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MADALGO seminar by Oren Weimann; Massachusetts Institute of Technology (MIT)

Finding an Optimal Tree Searching Strategy in Linear Time

We address the extension of the binary search technique from sorted arrays and totally ordered sets to trees and tree-like partially ordered sets. As in the sorted array case, the goal is to minimize the number of queries required to find a target element in the worst case. However, while the optimal strategy for searching an array is straightforward (always query the middle element), the optimal strategy for searching a tree is dependent on the tree's structure and is harder to compute. We present an O(n)-time algorithm that finds the optimal strategy for binary searching a tree, improving the previous best O(n^3)-time algorithm. The significant improvement is due to a novel approach for computing subproblems, as well as a method for reusing parts of already computed subproblems, and a linear-time transformation from a solution in the form of an edge-weighed tree into a solution in the form of a decision tree.