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Forthcoming Papers

J.-D. Fouks and L. Signac, The problem of survival from an algorithmic point of view

Our goal is to go deeper into the many writings on Behavior-Based Artificial Intelligence [Meyer et al., From Animals to Animals, MIT Press, 1992] and to understand the interest—rather than the mechanisms—of learning. Our intention is to study the complexity of the behavior of living beings from a theoretical point of view. To do so, we introduce formal environments that model the survival issue. Then we prove in this formal context that, many times, the extra cost imposed by the conservation of information, even if it is relevant, is greater than the benefit of knowing it. Consequently, in order to survive in our abstract worlds, one must manage his knowledge in a way that fits the evolution of the environment. Furthermore, physiological observations corroborate these purely theoretical results. Thus, we use these results to design a parallel system in which each module manages its knowledge in a specific way. This enables us to obtain a virtual creature whose behavior evokes that of a biological hen. © 2001 Published by Elsevier Science B.V.

P.M. Dung and T.C. Son, An argument-based approach to reasoning with specificity

We present a new priority-based approach to reasoning with specificity which subsumes inheritance reasoning. The new approach differs from other priority-based approaches in the literature in the way priority between defaults is handled. Here, it is conditional rather than unconditional as in other approaches. We show that any unconditional handling of priorities between defaults as advocated in the literature until now is not sufficient to capture general defeasible inheritance reasoning. We propose a simple and novel argumentation semantics for reasoning with specificity taking the conditionality of the priorities between defaults into account. Since the proposed argumentation semantics is a form of stable semantics of nonmonotonic reasoning, it inherits a common problem of the latter where it is not always defined for every default theory. We propose a class of stratified default theories for which the argumentation semantics is always defined. We also show that acyclic and consistent inheritance networks are stratified. We prove that the argumentation semantics satisfies the basic properties of a nonmonotonic consequence relation such as deduction, reduction, conditioning, and cumulativity for well-defined and stratified default theories. We give a modular and polynomial transformation of default theories with specificity into semantically equivalent Reiter default theories. © 2001 Published by Elsevier Science B.V.

R.I. Brafman and N. Friedman, On decision-theoretic foundations for defaults

In recent years, considerable effort has gone into understanding default reasoning. Most of this effort concentrated on the question of entailment, i.e., what conclusions are warranted by a knowledge-base

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of defaults. Surprisingly, few works formally examine the general role of defaults. We argue that an examination of this role is necessary in order to understand defaults, and suggest a concrete role for defaults: Defaults simplify our decision-making process, allowing us to make fast, approximately optimal decisions by ignoring certain possible states. In order to formalize this approach, we examine decision making in the framework of *decision theory*. We use probability and utility to measure the impact of possible states on the decision-making process. More precisely, we examine when a *consequence relation*, which is the set of default inferences made by an inference system, can be compatible with such a decision theoretic setup. We characterize general properties that such consequence relations must satisfy and contrast them with previous analysis of default consequence relations in the literature. In particular, we show that such consequence relations must satisfy the properties of *cumulative* reasoning. Finally, we compare our approach with Poole's decision-theoretic defaults, and show how both can be combined to form an attractive framework for reasoning about decisions.

O. Al-Jarrah and A. Halawani, Recognition of gestures in Arabic Sign Language using neuro-fuzzy systems

Hand gestures play an important role in communication between people during their daily lives. But the extensive use of hand gestures as a mean of communication can be found in *sign languages*. Sign language is the basic communication method between deaf people. A translator is usually needed when an ordinary person wants to communicate with a deaf one. The work presented in this paper aims at developing a system for automatic translation of gestures of the manual alphabets in the Arabic Sign Language. In doing so, we have designed a collection of ANFIS networks, each of which is trained to recognize one gesture. Our system does not rely on using any gloves or visual markings to accomplish the recognition job. Instead, it deals with images of bare hands, which allows the user to interact with the system in a natural way. An image of the hand gesture is processed and converted into a set of features that comprises of the lengths of some vectors which are selected to span the fingertips' region. The extracted features are rotation, scale, and translation invariat, which makes the system more flexible. The subtractive clustering algorithm and the least-squares estimator are used to identify the fuzzy inference system, and the training is achieved using the hybrid learning algorithm. Experiments revealed that our system was able to recognize the 30 Arabic manual alphabets with an accuracy of 93.55%.

