The spectrum of a graph is the set of eigenvalues of adjacency matrix and carries information about graph structure. So, comparing spectra provides metrics for network comparison. We use the adjacency spectral distance, defined as , to compare graph structure, where and are the adjacency spectrum of graphs and , respectively. The adjacency spectral distance has good performance to detect changes in graph across a wide range of scenarios.

To compare two populations of graphs,

1. Calculate the distance for each pair of graphs, where is drawn from and is drawn from . Define

where and .

1. Under the null hypothesis, the mean and variance of adjacency spectral distance can be approximated by the sample mean and sample variance of , where and are both drawn from . Define

and

where .

1. A Wald test of adjacency spectral distance is then constructed to compare the difference of CCCNs between disease and control samples: