AAAI-93

Eleventh National Conference on Artificial Intelligence
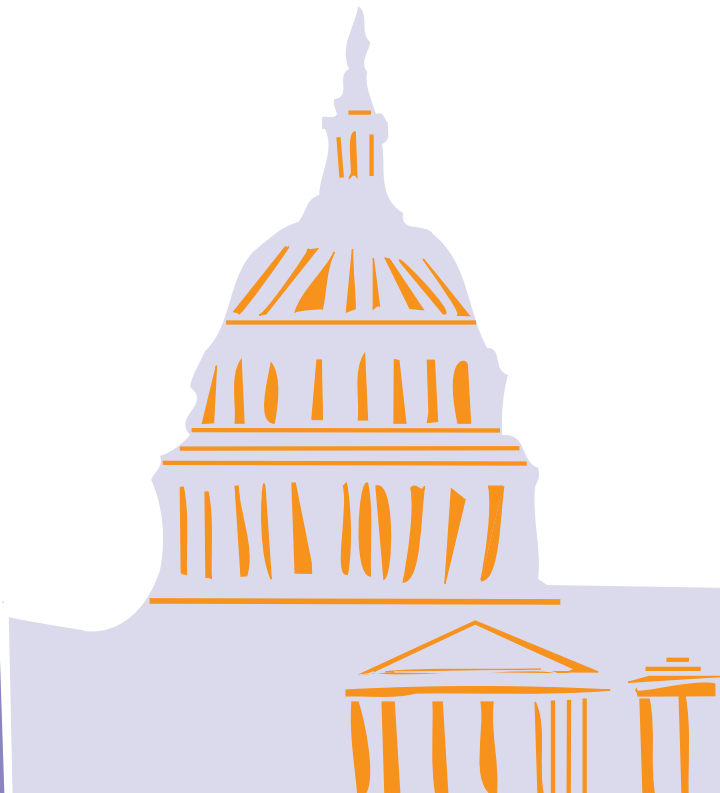
IAAI-93

Fifth Innovative Applications of Artificial Intelligence Conference

July 11 – 15, 1993

Washington Convention Center, Washington, DC

Registration Brochure

Featuring:

✔ **Keynote Address by Herbert Simon**
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✔ **Special Invited Talk by Ed Feigenbaum**
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✔ **Robot Exhibition & Competition**
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Please join us at AAAI–93

Each year the National Conference on Artificial Intelligence (NCAI) is the primary large scale forum where the highest quality new research in artificial intelligence (AI) is presented and discussed. Quality is maintained by a highly competitive review and selection process in which fewer than one of every four submitted papers is accepted.

Papers were solicited for this year's conference that describe significant contributions to all aspects of AI, including the principles underlying cognition, perception, and action in humans and machines; the design, application, and evaluation of AI algorithms and intelligent systems; and the analysis of tasks and domains in which intelligent systems perform. In recognition of the wide range of methodologies and research activities legitimately associated with AI, the conference program includes papers describing both experimental and theoretical results from all stages of AI research. This year we particularly encouraged submission of papers that present promising new research directions by describing innovative concepts, techniques, perspectives, or observations that are not yet supported by mature results. To be accepted to the conference, such submissions were required to include substantial analysis of the ideas, the technology needed to realize them, and their potential impact.

Because of the essential interdisciplinary nature of AI and the need to maintain effective communication across sub-specialties, authors were encouraged to position and motivate their work in the larger context of the general AI community. While papers concerned with applications of AI were invited, most such papers can be found in the program of the Innovative Applications of AI Conference, which is collocated with AAAI–93.

Session chairs will assure that time remains for questions after every paper presentation. We invite you to take advantage of the opportunity to ask incisive questions. The resulting dialog can vitalize a session and be a catalyst for new insights.

In addition to the refereed papers, the program includes a set of invited presentations by leaders of the AI research community and representatives from US government agencies. These presentations include Herb Simon's keynote address; surveys of major AI research areas, such as a talk by Ray Reiter on nonmonotonic reasoning research; symposia on topics of general interest to the AI community, such as a symposia chaired by Paul Cohen on methods for evaluating AI research; and a talk by Steve Cross on the Advanced Research Projects Agency's strategic plan for AI.

The conference this year will include two special events focused on the use of AI techniques to achieve effective behavior in the real world. In particular, we will again be holding a mobile robot competition patterned after the highly successful competition at last year's conference. In addition, we are introducing a robot building contest in which participants will design, build, and program small mobile robots on-site and in real-time.

This multi-faceted conference program is designed to provide attendees with many opportunities for stimulating and enlightening experiences. Come join us!

Richard Fikes & Wendy Lehnert
Cochairs, AAAI-93 Program Committee

AAAI-93 Program

July 11-15, 1993

The AAAI-93 program holds wide appeal for the varying interests of the members of the AI community. Highlights include:

- Three days of technical paper presentations by top scientists in the field
- A series of invited speakers and panels, including the opening keynote address by Herbert Simon
- Twenty four-hour tutorials that explore evolving techniques taught by experienced scientists and practitioners in AI (separate registration fee)
- AAAI–93 / IAAI–93 Joint Exhibition, featuring exhibits and demonstrations
- AAAI Robot Exhibition and Competition, combining a live competition of mobile robots from research labs around the world with video presentations from several US robot manufacturers
- A series of sixteen small workshops with selected focus. (Attendance is limited and determined prior to conference.)

Herbert A. Simon

AAAI-93 Keynote Address

Artificial Intelligence: An Experimental Science

by Herbert A. Simon, Carnegie Mellon University

A review of the journal *Artificial Intelligence* shows a rather steady drift, in recent years, from articles describing and evaluating specific computer programs that exhibit intelligence, to formal, theoretical articles that prove theorems about intelligence. This talk will discuss why a large part of our understanding of intelligence—artificial as well as natural—will continue to depend upon experimentation, and why much theory in AI will be relatively qualitative and informal.

