

AI News Bulletin

Emerging Trends in AI for the Media



FALL 2004 ■ AMERICAN ASSOCIATION FOR ARTIFICIAL INTELLIGENCE

2004 National Conference on Artificial Intelligence:

A Brief Synopsis of Current Trends

A number of trends in artificial intelligence emerged recently at the 2004 National Conference on Artificial Intelligence. The conference is sponsored by the American Association for Artificial Intelligence (AAAI).

In this issue of the *AI News Bulletin*, we cover the highlights from the conference. Please contact Sara Hedberg (hedberg@aaai.org or 425-643-5310) if you want further information or contacts.

The 120 accepted technical papers at the conference covered a broad array of research topics. A full list of papers can be found at www.aaai.org/Conferences/National/2004/aaai04.html under AAAI-04 Proceedings Contents. The Proceedings from the conference are available in book or CD form from MIT Press (<http://mitpress.mit.edu>).

AI for Counter-Terrorism, Defense and Emergency Response

For decades, the Department of Defense has been a major funding source for AI research and applications. Since the tragedies of September 11, there is a new urgency to develop and field AI systems to aid the intelligence, defense, and emergency response communities. While much of this work remains cloaked in secrecy, this year's AI conference included a number of papers on related topics, such as "Identifying Terrorist Activity with AI Plan Recognition Technology" by researchers from SRI International and Palo Alto Research Center; "Coordination Managers for First Responders" by researchers from Honeywell Laboratories; "Synthetic Adversaries for Urban Combat Training" by researchers from the Univer-

sity of Michigan and Soar Technology, Inc.; "Agent-based Simulation of Geo-Political Conflict" from Soar Technology, Inc. and General Dynamics—Advanced Information Systems; and "The KOJAK Group Finder," a data mining application for the intelligence community, from USC Information Sciences Institute,

In addition, AAAI's Mobile Robot Competition 2004 included a "Search and Rescue" program. This event challenges the mobile autonomous robots to navigate through the rubble in a simulated fallen building to find victims and direct human rescuers to victims. The course is provided by the National Institute of Standards and Technology in the hopes that researchers will make advances in robots for search and rescue efforts.

By way of background, in 2001, entrants in this event had barely re-

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turned home after the competition, when tragedy struck on September 11. Several teams that had participated in the competition rushed to Ground Zero in New York City to assist with the search and recovery efforts (see <http://www.aaai.org/Pressroom/Releases/release-02-0910.pdf> for more information).

AAAI's Intelligent Systems Demonstrations 2004 also included several prototype systems in this domain such as "Coalition Search and Rescue—Task Support," and "Agent-Based Modeling with Social Networks for Terrorist Recruitment."

The *AI News Bulletin* is published periodically by The American Association for Artificial Intelligence, 445 Burgess Drive, Menlo Park, California 94025. Copies are available from the association's web site at www.aaai.org/Pressroom/.

For more information about the contents of this newsletter, contact Sara Hedberg, AAAI Media Liason at hedberg@aaai.org.

Space Exploration – AI's Role

The country's vision for space exploration and the central role of AI were the focus of the keynote speaker at this year's National Conference on AI (AAAI-04). Daniel J. Clancy, NASA Ames (Acting) Director for Information Sciences and Technology Directorate, discussed the joint human-robotic exploration of the solar system, starting with a return to the moon and then the human exploration of Mars. In addition, he discussed the plans for a continued array of robotic missions to Mars and other destinations. Clancy surveyed how AI will play a key role in these efforts.

In addition, two papers from NASA Ames researchers were presented at this year's conference, and a demonstration was given of the autonomous science on the EO 1 spacecraft.

Mobile Robots Update

Robotics is seen by some as the capstone of AI research and applications. It brings together diverse threads of AI research such as vision, planning, sensor fusion, natural language, face recognition, and more. AAAI's Thirteenth Annual Mobile Robot Competition and Exhibition challenged teams from universities, colleges and research laboratories to compete and demonstrate state of the art research in robotics and AI. There were three events: (1) the Robot Challenge— competing robots were challenged to register, volunteer, and give talks at the conference, (2) Rescue Robot, which challenged competitors in a simulated fallen structure to find human victims and direct human rescuers to the victims, and (3) the Open Interaction Task, which involved human-robot interaction in an unstructured environment

In his talk "Real Robots for the Real World," invited speaker Sebastian Thrun from Stanford University described the Groundhog robot system designed to map abandoned mines.

According to a 1991 survey "tens of thousands, perhaps even hundreds of thousands, of abandoned mines exist in the United States. Not even the U.S. Bureau of Mines knows the exact number, because federal recording of mining claims was not required until 1976." Thrun presented some recent innovations in robotic mapping and exploration of unknown and hazardous environments. The Groundhog system was a joint effort between leading researchers at two of the leading robotics research centers—Stanford University and Carnegie Mellon University.

Computers—Getting Smarter?

