

Combinatorial Magic

Computing shortest paths between trees

What is a sensible distance between trees and how to calculate it? These are the two questions we address in the talk. To calculate distances between trees is an important requirement in biological applications when working with a specific class of weighted trees. The definition of the distance between two trees comes as an optimization problem: the goal is to find the minimal length of a 'piecewise Euclidean path' from one tree to another, which has intermediate trees on its way.

After visualizing the problem and getting an intuition for its hardness, we briefly state the main theorems that make it possible to tackle the problem combinatorially. The abstract problem of finding the shortest piecewise Euclidean path then translates to a series of well-known graph-theoretical problems. Using these reformulations we are able to state the structure of the algorithm and discuss its features. In the end, an explicit example of the distance calculation is presented. This includes all reformulations from the starting problem to the final maximum flow problems, which determine the shortest path and hence are the key to solving the problem.