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MADALGO seminar by Norbert Zeh, Dalhousie University

Optimal Cache-Oblivious Range Reporting Requires Superlinear Space

Abstract:

In recent years, a number of cache-oblvious range search structures for 3-sided range reporting in the plane, 3-d dominance reporting, and 3-d halfspace range reporting with the optimal query bound of $O(\log_B N + K/B)$ I/O's have been developed. These structures use $O(N \log N)$ space, while the best cache-aware structures for these problems use (almost) linear space. This raises the question whether linear-space cache-oblivious structures with the optimal query bound exist for these problems. We give a negative answer to this question by proving that $\Omega(N (\log \log N)^{eps})$ space is necessary to achieve the optimal query bound cache-obliviously. This is the first result that provides a gap between the resource consumption of a cache-oblivious algorithm or data structure and its cache-aware counterpart that grows with the input size.

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