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The 1996 AAAI Spring Symposia Reports

■ The American Association for Artificial Intelligence held its 1996 Spring Symposia Series on March 27 to 29 at Stanford University. This article contains summaries of the eight symposia that were conducted: (1) Acquisition, Learning, and Demonstration: Automating Tasks for Users; (2) Adaptation, Coevolution, and Learning in Multiagent Systems; (3) Artificial Intelligence in Medicine: Applications of Current Technologies; (4) Cognitive and Computational Models of Spatial Representation; (5) Computational Implicature: Computational Approaches to Interpreting and Generating Conversational Implicature; (6) Computational Issues in Learning Models of Dynamic Systems; (7) Machine Learning in Information Access; and (8) Planning with Incomplete Information for Robot Problems.

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Acquisition, Learning, and Demonstration: Automating Tasks for Users

This symposium brought together three different communities that are all looking at the problem of automating tasks through interactions with users: First, knowledge acquisition concentrates on how to structure a system's interactions with users based on the nature of the task to be automated. Second, machine learning seeks automated algorithms that do explanation or induction based on a user's actions. Third, programming by demonstration, which emerged from the user interface community, offers natural ways for nonprogrammers to automate repetitive tasks by demonstrating how the task is done.

The papers explored interactive tasks such as formatting text, creating plots and charts, robot programming, acquiring planning guidance, and specifying constraints for schedulers. Despite a variety of tasks and techniques and different backgrounds of the researchers, the presenters raised issues that resonated with each others' experiences.

Several interesting points came up during the discussion sessions. Even though negative examples are useful for machine-learning algorithms, experiments with users show that they are hard for people to formulate and understand. In systems that are able to take user instruction, users often provide incomplete instruction or none at all. Systems need to obtain feedback from the user to check that their model of the task is correct, which requires users to understand how the systems work and be comfortable with some formal language. One recurring topic was whether machine-learning algorithms can handle the types of example and data produced by users.

The symposium participants agreed on two exciting future directions: First, background knowledge would allow acquisition systems to make more intelligent guesses, whether provided by users or identified by system designers in advance. A second challenging direction is to share data to allow comparisons of different acquisition systems on the same problems.

Yolanda Gil
USC/Information Sciences Institute

Adaptation, Coevolution, and Learning in Multiagent Systems

This symposium was held as a follow-up to a workshop on a similar topic held during the Fourteenth International Joint Conference on Artificial Intelligence. The presenters and participants discussed the core research issues involved when agents adapt to, and learn both about and from, other agents. All through the symposium, discussion centered on two extremes of the multiagent-domain spectrum: (1) few complex agents modeling about, and negotiating with, similar agents using sophisticated reasoning and knowledge-acquisition techniques and (2) large numbers of agents with limited capabilities and simple behaviors adjusting their local behavior from environmental feedback. Interestingly, both groups deal with a common set of critical problems: incomplete global knowledge; variability of feedback because of changing context; and global effects of local decisions— earning individually or as a group, learning continually or not, learning synchronously versus asynchronously.

The symposium started with an invited talk given by Deborah Gordon (Department of Biological Sciences, Stanford University) entitled "The Organization of Work in Ant Colonies." This talk and a few other presentations triggered discussion on whether the assumption that more global knowledge is better is really essential for achieving coordination in all multiagent systems. A related issue on which the participants reached consensus was that for agent groups to be stable, some asymmetry or diversity (in knowledge, capability, decision times, and so on) of behavior seems to be essential. Other prominent issues that were discussed included application of multiagent learning systems (design, information gathering), cooperative versus competitive learning and evolution, and test beds (robotic soccer). More details can be found at http://euler.mcs.utulsa.edu/~sandip/ss.html.

