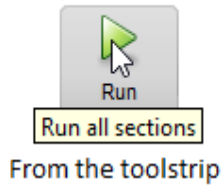
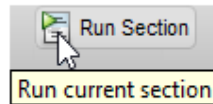


Use the Live Editor to **edit** and **run** this live script in your MATLAB.

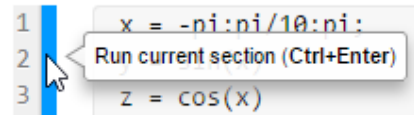
#### Run the entire script



#### Run an individual section



or



From the left margin

## Seed- & ICA-Based Analyses: What they are & How to Interpret Findings

This .mlx file contains an at-home assignment designed to familiarize the audience with the Group ICA of fMRI Toolbox Software (GIFT) software environment. For a more in-depth exploration of the software, the audience is strongly advised to visit the software's website (<https://trendscenter.org/software/gift/>).

### Download the assignment materials

First, you need to have downloaded the assignment material by following this link:

[https://livejohnshopkins-my.sharepoint.com/:f/g/personal/achoe2\\_jh\\_edu/EhXmWQem81RGvR8Pz7XYUe8BZjrsM4SvLX8Cit0sFh1NOA?e=WmDvWz](https://livejohnshopkins-my.sharepoint.com/:f/g/personal/achoe2_jh_edu/EhXmWQem81RGvR8Pz7XYUe8BZjrsM4SvLX8Cit0sFh1NOA?e=WmDvWz)

The password required to download the file is **E5913\_choe**

In the zipped file, you find a folder named **E5913\_choe\_assignment**. The folder contains the following:

- **E5913\_choe.mlx**: this file
- **E5913\_choe.pdf**: PDF printout of this .mlx file, for those who may not have access to Matlab
- **data**: a folder which contains a preprocessed rsfMRI data set from 3 different healthy subjects and one normalized anatomical image of one of the subjects.
- **gift\_output**: an output folder generated from the GIFT software after performing GICA.

Specific questions are indicated by the preceeding **++**. The assignments will also be in **bold**. Answers to the assignemnts are provided within the following parentheses.

### Explore GIFT

First, locate the folder you've downloaded the assignment material in, and move to the location. My gift\_output folder is located in `/Users/achoe2/Desktop/E5913_choe_assignment/gift_output`, so I used the **cd** command to change the current directory of Matlab.

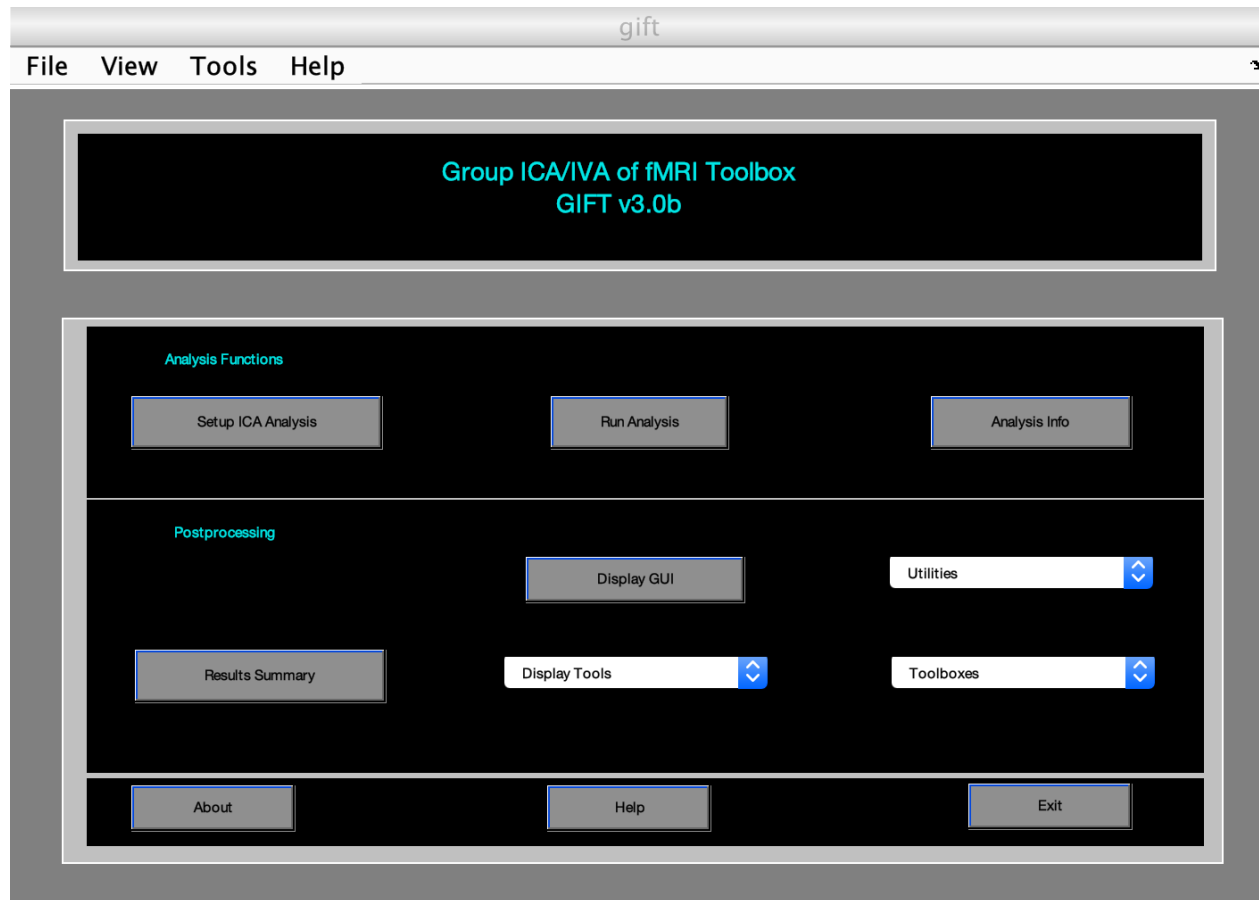
```
clear variables; close all; clc;
```

```
cd /Users/achoe2/Desktop/E5913_choe_assignment/gift_output
```

