

PARKA: A System for Massively Parallel Knowledge Representation

Matthew Evett

Department of Computer Science, University of Maryland, College Park, MD 20742, USA

Abstract:

PARKA is a frame-based knowledge representation system implemented on massively parallel hardware--the Connection Machine (CM-2). PARKA provides a representation language consisting of concept descriptions (frames) and binary relations on those descriptions (slots). The system is designed explicitly to provide extremely fast property inheritance inference capabilities. In particular, PARKA can perform fast recognition queries of the form find all frames satisfying p property constraints in $O(d+p)$ time---proportional only to the depth, d of the knowledge base (KB), and independent of its size. This performance compares very favorably with serial systems. For conjunctive queries of this type, PARKA's performance is measured in tenths of a second, even for KBs with 100,000+ frames. A PARKA implementation of the Cyc commonsense KB yields similar timing results. In addition, for queries in a case-based planning domain of over 30,000 frames, PARKA has demonstrated speed-ups of more than 10,000 over a highly-optimized serial representation system. Because PARKA's run-time performance is independent of KB size, it promises to scale up to arbitrarily larger domains. Thus, PARKA is computationally effective even for realistically sized KBs. Such run-time performance makes PARKA one of the fastest knowledge representation systems in the world.

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