Herbert A. Simon's research has ranged from computer science to psychology, administration, and economics. The thread of continuity through all his work has been his interest in human decision-making and problem-solving processes, and the implications of these processes for social institutions. In the past 25 years, he has made extensive use of the computer as a tool for both simulating human thinking and augmenting it with AI.

Born in 1916 in Milwaukee, Wisconsin, Simon was educated in political science at the University of Chicago (BA, 1936, Ph.D., 1943). He has held research and faculty positions at the University of California (Berkeley), Illinois Institute of Technology, and since 1949, Carnegie Mellon University, where he is Richard King Mellon University Professor of Computer Science and Psychology.

Simon's writings include *Administrative Behavior, Human Problem Solving,* jointly with Allen Newell, *The Sciences of the Artificial Scientific Discovery,* with Pat Langley, Gary Bradshaw, and Jan Zytkow, and *Models of My Life* (autobiography).

Please join us for IAAI-93

The Fifth Annual Conference on Innovative Applications of Artificial Intelligence will showcase the most impressive deployed AI applications of the past year. These applications are winners of a worldwide competition for the best uses of AI technology to solve real-world problems. Winning applications need to be fully deployed and achieve significant business benefit. The organizations honored this year will include many of the most prestigious names in the business world (AT&T, Boeing, Compaq, Ford, IBM, Nynex) and in the government (US Air Force, Department of the Energy, NASA). The IAAI conferences continue to demonstrate and showcase the importance of using AI technology within critical business functions.

Applications will be presented in talks that are accompanied by audiovisual presentations and live demonstrations. Meet-the-author discussions at the end of each session encourage close interaction between presenters and other conference participants. IAAI also includes the AI On-Line panels focusing on issues of particular interest to the business and government communities. For the first time, IAAI-93 will also include invited talks on the emergence of AI as a critical technology in helping organizations cope with change and competition.

IAAI-93 sessions have been scheduled to allow participants to attend Herb Simon's address as well as to engage in some of the other AAAI activities, including tutorials, workshops, and the exhibition. Please join us for a stimulating and rewarding conference!

Philip Klahr   *Elizabeth Byrnes*
IAAI-93 Chair   IAAI-93 Cochair

IAAI-93 Program

Paper Presentations

Sixteen deployed applications will be featured this year at IAAI, on topics such as space science experimentation, material deficiency analysis, eddy current evaluation, intelligent information repositories, outside plant engineering, operations research, jetliner design, and producting scheduling.
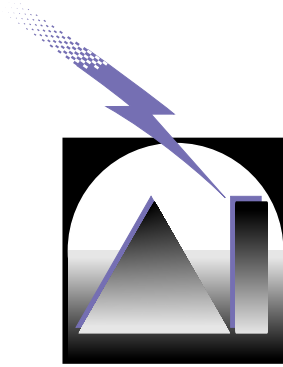
AI-on-Line

Now entering its fourth year, AI-on-Line is a series of issue-oriented panels and talks. Short presentations by users of deployed applications are followed by intensive, interactive discussions. Topics for 1993 include:

- Emerging Technologies
- Transitioning AI Technology into Government Information Systems
- KBS Technology for Industrial Use
- How to Market AI

Special Invited Talk

Tiger in a Cage: The Applications of Knowledge-based Systems

by Edward Feigenbaum, Stanford University

Some pioneers of AI dreamed of the super-intelligent computer, whose problem solving performance would rival or exceed human performance. Their dream has been partially realized—for narrow areas of human endeavor—in the programs called expert systems, whose behavior is often at world-class levels of competence. Their dream was partially transformed by programs that give intelligent help to humans with problems (rather than perform super-intelligently). These are called knowledge systems.

Edware Feigenbaum

Because knowledge is of such central importance to late twentieth century firms and economies, these two types of knowledge-based computer systems offer great economic and competitive leverage. The systems offer remarkable cost savings; some dramatically "hot selling" products; great return-on-investment; speedup of professional work by factors of ten to several hundred; improved quality of human decision making (often reducing errors to zero); and the preservation and "publishing" of knowledge assets of a firm. These benefits will be made vivid by descriptions of knowledge-based systems of prominence in 1993.

These stories of successful applications, repeated a thousand fold around the world, show that knowledge-based technology is a tiger. Rarely does a technology arise that offers such a wide range of important benefits of this magnitude. Yet as the technology moved through the phase of early adoption to general industry adoption, the response has been cautious, slow, and "linear" (rather than exponential). The tiger is in a cage, and we do not yet understand what the bars of the cage are made of. Are there fundamental flaws in the technology that are somehow not evident in "best practice" systems? Is there a specific set of technology transfer problems that arise with knowledge systems but not with other kinds of systems? It is important to the economy to free this competitive tiger, but to do so we must understand its cage.

Edward Feigenbaum is Professor of Computer Science at Stanford University and co-Scientific Director of Stanford's Heuristic Programming Project. A Past President of AAAI, Feigenbaum serves on the DARPA Advisory Committee for Information Science and Technology. Dr. Feigenbaum was elected to the National Academy of Engineering, the Productivity Hall of Fame of the Republic of Singapore, and the American College of Medical Informatics.

Professor Feigenbaum received his BS and Ph.D. from Carnegie Mellon University. His writings include *The Handbook of Artificial Intelligence,* coedited with Avron Barr and Paul Cohen, *Computers and Thought; Applications of Artificial Intelligence in Organic Chemistry: The DENDRAL Program; The Fifth Generation,* with Pamela McCorduck; and *The Rise of the Expert Company,* with Pamela McCorduck and Penny Nii.

