



**American Association for Artificial Intelligence**

## **Sixteenth Conference on Innovative Applications of Artificial Intelligence**

### **IAAI-04 SUMMARY OF 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 due to their use of artificial intelligence techniques. 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 [www.aaai.org/Pressroom/Backgrounders/backgrounders.html](http://www.aaai.org/Pressroom/Backgrounders/backgrounders.html). There you will find a host of award-winning applications by 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.

This white paper summarizes each of the 24 applications selected for this year's IAAI conference – four deployed, award-winning applications, as well as 20 emerging applications. The Proceedings of IAAI-04, including the complete technical paper describing each application, are available from MIT Press ([mitpress.mit.edu](http://mitpress.mit.edu)).

### **IAAI-04 AWARD WINNERS**

This year's four award-winning applications represent a diverse set of deployed applications, each making a significant impact within their organizations.

<b>Organization:</b>	<b>Ford Motor Company</b>
<b>Application Title:</b>	<i>Ergonomics Analysis for Vehicle Assembly Using Artificial Intelligence</i>
<b>Summary:</b>	Analysis of 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.

**Return on Investment:** Cost savings of over \$17 million in avoided injuries; stopped over 1100 process sheets with potential ergonomics problems from reaching assembly plants; reduced the workload of ergonomics engineers by 20%; improved initial composition of process sheets; all process improvements described supported both by Ford management and the Union of Automobile Workers.

**AI Technology:** Lispworks and Knowledgeworks tools (Xanalys Corporation)

**Organization:** **General Electric Plastics**

**Application Title:** *Tenth Anniversary of the Plastics Color Formulation Tool*  
**Summary:** Since 1994 this tool has been employed by GE Plastics, which manufactures many of the world's polymers, and has manufacturing and sales sites on 5 continents. The system determines the colorants and amounts to be added to plastics to match a given color – a problem that is much more complex than it sounds with multiple variables.

**Return on Investment:** Saved GE millions of dollars in productivity and material costs; saves 22,500 hours of work per year of developing test chips for customers (a free service to customers); colorant cost savings conservatively estimated at \$2.4 annually since 1996.

**AI Technology:** Case-based reasoning

**Organization:** **General Motors R&D Center**

**Application Title:** *The General Motors Variation-Reduction Adviser:  
Deployment Issues for an AI Application*

**Summary:** Knowledge system in use in a dozen GM Assembly Centers to support quality improvement for various assembly line processes. The original system is in English; now there are Spanish and German versions.

**Return on Investment:** The business case is sketched out in the paper. No details are available 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.

**AI Technology:** Case-based reasoning

**Organization:** **National University of Singapore**

**Application Title:** *Making Better Recommendations with Online Profiling Agents*  
**Summary:** Use of complex, adaptive autonomous agents with prior domain knowledge (e.g., real estate) assist users in identifying requirements, especially unstated ones, quickly and unobtrusively.

**AI Technology:** Machine learning, adaptive autonomous intelligent agents

## **EMERGING APPLICATIONS**

- Organization:** Honeywell Laboratories  
**Application Title:** *An Application View of COORDINATORS  
Coordination Managers for First Responders*  
**Summary:** DARPA- and Honeywell-sponsored research for electronic coordination managers for first response teams using off-the-shelf wireless PDAs; currently being ported to more specialized wearable computing devices.  
**AI Technology:** Software agents
- Organization:** Honeywell Laboratories  
**Application Title:** *The Independent LifeStyle Assistant: AI Lessons Learned*  
**Summary:** Experimental automated monitoring and caregiving research system that integrates emerging home automation devices, augments them with reasoning to create an intelligent, coherent, useful assistant to support independent living for the elderly. Field tested in 2003 to test the monitoring of medication and mobility.  
**Evaluation:** The agent-based system has been retired because, contrary to the researchers' expectations, an agent-based approach significantly increased development effort. Validated the importance of using machine learning techniques.  
**AI Technology:** Agents, ontology, automated reasoning, machine learning
- Organization:** Lehigh University  
**Application Title:** *CaBMA: Case-Based Project Management Assistant*  
**Summary:** 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.  
**Evaluation:** Positive preliminary results  
**AI Technology:** Case-based reasoning
- Organization:** NASA-Ames  
**Application Title:** *A Comparison of Techniques for Scheduling Earth Observing Satellites*  
**Summary:** Currently the approximately 60 scientific and commercial Earth Observing Satellites are scheduled with manual coordination. The satellites are chronically oversubscribed – there are more requests than can be satisfied. This study compared thirteen scheduling algorithms on test cases. NASA funded.

- Organization:** NASA-Ames Research Center  
**Application Title:** *SOFIA's Choice: An AI Approach to Scheduling Airborne Astronomy Observations*  
**Summary:** 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. NASA funded.  
**AI Technology:** heuristic search
- Organization:** Northwestern University  
**Application Title:** *VModel: A visual qualitative modeling environment for middle-school*  
**Summary:** Software system to help middle-school students learn by enabling them to create qualitative models.  
**Evaluation:** Used successfully to help students become modelers in several studies in Chicago Public School classrooms, using curricula developed in collaboration with teachers. "We are particularly encouraged by spontaneous uses of the visual qualitative language by students outside of the software; it suggests that this way of looking at the world is becoming a habit of mind, something that they, not the software, own," according to the paper's authors. NSF funded.
- Organization:** Simon Fraser University (Canada)  
**Application Title:** *The U.S. National Football League Scheduling Problem*  
**Summary:** Prototype system developed for the NFL to produce schedules satisfying a number of preferences and constraints.  
**Evaluation:** Built a successful prototype system that can find playable schedules for the NFL league.  
**AI Technology:** constraint programming, hybrid search schema
- Organization:** Soar Technology, Inc.  
**Application Title:** *Agent-based Simulation of Geo-Political Conflict*  
**Summary:** Framework for building executable models for conducting regional analysis to detect possible crises and provide decision makers with reasonable, supportable, explainable possible future scenarios. Allows intelligence analysts to hypothesize about relationships between countries, and to explore events and decisions leading up to conflict. US Government funded.  
**Evaluation:** Not yet deployed, but system demonstrates efficacy of approach.  
**AI Technology:** Agent-based framework

