Practice in resting-state fMRI (rs-fMRI) Analysis: PART II

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Download Demo Materials

心智科學腦研究推動網
心智影像研究(MRI)中心 @成大 活動網頁 → 實作資料

http://fmri.ncku.edu.tw/tw/course_view.php?no=126

盧家鋒 個人網頁
靜息態功能性磁振影像分析實作 → 實作資料、課程講義

http://www.ym.edu.tw/~cflu/CFLu_course_speech.html

Course Arrangement

PART I (10/3)
- rs-fMRI pre-processing
- REST and DPARSF
- REST go through: ReHo, Functional Connectivity, ALFF, fALFF, utilities

PART II (10/4)
- Advanced connectivity analysis, connectivity matrix
- Statistics
- DPARSF go through

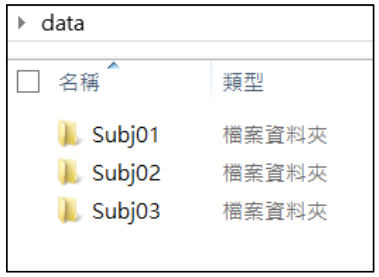
Employed Software/Package

1. **SPM** preprocessing
   - http://www.fil.ion.ucl.ac.uk/spm/
2. **REST** functional connectivity, ReHo, ALFF, fALFF, VMHC
   - http://restfmri.net/forum/index.php?q=rest
3. **DPARSF/DPABI**
   - http://rfmri.org/DPARSF
   - Data Processing Assistant for Resting-State fMRI (DPARSF)
   - Based on SPM and REST toolbox

REST: Song et al., PLoS ONE, 2011.
DPARSF: Yan et al., Frontiers in System Neuroscience, 2010.

Switch current folder to data folder

More convenient to execute the subsequent processing steps….



Functional Connectivity Analysis using REST toolbox

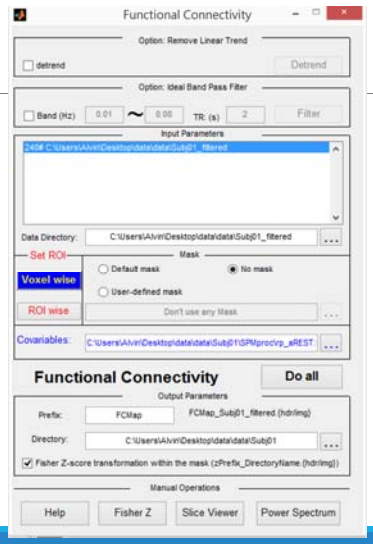
FunctCon

Functional Con.

Select folder of Subj01_filtered (No need to apply filter and mask again)

