

Celebrating Twenty-Five Years of AAAI: Notes from the AAAI-05 and IAAI-05 Conferences

Sara Reese Hedberg

Surveying the last quarter century of AI since the founding of AAAI in his Presidential Address, Ron Brachman outlined some of the highlights of the past 25 years. Of special note was Deep Blue, the IBM computer system that beat then-reigning world chess champion Garry Kasparov.

Then there was the boom and bust of expert systems companies, the times when AI was the most popular computer science major, and the 1985 AAAI conference that had over 5,500 attendees.

This was followed by what is commonly referred to as the "AI Winter." "This was not a prolonged phenomenon," observed Brachman. Indeed, in the current Presidential budget for fiscal year 2006, the Cognitive Computing Systems line item is \$200 million, and the proposed 2007 budget is \$240 million. Adding this figure together with the National Science Foundation and other national U.S. agency budgets, "the weather is getting warmer (for AI)," concluded Brachman.

"[In his Presidential Address], Ron Brachman focused on the problem of the centrifugal and centripetal tendencies of AI," says incoming AAAI President Alan Mackworth. "He emphasized that an exclusive focus on our increasingly specialized subdisciplines will not let us reach either our scientific or our technological goals. The way to overcome those centrifugal tendencies is to develop better theories of cognitive architectures and to work in integrated applications. He

then pointed out," continued Mackworth, "that AAAI is perhaps the premier venue for bringing together the subdisciplines and is therefore needed more than ever. Those messages resonate strongly with me."

Bringing Back the Momentum of Grander Moments in AI

Early in his talk, Brachman declared that he hoped to see AI "bring back the level of energy and excitement felt in the grander moments" of its history. Judging by this year's AAAI-05 and Innovative Applications of AI (IAAI-05) conferences, this energy and excitement is already building. Attendance to the conference was up by twenty percent for 2005. A record 803 technical papers were submitted for consideration. Various strains of AI are viewed as critical to homeland security, antiterrorism and emergency response. Governments are allocating huge amounts of funding for AI research.

Leading companies such as Microsoft and Google are using AI in increasingly more intelligent software and Web services. As seen in this year's Intelligent Systems demonstrations, scientists are using AI to assist with cancer research and biomarker discovery. This year's award-winning innovative and emerging applications at the IAAI-05 conference show that AI-based applications can be found throughout the fabric of our modern world—underground, on the

ground, in the ocean, and in space (see the sidebar "Snapshot of 2005 Innovative Applications of AI Papers").

There were many signs of the growing momentum in the AI field at this year's conferences. A look at the categories of the accepted papers (and the number of papers within each category) gives a brief glimpse of the breadth of research agendas currently underway: activity and plan recognition (5 papers); agents/multiagent systems (27 papers); analogical and case based reasoning (6 papers); auctions and market-based systems (5 papers); automated reasoning (12 papers); constraint satisfaction and satisfiability (20 papers); game theory and economic models (5 papers); human-computer interaction (6 papers); knowledge acquisition and engineering (2 papers); knowledge representation and reasoning (19 papers); logic programming (4 papers); machine learning (35 papers); machine perception (6 papers); Markov decision processes and uncertainty (12 papers); natural language processing and speech recognition (15 papers); planning and scheduling (17 papers); robotics (16 papers); search (10 papers); and semantic web, information retrieval, and extraction (7 papers).

The technical conference also included 16 tutorials, 14 workshops, 22 intelligent systems demonstrations, 26 student abstract papers, and reports from 15 specialized AI conferences (for example, constraint programming, intelligent user interfaces, data mining)—all of the above impressive for its quality far more than its quantity.

Growing System Complexity

Another general trend in AI-based systems that continues to hold true is that the problems being tackled, and therefore the resulting systems, are increasingly complex. Several years ago, for instance, AAAI hosted a game playing exhibition of AI-based software games. This year the conference included the First Annual General Game Playing Competition.

