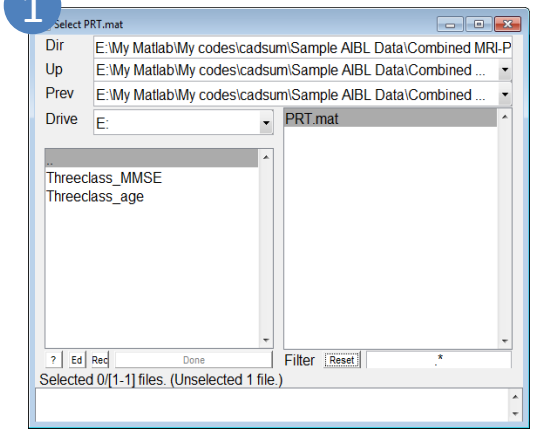


A sample batch is available in "PRoNTo batch" folder. It is related to 3*20 scans from 3 groups of AD, MCI and Healthy elderly subjects .

Building kernels

A example of combined PET–MRI

1



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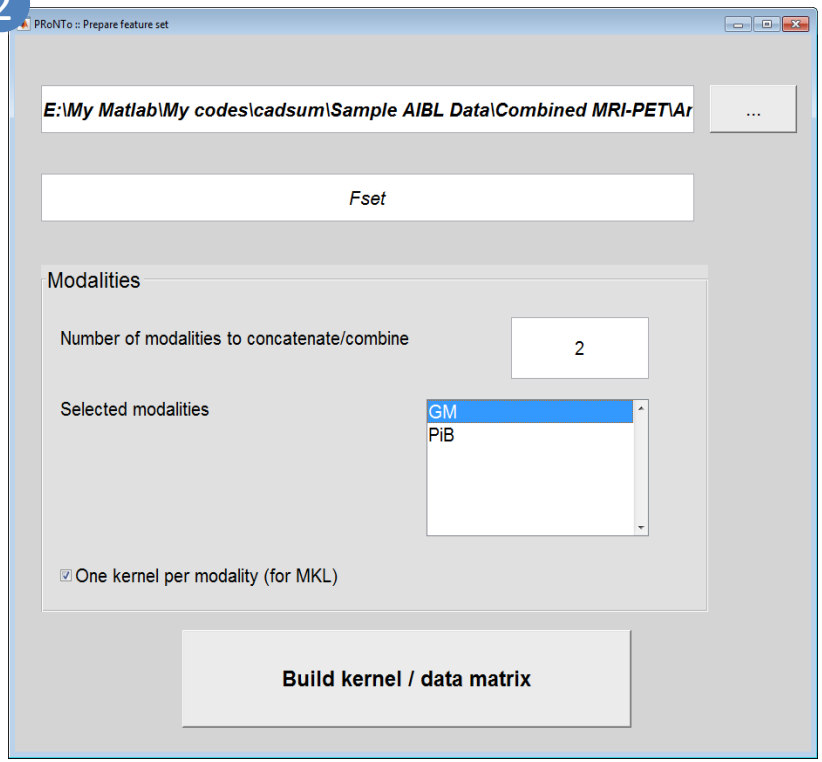