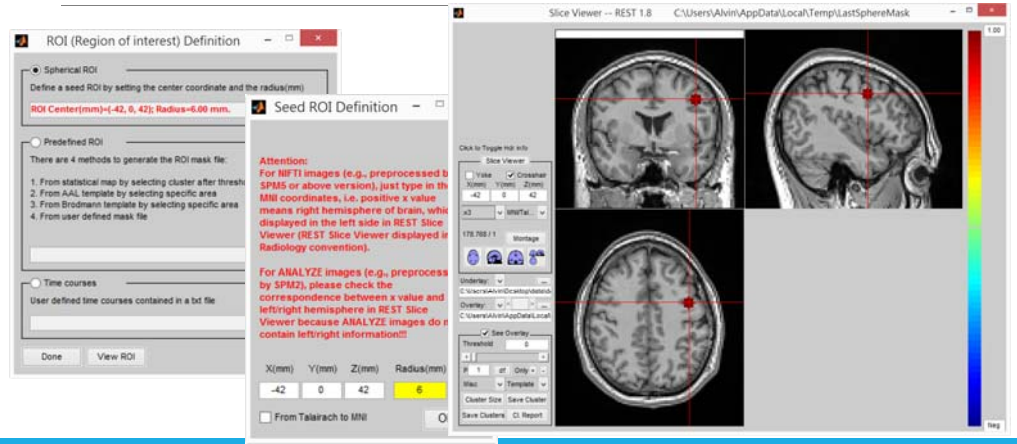
Voxel wise ⇔ ROI wise

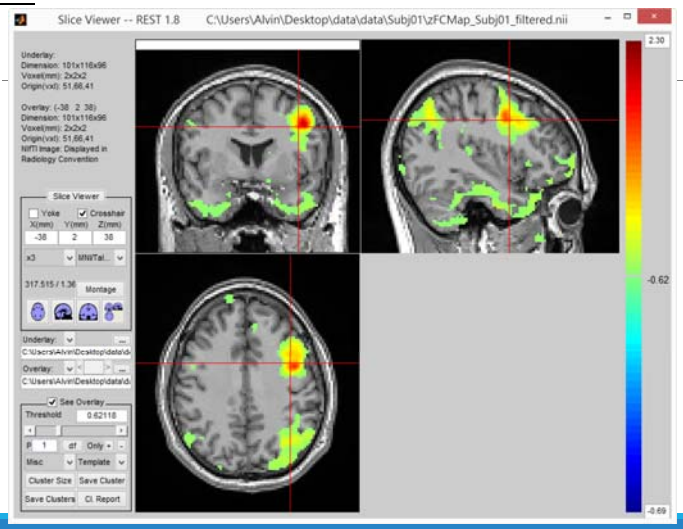
6 motion parameters as covariates



FunctCon

Spherical ROI

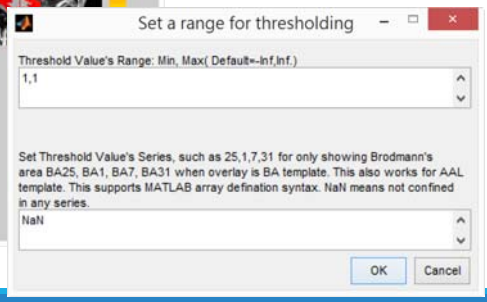




Left ECN for example

Atlas ROI

Misc → Set Range of Threshold



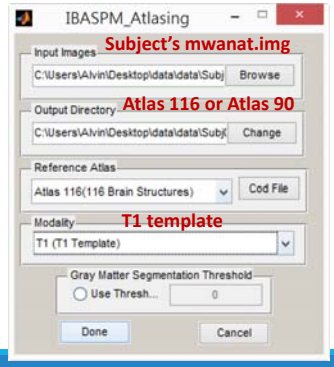
Extract Subject's Atlas

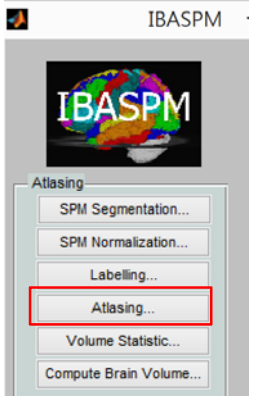
IBASPM 64-bit version

http://www.ym.edu.tw/~cflu/software/Ibaspm_64.zip

Only include the root folder of IBASPM!!

