The AAAI-02 and IAAI-02 Conferences

A Stimulating Five Days in Edmonton

Sara Hedberg

Over 1,100 attended the AAAI–02 and IAAI–02 conferences, and attendees included fathers of the field, noted researchers and practitioners, and students. "It was good to see the number of student attendees up," noted American Association for Artificial Intelligence (AAAI) President Tom Mitchell, "and that our attendance was so high despite the economic downturn. I think the meeting was even more stimulating because of the co-location of AAAI with so many other conferences in Edmonton at the same time."

This article provides a few snapshots of the vast and varied content of the 2002 conferences. Proceedings of AAAI-02 and IAAI-02 are available from AAAI Press (www.aaaipress.org).

AAAI is grateful for the outstanding work of the conference committee members as well the support of the following organizations for this year's conference: Association of Computing Machinery SIGART, Alberta Informatics Circle of Research Excellence (iCORE), Defense Advanced Research Projects Agency (DARPA), NASA Ames Research Center, the National Science Foundation's Directorate for Computer and Information Science and Engineering (CISE), and the Naval Research Laboratory.

Experimental New Format

For past conferences, all accepted papers were presented during several parallel tracks. With the breadth and diversity of the AI field, and more specialized conferences, this year's organizers tried a new format hoping to reduce the fragmentation.

Of the 470 papers submitted for the conference, 121 were accepted. From these papers, the review committee selected representative papers for a single conference track. "There was not a distinction based on quality," Mike Kearns, cochair of the conference, was quick to point out. "Rather, the oral program was selected for its unity." All accepted papers were presented at a poster session.

■ The Eighteenth National Conference on Artificial Intelligence (AAAI-02) and the Fourteenth Conference on Innovative Applications of AI (IAAI-02) were positively received by those who attended. This report provides a few snapshots of the vast and varied content of the 2002 conferences. Proceedings of AAAI-02 and IAAI-02 are available from AAAI Press (www.-aaaipress.org).

Synergy in Future

Synergy between various disciplines both within the AI field and with other sciences was a common theme at the conference. Tom Mitchell stated, "I think one of the major developments in AI over the past five years has come from the cross-fertilization between AI and statistics. This year's invited talks by Michael Jordan and Naftali Tishby provided great evidence of this cross-fertilization. My guess is that over the next decade, we'll see a new, equally important cross-fertilization between AI and studies of the brain—but we'll have to wait a few years to see whether my prediction is correct."

"Biology is going wild because of new instrumentation resulting in a scientific revolution," said Mitchell during his presidential address. By way of example, he cited functional magnetic resonance imaging (FMRI), a safe, noninvasive procedure that can render a three-dimensional movie of brain activity with very high resolution. Such new tools, Mitchell believes, mean that the day is not far off when it will be possible to couple machine learning with FMRI to model the different states and transitions of cognitive processes.

Keynote speaker Ray Kurzweil examined the future of a number of scientific and technological threads, intertwinings, and their implications for humanity. The exponential hardware growth, for example, will mean that by 2010 computers will "disappear," becoming invisible in the environment, clothes, and in full-immersion virtual reality neural implants. Nanobots will expand human intelligence "in ways we can't even anticipate today," he asserted.

Looking Back

While Kurzweil looked forward, Robin Murphy, a pioneer in search and rescue robotics, looked back to September 11, 2001, and its aftermath. She was part of the first-ever use of robots to assist in victim search and rescue at New York City's World Trade Center (WTC). In a compelling talk, she showed the utility of robots in hazardous environments. After describing in some detail the experiences at WTC, she spent time reflecting on the lessons she and her team learned. Their experiences produced a research agenda for search and rescue robots, including user interfaces to tell the remote operator the state of the robot and where it is and intelligent assistance for perception to reduce cognitive errors and deficits and increase perceptual and situational analysis.

Deployed Award-Winning Applications

- M**I**TAP, Text and Audio Processing for Bio-Security: A Case Study (MITRE Corp.)

  M**I**TAP is a prototype system for monitoring infectious disease outbreaks and other global events, providing multilingual access to multiple information sources for those involved in humanitarian assistance and relief work.

- RightNow E**SERVICE** C**ENTER**: Internet Customer Service Using a Self-Learning Knowledge Base (RightNow Technologies, Inc.)

  This customizable product delivers customer service on the internet using AI techniques for self-learning to facilitate automatic construction, knowledge base maintenance, and navigation.

- Staff Scheduling for Inbound Call Centers and Customer Contact Centers (Blue Pumpkin Software)

  D**IRECTOR** is a scheduling application to optimize staffing for customer contact centers.

- A Decision-Support System for Quote Generation (IBM T.J. Watson Research Center)

  This prototype agent-based system assists suppliers in responding to requests for quotes in a business-to-business electronic-commerce supply chain.

