Conn To Graph Metrics

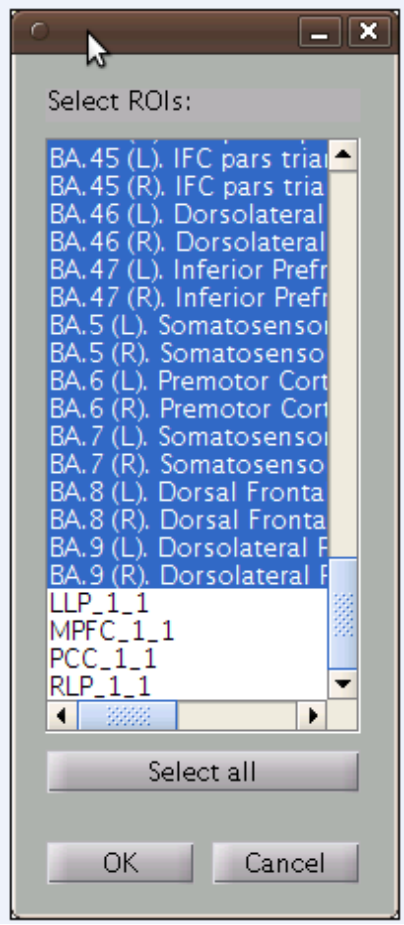
Conn_network and Conn_network_results

NYU Data Set (n=25, 3 sessions)

Step 1) Open Matlab and run conn_network from GUI file selection or input path name in argument:

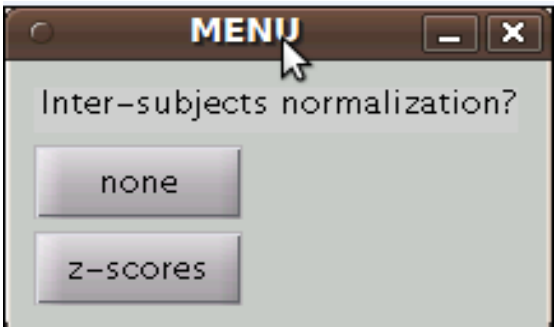
>>conn_network('/data/NYU_CSC/conn_NYU/results/firstlevel/ANALYSIS_01/**resultsRO1_Condition001.mat')**

Step 2) Choose ROIs for network nodes



Note: Don't want to select redundant nodes – so deselect Fox ROIs

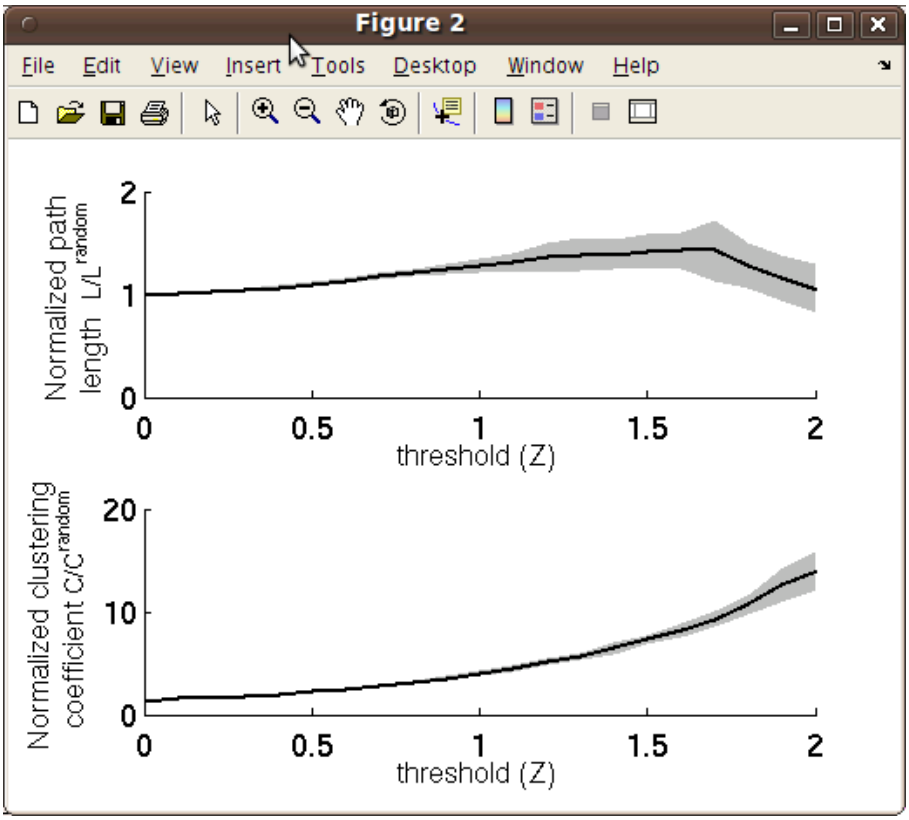
#3) Select Inter-subject normalization option