General game players are computer systems able to accept formal descriptions of arbitrary games and to play these games effectively without hu-

Snapshot of 2005 Innovative Applications of AI Papers

Members of the AI community are often asked for tangible examples of where AI is at work—for ways that it impacts the lives of the ordinary and extraordinary. Each year the IAAI conference provides stellar examples to hold up. This year's winners are described below. For summaries of the award winners and emerging applications since 2001, see www.aaai.org/Pressroom/Backgrounders/backgrounders.html. The complete papers are included in this year's conference proceedings available on CD-ROM from AAAI at orders05@aaai.org.

This year's Innovative Applications award winners illustrate that recently-deployed, cutting edge AI applications continue to be found around the world across a vast expanse of industries running operations underground, on the ground, in the ocean, in the air, and into space. They include the following:

General Electric Company / Genworth Financial—Automating the underwriting of insurance applications. Look under the covers of this \$98 billion company with annual sales of \$11 billion, and you will find an innovative AI-based underwriting system that is giving this insurance giant a competitive advantage. The automated underwriting system processes 3,500 applications per week for longterm care insurance, with near 100 percent accuracy, which has improved decision consistency, significantly reduced the number of incorrect decisions, and saved an estimated \$500,000 annually in telephone follow-up. In May of 2004, Genworth Financial was spun off from the General Electric Company. At the time of the IPO, stock analysts specifically cited this advanced technology as one of the key advantages GNW has over its competitors.

ConfigWorks, University Klagenfurt and Bausparkasse Wustenrot (Austria)—Knowledge-based interactive sales tool for financial services. This software assists sales representatives in determining personalized financial service portfolios for their customers. Commercially introduced in 2003, FSAdvisor is licensed to a number of major financial service providers in Austria. The tool is generalizable to nonfinancial areas as well.

MTR Corporation for the Hong Kong subway system—Automatic planning and scheduling of maintenance and re-

pair work. The Hong Kong MTR metro system carries 2.4 million passengers each weekday, compared with New York's subway system which carries roughly one-tenth that number, and is punctual more than 99 percent of the time. Each night the system is shut down at midnight for only 4 to 5 hours, during which time all necessary maintenance and repair work is performed. This AI-based system streamlines scheduling the maintenance work—maximizing the number of jobs done while ensuring operational safety and resource availability.

DCS Corporation for the U.S. Navy and Marine Corps—Planning software to load, store, and release weapons for the F-18 aircraft. This planning software can create legal and safe plans for loading weapons, determine flight restrictions, create safe weapon release sequences and determine weapons delivery restrictions throughout the entire flight scenario for F-18 aircraft. This system has been in use by the Super Hornet community (pilots, and so on) for approximately 2.5 years.

National Oceanic and Atmospheric Administration and Northrop Grumman—Decision support system for monitoring U.S. maritime environment. In support of NOAA's mission goal of ensuring safe, efficient, and environmentally sound maritime commerce, this AI-based application helps NOAA personnel monitor, process and disseminate maritime sensors-based information. This is especially important because 98 percent of all cargo entering the U.S. passes through the nation's ports and harbors, and nearly half of it is classified as hazardous.

NASA-Kennedy Space Center and University of Central Florida—Autonomous monitoring of the space shuttle's telemetry stream during ground operations. This system aids engineers with monitoring the data stream from the space shuttle and its ground equipment including environmental controls and hardware that loads propellant. It currently monitors some 50,000 temperatures, pressures, flow rates, liquid levels, turbine speeds, voltages, currents, valve positions, switch positions, and many other parameters that must be controlled and monitored. The system handles an incoming data stream that averages 1,800 changes per second, and 18,000 changes per second peak at launch. The system has been used for over half a year,

with more and more Shuttle engineers relying on the system each month.

Texas A&M University—Automated crystallographic protein structure determination. This system uses a variety of AI techniques to automate the process of determining the 3D structure of proteins by x-ray crystallography. It is being used by crystallographers around the world—both in industry and academe, saving up to weeks of effort to determine just one protein structure. Such techniques are critical to the structural genomics initiative, a worldwide effort to determine the 3D structure of all proteins.

Emerging AI Applications

In addition to the award-winning applications that are fully deployed, the Innovative Applications of AI (IAAI-05) conference recognizes emerging applications that are using AI techniques in ways that demonstrate significant promise point significant trends, including applications in the following areas:

Intelligent Web Services: Autocategorization of Web-based pictures of people (Google and Carnegie Mellon University).

Antiterrorism / Emergency Response: Simulator for teaching police force allocation in urban environments (University of Fortaleza, Brazil). Training tool to coordinate various disaster/emergency response entities (such as fire or police) (University of Southern California, Carnegie Mellon University).

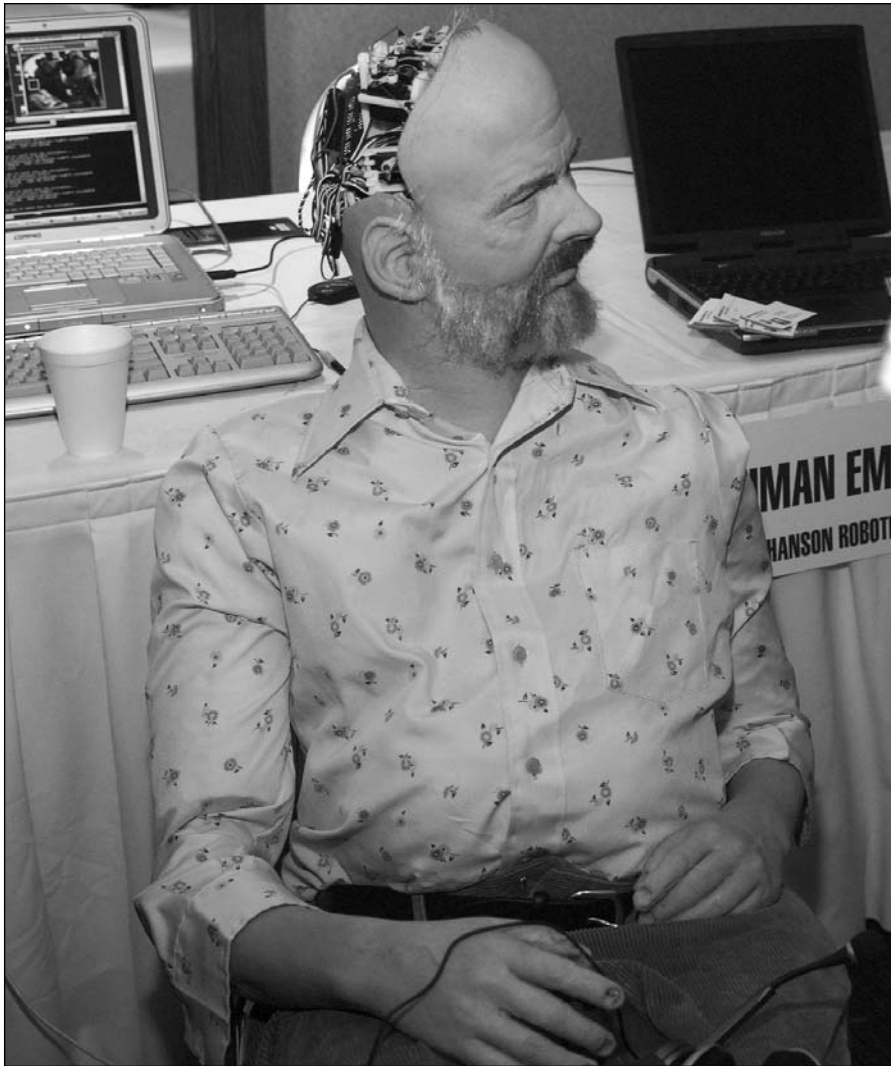
Health Care: Autonomous long-term patient health monitoring using a network of lightweight sensors (Childrens Hospital Los Angeles/University of Southern California). Recognizing user activity (such as falls) from sensors (Rutgers University).

Computer Science: Network security (Cycorp); autonomic self-reconfiguring computer systems (IBM India, IBM Zurich). AI for adaptive games (Lehigh University; Maastricht University, The Netherlands; Naval Research Laboratory).

Intelligent Environments: Automatic learning for automation (University of Texas at Arlington).

Electric Power Industry: Optimization of power distribution (Boreas Group, Maverick Technologies America).

Aerospace: Deep Space Network scheduling (Jet Propulsion Laboratory, Caltech).