- UTTSE**XAM**: A Campus-Wide University Exam-Timetabling System (National University of Singapore)

  UTTSE**XAM** is an automated exam scheduling system using genetic algorithms.

- A Structure-Based Configuration Tool: D**RIVE** S**OLUTION** D**ESIGNER** (D**SD**) (University of Bremen, encoway GmbH, University of Hamburg, and Lenze AG)

  This complex product configuration system is used by sales engineers to make on-site optimized quotes from a large and highly complex product catalog.

- Development and Deployment of a D**ISCIPLE** Agent for (Military Conflict) Center of Gravity Analysis (George Mason University for the U.S. Army War College)

  This learning agent shell can be used to build knowledge-based systems for intelligent computer-aided instruction.

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Reflection on the past can help us learn from both our mistakes and our triumphs. Neil Jacobstein, president and chief executive officer (CEO) of Teknowledge, organized a well-attended two-part panel entitled "Pioneering AI Businesses." "Part 1: A 20-Year Review" was followed (after lunch) by "Part 2: Recent Startups." Part 1 included a blue ribbon panel of company founders from the 1980's expert systems commercial wave of AI success: Mark Fox of the Carnegie Group, Ed Feigenbaum of Teknowledge and IntelliCorp, Amos Barzilay of Syntelligence, and Howie Shrobe of Symbolics. For veterans in the field, it was a poignant and sometimes painful walk through the lightning-fast boom-to-bust period of the 1980s, peppered with talk of InterLisp, Symbolics machines, and the Gang of Four (Teknowledge, Carnegie Group, IntelliCorp, and Inference.)

"Teknowledge is a $17 million company today," stated Jacobstein. "This is a far cry from what knowledge-based systems could have achieved if we had focused on (domain-specific) knowledge earlier (instead of generic shells)." Mark Fox, now a professor at the University of Toronto and chairman and CEO of Novator Systems, an electronic-commerce services and software company, said one of the biggest mistakes made in the 1980s was that "we were technology driven. It is not technology that wins. It is the ability to deliver solutions in a way that is easy to use and understand." Ed Feigenbaum asserted that "tools don't make much money. Solutions do. We had lathes, we didn't have furniture…. And beware of hubris," he cautioned.

The second part of the panel included founders of new companies: Dan Weld of the University of Washington, who has founded several companies, Tuomas Sandholm of Carnegie Mellon University who recently helped found CombineNet, and Tom Mitchell who helped found WhizBang! ("Now WasBang," Mitchell joked. "It went out of business in May 2002.") The panel examined the dynamics of business start-up. AI is the "raisin in the bread," as Sandholm described the role of AI in com-

pany product offerings. The attentive audience heard a good cross-section of the do's and don'ts of business start-up in today's market environment.

Innovative Applications

"The commercial side of AI is healthy and growing," according to Tom Mitchell. The IAAI-02 winning applications illustrate the diversity of application domains where AI is having a significant impact. "We see success after success appear not because of some one-time breakthrough but as the cumulative result of solid AI research…. Over the past several years these have led to successes like commercial speech recognition, automated detection of fraudulent credit card use, and automatic translation of web pages from French to Spanish to English. This year there is more, including robot vacuum cleaners for $199 and automatic face recognition systems that are already in use in several airports and law enforcement agencies."

IAAI-02 Summary of Applications

IAAI-02 included 18 papers—7 deployed award-winning applications (sidebar 1) that spotlight new AI technologies with measurable benefits and 11 emerging applications (sidebar 2) that showcase tools and techniques for next-generation intelligent applications.

Robots Evolving

"One thing that stood out for me (at the 2002 conference) was the appearance of robots roaming through the registration area of the meeting," mused Mitchell, "and in some cases successfully maintaining their position in the registration line as the line shortened and they moved up to the counter. Why did this strike me as interesting? Because it shows that robotics has come a very long way in the past decade, partly driven by the variety of AAAI-sponsored robot competitions over the years.

"In the early robot competitions,"