(Z-score – normalizes across subjects (subtract mean/divides by std))

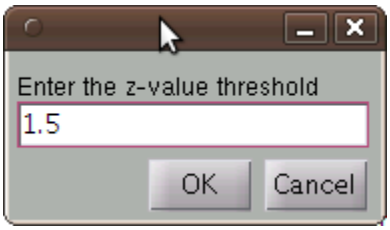
*Network computation takes a few minutes depending on the # of nodes

#4) View Normalized Path Length and Clustering Coefficient



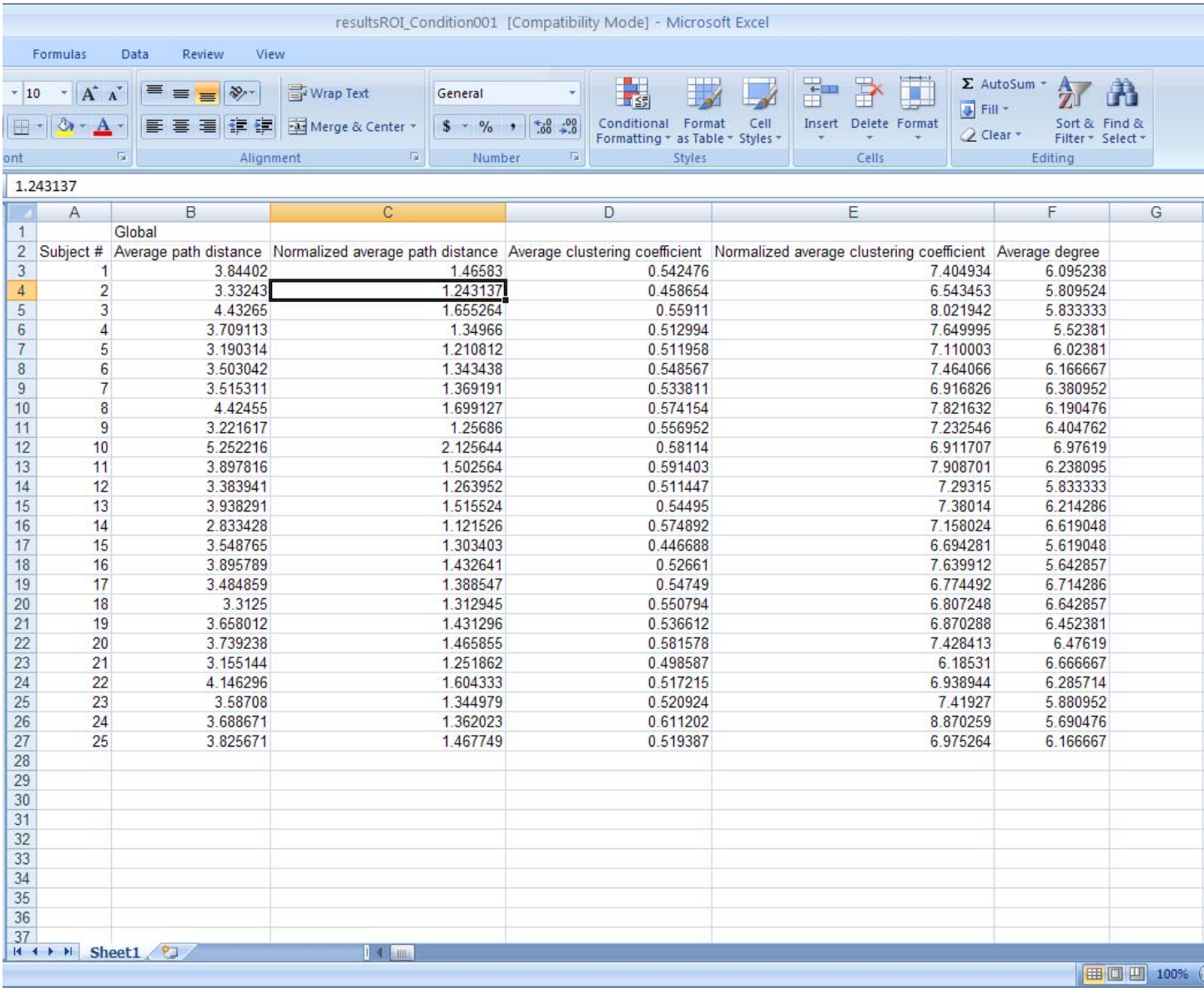
#5) Select threshold

Note: Want path length around 1 and high clustering coefficients (indicative of small world properties) – here you can select Z = 1.5 for thresholding



#6) View Output

There is a .dl file created for each subject which can be read by SONIA and a .csv file created that can be viewed and analyzed for 2nd level stats with conn_network_results. Below is the .csv file, open in excel with comma delimited option.



	A	B	C	D	E	F	G
1		Global					
2	Subject #	Average path distance	Normalized average path distance	Average clustering coefficient	Normalized average clustering coefficient	Average degree	
3	1	3.84402	1.46583	0.542476	7.404934	6.095238	
4	2	3.33243	1.243137	0.458654	6.543453	5.809524	
5	3	4.43265	1.655264	0.55911	8.021942	5.833333	
6	4	3.709113	1.34966	0.512994	7.649995	5.52381	
7	5	3.190314	1.210812	0.511958	7.110003	6.02381	