6   The Exhibit Program

AAAI–93 / IAAI–93 Joint Exhibition

The exhibit program will offer exhibits and demonstrations by the leading suppliers of AI hardware and software as well as AI consultants and publishers displaying the latest in AI books and periodicals. Graphic presentations by selected exhibitors will be featured in the Applications Pavilion. At the time of publication, 1993 exhibitors include AAAI Press, Ablex Publishing Corporation, Addison-Wesley Publishing Company, AI Expert Magazine, A. K. Peters Publishing, Andersen Consulting, Cambridge University Press, Cognitive Systems Inc., Covia Technologies, Elsevier Science Publishing Company, Exsys Inc., Franz Inc., Gensym Corporation, Harlequin Limited, ILOG, Inc., International Association of Knowledge Engineers, John Wiley & Sons, Inc., Kluwer Academic Publishers, Lawrence Erlbaum Associates, Inc., Lucid, Inc., Morgan Kaufmann Publishers, Naval Research Lab, Neuron Data, OXKO Corporation, *PC AI Magazine*, Pergamon Press Inc., Production Systems Technologies, Southwest Research Institute, Springer-Verlag, Inc. , Talarian Corporation, The MIT Press, Venue, Ward Systems Group, Inc.

Robot Building Event

Lynn Andrea Stein and David Miller

Do you suffer from robot envy? Do you bore colleagues and sponsors with dreary simulations when what you want is robots putting on a show? Are you sick and tired of people asking if you've implemented your system on a *real robot?*

Well here's your chance to change all that. Register now for the First Annual AAAI Robot Building and Talent Event Spectacular!

In this event, participants will design, build, and program small mobile robots onsite and in real-time. The event will begin with the Mobile Robots I tutorial on Monday morning and culminate in a mini-robot-contest on Thursday. At the conference, each team will receive a kit containing sensors, motors, a simple microprocessor control board, and LEGO™. Over the course of the week, teams will assemble these kits into working examples of modern robotic technology.

Constructing a capable robot is not a trivial task. In designing this event, we have taken several steps to ensure that there will be a high rate of success among the participants:

- All participants will be required to attend the Mobile Robots I tutorial. This will ensure that all participants will have a grounding in the critical technical areas.
- Specific materials describing the equipment and some possible techniques to be used in building the robots will be distributed to all participants in advance of the AAAI conference. Participants should arrive at AAAI with preliminary designs for their robots.
- The robot kits will have preassembled and tested electronics and connectors. These steps will greatly reduce the time required for system debugging and wiring—the two most time consuming, but least productive parts of robot building.
- The robot structures will be assembled from LEGO-Technics™, which facilitate rapid prototyping of mechanical systems.
- All participants will be pre-registered and will be sent literature and documentation of the kit and programming environment well in advance of the event.
- The event will be collocated with the robot competition. This will allow participants to draw on the expertise of established roboticists.
- The event will provide teaching assistants who have extensive experience with the laboratory kits.

Participants may pre-register in teams (of three or four people) or as individuals; individuals will be assigned to teams by the event organizers. Participants must also be pre-registered for the Mobile Robots I: Instantiating Intelligent Agents Tutorial. Basic familiarity with computer programming is assumed. However, no prior experience with mobile robotics, hardware, or mechanical design is required or expected. Teams may purchase their robot kits to take home.

Space is limited. To avoid disappointment, we recommend that you *register early!*

Robot Exhibition and Competition

Inaugurated last year, this exciting event will feature a competition among mobile robot entries from research laboratories and universities around the world. The competition will involve three tasks that are typical of an office environment, and that push the limits of current mobile robotics research.

- Escape from the office! Head-to-head slalom event, out of an office and across a finish line.
- Find and deliver. Robots search an office complex trying to find an object and bring it back.
- Block pushing. The added challenge of manipulating the environment to produce a pre-specified pattern.

At the time of print, approximately twenty participants on the forefront of mobile robotics research are readying their robots for the contest. We expect an exciting event, with many teams returning from last year, including the 1992 champion University of Michigan team, who will defend their overall title against an array of hungry challengers.

In addition to the competition, the exhibition will include displays and videos of the latest experimental robotics research. Highlights will include the results of a Legolike robot building workshop conducted just before the exhibition, and recent research on multi-robot coordination.

1993 AAAI Tutorials

The AAAI tutorial program for **1993** features twenty four-hour tutorials that explore evolving techniques. Each tutorial is taught by experienced scientists and practitioners in AI. A separate registration fee applies to each tutorial.

✔ **AI in Customer Service and Support, Including Help Desks (SA1)**
  Avron Barr and Anil Rewari

✔ **Automating the Design of Effective Graphics (MA1)**
  Steven Feiner, Jock Mackinlay, and Joe Marks

✔ **Building Expert Systems in the Real World (SA2)**
  Tod Hayes Loofbourrow and Ed Mahler

✔ **Business Process Re-engineering: Using AI to Change the Organization (SP5)**
  Neal M. Goldsmith and Robert A. Friedenberg

✔ **Case-Based Reasoning: Theory and Practice (MA3)**
  Kevin Ashley and Evangelos Simoudis

✔ **Computational Challenges from Molecular Biology (MA4)**
  Peter Karp and Russ B. Altman

✔ **Design and Implementation of an Intelligent Multimedia Tutor (SP2)**
  Beverly Park Woolf and Tom Murray

✔ **Distributed Artificial Intelligence Tools (SP4)**
  Edmund H. Durfee and Katia P. Sycara

✔ **Experimental Methods in AI (MP4)**
  Paul Cohen and Bruce Porter

✔ **Genetic Algorithms and Genetics-Based Machine Learning (MP3)**
  David E. Goldberg and John R. Koza

✔ **Intelligent Technologies in Transportation (SA5)**
  Lynden Tennison and Scott Smits

✔ **Manufacturing Applications of Integrated Knowledge-Based Systems (SP1)**
  Thomas S. Kaczmarek

✔ **Mobile Robots I: Instantiating Intelligent Agents (MA2)**
  David P. Miller and Marc G. Slack