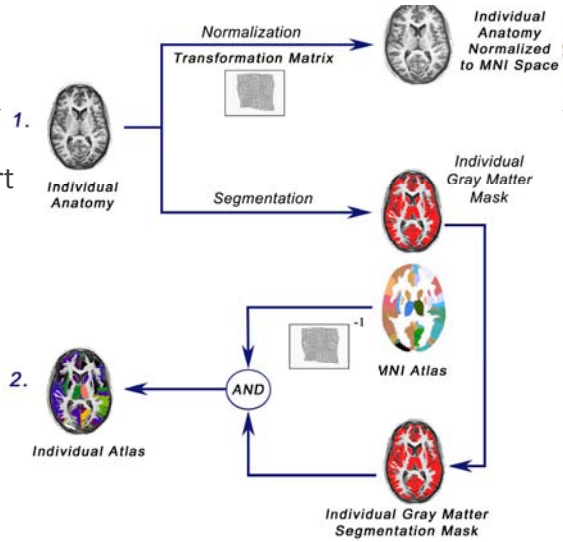
/Atlased/mwanat_Atlas.img



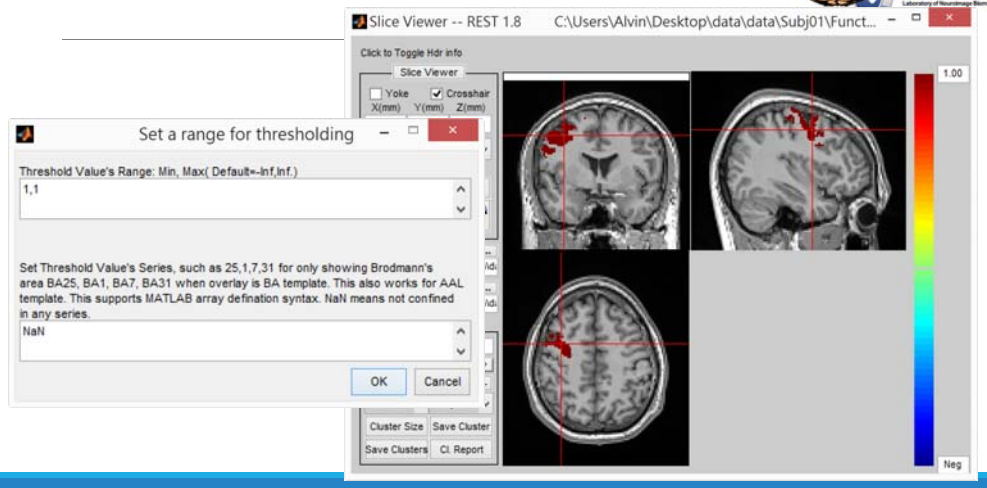


IBASPM

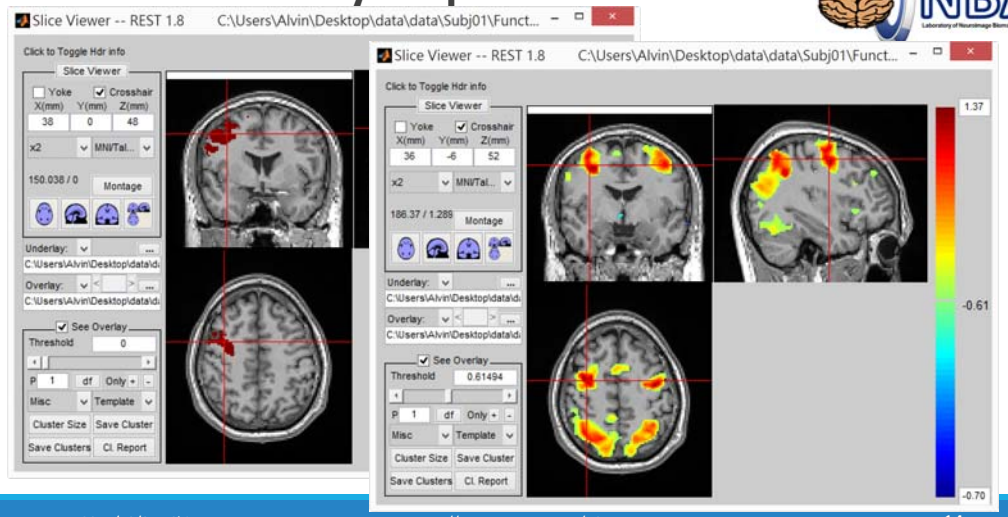
Individual atlas flowchart



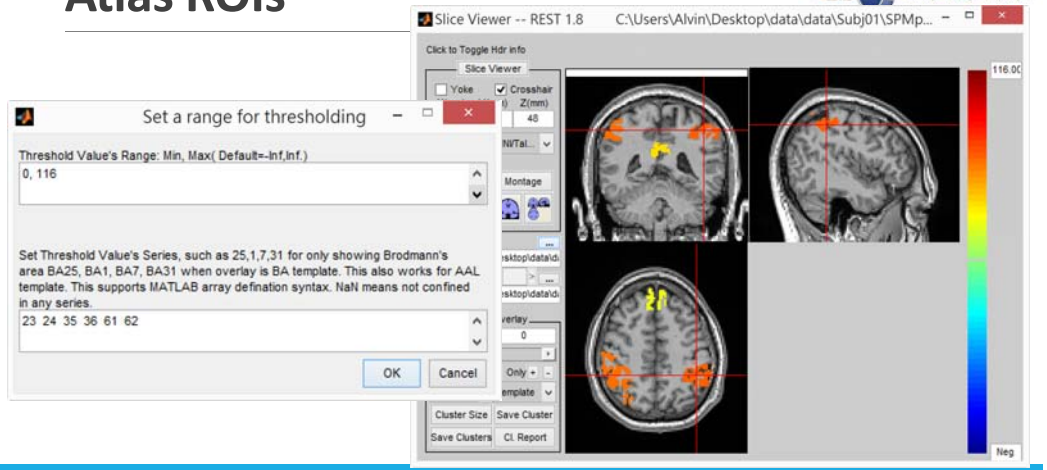
Atlas ROI



Connectivity Maps

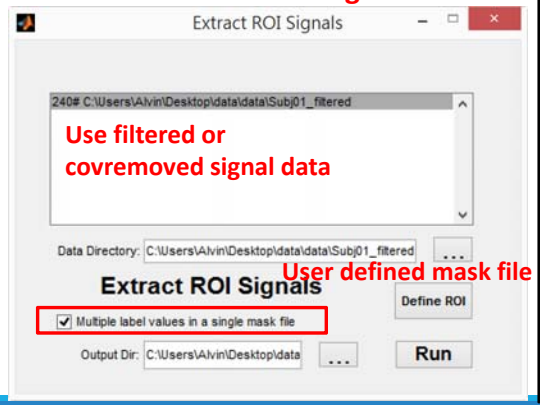


Atlas ROIs

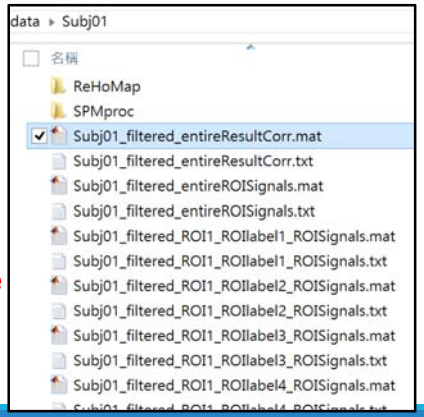


Extract Atlas ROI signals

Utilities → Extract ROI Signals