8	6	3.503042	1.343438	0.548567	7.464066	6.166667	
9	7	3.515311	1.369191	0.533811	6.916826	6.380952	
10	8	4.42455	1.699127	0.574154	7.821632	6.190476	
11	9	3.221617	1.25686	0.556952	7.232546	6.404762	
12	10	5.252216	2.125644	0.58114	6.911707	6.97619	
13	11	3.897816	1.502564	0.591403	7.908701	6.238095	
14	12	3.383941	1.263952	0.511447	7.29315	5.833333	
15	13	3.938291	1.515524	0.54495	7.38014	6.214286	
16	14	2.833428	1.121526	0.574892	7.158024	6.619048	
17	15	3.548765	1.303403	0.446688	6.694281	5.619048	
18	16	3.895789	1.432641	0.52661	7.639912	5.642857	
19	17	3.484859	1.388547	0.54749	6.774492	6.714286	
20	18	3.3125	1.312945	0.550794	6.807248	6.642857	
21	19	3.658012	1.431296	0.536612	6.870288	6.452381	
22	20	3.739238	1.465855	0.581578	7.428413	6.47619	
23	21	3.155144	1.251862	0.498587	6.18531	6.666667	
24	22	4.146296	1.604333	0.517215	6.938944	6.285714	
25	23	3.58708	1.344979	0.520924	7.41927	5.880952	
26	24	3.688671	1.362023	0.611202	8.870259	5.690476	
27	25	3.825671	1.467749	0.519387	6.975264	6.166667	
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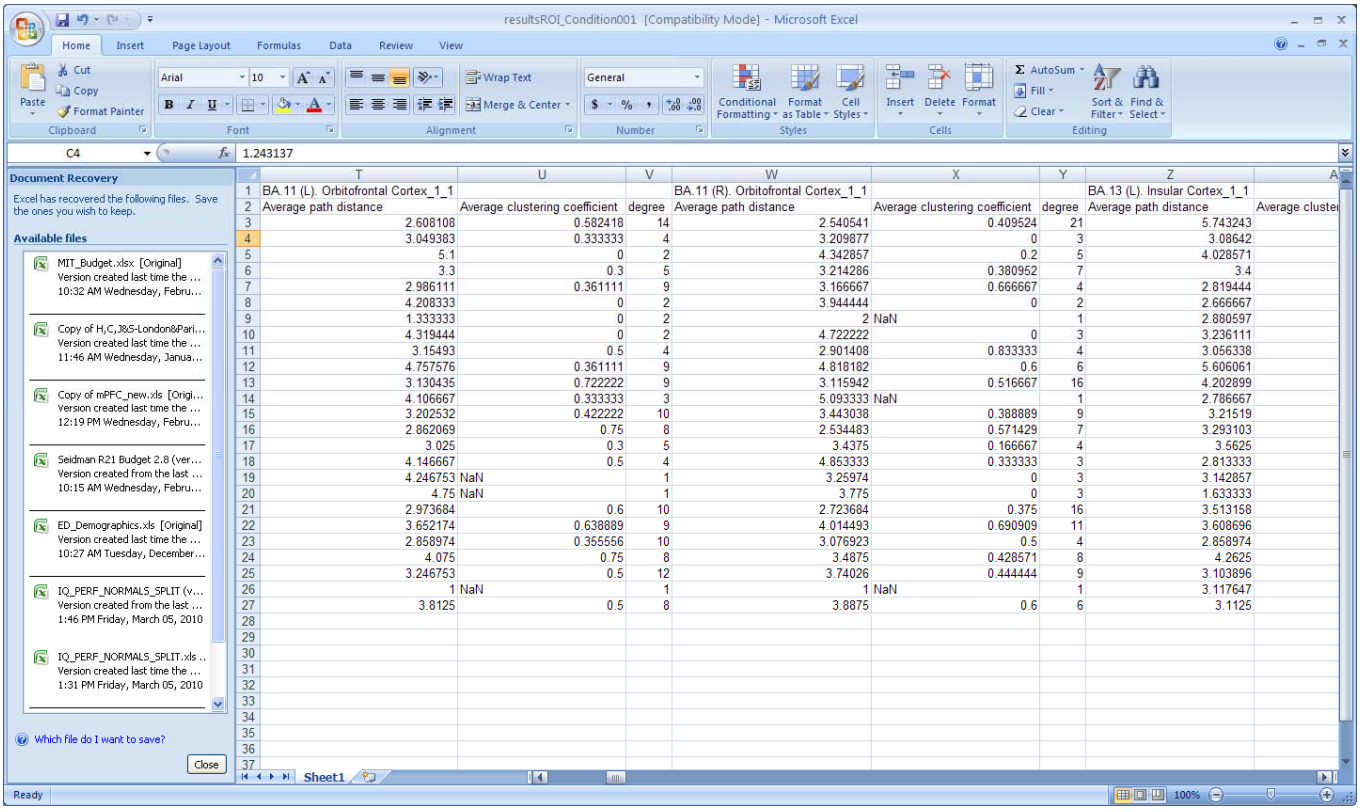