Sandip Sen
University of Tulsa

Artificial Intelligence in Medicine: Applications of Current Technologies

Bruce Buchanan set the tone for the Artificial Intelligence in Medicine (AIM) symposium with his keynote address describing the dramatic changes in health-care delivery. He noted that these changes presented several opportunities for the AIM community to affect clinical care in the direct care of patients as well as at the administrative level. The symposium itself demonstrated a transition from past years from tool development to working prototypes and clinical deployment. Machine-learning techniques, expert systems, and classification algorithms were embedded in user interfaces so that they appear almost invisible to the clinician user. Furthermore, there was much greater use of existing clinical databases and less reliance on manual data entry than in years past. The AIM community is clearly not immune to the larger trends in the computing community because many applications were built around new information-presentation and information-delivery technologies such as the World Wide Web and voice and handwriting recognition.

Isaac Kohane
Children's Hospital and
Harvard Medical School

Cognitive and Computational Models of Spatial Representation

One result of recent IJCAI and AAAI workshops on spatial language and the 1995 Fall Symposium on Computational Models for Integrating Language and Vision was the recognition of the rift that exists between cognitive and computational accounts of spatial representation. The principal aim of this symposium was to initiate an interdisciplinary dialogue to facilitate exchange of ideas and cross-fertilization among researchers into spatial representation, reasoning, and cognition.

As was planned, the event attracted interest from a wide range of disciplines, not only computer science and cognitive psychology but also geography, neurology, and philosophy. Over 80 papers and statements of interest were submitted, and the symposium was one of the largest in this symposium series with nearly 70 attendees.

Rather than being skeptical and absolutely critical of different views and approaches, which often results in accusations about the naiveté and ignorance of other disciplines, participants were actively supportive and constructive; the symposium atmosphere was positive and friendly. Topics presented spanned cognitive and computational accounts of spatial language, diagrammatic reasoning, spatial cognition, and cognitive maps.

To focus understanding on particular problem areas, three overview talks were delivered: (1) Barbara Tversky on cognitive aspects of linguistic accounts of spatial descriptions, (2) Janice Glasgow on computational imagery and its impact on diagrammatic reasoning, and (3) Tony Cohn on qualitative spatial reasoning based on spatial logic. Along with these general issues in each discipline, the symposium discussed 13 paper presentations over the 2-1/2 days. Two commentators from varying backgrounds were assigned to each paper and presented their concerns and comments, which served as pretexts to the discussion. Often, the commentaries were as captivating and stimulating as the paper presentation itself and posed well–thought-out questions that brought the ensuing discussion to a well-informed debate.

Patrick Olivier and Keiichi Nakata
University of Wales at Aberystwyth

Computational Implicature: Computational Approaches to Interpreting and Generating Conversational Implicature

A conversational implicature (CI) is a type of discourse inference (Grice, H. P. 1975. Logic and Conversation. In *Syntax and Semantics III: Speech Acts*, eds. P. Cole and J. L. Morgan. San Diego, Calif.: Academic). For example, B's response below licenses the CI that B has no more than two children.

A: Do you have any children?
B: I have 2 children.

Since the 1980s, various approaches have been developed for interpreting and generating classes of CIs and for generating discourse that avoids unintended CIs. The symposium brought together an international group of researchers from computational linguistics, linguistics, philosophy, and cognitive science. The purpose was to compare computational solutions, discuss how these solutions might be integrated, and stimulate future directions for research.

The first half of the symposium gave attendees an overview of current research. The second half included two panels: (1) one comparing different computational approaches and (2) the other on the proper role of Grice's theory. Finally, attendees participated in smaller working groups to devise a comprehensive generation and interpretation model and address future methodological and theoretical issues.

Themes that arose from the symposium's lively discussions include a closer examination of naturally occurring examples in context; the role that plans and goals play in computational models of CI, especially in a generator's decision to employ cancellation or reinforcement of potential CIs; and the need to address dynamic aspects of modeling CI. Further details can be found at http://www.isp.pitt.edu/implicature/.

Barbara Di Eugenio and Nancy Green
Carnegie Mellon University

Computational Issues in Learning Models of Dynamic Systems

Dynamic systems are mathematical objects used to represent the behavior of physical phenomena evolving over time. This symposium brought together physicists, computer scientists, and applied statisticians in an attempt to better understand the models, statistical techniques, and algorithms for inferring dynamic systems from data.