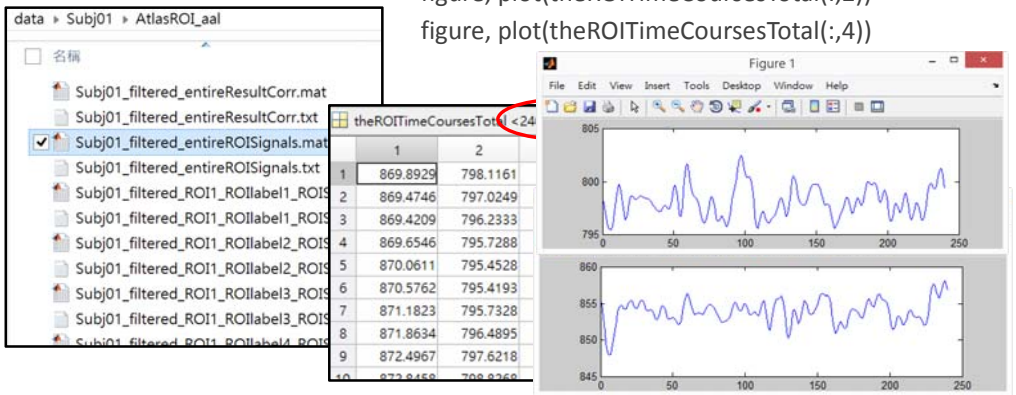


User defined mask file



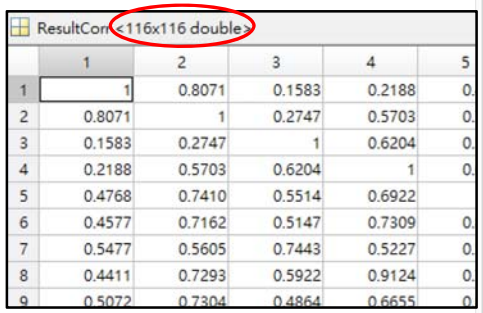
Extract Atlas ROI signals

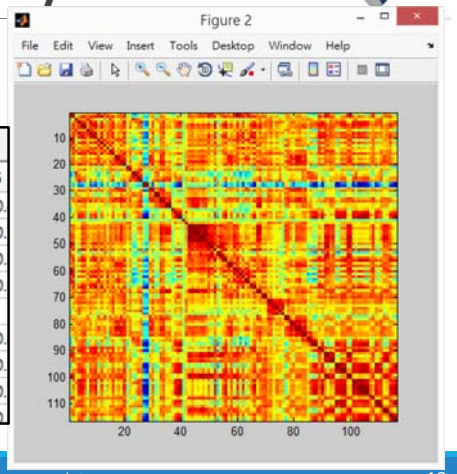
figure, plot(theROITimeCoursesTotal(:,2))
figure, plot(theROITimeCoursesTotal(:,4))



Correlation/Connectivity Matrix

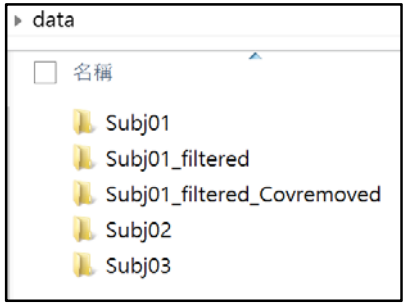
load entireResultCorr.mat
figure, imagesc(ResultCorr)