**Organization:** **Soar Technology Inc., University of Michigan**  
**Application Title:** *Synthetic Adversaries for Urban Combat Training*  
**Summary:** Describes development of virtual opponents for the Office of Naval Research's Virtual Training & Environments program's immersive virtual trainers for military operations on urbanized terrain on standard PC hardware.  
**AI Technology:** SOAR architecture for knowledge representation and execution

**Organization:** **SRI International, Palo Alto Research Center**  
**Application Title:** *Identifying Terrorist Activity with AI Plan Recognition Technology*  
**Summary:** Proof-of-concept prototype of DARPA-funded research system to plan recognition techniques to support human intelligent analysts in processing national security alert sets by automatically identifying the hostile intent behind them. Enables prioritizing and explaining the alert sets for succinct user presentation.  
**AI Technology:** Heuristic plan recognition

**Organization:** **University of Alberta (Canada)**  
**Application Title:** *Machine Learning for Adaptive Image Interpretation*  
**Summary:** Domain-independent tool for interpretation of aerial images. In this paper it considers its use for forest resource management (planting and cutting.)  
**Evaluation:** System presented is being considered for deployment at the Alberta government natural resources office within the next several months. It is being evaluated with respect to 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.  
**AI Technology:** Machine learning

**Organization:** **University di Chieti-Pescara (Italy), University of College Cork (Ireland)**  
**Application Title:** *Detecting and Eliminating the Cascade Vulnerability Program from Multilevel Security Networks using Soft Constraints*  
**Summary:** A new approach to help ensure multilevel security across a network configuration.  
**AI Technology:** Constraint satisfaction, reasoning

**Organization:** **University of Michigan**  
**Application Title:** *AI Characters and Directors for Interactive Computer Games*  
**Summary:** Investigating the role of advanced AI in interactive, story-based computer games with complex characters (such as in the

<b>Evaluation:</b>	Holodeck of Star Trek, The Next Generation), using Unreal Tournament game engine and Soar AI engine. Sufficient implementations of AI agents as actors and directors so actors can perform actions on their own as well as take actions sent by the director. Researchers plan to extend story beyond a single scene to a complete interactive drama (20-30 minutes of game play.)
<b>AI Technology:</b>	Agents/softbots
<b>Organization:</b>	<b>University of Southern California, Information Sciences Institute</b>
<b>Application Title:</b>	<i>Artemis: Integrated Scientific Data on the Grid</i>
<b>Summary:</b>	Scientific data analysis system to integrate distributed data repositories in the petabyte scale on the grid across organizational boundaries. Funded by NSF, Air Force, and Microsoft.
<b>Evaluation:</b>	Demonstration system and plans to move ahead with this work
<b>AI Technology:</b>	query mediator, query planning and execution, ontologies and semantic web tools, intelligent user interface.
<b>Organization:</b>	<b>University of Southern California, Information Sciences Institute</b>
<b>Application Title:</b>	<i>The KOJAK Group Finder: Connecting the Dots via Integrated Knowledge-Based and Statistical Reasoning</i>
<b>Summary:</b>	Link discovery system to find hidden groups and group members in a large evidence database. 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. Funded by DARPA and US Air Force.
<b>Evaluation:</b>	Successfully tested and evaluated on a variety of synthetic databases.
<b>AI Technology:</b>	knowledge representation & reasoning
<b>Organization:</b>	<b>University of Southern California, Institute for Creative Technologies</b>
<b>Application Title:</b>	<i>An Explainable Artificial Intelligence System for Small-unit Tactical Behavior</i>
<b>Summary:</b>	This paper describes the AI architecture and associated explanation capability used by a U.S. Army computer training system. Funded by the US Army.
<b>Organization:</b>	<b>University of Southern California, Institute for Creative Technologies</b>
<b>Application Title:</b>	<i>Branching Storylines in Virtual Reality Environments for Leadership Development</i>

- Summary:** A simulation-based story leadership training system that supports branching story lines realized within a virtual reality environment. Funded by the DoD.
- AI Technology:** Control architectures, mixed-autonomy agents, and natural language
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- Organization:** **University of Texas at Austin**  
**Application Title:** *Towards Autonomic Computing: Adaptive Job Routing and Scheduling*
- Summary:** New network simulator designed to study the application of machine learning methods from a system-wide perspective, and for job routing and scheduling in the simulated networks. IBM and NSF supported research.
- Evaluation:** Experimental results indicate machine learning outperforms heuristic and hand-coded approaches to this problem.
- AI Technology:** Machine learning
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- Organization:** **Utah State University**  
**Application Title:** *A Robotic Wayfinding System for the Visually Impaired*
- Summary:** Indoor assisted navigation system with mobile robotic base and sensors both on robot and mounted in the indoor environment.
- AI Technology:** Robotics
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- Organization:** **Zhejiang University (China), University of Hong Kong, Hong Kong Baptist University**  
**Application Title:** *Automatic Generation of Artistic Chinese Calligraphy*
- Summary:** 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.
- Evaluation:** Meets certain aesthetic requirements as judged by a group of four professional calligraphers and six amateurs.
- AI Technology:** Machine learning, representation, constraint-based reasoning