The Robotic Interactive Sculpture.



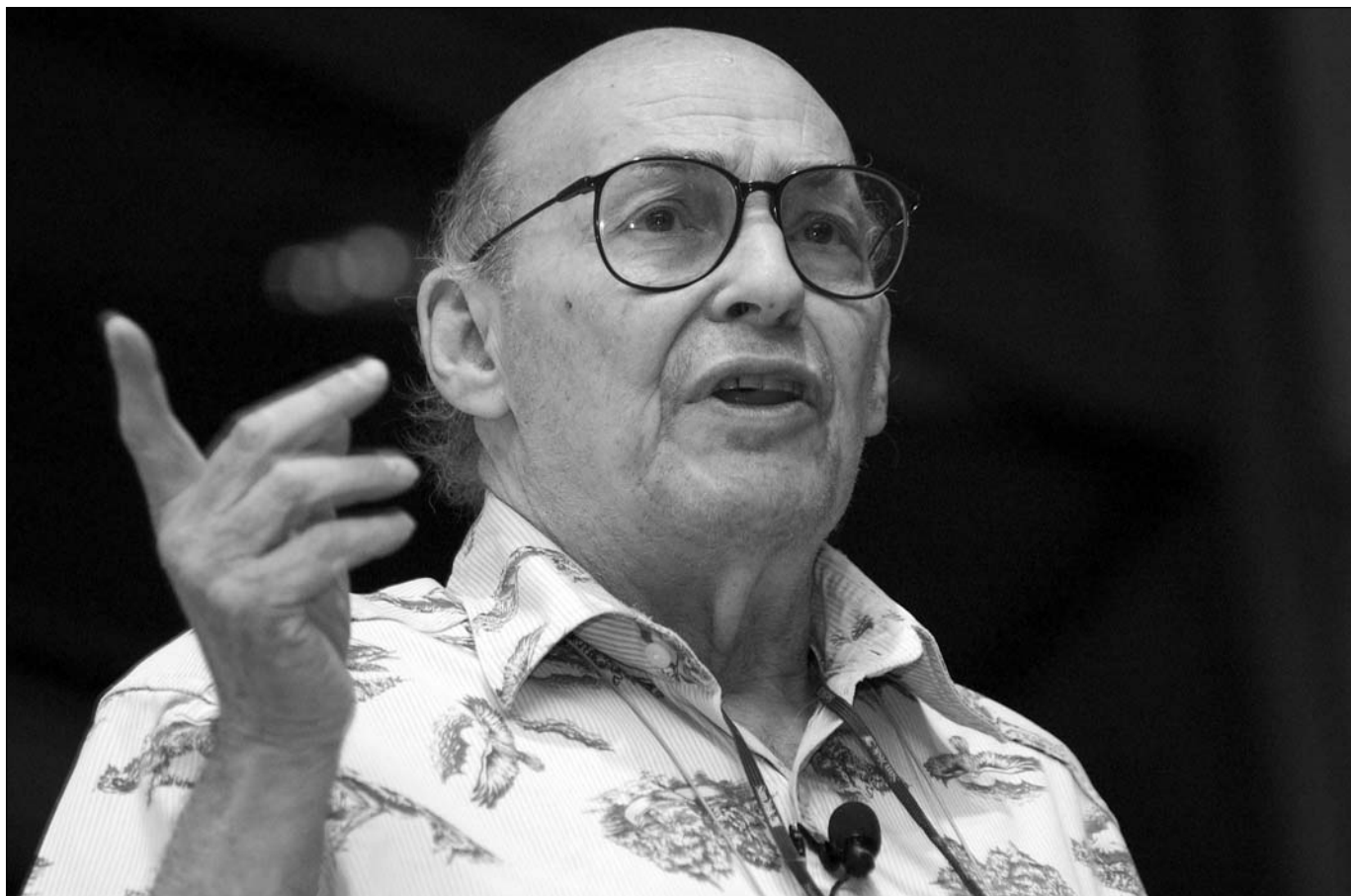
AAAI President Ron Brachman.

man intervention. Unlike specialized game playing systems such as Deep Blue, they do not rely on algorithms designed in advance for specific games. Prior to the competition, players were told nothing about the games to be played: the rules of all games were transmitted to the players electronically at the beginning of each game.

