Annexure D

Features used for classification of schizophrenic and healthy individuals

Table D.1 : Network based features of each subject that will be used for classification between two classes.

Weighted Network		Binary Network	
S.No.	**Property**	**S.No.**	**Property**
1.	Node count	1.	Edge count
2.	Minimum degree	2.	Edge density
3.	Maximum degree	3.	Assortativity
4.	Mean degree	4.	Mean node betweenness
5.	Median degree	5.	Maximum node betweenness
6.	Standard deviation of degrees	6.	Standard deviation of node betweenness
7.	Edge density with threshold	7.	Maximum edge betweenness
8.	Assortativity	8.	Longest distance between two vertices
9.	Mean node betweenness	9.	Global efficiency
10.	Maximum node betweenness	10.	Average clustering coefficient
11.	Minimum node betweenness	11.	Transitivity
12.	Standard deviation of node betweenness	12.	Maximum edge overlap
13.	Maximum edge betweenness	13.	Maximum matching index between two vertices
14.	Shortest distance between two vertices	14.	Mean closeness
15.	Global efficiency	15.	Characteristic pathlength
16.	Average clustering coefficient	16.	Number of weak ties
17.	Transitivity	17.	Minimum node betweenness
18.	Optimal community structure		
19.	Maximized modularity		
20.	Maximum of matching index between two vertices		
21.	Median coreness		
22.	Mean closeness		
23.	Median closeness		
24.	Standard deviation of closeness		
25.	Sum of product of degrees across all edges		
26.	Mean Vertex eccentricity		
27.	Standard deviation of node betweenness		
28.	Longest distance between two vertices		

D.2 NETWORK PROPERTIES:

These network properties are calculated using the Brain Connectivity Toolbox in MATLAB, created by Rubinov & Sporns [Rubinov and Sporns, 2010]. The description of properties described provided in the toolbox are mentioned here:

Degree: Number of edges connected to a node is called degree. Average of degrees of all nodes is called average degree.

Edge density: It is the ratio of edges present in the network to the possible number of edges i.e. it is the fraction of present connections to possible connections. So, if 'k' is the edges present and 'n' is the nodes in the network. Then edge density is:

$$\frac{2k}{n(n-1)}$$

Node betweenness: Node betweenness centrality is the fraction of all shortest paths in the network that contain a given node. Nodes with high values of betweenness centrality participate in a large number of shortest paths.

Assortativity: The assortativity coefficient is a correlation coefficient between the strengths (weighted degrees) of all nodes on two opposite ends of a link. A positive assortativity coefficient indicates that nodes tend to link to other nodes with the same or similar strength.

Edge betweenness: Node betweenness centrality is the fraction of all shortest paths in the network that contain a given node. Nodes with high values of betweenness centrality participate in a large number of shortest paths.

Efficiency: The global efficiency is the average of inverse shortest path length, and is inversely related to the characteristic path length. The local efficiency is the global efficiency computed on the neighborhood of the node, and is related to the clustering coefficient.

Optimal community structure & Maximized modularity: The optimal community structure is a subdivision of the network into non overlapping groups of nodes in a way that maximizes the number of within-group edges, and minimizes the number of between-group edges. The modularity is a statistic that quantifies the degree to which the network may be subdivided into such clearly delineated groups.

Coreness: The k-core is the largest subgraph comprising nodes of degree at least k. The coreness of a node is k if the node belongs to the k-core but not to the (k+1)-core. This function computes the coreness of all nodes for a given binary undirected connection matrix.

Closeness: It reflects proximity of a node to the core of the network.

$$Closeness\ of\ a\ node = \frac{1}{\sum distance\ from\ all\ other\ nodes}$$

Eccentricity: It is the maximum distance of a node to any other node.

Edge overlap: It measures the degree of connectivity of two nodes and is the relative number of neighbours of two nodes which are neighbours of each other.

$$O_{ij} = \frac{t_{ij}}{k_i - 1 + k_j - 1 - t_{ij}}$$

Where, t_{ij} is the common edges between node i and j, k_i is the degree of node, and k_j degree of node.

Clustering Coefficient: The weighted clustering coefficient is the average 'intensity' of triangles around a node.

SOP: The sum of products of degrees across all edges

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