Invited Talks

Decision Making under Uncertainty: Operations Research Meets AI (Again)

Craig Boutilier, *University of Toronto*

Models for sequential decision making under uncertainty (such as Markov decision processes, or MDPs) have been studied in operations research for decades. The recent incorporation of ideas from many areas of AI, including planning, probabilistic modeling, machine learning, and knowledge representation, have made these models much more widely applicable. In this talk, Boutilier will survey recent advances within AI in the use of fully- and partially-observable MDPs as a modeling tool, and the development of computationally-manageable solution methods. He will place special emphasis on algorithms that exploit specific problem structure and approximation techniques.

Why Do We Need a Body Anyway?

Justine Cassell, *MIT Media Lab*

Embodiment is all the rage: humanoid agents, robots with eyelashes. It brings back those glory days of AI when "human-like" was a goal in and of itself. But do bodies serve any use in today's AI? In this talk Cassell will support the use of embodiment in certain domains and demonstrate with a series of implemented systems. But she will argue that unless we understand the "affordances" of the body — for face-to-face conversation, for situating intelligence, for establishing trust and other kinds of interactional glue — then an embodied systems will never be more than just another pretty face.

Intelligence in "Artificial" Wireless (IAAI Invited Talk)

Bertrand du Castel, Schlumberger Ltd.

The background of the presentation is a perspective on the development of wireless technology from 2000 to 2010. The foreground of the presentation is a contrasted understanding of intelligence in "natural" wireless (human communication) versus "artificial" wireless (communication between devices).

Structure, Duality, and Randomization: Common Themes in AI and OR

Carla Pedro Gomes, *Cornell University*

Both the artificial intelligence (AI) community and the operations research (OR) communities are interested in developing techniques for solving hard combinatorial problems. OR has built heavily on mathematical programming formulations such as integer and linear programming, while AI has developed constraint-based search and inference methods. Recently, we have seen a convergence of ideas, drawing on the individual strengths of these paradigms. Problem structure, duality, and randomization are overarching themes in the study of AI and OR approaches. Gomes will compare and contrast the different views from AI and OR on these topics, highlighting potential synergistic benefits.

Missed Perceptions: AI versus the Funding Agencies

James Hendler, *University of Maryland & DARPA*

The relationship between the AI community and the funding establishment has often been very strained. In this talk, Hendler examines the reality of this and explore what we, as individuals and as a community, can do to improve our interaction with funding agencies.

Modeling High-Dimensional Data Distributions by Combining Simple Experts

Geoffrey Hinton, *University College London, UK*

It is possible to combine multiple non-linear probabilistic models of the same data by multiplying the probability distributions together and then renormalizing. This is a very efficient way to model data that simultaneously satisfies many different constraints. Hinton will describe an efficient way to fit a "Product of Experts" to data and show that this produces excellent models.

Design and Analysis of Heuristic Evaluation Functions

Richard E. Korf, *University of California, Los Angeles*

Korf will discuss recent progress in heuristic search, which has lead to optimal solutions to Rubik's Cube and the 5x5 TwentyFour Puzzle, problems with state spaces of size 10^{19} and 10^{25}, respectively. Korf will also present a new theory that allows us to accurately predict the performance of heuristic search algorithms.

Artificial Intelligence and Mobile Robots: Successes and Challenges

David Kortenkamp, *NASA Johnson Space Center/Metrica Inc.*

Mobile robots pose a unique challenge to artificial intelligence researchers. In recent years, successes in mapping and navigation have led to new challenges in human-robot interaction, multiple robots, mobile manipulation and learning. Kortenkamp's talk will discuss these successes and challenges within the context of the AAAI-2000 Mobile Robot competition.

Human-level AI's Killer Application: Interactive Computer Games

John E. Laird, *University of Michigan*

Over the last 30 years, there has been little progress in developing AI systems that integrate the varied intellectual capabilities of humans. In this talk, Laird proposes that interactive computer games can provide the unifying application area for research and development of integrated human-level AI.

Machines Reasoning about Machines

J. Strother Moore, *University of Texas at Austin*

Can machines reason about machines? The answer is "yes" and the question is of more than just philosophical interest. Today's microprocessors are extraordinarily complex machines; manufacturers are turning to mechanized reasoning tools to help them analyze sophisticated designs. These tools have their roots in early AI research.

Unconventional Vision Sensors

Shree K. Nayar, *Columbia University*

What can be perceived by a human or computed by a machine from an image is fundamentally restricted by the captured data. Current imaging systems are severely limited in spatial resolution, field of view, and dynamic range. In this talk, Nayar presents new vision sensors that provide unconventional forms of visual information. The first part of the talk focuses on the use of catadioptrics (lenses and mirrors) for capturing unusually large fields of view. Nayar describes several methods for obtaining single viewpoint and multi-

viewpoint images. The second part of the talk addresses the problem of acquiring high dynamic range images using a low dynamic range detector. Nayar presents two approaches for extracting the desired extra bits at each pixel; the first one uses multiple images while the second uses just a single image. Several interactive demonstrations of our results will be shown. These results have implications for digital photography, immersive imaging, image based rendering, 3D scene modeling, and advanced interfaces.

The Games Computers (and People) Play

Jonathan Schaeffer, *University of Alberta*

The development of high-performance game-playing programs has been one of the major successes of AI research. The results have been outstanding but, with the one notable exception (Deep Blue), they have not been widely disseminated. Schaeffer's talk will discuss the past, present and future of the development of game-playing programs.

The research emphasis in the past has been on high performance for two-player perfect-information games. The research emphasis of the present encompasses multi-player imperfect/non-deterministic information games. And what of the future? There are some surprising changes of direction occurring that will result in games being more of an experimental testbed for mainstream AI research.

Eye Movements and Spoken Language Comprehension:
Bridging the Language-as-Action and Language-as-Product Traditions

Michael K. Tanenhaus, *University of Rochester*

Eye movements allow one to monitor real-time language processing in natural situations at a remarkably fine temporal grain. Tanenhaus will present an overview of research using this approach focusing on (1) word recognition in

continuous speech and (2) the role that contextually-dependent representations play in reference resolution and syntactic ambiguity resolution.

Conceptual Indexing: Practical Large-Scale AI for Efficient Information Access

William A. Woods, *Sun Microsystems Laboratories*

Finding information is a problem shared by people and intelligent systems. Wood's talk describes an experiment combining both human and machine aspects in a knowledge-based system to help people find information in text. This system is the first to demonstrate a substantial improvement in information retrieval performance by using linguistic and

world knowledge. It is also an example of practical subsumption technology on a large scale and with domain-independent knowledge. Results from this experiment are relevant to general problems of knowledge-based reasoning with large-scale knowledge bases.