A look at the evolution of the Autonomous Mobile Robot Competition is a quick trip through the growing complexity and capabilities of robots. In the earliest days of the competition, the big events challenged robots to navigate through very simple mazes simulating office hallways to find a specific office or meeting room. In this year's competition, now in its fourteenth year, robots competed in the actual halls of the conference space where they had to avoid hitting humans and robots in real time, find their way to the conference registration desk, register, and give a talk. Other robots competed based on their social interaction skills.

Some highly intriguing and innovative experimental robots participated in this year's Robot Exhibition. A robot team from the University of Missouri-Columbia and the Naval Research Laboratory demonstrated the use of a sketch pad interface to an interacting team of robots. Instead of having to preload a quantitative map of an environment for a mobile robot, this approach promises a more flexible way to describe an environment qualitatively on-the-fly to robots. A peer-to-peer robot-human soccer team both on Segue Scooters from Carnegie Mellon University drew big crowds. A number of socially interactive robots were on display from the University of Sherbrooke, Quebec, including a two foot tall stuffed toy robot being used to help teach autistic children.

Perhaps the most eye-popping robot in this year's exhibition was Phil—a "Robotic Interactive Sculpture" that looked like the late science fiction writer Philip K. Dick. Phil won the open interaction competition. Looking rather like an animated Madame Tussaud figure, the potbellied robot sat in a chair chatting about his



Keynote speaker Marvin Minsky.

novels and personal habits. He made eye contact, smiled and scowled, powered by 37 servos that moved its face and four in its neck. Close to believable, it was a bit eerie to see the back of its skull uncovered and stuffed with mechanical devices and wires.

Pushing the Envelope

But the conference was not just a place to learn of today's cutting edge AI research and applications. It was a time of some big picture soul searching to examine anew the nature of the brain and intelligence. The highly distinguished Marvin Minsky was this year's keynote speaker. His talk was based on his forthcoming new book, *The Emotion Machine*, which he described as "a sequel to my book *The Society of Mind*." In his provocative talk, Minsky addressed the question, "Why we don't have truly intelligent machines yet. Although there have been terrific achievements such

as Deep Blue beating the chess champion," said Minsky, "there is no program that shows the resourcefulness of a two year old."

"As usual, I was inspired by Minsky's talk," notes Mackworth. "In one sentence he can challenge the presuppositions of an entire discipline. For example, 'neuroscience has no theory for the middle level,' and 'learning machines must be reflective,' and 'the solution to the mind-body problem is computer science.' He's thought deeply about various fundamental neuroscience, computational, psychological and philosophical problems and shared some great insights."

There were so many highlights to the conference. For new AAAI President Mackworth, a number of the invited talks were real highlights. "Tucker Balch, for example," says Mackworth, "showed how to model social insect behavior using simple multiagent models, and demonstrat-

ed how to validate those models using real insect experiments. This is really exciting new science: showing two-way interactions between AI and zoology. The Hendler and Tenenbaum talks demonstrated the impact and potential of AI applications on Web functionality and technology."

Conferences Celebrate AAAI's 25 Years

"There was a lot of evidence that AI is in a healthy state," says Mackworth. "The conferences were full of exciting new ideas and applications. Our field is reaching out to many related disciplines in an inclusive way. That to me is a sign of maturity: we are no longer insecure as a discipline. I was particularly excited to see lots of newcomers—plenty of students and new energy and researchers from those related disciplines. The buzz and ferment around the poster session, which I thought was the most suc-



A Robot Registering for the Conference.

cessful I've ever seen, was truly remarkable.

"All in all, he concludes, "the conferences were a huge celebration of AAAI's success over the last 25 years. A lot of the credit must go to all the AAAI staff who work so hard to provide the means to allow us to get together and function as a community."

Next Year: Milestone Anniversary of AI in Boston

AAAI is already planning for next summer. The AAAI-06 and IAAI-06 conferences will be held July 16-20 in Boston. 2006 will hold special signifi-

cance as it is the fiftieth anniversary of the Dartmouth Conference that launched AI research in the US. So stay tuned ...

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