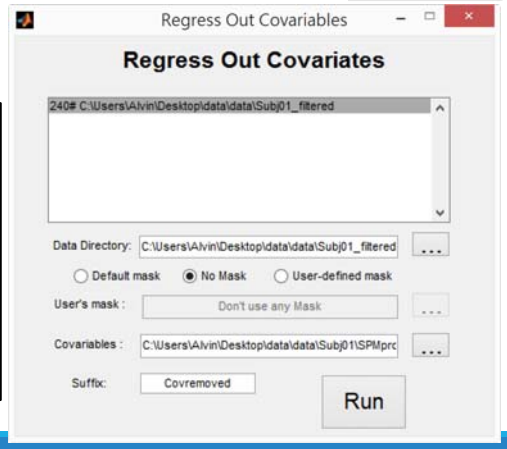




Regress Out Covariates

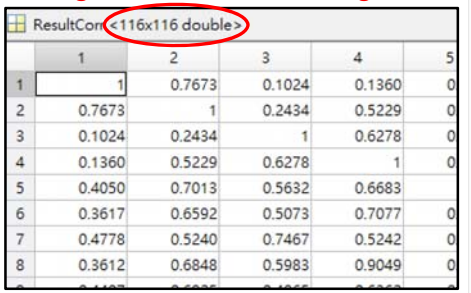
Utilities → Regress Out Covariates

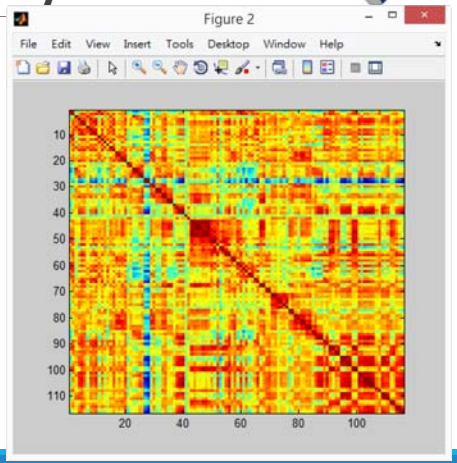




Correlation/Connectivity Matrix

load entireResultCorr.mat
figure, imagesc(ResultCorr)
Using Covariate-removed images

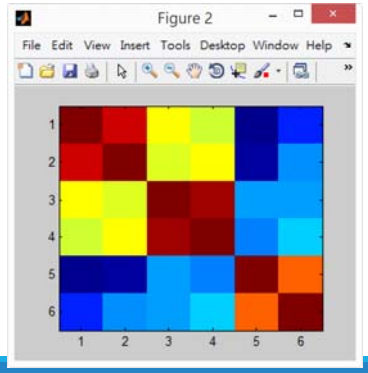




Exercise

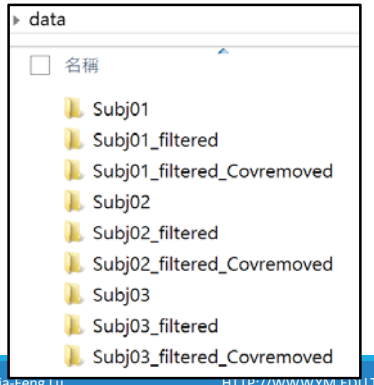
Extract AAL 23,24,35,36,61,62 ROI signals and correlation matrix.

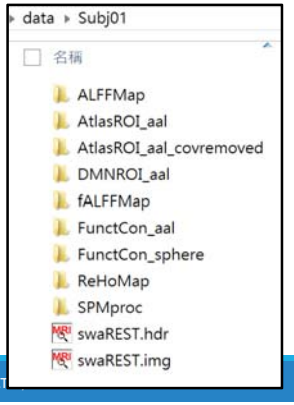
- Create a mask image with selected ROI labels
- Extract ROI signals
- Plot correlation/connectivity matrix



Organize data folder

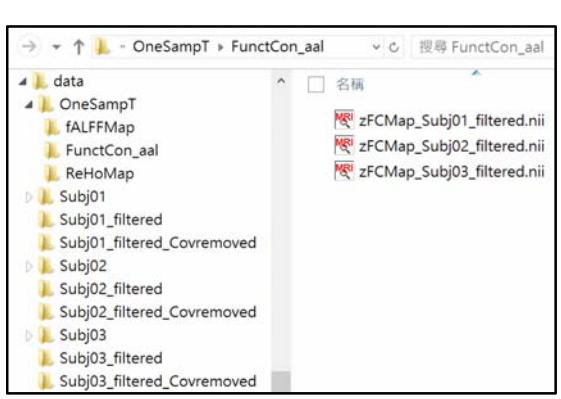
After all the processes by using REST toolbox, please organize your data folder by separating results into different folders