✔ **Mobile Robots II: Architectures for Reaction and Deliberation (MP2)**
  R. James Firby and Reid G. Simmons

✔ **Multistrategy Learning (SP3)**
  R. S. Michalski and G. Tecuci

✔ **Principles of Probabilistic Diagnosis (SA4)**
  Max Henrion and Eric J. Horvitz

✔ **Probabilistic Causal Modeling (MP5)**
  Judea Pearl

✔ **Qualitative Reasoning for Design and Diagnosis Applications (MP1)**
  Robert Milne and Louise Trave-Massuyes

✔ **Statistical Models in Natural Language Processing (MA5)**
  Eugene Charniak

✔ **Symbolic and Neural Network Approaches to Machine Learning (SA3)**
  Haym Hirsh and Jude Shavlik

SA1 (Sunday, 9 AM – 1 PM, July 11)

AI in Customer Service and Support, Including Help Desks

Avron Barr, Inference Corporation, and Anil Rewari, Digital Equipment Corporation

This tutorial will survey the use of AI technology in customer service and support—areas that are poised to be leading areas for revenue growth for many companies in the 1990's. It is exciting to note that in addition to the conventional rule-based approaches, many of the AI systems currently fielded in customer service and support are using more complex and powerful AI techniques. In this tutorial, we first explore AI techniques being used in developing intelligent applications and tools, such as case-based reasoning, semantic networks, model-based reasoning, neural nets, fuzzy logic, natural language processing, and distributed AI. We also describe real applications in service organizations that use such techniques.

Second, we will focus on service and support areas where AI techniques are being effectively used, such as knowledge-based troubleshooting systems, intelligent information management systems, force planning and dispatch systems, maintenance planning applications, analysis of field feedback data, and automatic letter generation applications. Help desks and call centers will be discussed in greater detail. We then describe and compare some of the popular shells that are available to build service and support applications. Finally, we look at certain current areas of AI research such as knowledge sharing, multi-functional knowledge bases, machine learning, and distributed AI, and argue that customer service and support activities are good testbeds for research and applications using these techniques.

Prerequisite Knowledge: Some familiarity with AI.

Avron Barr is Director of Marketing for Inference Corporation, a leading supplier of advanced application development tools. Barr coedited *The Handbook of Artificial Intelligence*, and was a cofounder of Teknowledge.

Anil Rewari is a Principal Software Engineer at Digital Equipment Corporation's AI Technology Center where he has worked on diagnostic and advisory systems for customer service and support using a variety of advanced AI techniques. Rewari holds a Master's degree in Computer Science (AI) from the University of Massachusetts in Amherst.

8 Tutorials

SA2 (Sunday, 9 AM – 1 PM, July 11)

Building Expert Systems in the Real World

Tod Hayes Loofbourrow, Foundation Technologies, Inc.; and Ed Mahler, DuPont

Building Expert Systems in the Real World will give you an understanding of how those companies that have been most successful in applying knowledge-based systems technology have organized, performed, and managed their activities. The tutorial will give participants a look behind the technology at the organizational steps taken by corporate and divisional managers, project managers, knowledge engineers, functional specialists, and data processing professionals to successfully build integrated knowledge-based systems, and successfully manage knowledge-based systems projects.

You will gain an understanding of the key factors that have led organizations to success in developing integrated knowledge-based systems programs, and an understanding of the strategic choices facing individuals and organizations charged with building knowledge-based systems. You will also learn the concrete steps you can take to improve your ability to successfully develop knowledge-based systems. The tutorial will stress diverse corporate and government examples, and will make use of numerous case studies.

Prerequisite Knowledge: No prerequisites are required or assumed, although familiarity with knowledge-based systems is helpful. This strategic and tactical focused tutorial is targeted at functional specialists in all business disciplines and their supervision; those charged with building and managing knowledge-based system projects; individuals interested in shaping organizational behavior and facilitating business process redesign; information systems professionals and their managers; and knowledge engineers.

Tod Hayes Loofbourrow is President and CEO of Foundation Technologies, Inc., a knowledge technology consulting firm and a teacher of AI courses at Harvard University. He also writes the "Managing Knowledge" column in *Expert Systems* magazine and is a columnist for the *Software Engineering Journal*.

Ed Mahler is known for his highly successful, no-nonsense, business-oriented approach to intelligent systems applications while Program Manager for AI at DuPont. Ed is CEO of E. G. Mahler and Associates, Inc., a knowledge management consulting group located in Wilmington, Delaware. Ed received his B.S. and Ph.D. degrees in chemical engineering from the University of Texas.

SA3 (Sunday, 9 AM – 1 PM, July 11)

Symbolic and Neural Network Approaches to Machine Learning

Haym Hirsh, Rutgers University; and Jude Shavlik, University of Wisconsin

Machine learning dates back to the beginnings of AI, but has seen its most vibrant growth in the last ten years. Building programs that can learn has seen success along two complementary fronts: symbolic and neural-network approaches to inductive learning. After an initial survey of machine learning, this tutorial will focus on symbolic and neural network approaches to inductive learning from examples. The problem is defined as follows: given descriptions of a set of examples each labeled as belonging to a particular class, determine a procedure for correctly assigning new examples to these classes. We provide an overview of both symbolic and neural-network approaches to this problem in a single, unified light that highlights their commonalties and relative

strengths and weaknesses. Quinlan's ID3 and Rumelhart's Backpropagation algorithms will be described and illustrated with simple examples. The approaches taken and the results obtained in applying these algorithms to real-world tasks will be covered. The tutorial will also describe some recent comparisons between ID3 and Backpropagation using real-world data sets. Finally, we discuss the strengths and weaknesses of this form of machine learning, and current research problems in the area.

Prerequisite Knowledge: This intermediate-level tutorial is addressed at computer scientists with introductory textbook experience in AI.

