

CS – 590.21 Analysis and Modeling of Brain Networks
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Plot of a Network and Degree of Connectivity – ReadMe file

This analysis introduces the script `main_graph` that takes as input the following datasets:

- 1) the biological data of an animal that contains information about the number of neurons, the type (e.g., interneuron, astrocyte or pyramidal) and the coordinates of each neuron
- 2) the representation of a network which is an $m \times 2$ array (m : the number of edges in this network). Each row represents a connection between the neuron with the id of the first column and the neuron with id of the second column.

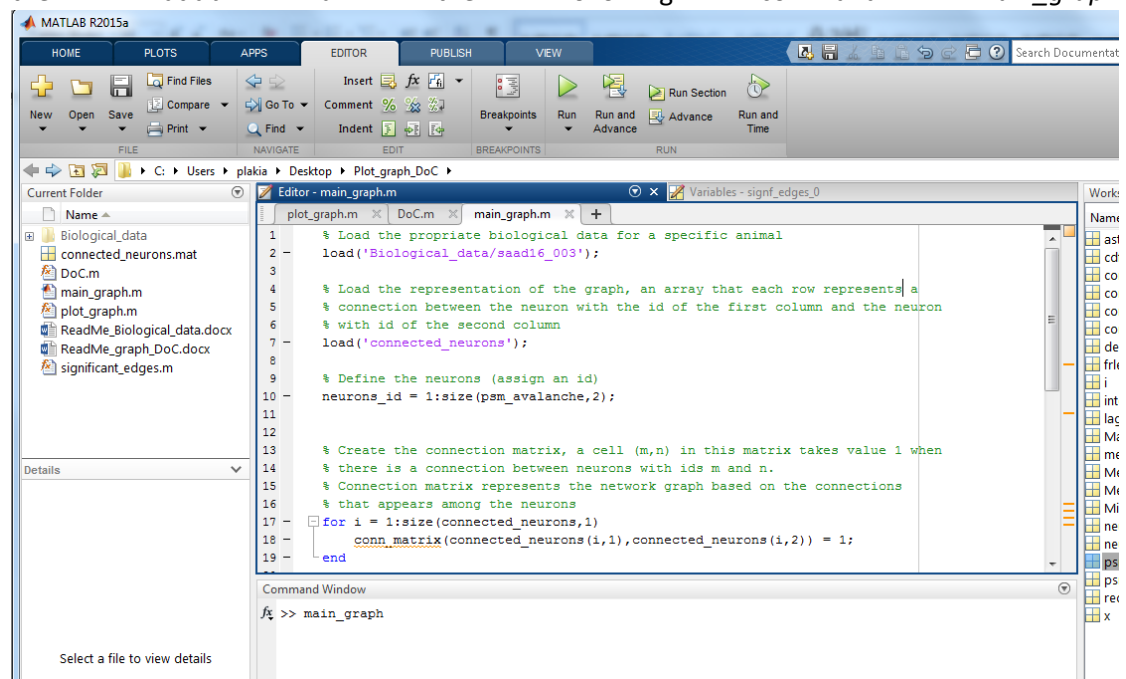
Considering the connections of the network and the coordinates of the neurons this script draws the network. Following `main_graph` estimates the degree of connectivity (DoC) of each neuron and produces the CDF plot and statistics of the DoC.

In order to produce these plots and statistics the following functions are used in the `main_graph` script:

- `plot_graph` (representation of the network)
- `DoC` (estimation of the degree of connectivity)

Various statistics such as the minimum, maximum, average and median degree of connectivity are also estimated in this script.

After downloading this folder, start from the `main_graph` script, on the command window of the Matlab run the following command: `main_graph`



The screenshot displays the MATLAB R2015a environment. The Editor window shows the `main_graph.m` script with the following code:

```
1 % Load the appropriate biological data for a specific animal
2 load('Biological_data/saad16_003');
3
4 % Load the representation of the graph, an array that each row represents a
5 % connection between the neuron with the id of the first column and the neuron
6 % with id of the second column
7 load('connected_neurons');
8
9 % Define the neurons (assign an id)
10 neurons_id = 1:size(psm_avalanche,2);
11
12
13 % Create the connection matrix, a cell (m,n) in this matrix takes value 1 when
14 % there is a connection between neurons with ids m and n.
15 % Connection matrix represents the network graph based on the connections
16 % that appears among the neurons
17 for i = 1:size(connected_neurons,1)
18     conn_matrix(connected_neurons(i,1),connected_neurons(i,2)) = 1;
19 end
```

The Command Window at the bottom shows the execution command: `main_graph`.

This command will produce all the plots and statistics that are described above.