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Guest Editors' Introduction

Neil Jacobstein and Bruce Porter

■ This editorial introduces the articles published in the *AI Magazine* special issue on Innovative Applications of Artificial Intelligence (IAAI), based on a selection of papers that appeared in the IAAI-05 conference, which occurred July 9–13 2005 in Pittsburgh, Pennsylvania. IAAI is the premier venue for learning about AI's impact through deployed applications and emerging AI application technologies. Case studies of deployed applications with measurable benefits arising from the use of AI technology provide clear evidence of the impact and value of AI technology to today's world. The emerging applications track features technologies that are rapidly maturing to the point of application. The six articles selected for this special issue are extended versions of papers that appeared at the conference. Three of the articles describe deployed applications that are already in use in the field. Three articles from the emerging technology track were particularly innovative and demonstrated some unique technology features ripe for deployment.

We are pleased to publish this selection of articles based on papers from the Seventeenth Annual Conference on Innovative Applications of Artificial Intelligence (IAAI-05), which occurred July 9–13 2005, in Pittsburgh, Pennsylvania. IAAI is the premier venue for learning about AI's impact through deployed applications and emerging AI application technologies. Case studies of deployed applications with measurable benefits arising from the use of AI technology provide clear evidence of the impact and value of AI technology to today's world. The emerging applications track features technologies that are rapidly maturing to the point of application. The six articles selected for this special issue are extended versions of papers that appeared at the conference. Three of the articles describe deployed applications that are already in use in the field. Three articles from the emerging technology track were particularly innovative and demonstrated some unique technology features ripe for deployment.

Deployed Applications

The TEXTAL system ("TEXTAL: Automated Crystallographic Protein Structure Determination" by Kreshna Gopal, Tod Romo, Erik Mckee, Kevin Childs, Lalji Kanbi, Reetal Pai, Jacob Smith, James Sacchettini, and Thomas Ioerger) demonstrates the value of persistence and continuous improvement in the community developing AI applications. One precursor to this application was CHRYSALIS, pioneered at Stanford's Knowledge Systems Laboratory twenty five years ago! TEXTAL infers the atomic structure of proteins from three-dimensional electron density data generated by x-ray crystallography. The system employs a variety of case-based reasoning and pattern recognition techniques to mimic the decision making processes of experts in solving protein structures. TEXTAL is currently available as a web service, and is incorporated as the automated structure determination component in the PHENIX crystallographic computing environment.

Glenn S. Semmel and Ladislau Boloni ("NESTA: NASA Engineering Shuttle Telemetry Agent") describe an application that increases situational awareness for system and hardware engineers during ground processing of the

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Shuttle's subsystems. NESTA uses the JESS open expert system shell, the Eclipse development environment, several hundred monitoring rules, and a variety of near real-time alerts, to monitor some 50,000 parameters of system health. The system implements some of the key program efficiency and safety recommendations made by NASA's *Columbia* Accident Investigation Board.

Another example of incremental AI application improvement is the end-to-end underwriting system developed by GE researchers at Genworth Financial, a 130 year-old business with 15 million customers, $98 billion in assets, and $11 billion in annual sales ("Automating the Underwriting of Insurance Applications" by Kareem Aggour and William Cheetham). This system automated the underwriting process using fuzzy logic rules and an evolutionary algorithm for parameter tuning. Deployed since 2002, the system is now in its third generation. The second generation system automated 19.2 percent of applications, with nearly 100 percent accuracy. Conservative estimates of savings due to error reduction alone were $500,000 per year. This article discusses cultural, process, and system maintenance issues key to the success of deployed AI applications.

Emerging Applications

Robert J. Sárfi and Ashu M. G. Solo describe a system that exploits the distinct advantages of knowledge-based and numerical methods in "Development of a Hybrid Knowledge-Based System for Multiobjective Optimization of Power Distribution System Operations." Their system uses heuristic rules for optimization of network radiality, network parameters, and network performance.

Vasco Furtado and Eurico Vasconcelos combine the power of multiple knowledge-based agents with simulation in "A Multiagent Simulator for Teaching Police Allocation." Student police officers configure a police force according to crime patterns in a region, then interact with the simulation. The ExpertCop tutor agent uses a machine-learning algorithm to identify patterns in the simulation data and formulate questions to the student about these patterns.

AI agents in game environments have become a hot area for research for both commercial and military applications. Marc Ponsen, Héctor Muñoz-Avila, Pieter Spronck, and David Aha focus on the key problem of knowledge acquisition in their article "Automatically Acquiring Domain Knowledge for Adaptive Game AI Using Evolutionary Learning." Dynamic scripting is used to learn what tactics (or action sequences) an AI opponent should select to play effectively against the human player. The adaptive game AI generated by an evolutionary algorithm can automatically fix weaknesses in its tactics and respond to changes in human-player tactics.

Neil Jacobstein is president and chief executive officer of Teknowledge Corporation, now in its twenty-fifth year. He has participated directly in knowledge systems development projects and technical advisory boards sponsored by a wide range of corporate and government customers. Jacobstein was a graduate research intern and consultant at Xerox PARC. He is a crown fellow at the Aspen Institute, and a member of AAAS, IEEE, AAAI, and ACM. He was the 2005 Innovative Applications of Artificial Intelligence conference program chair.

Bruce Porter is a professor in the Department of Computer Science at the University of Texas at Austin and the director of the Artificial Intelligence Laboratory. His primary focus of research and teaching is knowledge systems and related topics such as knowledge representation, question answering, and explanation generation. Porter has served as the chair of the National Conference on Artificial Intelligence (2001) and cochair of the Innovative Applications of Artificial Intelligence conference (2005). He earned his Ph.D. in 1984 from the University of California at Irvine, and received a Presidential Young Investigator award from the National Science Foundation in 1988.