E. Bradley, M. Easley and R. Stolle, Reasoning about nonlinear system identification

System identification is the process of deducing a mathematical model of the internal dynamics of a system from observations of its outputs. The computer program PRET automates this process by building a layer of artificial intelligence (AI) techniques around a set of traditional formal engineering methods. PRET takes a generate-and-test approach, using a small, powerful *meta-domain theory* that tailors the space of candidate models to the problem at hand. It then tests these models against the known behavior of the target system using a large set of more-general mathematical rules. The complex interplay of heterogeneous reasoning modes that is involved in this process is orchestrated by a special first-order logic system that uses static abstraction levels, dynamic declarative meta control, and a simple form of truth maintenance in order to test models quickly and cheaply. Unlike other modeling tools—most of which use libraries to model small, well-posed problems in limited domains and rely on their users to supply detailed descriptions of the target system—PRET works

with nonlinear systems in multiple domains and interacts directly with the real world via sensors and actuators. This approach has met with success in a variety of simulated and real applications, ranging from textbook systems to real-world engineering problems.

J. Aisbett and G. Gibbon, A general formulation of conceptual spaces as a meso level representation

Representing cognitive processes remains one of the great research challenges. Many important application areas, such as clinical diagnosis, operate in an environment of relative magnitudes, counts, shapes, colours etc. which are not well captured by current representational approaches. This paper presents conceptual spaces as a meso level representation for cognitive systems, between the high level symbolic representations and the subconceptual connectionist representations which have dominated AI. Conceptual spaces emphasize orders and measures and therefore naturally represent counts, magnitudes, and volumes. Taking Gärdenfors' decade-long investigation of conceptual spaces [Gärdenfors, Conceptual Spaces: The Geometry of Thought, MIT Press, 2000] as start point, the paper presents a formal foundation for conceptual spaces, shows how they are theoretically and practically linked to higher and lower representational levels, and develops dynamics which allow the orbits of states in the space to solve appropriate meso level reasoning tasks. Interpretations of conceptual spaces are given to illustrate the formal definitions and show the flexibility of the representation.

J.L. Pollock, Defeasible reasoning with variable degrees of justification

The question addressed in this paper is how the degree of justification of a belief is determined. A conclusion may be supported by several different arguments, the arguments typically being defeasible, and there may also be arguments of varying strengths for defeaters for some of the supporting arguments. What is sought is a way of computing the "on sum" degree of justification of a conclusion in terms of the degrees of justification of all relevant premises and the strengths of all relevant reasons.

I have in the past defended various principles pertaining to this problem. In this paper I reaffirm some of those principles but propose a significantly different final analysis. Specifically, I endorse the weakest link principle for the computation of argument strengths. According to this principle the degree of justification an argument confers on its conclusion in the absence of other relevant arguments is the minimum of the degrees of justification of its premises and the strengths of the reasons employed in the argument. I reaffirm my earlier rejection of the accrual of reasons, according to which two arguments for a conclusion can result in a higher degree of justification than either argument by itself. This paper diverges from my earlier theory mainly in its treatment of defeaters. First, it argues that defeaters that are too weak to defeat an inference outright may still diminish the strength of the conclusion. Second, in the past I have also denied that multiple defeaters can result in the defeat of an argument that is not defeated by any of the defeaters individually. In this paper I urge that there are compelling examples that support a limited version of this "collaborative" defeat.

The need to accommodate diminishers and collaborative defeat has important consequences for the computation of degrees of justification. The paper proposes a characterization of degrees of justification that captures the various principles endorsed and constructs an algorithm for computing them.

K. Markert and U. Hahn, Understanding metonymies in discourse

X. Nguyen, S. Kambhampati and R.S. Nigenda, Planning graph as the basis for deriving heuristics for plan synthesis by state space and CSP search

T. Sandholm, Algorithm for optimal winner determination in combinatorial auctions

B. Guijarro-Berdiñas, A. Alonso-Betanzos and O. Fontenla-Romero, Intelligent analysis and pattern recognition in cardiotocographic signals using a tightly coupled hybrid system