Emerging Applications

- Getting from Here to There: Interactive Planning and Agent Execution for Optimizing Travel (University of Southern California/Information Sciences Institute and Fetch Technologies)
  An automated, responsive business travel planning system, it uses intelligent agents in initial travel planning and adjustments based on updates in real conditions (flight delays, fare changes, and so on).
- WHYNOT: Debugging Failed Queries in Large Knowledge Bases (University of Southern California/Information Sciences Institute)
  WHYNOT guides a user in debugging a failed query to a large knowledge base.
- An Analogy Ontology for Integrating Analogical Processing and First-Principles Reasoning (Northwestern University, Georgia Institute of Technology)
  There is mounting psychological evidence that much human cognition involves using analogies. This paper presents research work in integrating analogical processing into AI systems.
- Applying Perceptually Driven Cognitive Mapping to Virtual Urban Environments (University of Southern California/Institute for Creative Technologies)
  This paper discusses a method for building a cognitive map of a virtual urban environment. The goal is to develop virtual humans with believable perceptual and spatial behaviors for computer games, military training simulations, and immersive learning environments.
- Toward Practical Knowledge-Based Tools for Battle Planning and Scheduling (BBN Technologies, U.S. Army, Austin Information Systems)
  The COURSE OF ACTION DEVELOPMENT AND EVALUATION TOOL (CADET) is a knowledge-based tool for developing realistic battle plans for large units of the U.S. Army.
- Knowledge Formation and Dialogue Using the KRAKEN Toolset (Cycorp)
  KRAKEN is a natural language knowledge-acquisition tool for the CYC knowledge base for subject-matter (not computer) experts.
- AI on the Battlefield: An Experimental Exploration (U.S. Army, BBN Technologies, Northwestern University)
  This paper describes an experiment that loosely integrated several advanced research tools for performing successive steps in complex planning.
- Intelligent Control of Auxiliary Ship Systems (The Johns Hopkins University Applied Physics Laboratory)
  The OPEN AUTONOMY KERNEL is a generic architecture for autonomous distributed process control with incomplete sensor coverage.
- Computational Vulnerability Analysis for Information Survivability (Massachusetts Institute of Technology Artificial Intelligence Laboratory)
  This paper describes experiments in developing self-adaptive software systems that can survive attacks, whether simple or insidious and covert.
- A Web-Based Ontology Browsing and Editing System (SRI International, Boeing Research and Technology, University of Texas at Austin)
  This paper describes efforts to develop SHAKEN, a tool that enables domain experts to build knowledge bases with very little training.
- The 2001 Trading Agent Competition (University of Michigan, Brown University, AT&T Labs—Research, North Carolina State University)
  The second Trading Agent Competition involved agents with difficult issues in bidding strategy, market prediction, and resource allocation.

Mitchell continued, "robots were cordoned off in a carefully controlled static environment where they couldn't hurt themselves or others. Now we have reached a stage where robots can successfully navigate in complex environments with many humans moving about. And we are beginning to study the social interactions between robots and people—interactions such as the body language people use to maintain their place in that registration line."

This year's competition included several events: Robot Search and Rescue, the Robot Challenge (to register for the conference), and Robot Host (to serve desserts at the conference reception). The Search and Rescue course was far more difficult than last year's. Designed and installed by the U.S. National Institute of Standards and Technology, it included elements to confuse the robots' sensors and challenge their ability to move successfully through the rubble of a de-

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stroyed site where victims might still be alive.

2002 Mobile Robot Competition Winners

There were winners in each of three categories: (1) Search and Rescue, (2) Robot Challenge, and (3) Robot Host.

Search and Rescue

First Place—YSC (Iran). The two robots found three victims and navigated into all three zones from the least to most hazardous. These robots were the only in the competition to venture into the most hazardous red zone.

Second Place—Swarthmore College. Two robots found four victims.

Third Place—Georgia Institute of Technology. A marsupial-like robot carrying four smaller robots on a shelf to deploy in smaller spaces found three victims.

Robot Challenge Event

Because this event was not a contest, no place awards were given, but, rather, each participating robot team received recognition for what it did uniquely well.

GRACE—This robot was a multi-institutional collaboration between Carnegie Mellon University, the Naval Research Lab, Northwestern

University, Swarthmore College, and Metrica for human-robot interaction.

COWORKER—iRobot Corporation's robot was recognized for its ability to combine robot autonomy with human intervention when needed.

Massachusetts Institute of Technology's unnamed robot was honored for its ability to know where it was.

Robot Host

University of Rochester—MABEL THE MOBILE TABLE

Kansas State University—BORIVOJ

Swarthmore College—Unnamed entry

Wegbreit Award

Established by Stanford University scientist and successful entrepreneur Ben Wegbreit, this $1,000 prize is awarded for the most outstanding robot of the entire program. In 2002, the Grace consortium received the prize for innovation in successfully integrating various AI technologies.

This year's Robot Exhibit included a number of interesting and innovative experimental robots. Most notable were two polymorphic robots that could assume different shapes. Daniela Rus of Dartmouth College demonstrated a CRYSTAL robot that had different plug-in modules, each having its own intelligence on board. The modules could be plugged into various configurations and work together as an orchestrated whole. Weimen Shen of the University of Southern California showed CONRO, a small modular robot with localized intelligence on each module. First, he plugged the components together into a figure resembling a snake, and the robot quickly perceived its shape and began to move across the floor as a sidewinder. The robot was then reconfigured to four legs and walked.

Conclusion

The AAAI conferences are a perennial font of emerging research and applications. Planning is already under way for the IJCAI conference that will be held in Acapulco, Mexico, 9 to 15 August 2003.