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Forthcoming Papers

X.J. Chen and G. De Giacomo, Reasoning about nondeterministic and concurrent actions: a process algebra approach

We present a framework for reasoning about *processes* (complex actions) that are constituted by several concurrent activities performed by various interacting agents. The framework is based on two distinct formalisms: a representation formalism, which is a CCS-like process algebra associated with an explicit *global store*; and a reasoning formalism, which is an extension of modal mu-calculus, a powerful logic of programs that subsumes dynamic logics such as *PDL* and *ΔPDL*, and branching temporal logics such as CTL and CTL*. The reasoning service of interest in this setting is *model checking* in contrast to logical implication. This framework, although directly applicable only when complete information on the system behavior is available, has several interesting features for reasoning about actions in Artificial Intelligence. Indeed, it inherits formal and practical tools from the area of Concurrency in Computer Science, to deal with complex actions, treating suitably aspects like nonterminating executions, parallelism, communications, and interruptions.

Ch. Bessière, E.C. Freuder and J.-C. Régin, Using constraint metaknowledge to reduce arc consistency computation

Constraint satisfaction problems are widely used in artificial intelligence. They involve finding values for problem variables subject to constraints that specify which combinations of values are consistent. Knowledge about properties of the constraints can permit inferences that reduce the cost of consistency checking. In particular, such inferences can be used to reduce the number of constraint checks required in establishing arc consistency, a fundamental constraint-based reasoning technique. A general AC-Inference algorithm schema is presented and various forms of inference discussed. A specific algorithm, AC-7, is presented, which takes advantage of a simple property common to all binary constraints to eliminate constraint checks that other arc consistency algorithms perform. The effectiveness of this approach is demonstrated analytically, and experimentally.

N.M. Sgouros, Dynamic generation, management and resolution of interactive plots

Rapid advances in entertainment technology necessitate the development of computational models for interactive plots capable of creating engaging stories that are meaningfully interactive. This work describes a computational framework for supporting dynamic generation, management and resolution of interactive plots. In this framework, the user takes the place of the story protagonist. The rest of the cast consists of discrete computer characters, each playing specific roles in the story.

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The plot is dynamically shaped by the interaction between the user and the rest of the cast. This framework supports an Aristotelian plot conception, in which a conflict between antagonistic forces develops out of an initial situation. The plot moves from this initial situation towards its antagonistic climax, through a sequence of conflicts, and then towards an unambiguous solution at the end. This paper describes dynamic techniques that analyze the evolving plot to support user participation, adopt dramatically interesting story developments and resolve the plot in engaging ways based on the motives of the characters involved. This framework has been implemented as part of DEFACTO, a research project for designing interactive story systems.

R. Greiner, The complexity of theory revision

A knowledge-based system uses its database (also known as its "theory") to produce answers to the queries it receives. Unfortunately, these answers may be incorrect if the underlying theory is faulty. Standard "theory revision" systems use a given set of "labeled queries" (each a query paired with its correct answer) to transform the given theory, by adding and/or deleting either rules and/or antecedents, into a related theory that is as accurate as possible. After formally defining the theory revision task, this paper provides both sample and computational complexity bounds for this process. It first specifies the number of labeled queries necessary to identify a revised theory whose error is close to minimal with high probability. It then considers the computational complexity of finding this best theory, and proves that, unless $P = NP$, no polynomial time algorithm can identify this near-optimal revision, even given the exact distribution of queries, except in certain simple situation. It also shows that, except in such simple situations, no polynomial-time algorithm can produce a theory whose error is even close to (i.e., within a particular polynomial factor of) optimal. The first (sample-complexity) results suggest reasons why theory revision can be more effective than learning from scratch, while the second (computational complexity) results explain many aspects of the standard theory revision systems, including the practice of hill-climbing to a locally-optimal theory, based on a given set of labeled queries.

J. Larrosa, P. Meseguer and T. Schiex, Maintaining reversible DAC for Max-CSP (Research Note)

We introduce an exact algorithm for maximizing the number of satisfied constraints in an overconstrained CSP (Max-CSP). The algorithm, which can also solve weighted CSP, probabilistic CSP and other similar problems, is based on directed arc-inconsistency counts (DAC). The usage of DAC increases the lower bound of branch and bound based algorithms for Max-CSP, improving their efficiency. Originally, DAC were defined following a static variable ordering. In this paper, we relax this condition, showing how DAC can be defined from a directed constraint graph. These new graph-based DAC can be effectively used for lower bound computation. Interestingly, any directed constraint graph of the considered problem is suitable for DAC computation, so the selected graph can change dynamically during search, aiming at optimizing the exploitation of directed arc-inconsistencies. In addition, directed arc-inconsistencies are maintained during search, propagating the effect of value pruning. With these new elements we present the PFC *maintaining reversible* DAC algorithm (PFC-MRDAC), a natural successor of PFC-DAC for Max-CSP. We provide experimental evidence for the superiority of PFC-MRDAC on random and real overconstrained CSP instances, including problems with weighted constraints.

N. Kurtonina and M. de Rijke, Expressiveness of concept expressions in first-order description logics

E. Boros, T. Ibaraki and K. Makino, Logical analysis of binary data with missing bits

J.Q. Smith and K.N. Papamichail, Fast Bayes and the dynamic junction forrest

W.K. Yeap and M.E. Jefferies, Computing a representation of the local environment

A. Bochmann, A foundational theory of belief and belief change

Y. Wilks, K. Sparck Jones and J. Galliers, *Evaluating Natural Language Processing Systems*: An analysis and review (Book Review)