Dr. Haym Hirsh is Assistant Professor of Computer Science at Rutgers University. He received his Ph.D. degree in Computer Science from Stanford University. He is the author of *Incremental Version-Space Merging: A General Framework for Concept Learning*. His current research interests include applications of machine learning in both molecular biology and ship design, as well as computational issues for inductive learning.

Dr. Jude Shavlik is Assistant Professor of Computer Science at the University of Wisconsin. He received his Computer Science Ph.D. from the University of Illinois. He is the author of *Extending Explanation-Based Learning by Generalizing the Structure of Explanations*, and coeditor of *Readings in Machine Learning*. His current research interests include comparing and combining symbolic and neural network approaches to machine learning, as well as the application of machine learning techniques to problems in the Human Genome Project.

SA4 (Sunday, 9 AM – 1 PM, July 11)

Principles of Probabilistic Diagnosis

Max Henrion, IDSR; and Eric J. Horvitz, Rockwell International

Probability and utility theory provide a set of general principles for reasoning and decision making under uncertainty. Now, development of practical knowledge representations and efficient software tools based on these principles are leading to their application to knowledge-based systems for diagnosis and decision support. This tutorial provides you with an overview of probability-based reasoning methodologies.

In this tutorial, you will gain an intuitive feel for key principles of probabilistic reasoning and decision analysis; and a critical appreciation of what kinds of problem are good candidates for application of these methods, and the critical issues for developing successful applications. We will focus on the use of Bayesian belief networks and influence diagrams, as effective representations for knowledge engineering, and for probabilistic reasoning. We will discuss qualitative and quantitative approaches, as well as how to obtain numerical probabilities from expert judgment or data. We will review several successful probability-based reasoning systems, fielded in real-world applications in machine troubleshooting and in medicine. We will also provide an overview of current software tools. Finally, we will review ongoing research in uncertainty in AI, describing the challenges and research opportunities ahead in the construction and use of decision-theoretic reasoning systems.

Prerequisite Knowledge: Previous introductory college level exposure to probability will be helpful —but is not essential.

Dr. Max Henrion is the Director of the Institute of Decision Systems Research (IDSR), in Palo Alto, CA, President of Lumina Decision Systems, and a Consulting Associate Professor at Stanford University. He received his Ph.D. from Carnegie Mellon University, and was founding president of the Association for Uncertainty in AI. He is a coauthor of *Uncertainty*, and editor of two volumes of *Uncertainty and AI*.

Dr. Eric Horvitz is a principal investigator at the Palo Alto Laboratory of the Rockwell International Science Center and a research

affiliate at the Medical Computer Science Group of Stanford's Knowledge Systems Laboratory. He received his Ph.D. from Stanford University. His research interests include the utility-directed control of inference in large knowledge bases, flexible procedures for determining ideal actions under varying resources, and techniques for exploiting the relationships between deliberative and compiled reasoning.

SA5 (Sunday, 9 AM – 1 PM, July 11)

Intelligent Technologies in Transportation

Lynden Tennison, Union Pacific Railroad; and Scott Smits, American Airlines

This tutorial will cover the business areas within transportation companies that offer significant opportunities for intelligent technologies. The focus of the tutorial will be identifying these areas and providing a matrixed approach to match technologies to these business areas. The session will address technologies such as: rule based languages and systems, operations research techniques, heuristic search techniques, inexact reasoning, neural networks, object technologies, intelligent text retrieval and imaging.

Prerequisite Knowledge: The recommended audience includes transportation company automation system planners, developers and managers. Industry consultants or product providers would also benefit from this session.

Lynden Tennison is the Director of Distributed Computing at Union Pacific Railroad. He joined Union Pacific from American Airlines where he managed the knowledge systems organization. He had past assignments with Southwestern Bell Telephone, AT&T, and LTV Aerospace.

SP1 (Sunday, 2 PM – 6 PM, July 11)

Manufacturing Applications of Integrated Knowledge-Based Systems

Thomas S. Kaczmarek, General Motors

The manufacturing organizations that survive today's intensely competitive environment will be those that understand the importance of knowledge. The world class manufacturers of tomorrow are taking action today to insure that their workers are applying corporate knowledge to all phases of their business. Integrated knowledge based systems are being used to support corporate objectives for agility and quality. Integrated knowledge based systems strive to take full advantage of all personal, organizational and information technology capabilities in a balanced approach.

Prerequisite Knowledge: This tutorial will present a survey of opportunities and success stories for integrated knowledge based systems in the manufacturing enterprise. The territory covered will range from deriving customer requirements through design, engineering, tooling, scheduling, operations, supplier interaction, logistics, sales, marketing, customer support , and customer feedback. The tutorial will also present lessons learned to help you take advantage of the opportunities. The lessons learned will help you to prepare your organization to exploit knowledge based systems and provide you with a focused approach for introducing integrated knowledge based systems that will lead you from simple to more complex applications.

Thomas S. Kaczmarek, Ph.D. did his graduate work at the University of Pennsylvania in AI. He was founding manager of the Detroit based knowledge engineering facility of Inference Corporation. While with Inference, he was instrumental in initiating and managing many applications developed for Ford Motor Company. Three of these applications have been presented at the Innovative Applications of Artificial Intelligence. Dr. Kaczmarek is now at GM where he serves as a senior staff member responsible for knowledge based architecture and the integration of knowledge based technology with CAD, CAM, CAE, and CIM systems.

SP2 (Sunday, 2 PM – 6 PM, July 11)

Design and Implementation of an Intelligent Multimedia Tutor

Beverly Park Woolf, University of Massachusetts; and Tom Murray, Asea Brown Boveri Inc.

Recent success in achieving efficient and reliable intelligent tutors demonstrates that these systems can be twice as effective as classroom teaching and can teach in 1/3 the time. This tutorial offers you techniques for building flexible and customizable intelligent tutors and for modifying existing training systems towards increased flexibility and intelligence. We focus on building tutoring systems and developing interface tools for increasing the knowledge of tutors.