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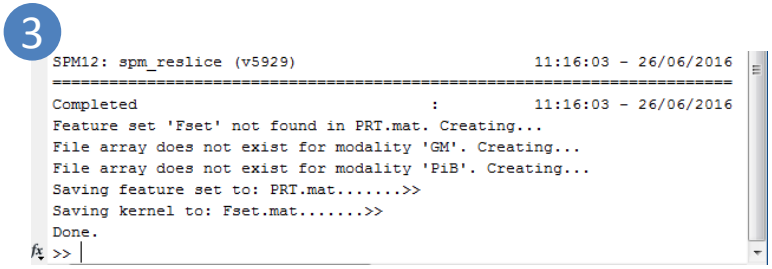
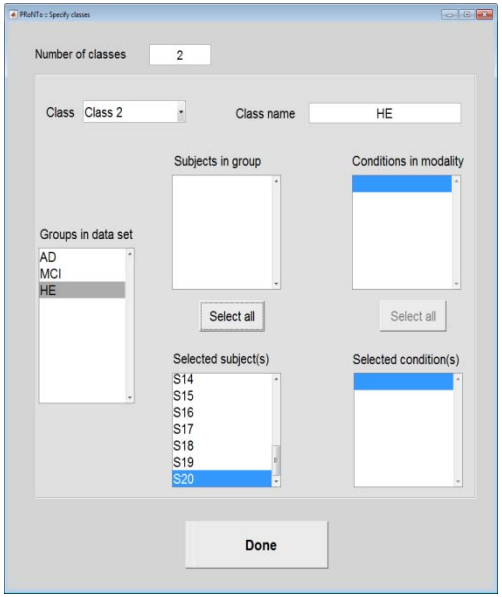
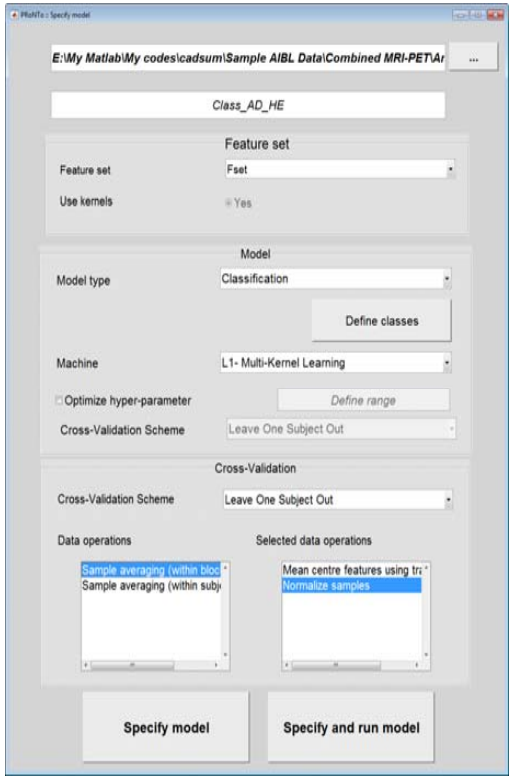
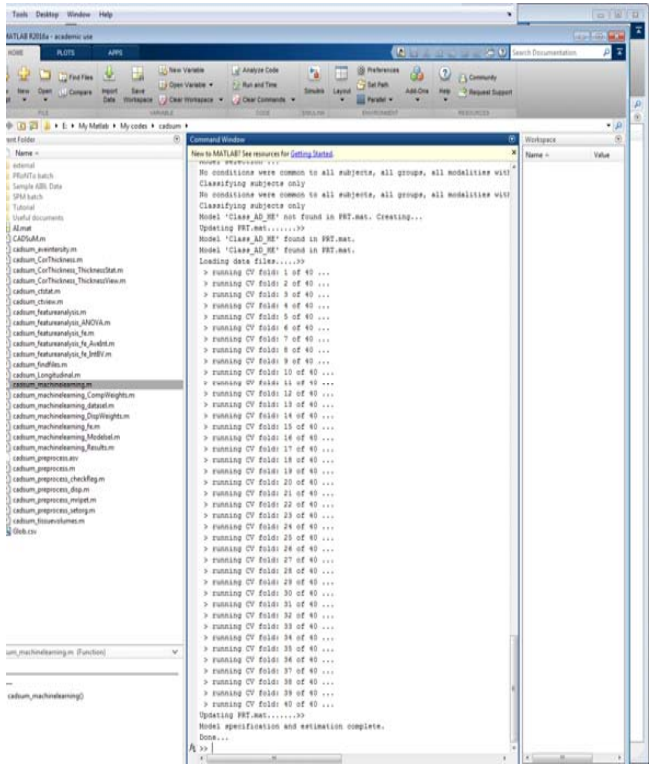