## 1) Open GIFT from Matlab

Open GIFT from the Matlab command window.

```
gift
```



## 2) Load Analysis Info, and explore the setup parameters.

Click on **Analysis Info**

>> Select **E5913\_choe\_ica\_parameter\_info.mat**

>> Click **OK**

Take a look at the *Parameter Info*, *Data Reduction Info*, and *File Output Info*

- ++Which ICA algorithm was used to run this GICA? (Infomax)
- ++What was the number of scans/timepoints? (210)
- ++How many data reduction steps were performed? (2)
- ++Were the backreconstructed results generated as output? (yes)

Note: I always find it useful to check this section, even before finish running the GICA, to check if I've made any mistakes while setting up the GICA parameters.

### 3) Browse independent components

Click on *Display GUI*

>> Select **E5913\_choe\_ica\_parameter\_info.mat**

>> Select the **mean\_component\_ica\_s\_all.nii** file

>> Select **1-1 mean\_component\_ica\_s\_all**

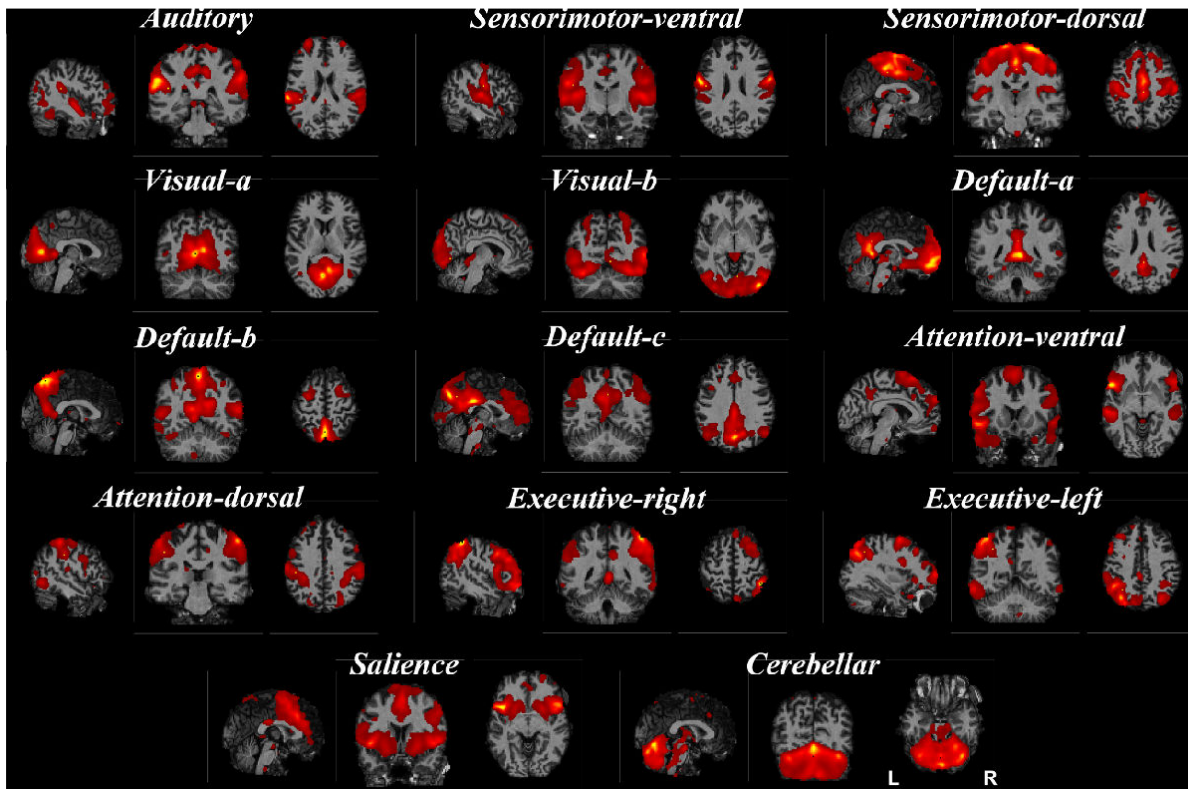
>> Click ***Load Anatomical*** on the bottom left