We will demonstrate working intelligent tutors, including systems that tutor about complex industrial boilers, concepts of high-school statics and electricity, and advanced cases of cardiac failure. We will describe noteworthy systems in the military, industry and education along with an overview of the capabilities and limitations of current intelligent tutors.

A modular approach will be discussed for making traditional computer-based instructional systems more intelligent by selectively adding simple yet powerful features. High-level design specifications will be proposed along with a structure for supporting the organization of domain and pedagogical knowledge. Practical tools and shells will be demonstrated to enable teachers and trainers to transfer their knowledge to a tutor. For each tutor component we will discuss content covered; alternative representations; control structures for perusing the content knowledge; and possible knowledge acquisition tools.

Prerequisite Knowledge: This tutorial is intended for those who will participate in developing tutoring, training and advisory systems, as well as those who would like a basic understanding of the technology. Minimal familiarity with AI and some computing experience is helpful, but not prerequisite.

Beverly Park Woolf is a research scientist at the University of Massachusetts. She has a Ph.D. in Computer Science and an Ed. D. in Education, both from the University of Massachusetts and has more than 15 years experience in educational computer science research, production of intelligent tutoring systems and development of multimedia systems.

Tom Murray has a Ph.D. in Education. He is affiliated with the Advanced Computation Systems Group of Asea Brown Boveri Inc. His interests include knowledge acquisition of tutoring (including building tools) and domain knowledge.

SP3 (Sunday, 2 PM – 6 PM, July 11)

Multistrategy Learning

R. S. Michalski and G. Tecuci, George Mason University

Multistrategy learning is concerned with developing systems that integrate two or more inferential strategies or computational mechanisms. One of the central and the fastest growing new directions in machine learning, multistrategy learning systems integrate empirical induction with explanation-based learning, deduction with abduction and analogy, quantitative and qualitative discovery, symbolic and neural net

learning, symbolic and genetic algorithm-based learning. Because integrated methods are complementary, multistrategy learning systems sometimes apply to a wider range of practical problems than the more traditional monostrategy systems.

In this tutorial we present an overview of methods, systems and applications of multistrategy learning. First, we will review basic issues in machine learning, analyze learning strategies, and compare existing methodologies. Advantages, limitations and appropriate application areas for monostrategy learning methods will be summarized. Next, we present theoretical foundations, methods and representative systems for multistrategy learning, followed by applications of multistrategy systems, in particular, to areas such as automated knowledge acquisition, knowledge discovery in databases, planning, robotics, engineering design, technical and medical decision making, and computer vision. Finally, we will discuss major current and prospective research directions in multistrategy learning. The materials for the tutorial will include an extensive bibliography of this field.

Prerequisite Knowledge: This tutorial is designed for those who are interested in building advanced learning systems and applying them to various practical domains. Basic introductory-course AI knowledge is highly desirable.

Ryszard S. Michalski is PRC Chaired Professor of Computer Science and Systems Engineering, and Director of the Center for Artificial Intelligence at George Mason University. He cofounded the field of machine learning, co-edited *Machine Learning* , and co-founded *Machine Learning* journal.

G. Tecuci is Associate Professor of Computer Science at George Mason University. He has published over fifty papers in machine learning, knowledge acquisition, AI, advanced robotics, graph theory and compilers.

SP4 *(Sunday, 2 PM – 6 PM, July 11)*

Distributed Artificial Intelligence Tools

Edmund H. Durfee, University of Michigan; and Katia P. Sycara, Carnegie Mellon University

This tutorial will thoroughly survey problems, techniques and applications in contemporary DAI, in preparation for building DAI systems or as background for doing research to advance the state of DAI practice. Particular emphasis will be given to DAI tools and to methodologies for building and evaluating DAI systems. Real-world DAI applications, such as heterogeneous intelligent information systems and coordinated intelligent vehicles, are only beginning to emerge. We hope, through this tutorial, to speed this process by introducing DAI algorithms and paradigms to attendees in practical, rather than only theoretical, terms.

Prerequisite Knowledge: The tutorial presumes knowledge of AI at the level of an introductory course, and familiarity with such general concepts as object-oriented systems, planning, heuristic search, knowledge-based systems, reasoning under uncertainty, and so on.

Edmund H. Durfee received his Ph.D. degree in computer and information science from the University of Massachusetts, Amherst. He is currently an Assistant Professor in the Dept. of Electrical Engineering and Computer Science at the University of Michigan, where his interests are in distributed AI, planning, blackboard systems, and real-time problem solving. He is the author of *Coordination of Distributed Problem Solvers*, and is also a 1991 recipient of a Presidential Young Investigator award from the National Science Foundation.

Katia P. Sycara is a Research Scientist in the School of Computer Science at Carnegie Mellon University. She is also the Director of the Laboratory for Enterprise Integration, where she is conducting research in investigating and integrating decision making across the manufacturing product life cycle. She received her Ph.D. in Computer Science from Georgia Institute of Technology, and is area editor for *Group Decision and Negotiation* journal.

SP5 *(Sunday, 2 PM – 6 PM, July 11)*

Business Process Re-engineering:
Using AI to Change the Organization

Neal M. Goldsmith, Business Technology; and Robert A. Friedenberg, Inference Corporation

There are three central issues in planning for and managing advanced information systems in business: re-designing business processes (also known as business process re-engineering or BPR) through the application of advanced information systems; aligning systems strategy with corporate priorities; and increasing return on investments in emerging information systems through effective technology transfer and change management. If those three things are done well, the battle has been won; if they aren't, it doesn't matter how well anything else is done, we might as well save our money and go home. This tutorial will assist AI professionals in responding to these three crucial challenges.