Model selection

- Two-class classification example: AD vs HE

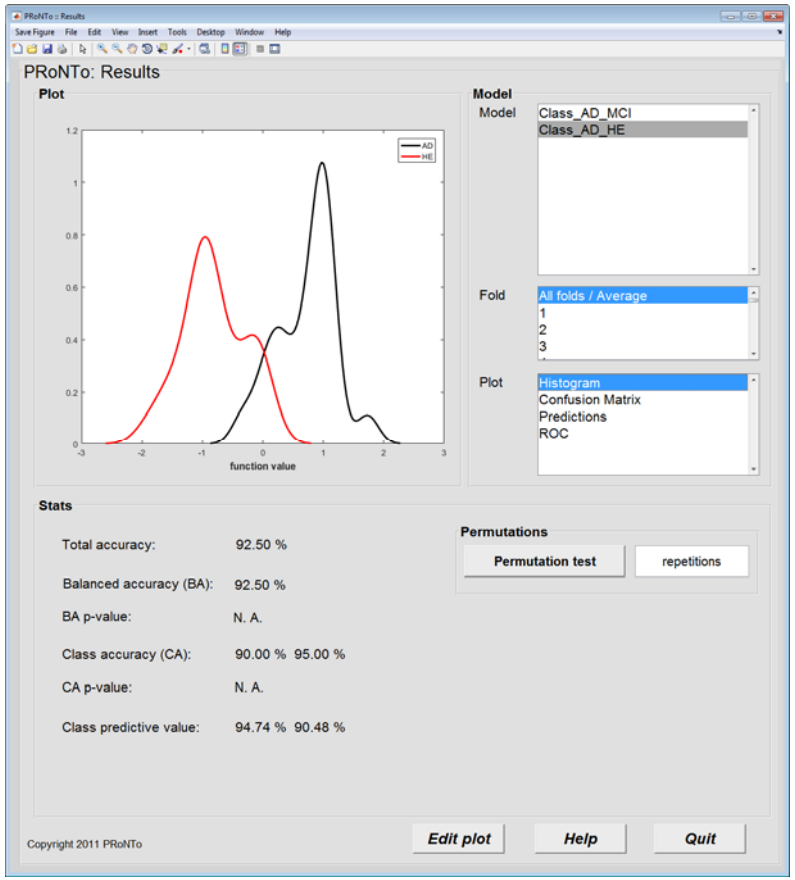


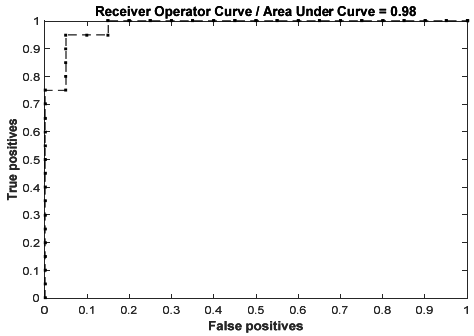


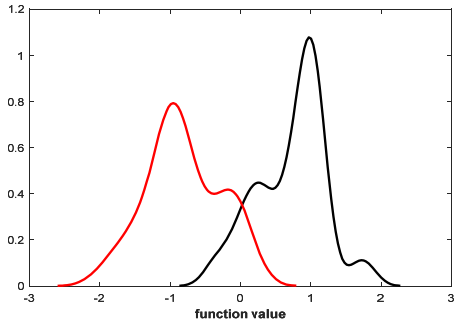


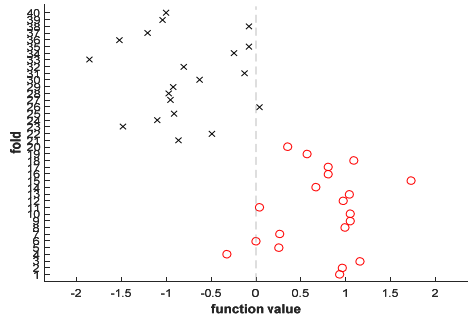
Display results & stat

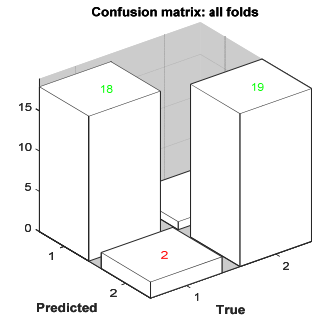