	T	U	V	W	X	Y	Z
1	BA.11 (L). Orbitofrontal Cortex_1_1			BA.11 (R). Orbitofrontal Cortex_1_1			BA.13 (L). Insular Cortex_1_1
2	Average path distance	Average clustering coefficient	degree	Average path distance	Average clustering coefficient	degree	Average path distance
3	2.608108	0.582418	14	2.540541	0.409524	21	5.743243
4	3.049383	0.333333	4	3.209877	0	3	3.08642
5	5.1	0	2	4.342857	0.2	5	4.028571
6	3.3	0.3	5	3.214286	0.380952	7	3.4
7	2.986111	0.361111	9	3.166667	0.666667	4	2.819444
8	4.208333	0	2	3.944444	0	2	2.666667
9	1.333333	0	2	2	NaN	1	2.880597
10	4.319444	0	2	4.722222	0	3	3.236111
11	3.15493	0.5	4	2.901408	0.833333	4	3.056338
12	4.757576	0.361111	9	4.818182	0.6	6	5.606061
13	3.130435	0.722222	9	3.115942	0.516667	16	4.202899
14	4.106667	0.333333	3	5.093333	NaN	1	2.786667
15	3.202532	0.422222	10	3.443038	0.388889	9	3.21519
16	2.862069	0.75	8	2.534483	0.571429	7	3.293103
17	3.025	0.3	5	3.4375	0.166667	4	3.5625
18	4.146667	0.5	4	4.853333	0.333333	3	2.813333
19	4.246753	NaN	1	3.25974	0	3	3.142857
20	4.75	NaN	1	3.775	0	3	1.633333
21	2.973684	0.6	10	2.723684	0.375	16	3.513158
22	3.652174	0.638889	9	4.014493	0.690909	11	3.608696
23	2.858974	0.355556	10	3.076923	0.5	4	2.858974
24	4.075	0.75	8	3.4875	0.428571	8	4.2625
25	3.246753	0.5	12	3.74026	0.444444	9	3.103896
26	1	NaN	1	1	NaN	1	3.117647
27	3.8125	0.5	8	3.8875	0.6	6	3.1125

