Lecture 3 exercise 2 - Browsing 4D NIfTI data sample

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The objective is to explore 4D data: 1) open a functional MRI (fMRI) NIfTI dataset (4D data); 2) display the fMRI temporal sequence signals corresponding to two different brain voxels; 3) display the temporal signal averaged in a cubic Region of Interest (ROI) ...; 4) ... and see what happens with different ROI sizes.

Sample NIfTI images for this exercise are available at INFN Pandora or on drive Google drive folder in the IMAGES/NIfTI_Examples/Brain_MRI_Sub01/ directory. Choose the fMRI data sample: sub-01-func-sub-01_task-read_run-1_bold.nii

Complete the lines starting with %c

1) Open a functional MRI (fMRI) NIfTI dataset (4D data)

Clear the workspace, close all figures and clear the command window

```
%c
```

a) define the filename of the NIfTI file to open

```
%c filename=...
```

b) read the file info with niftiinfo

```
%c info = ...
```

c) check the PixelDimensions and TimeUnits

```
%c info. ...        % the forth dimension is time
%c info. ...
```

d) store in a variable the voxel size along the temporal dimension

```
%c vt=...           % vt is the voxel size along the temporal
 dimension
```

e) read the image data with niftiread and store it in a Matlab array

```
%c Im= ...
```

f) check the size of the array

```
%c ...
```

g) display one central axial slice at the first time point

```
%c k_slice=...
%c figure; ...
```

2) Display the fMRI temporal sequence signals corresponding to two different voxels of the brain

a) choose the coordinates of P1 and P2 selecting two points corresponding to gray matter from the previously displayed figure, e.g. P1=[26 26 k_slice]; P2=[28 40 k_slice];

```
%c P1= ...
%c P2= ...
```

b) Select the corresponding temporal sequence from Im. Check for singleton dimensions and squeeze the signal

```
%c TS1= ...
%c TS2= ...
```

c) plot the temporal signals reporting physical units (i.e. seconds, as reported in info.TimeUnits) on the time axis

```
%c time=...;
%c figure; ...
%c xlabel ...
%c ylabel ...
%c legend ...
```

3) Display the temporal signal averaged in a cubic Region of Interest (ROI) ...

a) define a three-element vector reporting the displacement in the three directions from P to build a cube or parallelepiped ROI centered at P; define P1a and P1b as the opposite corners of the cube/ parallelepiped ROI.

```
%c L=[2 2 1];
%c P1a=P1-L;
%c P1b=P1+L;
```

b) select the 4D array with signals from the defined ROI

```
%c ROI_P1=...
```

c) average the signal over the spatial dimensions and remove singleton dimensions

```
%c ROI_P1_t=...
```

```
%c ROI_P1_t=...
```

d) plot the signal at P1 and the signal averaged in the ROI_P1 for comparison

```
%c figure;...   % plot with axis label and legend
```

4) ... and see what happens with different ROI sizes

try with a for loop over the ROI side dimension (a cube is fine)

5) Extra question: Compute the Pearson correlation between the signals at P1 and P2

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