- Example: AD vs HE classification



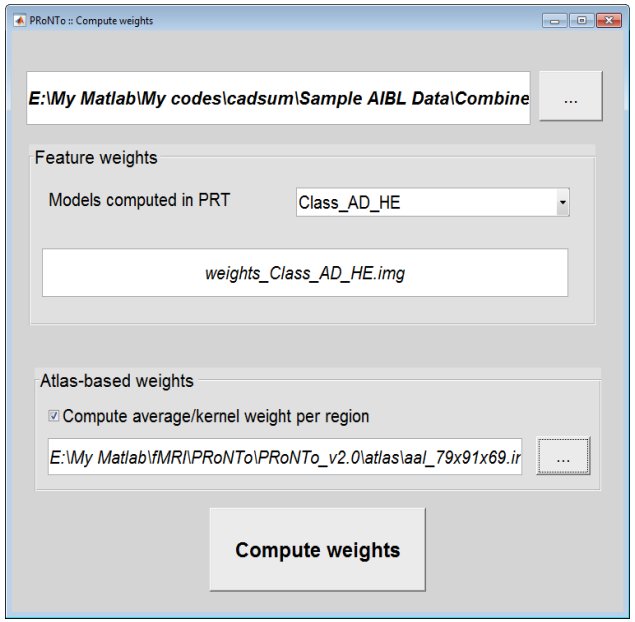


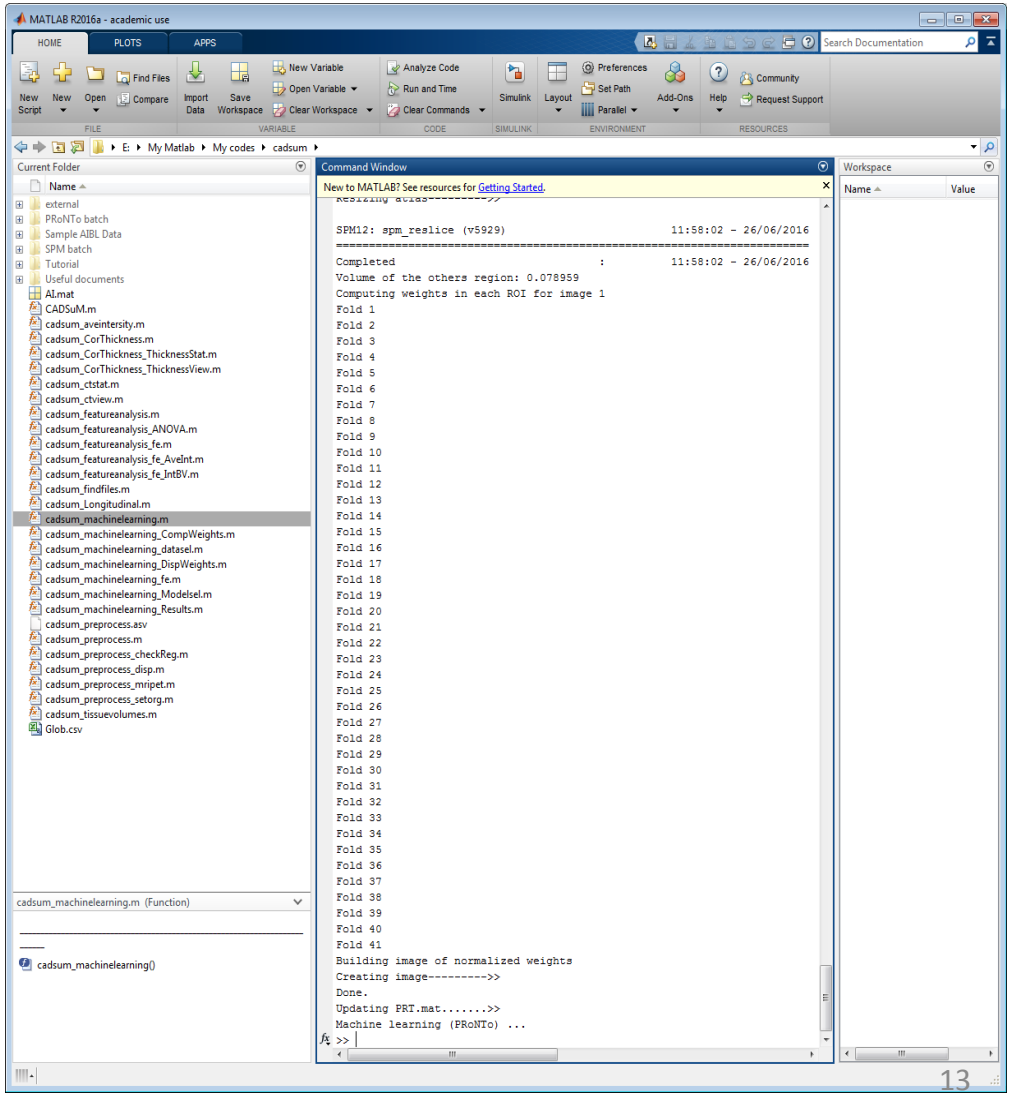






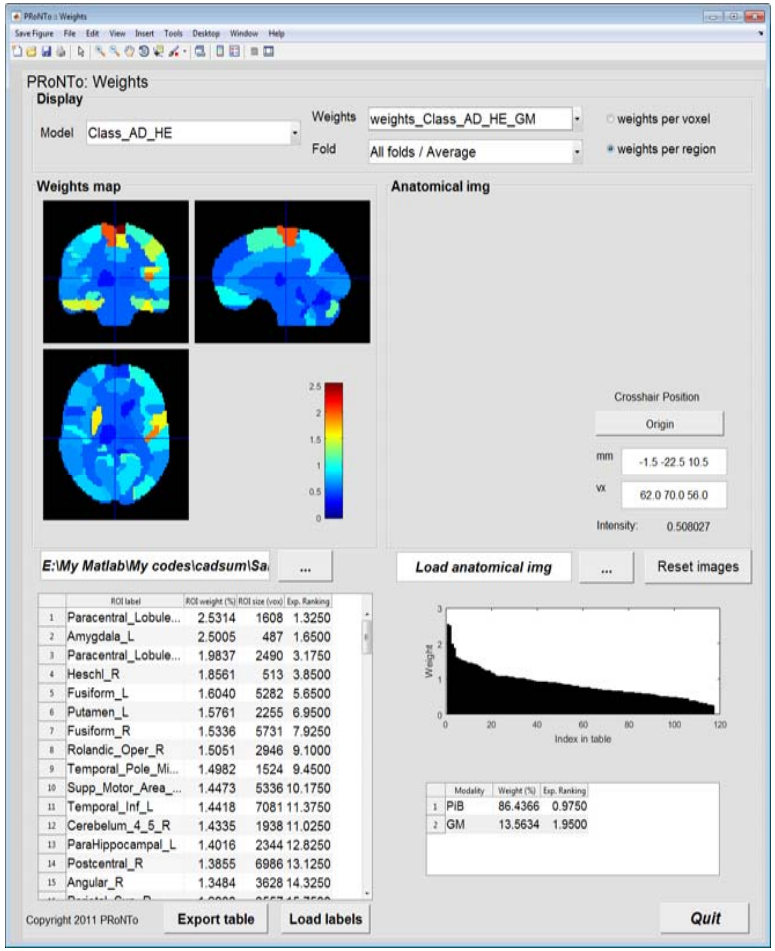
Compute weight maps



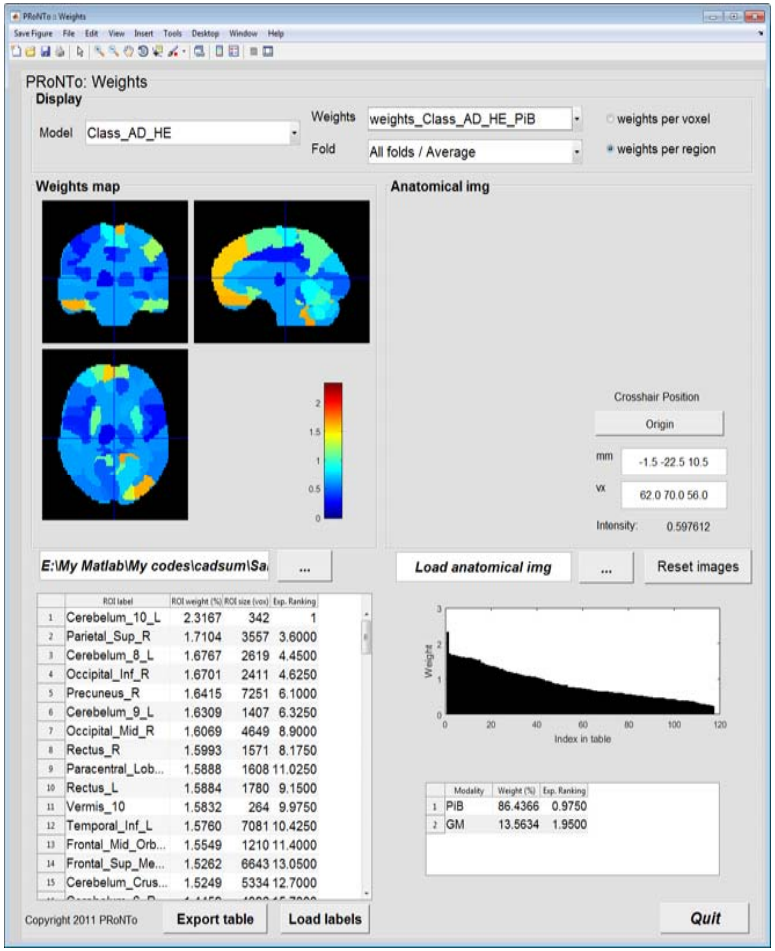


Display weights

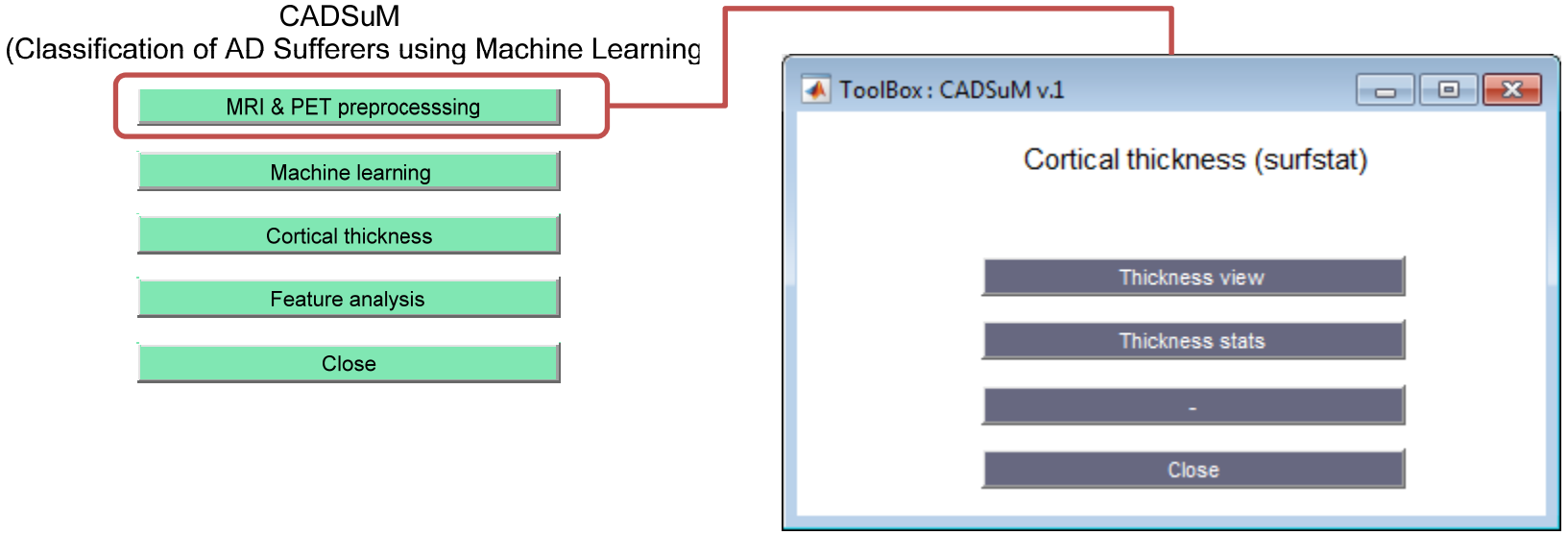
