The aim of this write-up is to briefly summarize the data-extraction procedure used for the analysis in our project.

**Data**

The initial dataset comprised of fMRI scans collected from 16 subjects/participants. The experiment was that each participant was asked to watch 4 video stimuli inside the scanner during which they were constantly being scanned.

**Procedure**

We had 4 different scan sets for each subject corresponding to 4 video stimuli. Same procedure was followed to extract the time-series data from each scan set for each subject. Steps followed for data extraction are mentioned below.

*Step-1*

The raw data images were initially preprocessed using SPM8. The preprocessing steps applied were -:

Realign( Estimate & Reslice ) :: Realignment was applied to remove the movement artefact from the fMRI data and reslicing was done to match all images voxel-for-voxel.

Coregistration( Estimate ) :: In this step, the structural image of the subject was coregistered with the mean fMRI scan from the realignment step.

Segmentation :: The grey and white matter images were generated here.

Normalization :: This was performed for both the anatomical and functional images.

All the above mentioned preprocessing steps were performed with the default parameters. These normalized images were then used to extract the time-series data from each voxel. The normalized images were selected to extract data so that each voxel now corresponds to standard MNI space and data can be extracted from specific voxel by mentioning the (x,y,z) coordinate in MNI space. The voxel size in our case is (1.89mm,1.89mm,5mm) in x, y and z directions respectively.

*Step-2*

Matlab code was used to extract the time-series data from the specific regions of interest.

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imgs=spm\_select(Inf, 'image', 'get timeseries data');

V=spm\_vol(imgs);

[Y,XYZ]=spm\_read\_vols(V);

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The above 3 lines of code selects the data images( normalized in our case ) and reads them into ‘Y’ and ‘XYZ’ matrices. Both of these matrices are 2-dimensional matrices. The ‘Y’ matrix contains the voxel-wise time-series data where each column in the matrix represent one voxel and each row represent activity of each voxel at certain time-point. The ‘XYZ’ matrix contains the (x,y,z) coordinates for each voxel. Here also the columns represent the voxels, hence, if the 1st column in ‘Y’ contains time-series for voxel ‘v1’ then 1st column of ‘XYZ’ contains (x,y,z) coordinates for same voxel ‘v1’ and similar for other columns.

For XYZ locations of each voxel, region-wise, we follow the below procedure

1. Use the link <https://bioimagesuiteweb.github.io/webapp/mni2tal.html>
2. Select the region with the region number of interest in the drop down.
3. In the obtained Brodmann map, fix Z (round it off to the lower even number if it is odd)
4. Once fixed Z, use the axial plane and move from the top of the region to the bottom of the region to generate and for each Y, iterate over all of X that is in bound to stay in the region.
5. Stack all these locations in a matlab files.
   1. Stack all the right region coordinates with the name R<Brodmann\_region\_number>\_R.mat, left region coordinates with the name R<Brodmann\_region\_number>\_L.mat
   2. Save all of them in one mat file.

Finally, run the code below.

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%% Read voxel locations

LOC = load("VoxelLocations.mat").LOC;

%% Iterate over all regions

fNames = fieldnames(LOC);

R = length(fieldnames(LOC));

extractedData = LOC;

for r = 1:R

%% Choose region

right = LOC.(fNames{r}).R;

left = LOC.(fNames{r}).L;

L = size(right);

L = L(1);

%% Set xyz location of voxels

concatenate = [];

for i=1:L

%% Find the index with the XYZ coordinates

coord = find(ismember(XYZ',right(i,:),'rows'));

%% Reshape

sz = size(Y);

Y1 = reshape(Y,[],sz(4));

%% get time series

series1 = Y1(coord,:);

%% Concatenate

concatenate = [concatenate;series1];

end

concatenate = concatenate';

extractedData.(fNames{r}).R = concatenate;

L = size(left);

L = L(1);

%% Set xyz location of voxels

concatenate = [];

for i=1:L

%% Find the index with the XYZ coordinates

coord = find(ismember(XYZ',left(i,:),'rows'));

%% Reshape

sz = size(Y);

Y1 = reshape(Y,[],sz(4));

%% get time series

series1 = Y1(coord,:);

%% Concatenate

concatenate = [concatenate;series1];

end

concatenate = concatenate';

extractedData.(fNames{r}).L = concatenate;

end