Traditionally, physicists are concerned with the basic phenomena and are interested in providing explanatory theories. Physicists conceptualize dynamic systems in terms of *attractor-basin portraits,* models that are used frequently in model-based learning in AI and qualitative reasoning in particular. The physicists also addressed the issue of measurement, which is often neglected in more abstract discussions of dynamic systems.

Applied statisticians working in the area of time-series analysis and hidden Markov models are interested in the relation between data and models that attempt to summarize the data succinctly and generalize to account for unobserved features. There was much consciousness raising in terms of issues of bias; the role of the so-called no-free-lunch theorems; and the use of mixture models, that is, instead of choosing a single model, Bayesians prefer using a probability-weighted combination of models.

The computer scientists included computational learning theorists and problem-driven but theoretically well-informed AI researchers interested in learning dynamic systems for applications in robotics; economic forecasting; and the control of complex devices, including spacecraft and maglev trains. Both physicists and computer scientists drew on linkages to formal language models and automata theory as one method of accounting for computational issues. The computer scientists were concerned with building algorithms that scale well (in terms of time and space) with problem size and identifying and exploiting structural properties that help to reduce computational overhead. Particular methods involving decomposition and aggregation were discussed in regard to the latter. There are plans for follow-on workshops.

Thomas Dean
Brown University

Machine Learning in Information Access

This symposium was the first professional gathering devoted to the use of machine-learning techniques to enable and improve information-access (that is, information-retrieval) tasks. Presentations described applications on a range of tasks, such as finding interesting pages on the World Wide Web, identifying text topics, and e-mail filtering.

One central theme of the symposium—labeled by Bill Cooper in his lead-off invited talk as the *rubber ceiling effect*—was that sophisticated methods rarely generate results that are substantially better than those of more straightforward approaches. One question this raised was whether sophisticated methods would find success on niche problems, such as constrained classes of information sources or information-access tasks. Discussions also addressed a number of more technical questions, such as how to evaluate work in the context of real users and how to select good features for learning from text.

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More generally, though, many attendees emphasized the need to "break out of the box" in terms of the problems, methods, and evaluation criteria studied by researchers in this area. For example, as pointed out by Rich Sutton in his invited talk, information access is often an iterative process of formulating a query or information request, then refining it based on the retrieved information in contrast to the one-shot model of information access that is common in much of the work in this area. For further information, the symposium's web page can be found at http://www.parc.xerox.com/mlia.

Marti Hearst
Xerox PARC

Planning with Incomplete Information for Robot Problems

This symposium brought together the planning and robotics communities to address the common problem of planning and acting robustly in spite of incomplete information (actions backfire, camera lenses crack, graduate students block the robot's path, and so on). Stan Rosenschein (Teleos Research and Stanford University) set the tone with a keynote address on the automatic design of control systems that track the world and achieve their goals. Subsequent presentations described planning systems capable of constructing solutions despite incomplete information as well as control systems that allow multiple episodes of planning and execution, gaining perceptual information at execution time to simplify subsequent planning episodes.

The planning and robotics communities have converged on perhaps the biggest lesson of incomplete information: Planning and execution must be interleaved if an agent is to function in the uncertain real world. The point was made dramatically in a presentation by Anthony Stentz (Carnegie Mellon University). He demonstrated an extremely effective navigation strategy for a robot in an unknown environment. The surprise was that his robot replans globally each time it encounters an unexpected obstacle, successfully interleaving planning and execution to an extreme degree.

A final ingredient of the symposium was a one-session robot laboratory using four actual robots in a large maze world. Low-level motion code was supplied before the symposium and attendees were asked to provide planning- and execution-control systems that would allow the robot to gather gold balloons at specified positions in the maze despite complete initial uncertainty about its starting position.

Several participants designed successful control systems, demonstrating perhaps for the first time that an individual can write high-level control code for a real-world robot several thousand miles removed from the robot, and it can work on the actual robot on the first try.

Illah R. Nourbakhsh
Stanford University