

Invited Talks

Intelligent Agents for Large-Scale Distributed Simulations

John Laird, University of Michigan, Ann Arbor, MI

In 1992, researchers from the University of Michigan, University of Southern California Information Sciences Institute, and Carnegie Mellon University started work on a project to develop autonomous synthetic pilots for large-scale distributed simulations. Our research goal was to develop real-time, high-fidelity models of human behavior, with the practical goal of transitioning AI research into training of military pilots. We built our synthetic pilots using an AI architecture called Soar. In this talk, I will describe the challenges involved in developing these intelligent agents, integrating them into the existing military command structure, and finally fielding them in a series of DOD training exercises. Finally, I will also discuss how we have adopted this technology to the development of AI entities that "play" Quake II and Descent 3.

Beyond Inductive Learning

Bruce G. Buchanan, University of Pittsburgh, Pittsburgh, PA

Classification learning is one of the success stories of AI. Several methods work well and are routinely incorporated into multi-strategy learning and discovery systems to make accurate predictions about the characteristics and behavior of people and objects.

Model building from empirical data makes use of inductive learning but requires more than accurate predictions for new individuals. Different investigators, and the same investigator at different

times, choose to emphasize different characteristics of models. For example, in exploratory investigations it is more important to see many of the kinds of relationships that exist in the data than to define the one or two most accurate relationships.

Besides accuracy, good models should be as simple as possible (but, as Einstein noted, no simpler). We argue that simplicity has both syntactic and semantic components and that both are necessary considerations in model building. In addition, many models are required to be cost-effective in any of several ways. We are developing a general framework for model building that incorporates these global characteristics as well as more local evaluations of accuracy.

Cognitive Prostheses

Kenneth M. Ford and Patrick J. Hayes, Institute for Human & Machine Cognition, University of West Florida

The emerging concept of human-centered computing (HCC) represents a significant shift in thinking about intelligent machines, and indeed about information technology in general. It embodies a "systems view," in which human thought and action and technological systems are seen as inextricably linked and equally important aspects of analysis, design, and evaluation. This framework focuses less on stand-alone exemplars of mechanical cognitive talent, and is concerned more with computational aids designed to amplify human cognitive and perceptual abilities. Essentially these are cognitive prostheses, computational systems that leverage and extend human intellectual capacities, just as the steamshovel was a sort of muscular prosthesis. The prosthe-

ses metaphor implies the importance of designing systems that fit the human and machine components together in ways that synergistically exploit their respective capacities. The design and fit of these computational prostheses seems to require a larger interdisciplinary range than has traditionally been associated with AI work, including computer scientists, cognitive scientists, and social scientists of various stripes. This shift in perspective places human/machine interaction issues at the center of the subject. The "system" in question isn't "the computer" but instead includes cognitive and social systems, computational tools, and the physical facilities and environment. Thus, HCC provides a new research outlook, with new research agendas and goals.

The HAL 9000 Computer and the Vision of 2001: A Space Odyssey

David Stork, Ricoh Silicon Valley and Stanford University, CA

2001: A Space Odyssey, Stanley Kubrick and Arthur C. Clarke's 1968 epic film about space exploration, extraterrestrials and the evolution of intelligence, was the most scientifically precise feature film ever made. Now, on the occasion of HAL's "birth" (as given in the novel), we can compare the film's computer science "predictions" with current technological fact — in particular those related to its central character, the HAL 9000 computer. We review the reflections of Arthur C. Clarke, Marvin Minsky, Doug Lenat, Stephen Wolfram, Raymond Kurzweil, Roger Schank, Donald Norman, Murray Campbell, Daniel Dennett, David G. Stork, Rosalind Picard, Dave Wilkins, Joe Olive,

Dave Kuck, and Ravishankar Iyer concerning the film, specifically addressing topics such as artificial intelligence, computer vision, computer lipreading, speech recognition, reasoning, chess, reliability, computer emotion and interface design. Where were the film's creators optimistic, where pessimistic, and why? What trends and issues were overlooked? Could we build a HAL?

This non-technical talk is profusely illustrated with clips from 2001 and current research and sheds new light on key moments of the film — you will never see the film the same way again.

Tracking Tractable Temporal Techniques

Frank Anger, National Science Foundation

Time has become a common attribute in information representation and reasoning applications, but it is one that generally demands special methods. Unlike attributes such as color, it is constantly changing; unlike properties such as size, time is pervasive and comes with a structure that affects the way we reason about the information. Many approaches have been used for modeling and reasoning about time, from temporal logics to axiomatic models. This talk will discuss a number of approaches and their uses. Special attention will be given to interval representations of time and constraint satisfaction techniques for reasoning about qualitative temporal information. While the complexity of some of the standard problems is well known, recent work has uncovered a filigree of tractable and intractable problems, depending on the temporal model and the initial relations allowed between events.