

## **GROUP GRAPH MEASURES OF BRAIN NETWORKS: NEW CONCEPTS AND DEFINITIONS**

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Brain networks consist of cortical and subcortical regions as nodes and connections between them as edges. These brain networks convey a huge amount of information that has been almost unexplored previously and the fundamentals of brain network analysis arrived from graph theory. Graph theoretical approaches have been used by many studies to investigate the human brain network related to health. Different aspects of global and local brain connectivity are characterized by graph measures of brain networks. However, the full potential of the graph theory on brain network has not been fully exploited by the research community as studies have used the same measures and techniques. All published local graph measures, such as centrality are intended to apply for a single node and the global graph measures such as efficiency have been applied for the whole-network. But a group of nodes such as a lobe would be benefited from a formulation that applies to group of nodes rather than a single node or the whole network. A question such as “which brain-lobe is more structurally central in the normal brain?” could be answered to some extent by the application of a centrality measure that applied to a group of nodes. In brain asymmetric studies, global metrics have been applied to left and right hemispherical networks separately by considering only intra-hemispheric edges. However, for the valid comparison, global measures must include the inter-hemispheric edges as well. The concept of group graph measures has the potential to solve such problems. Here, we develop novel definitions for group graph measures based on the existing graph measures to the group context and these group measures make sure the proper generalization of the corresponding single node or whole network measure. These group measures are evaluated on structural brain networks of Alzheimer’s and healthy subjects and obtained number of significant results. The new outcomes of this study will push forward the understanding of the brain connectivity.

**Keywords:** Alzheimer, Brain network, Group graph measures.