

[P14] Efficient dynamic algorithm for mutually connected components

Deokjae Lee, Seoul National University

Mutually connected components (MCCs) play an important role as a measure of resilience in the study of interdependent networks. Despite their importance, an efficient algorithm to obtain the statistics of all MCCs during the removals of links has thus far been absent. Here, using a well-known fully dynamic algorithm for graph connectivity, we propose an efficient algorithm to accomplish this task. We show that the time complexity of this algorithm is approximately $O(N^{1.2})$ for random graphs, which is more efficient than $O(N^2)$ of the brute-force algorithm. We confirm the correctness of our algorithm by comparing the behavior of the order parameter as links are removed with existing results for three types of double-layer multiplex networks: (i) ER random graphs, and (ii) scale-free random graphs, in which degree of a node in one layer is stochastically the same as the one of the corresponding node in the other layer, and (iii) two-dimensional regular lattices. We anticipate that this algorithm will be used for simulations of large-size systems that have been previously inaccessible.