This tutorial will begin with an overview of basic concepts of strategic alignment, BPR and change management. Following the overview session, case examples will be provided of the techniques used, in some cases literally to turn companies around through re-engineering with knowledge-based tools. After the case examples, attendees will be invited to describe their own experiences and to begin to apply the concepts and cases directly.

Prerequisite Knowledge: This is an introductory tutorial. No formal business background is required.

Neal M. Goldsmith, Ph.D. is publisher of *Business Technology*, a periodical for CIOs that focuses on tools and techniques in business process re-engineering, strategic alignment, ROI and change management. He is also President of Tribeca Research, a technology management consulting firm.

Robert A. Friedenberg, Ph.D. is Vice President of Inference Corporation's Business Process Re-Engineering Consulting Group. Prior to joining Inference Corporation, he was responsible for Coopers and Lybrand's Financial Services and Retail Industry Decision Support practices, and a faculty member of the University of Washington.

MA1 *(Monday, 9 AM – 1 PM, July 12)*

Automating the Design of Effective Graphics

Steven Feiner, Columbia University; Jock Mackinlay, Xerox PARC; and Joe Marks, DEC CRL

The notion of a linguistically articulate computer system—one that can compose natural-language utterances to communicate given information—is the ultimate goal of research in natural-language generation. A complementary notion is that of a graphically articulate computer system, one that can design effective graphics automatically to communicate given information. In this tutorial, we will survey recent research on graphically articulate systems, emphasizing the potential roles for such systems in the next generation of intelligent user interfaces.

In this tutorial, we will present a comprehensive survey of previous and current research on the automated design of effective graphics, organized by the graphic being designed, the type of information being presented, and the target domain; a description of themes and algo-

rithmic techniques that have arisen in the development of graphically articulate systems; detailed case studies of projects that concern business graphics, 2D and 3D graphics for technical documentation, and automated cartography; and possible future applications of this technology.

Prerequisite Knowledge: The tutorial describes current research in an area that is in the intersection of computer graphics, AI, and computer human interaction. The course is intended for intermediate and experienced researchers and developers who are interested in methodologies for intelligent user interfaces. A general background in graphical user interfaces and information presentation will be assumed. Some familiarity with computer-graphics and AI techniques will be useful, though all relevant concepts and terms will be explained.

Steven Feiner is an Associate Professor of Computer Science at Columbia University. His research focuses on interactive 3D graphics, applications of AI to graphics, user interfaces, hypermedia, and virtual worlds. He is co-author of *Computer Graphics: Principles and Practice*.

Jock Mackinlay is a member of the User Interface Research group at Xerox PARC. He has worked on automating the design of various aspects of user interfaces, including graphical presentations and input devices, and on incorporating 3D animation into user interfaces.

Joe Marks is a member of the research staff at DEC CRL. His current research interests include automated cartography, animation, and evolutionary computation.

MA2 (*Monday, 9 AM – 1 PM, July 12*)

Mobile Robots I: Instantiating Intelligent Agents

David P. Miller, MIT AI Lab, and JPL; and Marc G. Slack, MITRE Corp.

Much of the current AI research deals with the actions of embedded agents. Simulations of an agent's environment are often inadequate for effective system evaluation. This tutorial will give you critical information to start embedding your systems in physical agents—mobile robots that can interact with real environments. This tutorial will concentrate on tools and techniques for allowing a physical agent to interact with the real world, including, techniques for mobility and manipulation, sensing, perception, reactive control, and navigation will be covered. Issues of integration of these capabilities with high-level reasoning techniques will also be introduced, providing a connection to Mobile Robots II. We hope to sensitize you to the relevant issues of dealing with mechanical agents and provide you with the tools to create and evaluate your work in the context of these agents. We will demonstrate and discuss the current state of the art in mobile robotics.

Prerequisite Knowledge: This tutorial assumes that the participants have a basic understanding of common AI techniques and programming languages. No previous experience with robotics is required. We recommend you follow this tutorial with Mobile Robots II for a more in depth look at the architectural principles involved in dealing with multiple goals, resource constraints, and other aspects of higher-level reasoning.

David Miller received his Ph.D. in Computer Science from Yale University. He joined NASA's Jet Propulsion Laboratory in 1988 where he ran the Robotic Intelligence Research Group for several years. He is currently on sabbatical at the MIT Artificial Intelligence Laboratory.

Marc Slack received his Ph.D. in Computer Science from Virginia Polytechnic Institute. He is currently a MITRE corporation lead scientist in the Autonomous Systems Laboratory. His current efforts include the development of a robot independent control architecture and support to NASA Johnson's Autonomous systems research program.

MA3 (*Monday, 9 AM – 1 PM, July 12*)

Case-Based Reasoning: Theory and Practice

Kevin Ashley, University of Pittsburgh, and Evangelos Simoudis, Lockheed

The objective of the tutorial is to present the mechanisms and techniques underlying Case-Based Reasoning (CBR) with special emphasis on CBR's potential as an alternative to current expert systems techniques for the development of applications. We will explore both theoretical and practical issues, identify advantages of CBR vis a vis other reasoning methods, and characterize application domains where CBR seems to be most promising.

Prerequisite Knowledge: This tutorial is intended for professionals interested in current CBR research issues, managers interested in alternative methodologies for expert system development, and knowledge engineers considering developing CBR applications. There are no special prerequisites for the tutorial although some experience in designing expert systems and familiarity with basic AI concepts and approaches to representing knowledge and controlling inference will be helpful.

Dr. Kevin Ashley is an Assistant Professor of Law at the University of Pittsburgh School of Law and a Research Scientist at the Learning Research and Development Center. He also is an Adjunct Assistant Professor of Computer Science. His research interests include case-based and analogical reasoning, argumentation and explanation and developing computer systems to assist attorneys in the teaching and practice of law. He received a J. D. from Harvard Law School and a Ph.D. in computer science from the University of Massachusetts .