MRI



PET



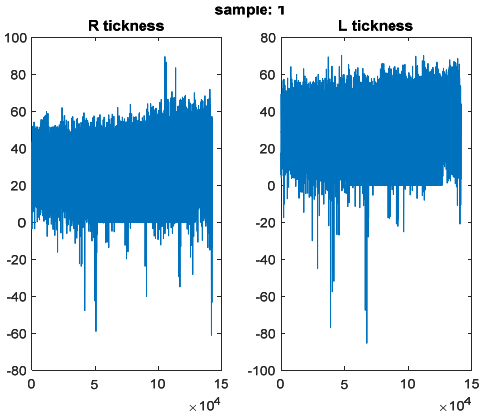
Cortical thickness

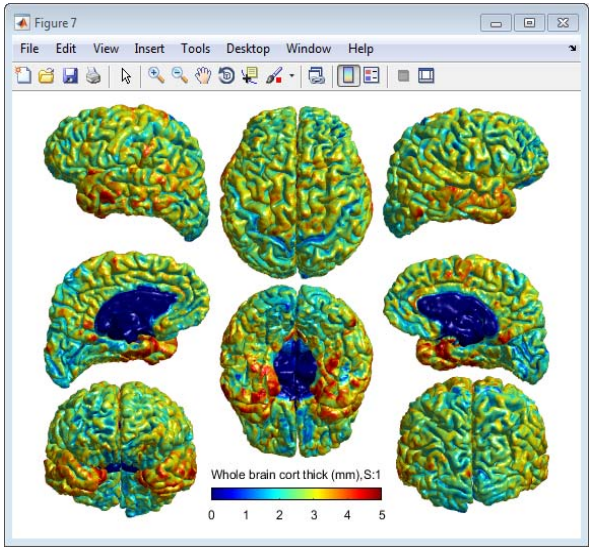


- Surfstat toolbox has to be added to Matlab routines

Thickness view

- Note: the cortical thickness files has to be already calculated by free surfer!





