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Forthcoming Papers

H. Eriksson, Y. Shahar, S.W. Tu, A.R. Puerta and M.A. Musen, Task modeling with reusable problem-solving methods

Problem-solving methods for knowledge-based systems establish the behavior of such systems by defining the roles in which domain knowledge is used and the ordering of inferences. Developers can compose problem-solving methods that accomplish complex application tasks from primitive, reusable methods. The key steps in this development approach are task analysis, method selection (from a library), and method configuration. PROTÉGÉ-II is a knowledge-engineering environment that allows developers to select and configure problem-solving methods. In addition, PROTÉGÉ-II generates domain-specific knowledge-acquisition tools that domain specialists can use to create knowledge bases on which the methods may operate.

The *board-game method* is a problem-solving method that defines control knowledge for a class of tasks that developers can model in a highly specific way. The method adopts a conceptual model of problem solving in which the solution space is construed as a "game board" on which the problem solver moves "playing pieces" according to prespecified rules. This familiar conceptual model simplifies the developer's cognitive demands when configuring the board-game method to support new application tasks. We compare configuration of the board-game method to that of a chronological-backtracking problem-solving method for the same application tasks (for example, Towers of Hanoi and the Sisyphus room-assignment problem). We also examine how method designers can specialize problem-solving methods by making ontological commitments to certain classes of tasks. We exemplify this technique by specializing the chronological-backtracking method to the board-game method.

W. Zhang and R.E. Korf, Performance of linear-space search algorithms

Search algorithms that use space linear in the search depth are widely employed in practice to solve difficult problems optimally, such as planning and scheduling. In this paper, we study the average-case performance of linear-space search algorithms, including depth-first branch-and-bound (DFBnB), iterative-deepening (ID), and recursive best-first search (RBFS). To facilitate our analyses, we use a random tree $T(b,d)$ that has mean branching factor b, depth d, and node costs that are the sum of the costs of the edges from the root to the nodes. We prove that the expected number of nodes expanded by DFBnB on a random tree is no more than bd times the expected number of nodes expanded by best-first search (BFS) on the same tree, which usually requires space that is exponential in depth d. We also show that DFBnB is asymptotically optimal when BFS runs in exponential time, and ID and RBFS are asymptotically optimal when the edge costs of $T(b,d)$ are integers. If bp_0 is the expected number of children of a node whose costs are the same as that of their parent, then the expected number of nodes expanded by these three linear-space algorithms is exponential

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when $bp_0 < 1$, at most $O(d^4)$ when $bp_0 = 1$, and at most quadratic when $bp_0 > 1$. In addition, we study the heuristic branching factor of $T(b, d)$ and the effective branching factor of BFS, DFBnB, ID, and RBFS on $T(b, d)$. Furthermore, we use our analytic results to explain a surprising anomaly in the performance of these algorithms, and to predict the existence of a complexity transition in the Asymmetric Traveling Salesman Problem.

R. Fagin, J.Y. Halpern and M.Y. Vardi, A nonstandard approach to the logical omniscience problem

We introduce a new approach to dealing with the well-known *logical omniscience* problem in epistemic logic. Instead of taking possible worlds where each world is a model of classical propositional logic, we take possible worlds which are models of a nonstandard propositional logic we call NPL, which is somewhat related to *relevance logic*. This approach gives new insights into the logic of implicit and explicit belief considered by Levesque and Lakemeyer. In particular, we show that in a precise sense agents in the structures considered by Levesque and Lakemeyer are perfect reasoners in NPL.

P.G. Jeavons, M.C. Cooper, Tractable constraints on ordered domains

Finding solutions to a constraint satisfaction problem is known to be an NP-complete problem in general, but may be tractable in cases where either the set of allowed constraints or the graph structure is restricted. In this paper we identify a restricted set of contraints which gives rise to a class of tractable problems. This class generalizes the notion of a Horn formula in propositional logic to larger domain sizes. We give a polynomial time algorithm for solving such problems, and prove that the class of problems generated by *any* larger set of constraints is NP-complete.

S.W. Smoliar, The music collection (Editorial)

J. Berger, Book Review of *Computers and Musical Style* (David Cope)

E. Handelman, Book Review of *Interactive Music Systems: Machine Listening and Composing* (Robert Rowe)

S.W. Smoliar, Book Review of *Music, Mind and Machine: Studies in Computer Music, Music Cognition and Artificial Intelligence* (Peter Desain and Henkjan Honing)

G.A. Wiggins, Book Review of *Understanding Music with AI—Perspectives on Cognitive Musicology* (M. Balaban, K, Ebcuoglu and O. Laske, eds.)

B. Garton, Book Review of *Music and Connectionism* (Peter Todd and D. Gareth Loy, eds.)

J.E. Larsson, Diagnosis based on explicit means–end models

M.M. Fleck, The topologies of boundaries

M. Stefik and S.W. Smoliar, *What Computers Still Can't Do*: five reviews and a response (Editorial)

H.M. Collins, Embedded or embodied?: a review of Hubert Dreyfus' *What Computers Still Can't Do*

J. Haugeland, Body and world: a review of *What Computers Still Can't Do*: *A Critique of Artificial Reason* (Hubert L. Dreyfus)

T. Koschmann, Of Hubert Dreyfus and dead horses: some thoughts on Dreyfus' *What Computers Still Can't Do* (Book Review)

J. McCarthy, Book Review of *What Computers Still Can't Do* (Hubert Dreyfus)

J.D. Strom and L. Darden, Is artificial intelligence a degenerating programme?: a review of Hubert Dreyfus' *What Computers Still Can't Do*

H.L. Dreyfus, Response to my critics