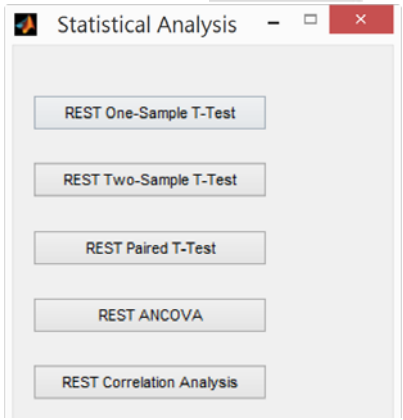




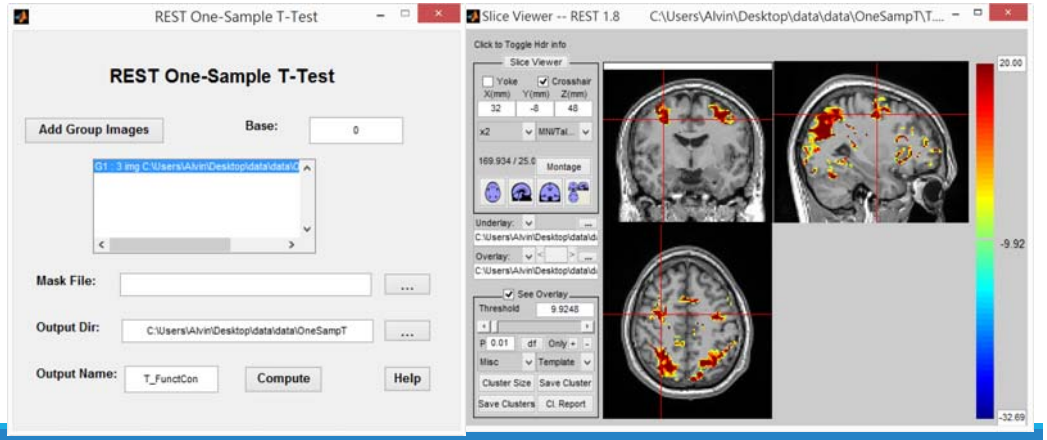
Perform Statistics using REST

Statistical Analysis

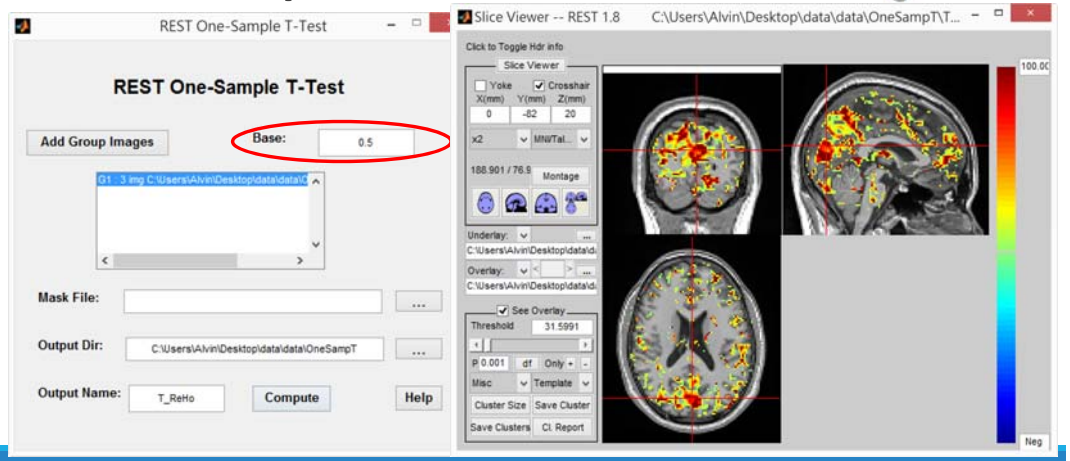




One sample T-test - FunctCon



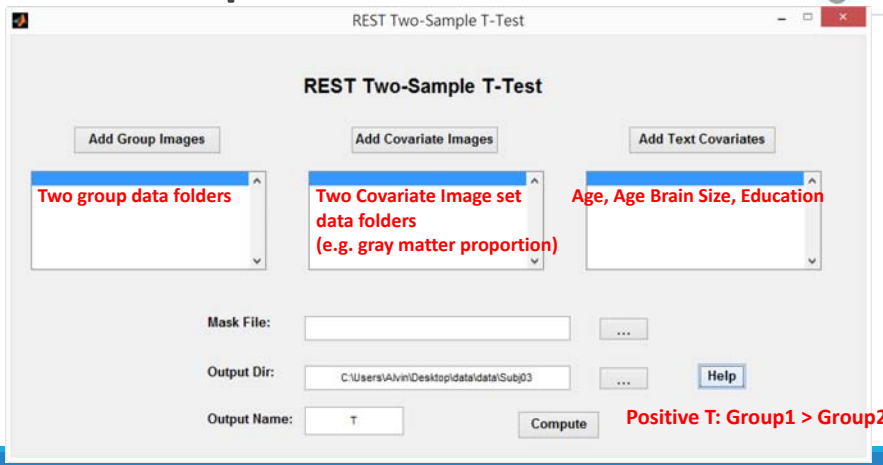
One sample T-test - ReHo



One sample T-test - fALFF

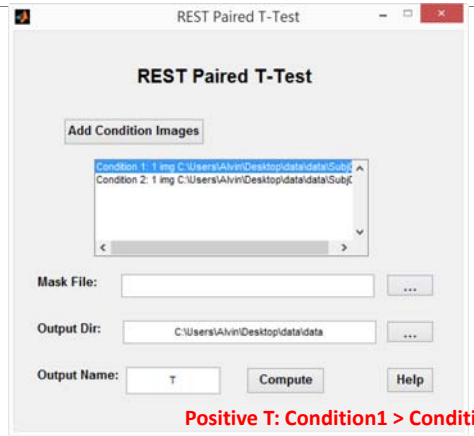
Two-sample T-test

Patients vs Healthy Volunteers
