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Forthcoming Papers

X. Fan, J. Yen, R.A. Volz, A theoretical framework on proactive information exchange in agent teamwork

Proactive information delivery is critical to achieving effective teamwork. However, existing theories do not adequately address proactive information delivery. This paper presents a formal framework for proactive information delivery in agent teamwork. First, the concept of information need is introduced. Second, a new modal operator, InfoNeed is used to represent information needs. The properties of the InfoNeed operator and its relationships to other mental modal operators are examined, four types of information needs are formally identified, and axioms for anticipating the information needs of other agents are proposed and justified. Third, the axiom characterizing chains of helpful behavior in large agent teams is given. Fourth, the semantics for two proactive communicative acts (ProInform and 3PTSubscribe) is given using a reformulation of the Cohen–Levesque semantics for communicative acts in terms of the SharedPlans formalism of Grosz and Kraus. The work in this paper not only provides a better understanding of the underlying assumptions required to justify proactive information delivery behavior, but also provides a coherent basis for the specification and design of agent teams with proactive information delivery capabilities.

R. Ben-Eliyahu–Zohary, An incremental algorithm for generating all minimal models

The task of generating minimal models of a knowledge base is at the computational heart of diagnosis systems like truth maintenance systems, and of nonmonotonic systems like autoepistemic logic, default logic, and disjunctive logic programs. Unfortunately, it is NP-hard. In this paper we present a hierarchy of classes of knowledge bases, $\Psi_1, \Psi_2, \ldots$, with the following properties: first, Ψ_1 is the class of all Horn knowledge bases; second, if a knowledge base T is in Ψ_k, then T has at most k minimal models, and all of them may be found in time $O(lk^2)$, where l is the length of the knowledge base; third, for an arbitrary knowledge base T, we can find the minimum k such that T belongs to Ψ_k in time polynomial in the size of T; and, last, where $\mathcal{K}$ is the class of all knowledge bases, it is the case that $\bigcup_{i=1}^{\infty} \Psi_i = \mathcal{K}$, that is, every knowledge base belongs to some class in the hierarchy. The algorithm is incremental, that is, it is capable of generating one model at a time.

B.W. Wah, Y. Chen, Constraint partitioning in penalty formulations for solving temporal planning problems

In this paper, we study the partitioning of constraints in temporal planning problems formulated as mixed-integer nonlinear programming (MINLP) problems. Constraint partitioning is attractive be-

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cause it leads to much easier subproblems, where each is a significant relaxation of the original problem. Moreover, each subproblem is very similar to the original problem and can be solved by any existing solver with little or no modification. Constraint partitioning, however, introduces global constraints that may be violated when subproblems are evaluated independently. To reduce the overhead in resolving such global constraints, we develop in this paper new conditions and algorithms for limiting the search space to be backtracked in each subproblem. Using a penalty formulation of a MINLP where the constraint functions of the MINLP are transformed into non-negative functions, we present a necessary and sufficient extended saddle-point condition (ESPC) for constrained local minimization. When the penalties are larger than some thresholds, our theory shows a one-to-one correspondence between a constrained local minimum of the MINLP and an extended saddle point of the penalty function. Hence, one way to find a constrained local minimum is to increase gradually the penalties of those violated constraints and to look for a local minimum of the penalty function using any existing algorithm until a solution to the constrained model is found. Next, we extend the ESPC to constraint-partitioned MINLPs and propose a partition-and-resolve strategy for resolving violated global constraints across subproblems. Using the discrete-space ASPEN and the mixed-space MIPS planners to solve subproblems, we show significant improvements on some planning benchmarks, both in terms of the quality of the plans generated and the execution times to find them.

M. Fox, M. Ghallab, G. Infantes, D. Long, Robot introspection through learned hidden Markov models

In this paper we describe a machine learning approach for acquiring a model of a robot behaviour from raw sensor data. We are interested in automating the acquisition of behavioural models to provide a robot with an introspective capability. We assume that the behaviour of a robot in achieving a task can be modelled as a finite stochastic state transition system.

Beginning with data recorded by a robot in the execution of a task, we use unsupervised learning techniques to estimate a hidden Markov model (HMM) that can be used both for predicting and explaining the behaviour of the robot in subsequent executions of the task. We demonstrate that it is feasible to automate the entire process of learning a high quality HMM from the data recorded by the robot during execution of its task.

The learned HMM can be used both for monitoring and controlling the behaviour of the robot. The ultimate purpose of our work is to learn models for the full set of tasks associated with a given problem domain, and to integrate these models with a generative task planner. We want to show that these models can be used successfully in controlling the execution of a plan. However, this paper does not develop the planning and control aspects of our work, focussing instead on the learning methodology and the evaluation of a learned model. The essential property of the models we seek to construct is that the most probable trajectory through a model, given the observations made by the robot, accurately diagnoses, or explains, the behaviour that the robot actually performed when making these observations. In the work reported here we consider a *navigation* task. We explain the learning process, the experimental setup and the structure of the resulting learned behavioural models. We then evaluate the extent to which explanations proposed by the learned models accord with a human observer's interpretation of the behaviour exhibited by the robot in its execution of the task.

P.M. Dung, R.A. Kowalski, F. Toni, Dialectic proof procedures for assumption-based, admissible argumentation

S. Li, H. Wang, RCC8 binary constraint network can be consistently extended

V. Vidal, H. Geffner, Branching and pruning: An optimal temporal POCL planner based on constraint programming

G. Lamperti, M. Zanella, Flexible diagnosis of discrete-event systems by similarity-based reasoning techniques