

Example Code for Network Preprocessing and Analysis

Network Flexibility and Reinforcement Learning

See paper for details when it comes out

Preprocessing

Need to add

Running nonlinear registration with FNIRT

Run this after confound regression. Make sure fsl_anat has been run on each structural image first. Bash script.

```
for i in /data/engine/rgerraty/learn_dyncon/4*/Learn*; do
    flirt -ref ${i}/../structural/mprage.anat/T1_biascorr_brain.nii.gz\
        -in ${i}/reg/example_func.nii.gz -omat ${i}/reg/example_func2highres.mat;
    echo warping ${i};
    applywarp --ref=$FSLDIR/data/standard/MNI152_T1_2mm.nii.gz\
        --in=${i}/36par+spikes.feats/stats/res4d.nii.gz\
        --out=${i}/36par+spikes.feats/stats/res4d_std.nii.gz\
        --warp=${i}/../structural/mprage.anat/T1_to_MNI_nonlin_field.nii.gz\
        --premat=${i}/reg/example_func2highres.mat;
done
```

Extracting time courses

Input a folder of ROIs and preprocessed 4D data. Bash script.

```
for i in /data/engine/rgerraty/learn_dyncon/4*/Learn?_PEprior.feats/36par+spikes.feats/;
do
    bash ~/GitHub/rl_flexibility/extract_ROIs.sh ${i}/stats/res4d_std.nii.gz ~/Harvard-Oxford;
done
```

Calculate coherence matrices for each time window

In MATLAB. Input ROI timecourses for each block, number of windows per block in TRs, and minimum/maximum frequency in Hz.

```
addpath ~/GitHub/rl_flexibility
[a,b]=system('ls -d /data/engine/rgerraty/learn_dyncon/4*/Learn?_PEprior.feats/36par+spikes.f
```

```

c=strread(b,'%s');

for i=1:size(c,1)
    filename=char(strcat(c(i),'/all_rois.txt'))
    conn_cell=coherence_by_block(filename,25,.5,.06,.12);
    save(char(strcat(c(i),'/conn_cells')), 'conn_cell')
end

```

Run multi-slice community detection and flexibility statistics

Input coherence matrix for each block. Also need number of blocks, resolution and coupling parameters. In Matlab

```

%%%%%%pretty hacky, remember to fix
addpath ~/GitHub/rl_flexibility
addpath ~/scripts/MATLAB/GenLouvain_for_Raphael/
addpath ~/scripts/MATLAB/Bassett_Code/
[a,b]=system('ls -d /data/engine/rgerraty/learn_dyncon/4*/Learn?_PEprior.feat/36par+spikes.f');
c=strread(b,'%s');
numruns=4;
k=1;
for j=1:size(c,1)/numruns
    c(k)
    conn_cell_cat=[];
    for i=1:numruns
        load(strcat(char(c(k-1+i)), '/conn_cells'))
        conn_cell_cat=cat(3,conn_cell_cat,conn_cell)
    end
    [a_mat,flex]=network_diags(conn_cell_cat,4,100,1,1.1813)
    save(char(strcat(c(k), '/../../../../../a_mat')), 'a_mat')
    save(char(strcat(c(k), '/../../../../../flex')), 'flex')
    k=k+numruns;
end

```

Pull flexibility scores

For plotting and analysis. Matlab.

```

[a,b]=system('ls -d /data/engine/rgerraty/learn_dyncon/4*/flex.mat');
c=strread(b,'%s');
flex_cat=[];
for j=1:size(c,1)
    load(char(c(j)))
    flex_cat=cat(3,flex_cat,flex)
end

```

```
end  
plot(squeeze(mean(flex_cat)))
```