AI technology is an integral component of current and future trends in intelligent computing. AAAI-04 included a number of talks and papers by noted experts in this field. Peter Norvig, Google Director of Search Quality, spoke about AI trends in Web search engines. Alex (Sandy) Pentland, Director of Human Dynamics Research at the Massachusetts Institute of Technology's Media Laboratory, discussed trends in wearable machine perception to characterize, annotate, and influence face to face interactions. He asserted that such technology can augment people's memory, initiate productive interactions, and improve group decision making and distributed work force functioning. Tim Finin, of the University of Maryland, discussed emerging trends in software agents. There were also several papers presented in this domain.

AI in Health Care and Elder Care

The world's population is rapidly aging. Some are predicting a coming "crisis in caregiving." Some assert that intelligent technologies have the potential to help avoid this crisis by providing people with ways to adapt to the physical and cognitive changes that can accompany aging. In her talk "Intelligent Technology for Adaptive Aging," Martha Pollack of the University of Michigan described the state-of-the-art in such technology, highlighting the important role of AI. Two related papers were also presented: "A Robotic Wayfinding System for the Visually Impaired," and "The Independent LifeStyle Assistant."

Scientific Research

Much scientific research is so data-rich that traditional information management, extraction and analysis tools are ineffective. The latest AI techniques to assist with biomedical research, cross-disciplinary and large-scale experimentation and analysis were presented in invited talks, papers such as "Machine Learning for Adaptive Image Interpretation, and a panel discussion.

Education

Intelligent computer-assisted instruction (ICAI) continues to be a frontier of computer science. Several IAAI papers were presented on innovative ICAI.

Manufacturing / Business

For more than two decades, manufacturing has been a very fruitful domain for AI applications. As recipients of this year's Innovative Applications of AI award, several of the earliest major corporate investors in AI technology received awards for strategic, high-impact AI-based applications, including General Motors, Ford Motor Company and General Electric.

Innovative Applications of AI 2004 Conference

Summary of Award-winning and Emerging AI Applications

Since 1989, the American Association for Artificial Intelligence has sponsored the Innovative Applications of Artificial Intelligence Conference. IAAI awards spotlight recently deployed applications that make a significant impact on an organization, and yield an impressive return on investment. Further, these applications utilize AI technology in novel ways, pointing the way towards new trends in intelligent systems.

A look back through the fifteen years of the conference award winners yields a glance at the evolution of the field. For a summary of applications from the past three conferences, please visit the AAAI e-Press Room's Background Information page in <http://www.aaai.org/Pressroom/Backgrounders/backgrounders.html>. There you will find a host of award-winning applications from major corporations and government agencies.

In 1997, AAAI expanded the scope of the Innovative Applications conference. Recognizing the growing number of emerging applications that were still in a pilot phase, a second track was added to the conference. The emerging applications selected for this track, while not yet fully deployed, are far enough along in their development process to indicate that the approach is useful and development may continue to fruition and eventual deployment.

Elsewhere in this newsletter are summaries of each of the 24 applications selected for this year's IAAI conference—four deployed, award-winning applications, as well as twenty emerging applications. The Proceedings of IAAI-04, including the complete technical papers describing each application, are included in the AAAI-04 Conference Proceedings available from The MIT Press (<http://mitpress.mit.edu>).

IAAI-04 Award Winners

Ford Motor Company. "Ergonomics Analysis for Vehicle Assembly Using Artificial Intelligence" analyzes potential ergonomic concerns to reduce workplace injuries and their associated costs and lost productivity. The system has also become a global repository for standardized engineering process and data for assembling all Ford vehicles, including parts, tools and standard labor time. This application is saving Ford over \$17 million in avoided injuries and has stopped over 1,100 process sheets with potential ergonomic problems from reaching assembly plants.

General Electric Plastics. "Tenth Anniversary of the Plastics Color Formulation Tool." Since 1994 this case-based reasoning tool has been employed by GE Plastics, which manufactures many of the world's polymers, and has operations on 5 continents. The system determines the colorants and amounts to be added to plastics to match a given color—a complex, multi-variable problem. The system has saved GE millions of dollars in productivity and material costs, such as saving 22,500 hours of work per year developing test chips for customers (a free service to customers). Colorant cost savings are conservatively estimated at \$2.4 million annually.

General Motors R&D Center. "The General Motors Variation-Reduction Adviser: Deployment Issues for an AI Application." This case-based reasoning knowledge system is in use in a dozen GM assembly centers to support quality improvement for various assembly line processes. The original system was written in English; now there are Spanish and German versions as well. The business case is sketched out in this award winning paper, although GM provides no details for competitive business reasons. Testament to the value of the system is best demonstrated by the fact that the system is being deployed to all GM assembly centers and is in daily use in all the centers where it is currently deployed.

National University of Singapore. "Making Better Recommendations with Online Profiling Agents." Use of complex, adaptive autonomous agents with prior domain knowledge (such as real estate) assist users in identifying requirements, especially unstated ones, quickly and unobtrusively.