>> Select **anat\_final.subj01+tlrc.nii** from your data folder

>> Change display defaults as desired, by clicking on ***Display Defaults***

>> Click ***Display***

While browsing the independent components, you could use the following figure to compare the components with a known set of resting-state networks (RSN).



- ++Can you identify a default mode network? What is the component number? (7)
- ++Can you identify a visual network? What is its component number? (13)
- ++Can you identify a component containing a nuisance component? What is its component number, and why do you think so? (One of the answers is 4, which shows the eye component)

#### 4) Take a look at the Results Summary

In order to generate the Results Summary,

Click **Results Summary**

>> Select **E5913\_choe\_ica\_parameter\_info.mat**

>> Click **No**

>> Click **Okay**

Note: This process take a bit of time. I found out the hard way that if you try to do anything else (e.g., check emails, open browser) during this process, it will sometime mess with the look of the summary report.

- ++ Take a look at the FC correlation

## Explore GICA output folder

### 1) ++Where are the mean spatial maps and time courses located?

```
cd /Users/achoe2/Desktop/E5913_choe_assignment/gift_output
ls -l
```

```
total 4992
-rw-r--r--  1 achoe2  staff      348 Apr 29 14:04 E5913_choeMask.hdr
-rw-r--r--  1 achoe2  staff 1245184 Apr 29 14:04 E5913_choeMask.img
-rw-r--r--  1 achoe2  staff  138080 Apr 23 13:59 E5913_choeSubject.mat
drwxr-xr-x  5 achoe2  staff    160 Apr 23 14:04 E5913_choe_back_reconstruction_files
drwxr-xr-x  6 achoe2  staff    192 Apr 23 14:03 E5913_choe_data_reduction_files
drwxr-xr-x 48 achoe2  staff   1536 Apr 24 15:03 E5913_choe_gica_results
drwxr-xr-x 14 achoe2  staff    448 Apr 23 14:04 E5913_choe_group_stats_files
drwxr-xr-x  7 achoe2  staff    224 Apr 23 14:04 E5913_choe_ica_files
-rw-r--r--  1 achoe2  staff   910128 Apr 29 14:04 E5913_choe_ica_parameter_info.mat
-rw-r--r--  1 achoe2  staff  156457 Apr 24 15:03 E5913_choe_postprocess_results.mat
-rw-r--r--  1 achoe2  staff   46621 Apr 23 14:04 E5913_choe_results.log
drwxr-xr-x 14 achoe2  staff    448 Apr 23 14:04 E5913_choe_scaling_components_files
```

