DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE
UNIVERSITY OF SOUTHERN DENMARK, ODENSE

COMPUTER SCIENCE COLLOQUIUM

The Complexity of Constructing Evolutionary Trees Using Experiments

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Abstract: We present tight upper and lower bounds for the problem of constructing evolutionary trees in the experiment model. We describe an algorithm which constructs an evolutionary tree of n species in time $O(nd \log_d n)$ using at most $n\lceil d/2 \rceil(\log_{2\lceil d/2 \rceil -1} n + O(1))$ experiments for $d > 2$, and at most $n(\log n + O(1))$ experiments for $d = 2$, where d is the degree of the tree. This improves the previous best upper bound by a factor $\Theta(\log d)$. For $d = 2$ the previously best algorithm with running time $O(nlogn)$ had a bound of $4n \log n$ on the number of experiments. By an explicit adversary argument, we show an $\Omega(nd \log_d n)$ lower bound, matching our upper bounds and improving the previous best lower bound by a factor $\Theta(\log_d n)$. Central to our algorithm is the construction and maintenance of separator trees of small height, which may be of independent interest.

This work is joint with Gerth Stølting Brodal, Rolf Fagerberg, and Christian N. S. Pedersen and has appeared in the proceedings of the 28th International Colloquium on Automata, Languages, and Programming, volume 2076 of Lecture Notes in Computer Science, pages 140–151. Springer Verlag, Berlin, 2001.

Host: Joan Boyar