Males vs Females
Young vs Old



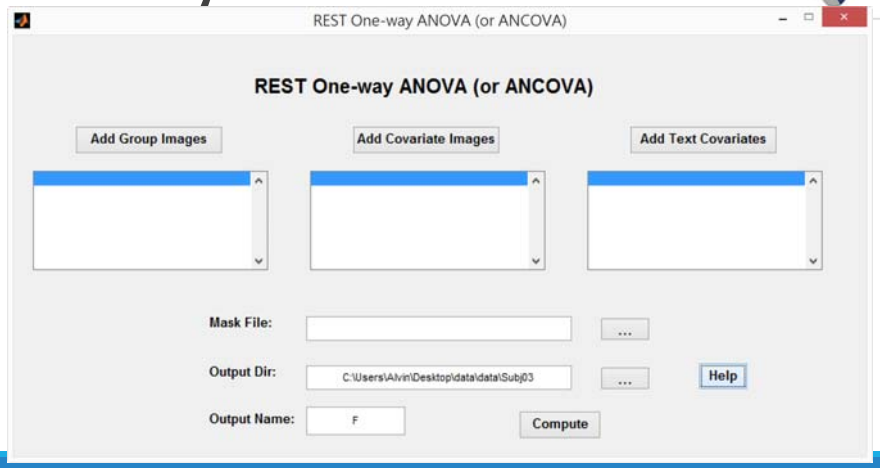
Paired T-test

Task1 vs Task2
Task vs Resting
Pre vs Post



Positive T: Condition1 > Condition2

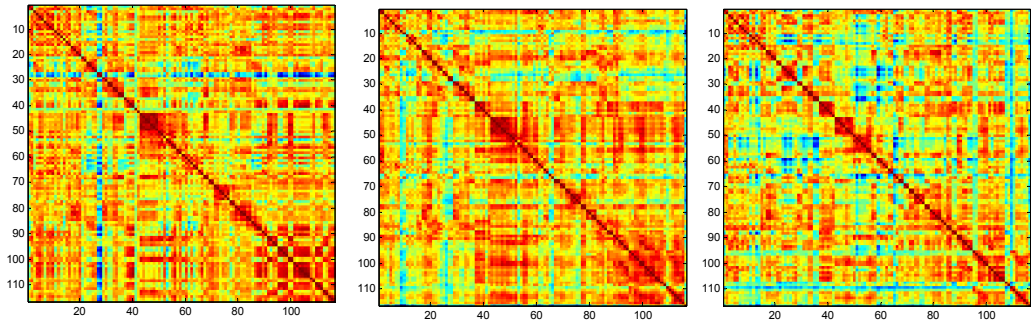
One-way ANOVA



Statistics on Connectivity Matrices

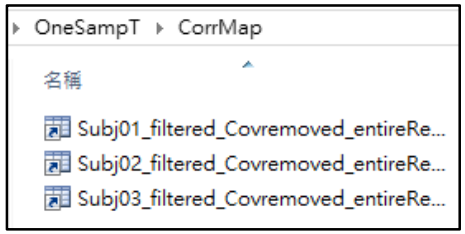
Descriptive statistics, one-sample t-test, two-sample t-test, paired t-test,….