II) Conn_network_results for 2nd Level Group Statistics

Step 1) run conn_network_results from GUI file selection or input path name in argument:

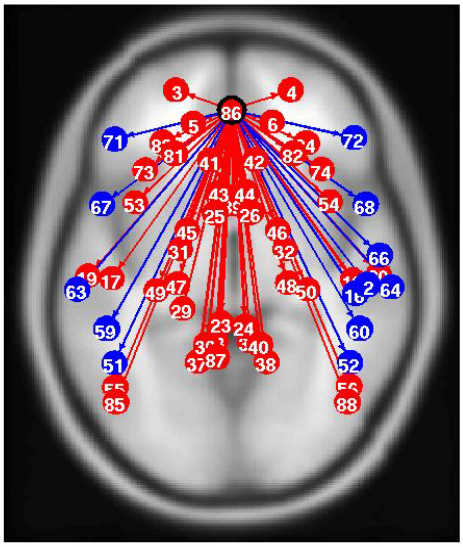
>>conn_network_results('/data/NYU_CSC/conn_NYU/results/firstlevel/ANALYSIS_01/**resultsRO1_Condition001.network')**

Step 2) Choose 2nd Level model, and define the model parameters

Two-sample t-test (for between-group comparisons)

two-sample t-test	
Subjects in group	find(z<=median(
Subjects in group	find(z>median(z
Regressor #1name?	strong
Regressor #2name?	weak
[2] Contrast	[1,-1]
Contrast name?	strong-weak

Note: In this example we have created a variable z that describes the anticorrelation, for each subject, between MPFC and DLPFC (BA.46, bilaterally; areas labeled 71-72 in the graph to the right). You can get this variable by loading the z.mat file in zip8/z.mat. From this, we defined two groups of subjects: a) those that show *strong* anticorrelations (with negative associations below the sample median; n=13) ; and b) those that show *weak* anticorrelations (with negative associations above the sample median; n=12). We then define a contrast [1,-1] comparing these two groups, and name this contrast *strong-weak.*



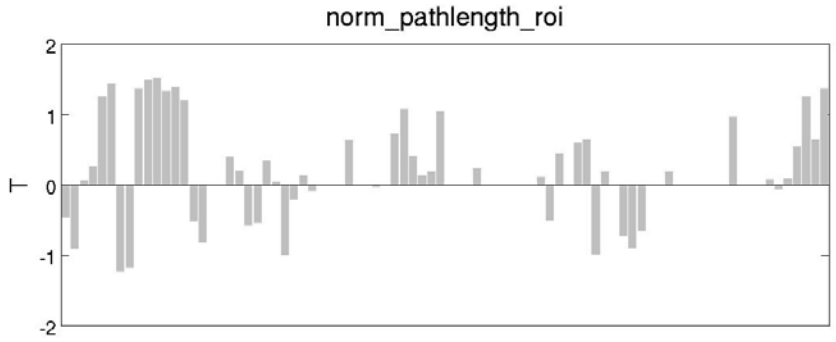
Step 3) Explore the 2nd-level results

We find no significant differences in the global network topology between these two groups:

Degree **Path length** **Clustering** **Path length (normalized)** **Clustering (normalized)**

When looking at the topological properties of each node (ROI) in the network, we find:

a) no significant differences between the groups in the path length (average distance between each node and every other node in the network)



b) Significant (but not significant when corrected by multiple comparisons) differences in clustering coefficients in area BA.21 billaterally (Middle temporal gyrus; lower clustering coefficients in the *strong anticorrelations* group) and right BA.41 (Primary auditory cortex; higher clustering coefficients in the *strong anticorrelations* group)

c) Significant (corrected by multiple comparisons) differences in degree (degree centrality; number of connected nodes) in left BA.46 (DLPFC; higher degree in the *strong anticorrelations* group) and right BA.44 (IFC pars

opercularis; higher degree in the *strong anticorrelations* group). This would seem to indicate that higher anticorrelations between DLPFC and the default network could be associated with higher overall degree of connectivity between DLPFC (as well as other frontal cortex areas) and the rest of the brain.