A PARALLEL ALGORITHM FOR CONTEXT-FREE PARSING

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Abstract

We present an algorithm which solves the parsing problem for any context-free grammar, and is suitable for execution on a synchronous computer with unbounded parallelism. The algorithm parses arbitrary input strings of length n in time $O(\log n)$ on a unit-cost SIMDAG, or in time $O(\log^2 n)$ on a log-cost SIMDAG, using $O(n^6)$ processors in each case. (A SIMDAG is a model of a synchronous parallel machine [3].)

Comments

Only the Abstract is given here. The full paper appeared as [1]. The result shows that context-free language recognition is in Pippinger's class NC. This result was obtained independently by Ruzzo [4], but his proof is rather indirect and his processor bound is $O(n^{15})$, so our method of proof is more likely to be of use in practice. Our exponent 6 is still uncomfortably high, and can be reduced somewhat using "fast" matrix multiplication techniques [2].

References

1. R. P. Brent and L. M. Goldschlager, "A parallel algorithm for context-free parsing", *Proc. Seventh Australian Computer Science Conference*, special issue of *Australian Computer Science Communications* 6 (1984), 7.1–7.10. Also appeared as Report CMA-R50-83, CMA, ANU, 1983, 11 pp. rpb085.
2. D. Coppersmith and S. Winograd, "On the asymptotic complexity of matrix multiplication", *SIAM J. on Computing* 11 (1982), 472–492.
3. L. M. Goldschlager, "A universal interconnection pattern for parallel computers", *J. ACM* 29 (1982), 1073–1086.
4. W. L. Ruzzo, "On uniform circuit complexity", *J. Computer and System Sciences* 22 (1981), 365–383.

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