Subj01 **Subj02** **Subj03**



Perform ttest on Correlation Maps

Put all Correlation Maps file in a “CorrMap” directory




```
clear all

dirname='.\CorrMap';
dirinfo=dir(dirname);
dirinfo(1:2)=[];

CorrMapall=[];
for i=1:length(dirinfo)
    load([dirname '\' dirinfo(i).name])
    CorrMapall(:,:,i)=ResultCorr;
end
figure,imagesc(mean(CorrMapall,3))
```

Perform ttest on Correlation Maps

```
14 –  pMap=zeros(size(CorrMapall,1),size(CorrMapall,2));
15 –  hMap=zeros(size(CorrMapall,1),size(CorrMapall,2));
16 –  for i=1:size(CorrMapall,1)
17 –    for j=i+1:size(CorrMapall,2)
18 –      tmp=squeeze(CorrMapall(i,j,:));
19 –      tmp(isnan(tmp))=[];
20 –      [hMap(i,j),pMap(i,j)]=ttest(tmp,0);  % one-sample
21 –    end
22 –  end
23
24    %% hint for two-sample t-test, and paired t test
25    %       [hMap(i,j),pMap(i,j)]=ttest2(tmp1,tmp2,0);  % two-sample
26    %       [hMap(i,j),pMap(i,j)]=ttest(tmp1,tmp2,0);  % paired ttest
```

Correct “nanvar_base” error in ttest.m

```
103 –  df = max(samplesize - 1,0);
104 –  xmean = nanmean(x,dim);
105    % sdpop = nanstd(x,[],dim);  % by
106 –  sdpop = std(x,[],dim);
107 –  ser = sdpop ./ sqrt(samplesize);
108 –  tval = (xmean - m) ./ ser;
```

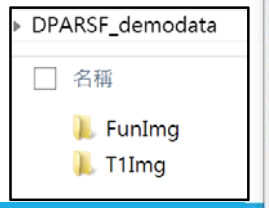

DPARSF: walk through

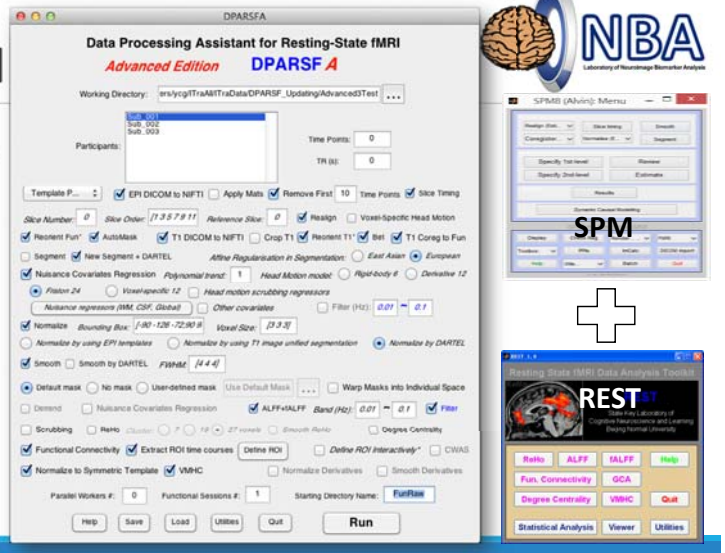
DPARSF GUI

One-stop service

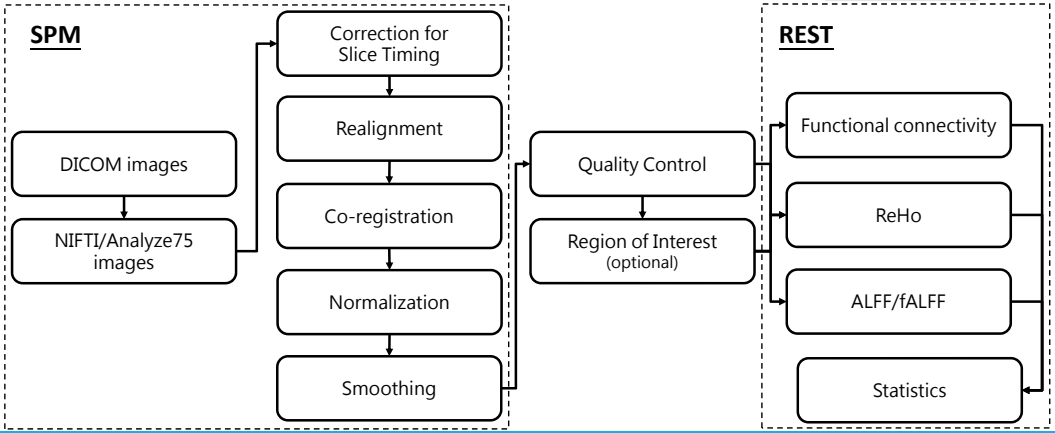
- Similar to the SPM batch

```
>> DPARSF
>> DPARSFA
>> dpabi
```





Processing Flow in DPARSF



Q & A

臺北醫學大學
轉譯影像研究中心
Translational Imaging Research Center
Taipei Medical University

TIRC Team
2015.7.20 at TMU