Emerging Applications

Honeywell Laboratories. "An Application View of COORDINATORS: Coordination Managers for First Responders." This DARPA- and Honeywell-sponsored research paper describes coordination manager agents that provide decision support to first response teams by reasoning about who should be doing what, when, with what resource, and so forth.

Honeywell Laboratories. "The Independent LifeStyle Assistant: AI Lessons Learned." This experimental automated monitoring and caregiving research system integrates emerging home automation devices and augments them with reasoning to create an intelligent, coherent, useful assistant that supports independent living for the elderly. Field tested in 2003 to test the monitoring of medication and mobility.

Lehigh University. "CaBMA: Case-Based Project Management Assistant" adds a knowledge layer on top of a commercial project management tool, MS Project, enabling case reuse. Automatically extracts cases from user interactions with MS Project.

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NASA Ames. "A Comparison of Techniques for Scheduling Earth Observing Satellites." Currently the approximately 60 scientific and commercial Earth observing satellites are scheduled with manual coordination and are chronically oversubscribed—there are more requests than can be satisfied. This study compared thirteen alternate scheduling algorithms on test cases.

NASA Ames Research Center. "SOFIA's Choice: An AI Approach to Scheduling Airborne Astronomy Observations." SOFIA (stratospheric observatory for infrared astronomy) is NASA's next generation airborne astronomical observatory, a modified 747-SP with a 2.5 meter telescope, scheduled to commence operations early in 2005. The scheduler will plan flights and observation sequences taking into account such considerations as the position and time at which the observation begins, telescope elevation limits and available fuel.

Northwestern University. "VModel: A Visual Qualitative Modeling Environment for Middle School." This system helps middle-school students learn by enabling them to create qualitative models. The system has been used successfully to help students in several studies in Chicago Public School classrooms.

Simon Fraser University. "The U.S. National Football League Scheduling Problem" describes a prototype system developed for the National Football League to produce schedules satisfying a number of preferences and constraints.

Soar Technology, Inc. "Agent-based Simulation of Geo-Political Conflict" describes a framework for building executable models for conducting regional analysis to detect possible crises and provide decision makers with reasonable, supportable, explainable possible future scenarios. It allows intelligence analysts to hypothesize about relationships between countries, and to explore events and decisions leading up to conflict.

Soar Technology Inc., University of Michigan. "Synthetic Adversaries for

Urban Combat Training." This paper describes requirements for synthetic adversaries to be used in urban combat training, and MOUTBots, a prototype application.

SRI International, Palo Alto Research Center. "Identifying Terrorist Activity with AI Plan Recognition Technology" describes a proof-of-concept prototype that supports human intelligence analysts in processing national security alerts by automatically identifying the hostile intent behind them.

University of Alberta. "Machine Learning for Adaptive Image Interpretation" is a tool for interpretation of aerial images. It is being considered for deployment at the Alberta government natural resources office for identification of forest fire burn boundaries and validation of commercial thinning practices. It is also being tested as an approach for brain tumor detection in magnetic resonance imaging scans in cooperation with the Alberta Cross Cancer Institute.

University di Chieti-Pescara, University of College Cork. "Detecting and Eliminating the Cascade Vulnerability Program from Multilevel Security Networks Using Soft Constraints." This software offers a promising new approach to help ensure multilevel security across a network.

University of Michigan. "AI Characters and Directors for Interactive Computer Games." This team is investigating the role of advanced AI in interactive, story-based computer games with complex characters.

University of Southern California, Information Sciences Institute. "Artemis: Integrated Scientific Data on the Grid" describes a scientific data analysis system that integrates petabyte-sized distributed data repositories across organizational boundaries.

University of Southern California, Information Sciences Institute. "The KOJAK Group Finder: Connecting the Dots Via Integrated Knowl-

edge-Based and Statistical Reasoning" describes a discovery system that finds hidden groups and group members in a large evidence database. It is intended as an aid to law enforcement and intelligence agencies in their efforts to detect and prevent illegal and fraudulent activities as well as threats to national security.

University of Southern California, Institute for Creative Technologies. "An Explainable Artificial Intelligence System for Small-unit Tactical Behavior." This paper describes the AI architecture and associated explanation capability used by a U.S. Army computer training system.

University of Southern California, Institute for Creative Technologies. "Branching Storylines in Virtual Reality Environments for Leadership Development." This paper describes a simulation-based leadership training system that supports branching story lines realized within a virtual reality environment.

University of Texas at Austin. "Towards Autonomic Computing: Adaptive Job Routing and Scheduling" describes a new network simulator designed to study the application of machine learning methods from a system-wide perspective. The system is also used for job routing and scheduling in the simulated networks.

Utah State University. "A Robotic Wayfinding System for the Visually Impaired." This paper describes an indoor assisted navigation system with a mobile robotic base and sensors mounted on the robot and in the indoor environment.

Zhejiang University, University of Hong Kong, Hong Kong Baptist University. "Automatic Generation of Artistic Chinese Calligraphy" describes a novel intelligent system that generates new Chinese calligraphic artwork in a variety of styles automatically and in real time with only a limited number of samples.