Algorithms for Computing the Wiener Index in Low Density Graphs and Maximizing the Vertex Weighted Wiener Index

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The Wiener Index is a well-known topological index that is defined as the sum of the shortest paths between pairwise vertices in a graph. For undirected, unweighted graphs, the established time complexity for the calculation of the Wiener Index is quadratic. While there exist more efficient algorithms for the calculation of the Wiener Index in special graphs such as trees, there is no established optimization that covers general graphs. A cut-edge is an edge that when removed, increases the number of connected components by one. In this talk, I present an algorithm for the calculation of the Wiener Index that runs significantly faster than quadratic time for non-unique graphs with a high number of cut-edges and a resulting low density. Furthermore, I provide a pseudo-polynomial algorithm for the maximization of the vertex weighted Wiener Index.

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