Thickness stats

The data from a single subject or a group of subject can be analyzed.

An example of longitudinal analysis: multiple scans of one AD subject in 4 intervals.

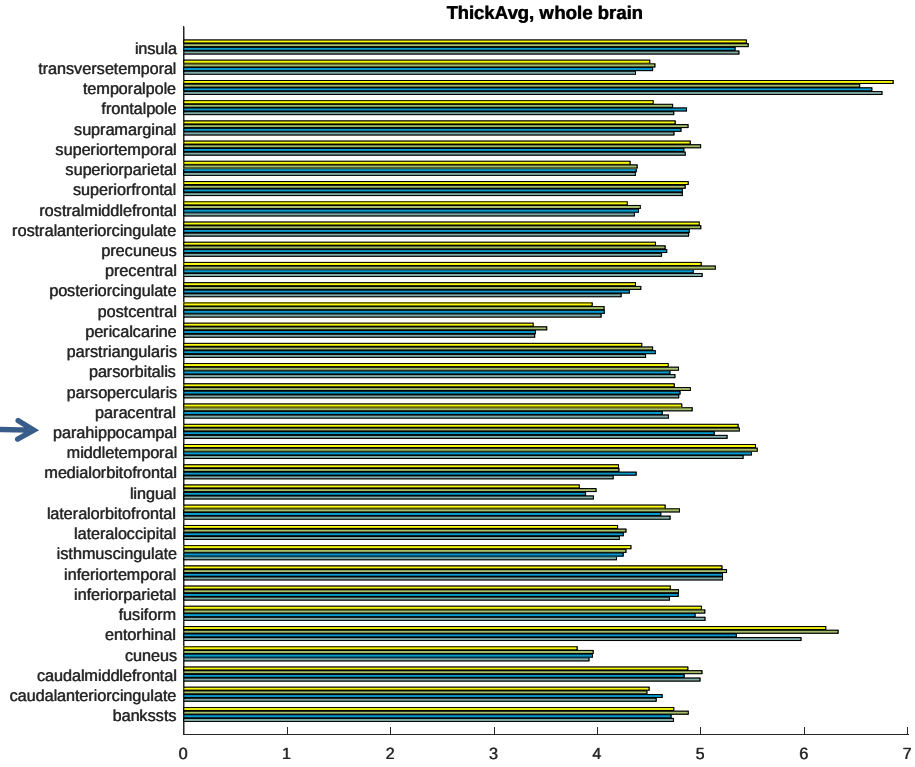
RID	SITEID	VISCODE	DXCURREN
5	1	bl	2
5	1	m18	1
5	1	m36	1
5	1	m54	1

RID =
Subject ID

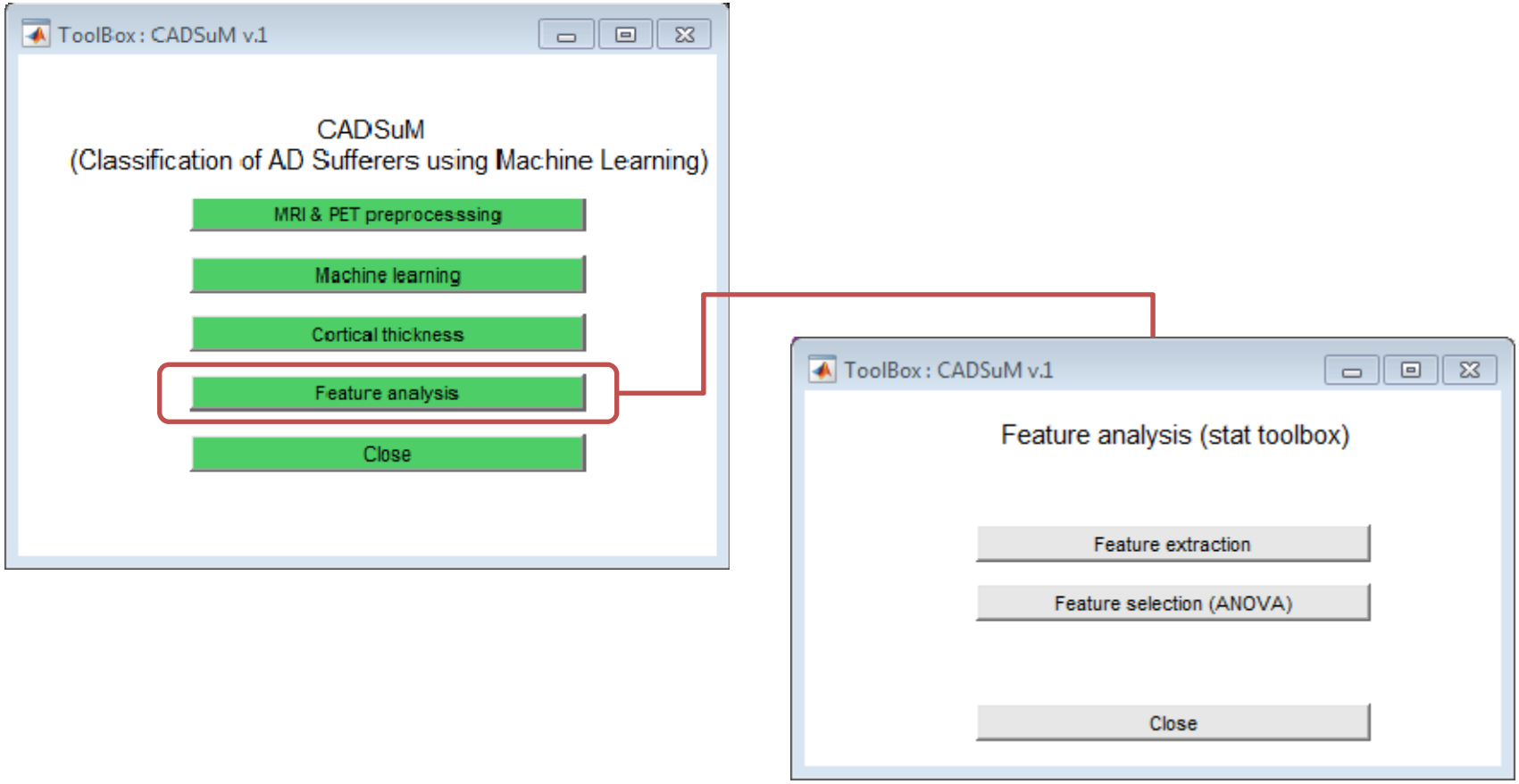
VISCODE =
time Interval

DXCURREN =
3 = AD
2 = MCI
1 = Healthy

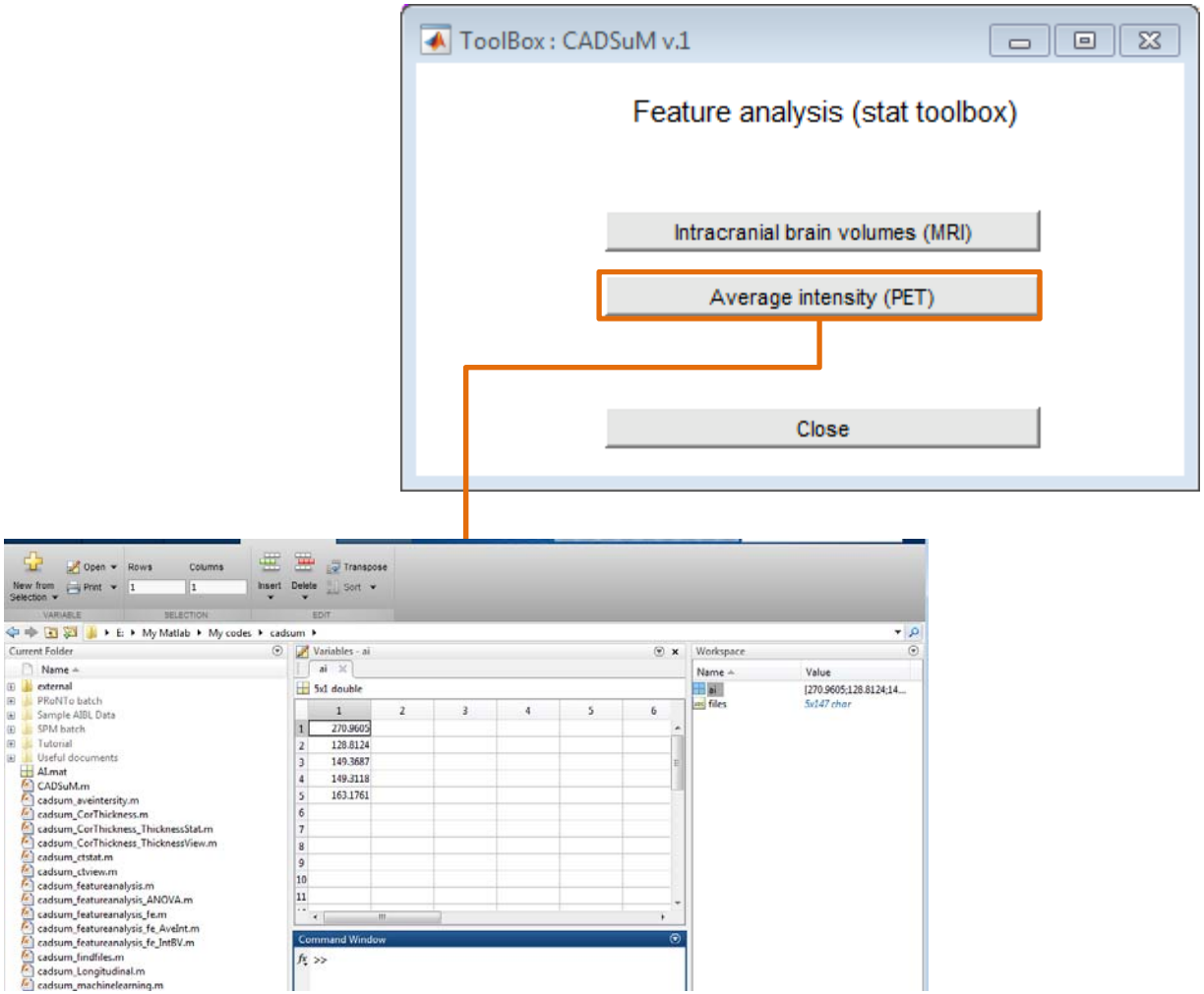
Results indicates an improvement: Increased cortical thickness from interval 3 (m36) to interval (m54) e.g. at Parahippocampus area~ transition from MCI to Healthy conditions.



Feature analysis (stat toolbox)



Intracranial brain volumes (MRI)
Average intensity (PET)



Feature selection (statistical analysis)

- Statistical tests, t-test (2-group analysis) and ANOVA (more than 2 groups) are utilized to analyses features.
- This is under reconstruction!

References

1. Youssofzadeh V, McGuinness B, Maguire L and Wong-Lin K, 2016. A kernel-based Gaussian process for combined MRI and PET in Alzheimer's disease. In: Alzheimer's Research UK (ARUK) 2016 Conference, Manchester, UK. 8-9 March 2016.
2. Youssofzadeh V, McGuinness B, Maguire L and Wong-Lin K. Multi-kernel learning with Dartel enhances MRI-PET classification and prediction of Alzheimer's disease: group and individual analyses, Submitted to Front. Hum. Neurosci.