Here they are!

```
cd E5913_choe_group_stats_files
ls -l
```

```
total 340800
-rw-r--r--  1 achoe2  staff    244 Apr 23 14:04 mean_component_ica_s1.mat
-rw-r--r--  1 achoe2  staff 43581792 Apr 23 14:04 mean_component_ica_s1.nii
-rw-r--r--  1 achoe2  staff    244 Apr 23 14:04 mean_component_ica_s_all.mat
-rw-r--r--  1 achoe2  staff 43581792 Apr 23 14:04 mean_component_ica_s_all.nii
-rw-r--r--  1 achoe2  staff   29752 Apr 23 14:04 mean_timecourses_ica_s1.nii
-rw-r--r--  1 achoe2  staff   29752 Apr 23 14:04 mean_timecourses_ica_s_all.nii
-rw-r--r--  1 achoe2  staff    244 Apr 23 14:04 std_component_ica_s1.mat
-rw-r--r--  1 achoe2  staff 43581792 Apr 23 14:04 std_component_ica_s1.nii
-rw-r--r--  1 achoe2  staff   29752 Apr 23 14:04 std_timecourses_ica_s1.nii
-rw-r--r--  1 achoe2  staff    244 Apr 23 14:04 tmap_component_ica_s1.mat
-rw-r--r--  1 achoe2  staff 43581792 Apr 23 14:04 tmap_component_ica_s1.nii
-rw-r--r--  1 achoe2  staff   29752 Apr 23 14:04 tmap_timecourses_ica_s1.nii
```

(The **mean\_component\_ica\_s\_all.mat** is the mean images, and the **mean\_timecourses\_ica\_s\_all.mat** is the mean time courses)

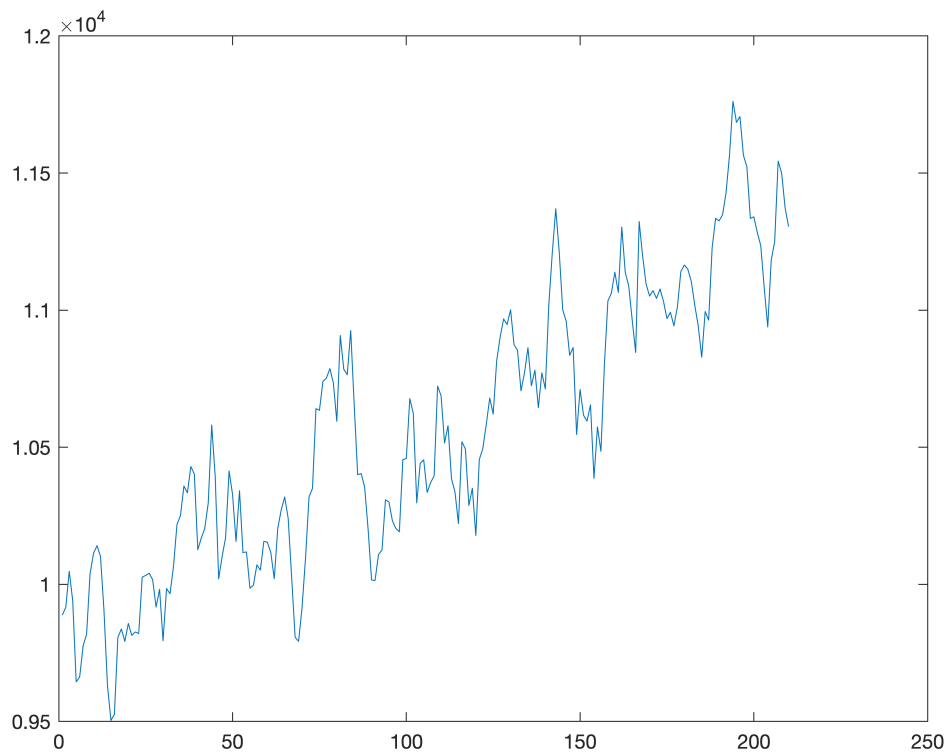
### 2) ++Plot the mean time course of the default mode network

We perviously identified the component number 7 as one of the DMNs. Let's plot its time course.

```
clear variables
```

```
meanTC = niftiread('mean_timecourses_ica_s_all.nii');
tc_DMN = meanTC(:, 7);

figure
plot(tc_DMN)
```



### 3) ++Where are the backreconstructed (i.e., subject-specific) spatial maps and the time courses located?

```
cd ../E5913_choe_back_reconstruction_files/
ls -l
```

```
total 124584
-rw-r--r--  1 achoe2  staff   21259880 Apr 23 14:04 ica_br1.mat
-rw-r--r--  1 achoe2  staff   21259880 Apr 23 14:04 ica_br2.mat
-rw-r--r--  1 achoe2  staff   21259880 Apr 23 14:04 ica_br3.mat
```

Here they are. Let's see what is contained in the backreconstructed file of subject01.

```
load("ica_br1.mat")
compSet
```

```
compSet = struct with fields:
    ic: [35x75717 double]
    tc: [210x35 double]
```

As you can see, the variable **ic** contains the independent component spatial maps, and **tc** contains the associated time courses.