Evangelos Simoudis is a research scientist in the AI Center of Lockheed Corporation, where he is directing research on knowledge discovery from multimedia databases, and an adjunct assistant professor at the Computer Engineering Department of Santa Clara University. Simoudis received his Ph.D. in Computer Science from Brandeis University in 1991. He has consulted and taught courses in the United States and abroad in the areas of case-based reasoning, knowledge-based design, and distributed AI.

MA4 (*Monday, 9 AM – 1 PM, July 12*)

Computational Challenges from Molecular Biology

Peter Karp, SRI International; and Russ B. Altman, Stanford Program in Medical Informatics

Computational problems in molecular biology provide a rich set of challenges for AI researchers. These problems have the potential to motivate the development of more powerful AI techniques, and to shift the focus of AI researchers from toy problems to real problems with large potential payoffs. This tutorial will introduce computational problems in molecular biology to computer scientists, with an emphasis on challenges to AI. We will provide a brief road map to computational biology in general, and then focus on those problems that are particularly important. Attendees will be exposed to a smorgasbord of problems and provided with a clear problem definition, review of approaches that have been tried, summary of progress-to-date , and distillation of chief lessons that remain within that problem area.

We will begin by surveying computational biology in general, including the fundamental biological notions that will be used throughout the tutorial. We will then provide a breadth-first summary of those problems that may be amenable to solution by AI techniques. Finally, we will discuss four particular problems in more depth, examining issues in technical detail, in order to stress the types of problem that arise when dealing with biological problem and show some of the ma-

jor successes in the field. We will also discuss the research culture of this area.

Prerequisite Knowledge: Tutorial attendees should have a firm understanding of basic issues in computer science. Registrants will receive advance readings on the critical biological concepts.

Russ B. Altman, MD, Ph.D. is an Assistant Professor of Medicine at Stanford University. He received his Ph.D. and MD from Stanford University. His research interests currently focus on new methods for the analysis and prediction of protein structure, especially with respect to probabilistic algorithms and evaluation of uncertainty. He also is interested in the use of abstract representations of protein and nucleic acids for the purposes of more efficient computation.

Peter D. Karp, Ph.D. is a Computer Scientist in the AI Center at SRI International. He received his Ph.D. degree in Computer Science from Stanford University. His current research interests focus on building large biological knowledge bases to support tasks such as design, simulation, and machine learning.

MA5 (Monday, 9 AM – 1 PM, July 12)

Statistical Models in Natural Language Processing

Eugene Charniak, Brown University

Most traditional programs for understanding natural language are limited in domain and fragile in use. One response to this has been a shift to statistical techniques. These techniques work by collecting statistics on large bodies of text and then use the statistics to perform simple tasks, typically without much restriction on domain, and without "bombing. " What makes these methods particularly powerful is that while sometimes the text must be annotated with the correct answers, there is a powerful training algorithm that often allows the models to be trained from raw test. Because they work by training on a large body of text, statistical techniques trade data availability and processing power for "smarts."

One problem that confronts people considering statistical techniques is the seeming impenetrability of the mathematics that underlie them. We will try to overcome this problem first by stressing the intuitive aspects whenever possible and second by showing that the mathematics is not really all that difficult. Tutorial topics will include: everything you need to know about probability theory, statistical models of language and how they relate to speech recognition, entropy and cross-entropy as measures of language models, trigrams as a simple language model, sparse-data problems in trigram models, word-tagging models, finding the best tags using the Viterbi algorithm, how statistical models can be improved using forward-backward training, context-free grammars and chart-parsing, probabilistic context-free grammars and probabilistic chart-parsing, finding the most likely parse, grammar learning, statistical models of prepositional phrase attachment, techniques that can classify words by meaning, finding word senses, statistical models of word-sense disambiguation, applications of statistical models, hidden Markov models, deriving the trigram model from basic assumptions, deriving word-tagging models, finding the probability of a string according to HMM, training an HMM, and training a context-free grammar.

Eugene Charniak is Professor of Computer Science and Cognitive Science at Brown University and the Chairman of the Department of Computer Science. He received his Ph.D. from MIT and is the author of *Computational Semantics* with Yorick Wilks, *Artificial Intelligence Programming* with Chris Riesbeck, Drew McDermott, and James Meehan, and *Introduction to Artificial Intelligence* with Drew McDermott.

MP1 (Monday, 2 PM – 6 PM, July 12)

Qualitative Reasoning for Design & Diagnosis Applications

Robert Milne, Intelligent Applications Ltd.; and Louise Trave-Massuyes, LAAS

Qualitative reasoning is an increasingly significant, but relatively new AI technology now mature enough for serious applications. For applications where the limitations of rule-based approaches cause serious problems, qualitative reasoning techniques provide considerable efficiencies for the development and long term support of an application.

In this tutorial we concentrate on how to develop successful applications using qualitative reasoning. Case studies and examples of application oriented work is used to integrate an introduction to the fundamentals of qualitative reasoning with guidance on how to make applications successful. We explore why most prototypes never become successful applications, and describe strategies to increase the chances of success.

Tutorial topics include qualitative representations, qualitative models, causal representations, qualitative propagation, qualitative simulation, selecting the appropriate paradigm, developing diagnostic, design and other systems, and strategies for building successful applications. We will also summarize current application oriented work using qualitative reasoning, the techniques used by each and the motivations for using qualitative reasoning.

Prerequisite Knowledge: This tutorial will appeal to those involved in engineering development who would like to know how they can use qualitative reasoning for practical applications. A background in basic AI techniques is helpful, but not essential.

Dr. Robert Milne is the Managing Director of Intelligent Applications Ltd., Edinburgh, Scotland He has a B. Sc. in Electrical Engineering and Computer Science with special emphasis on AI from MIT and a Ph.D. in AI from Edinburgh University.

Dr. Louise Trave-Massuyes is a CNRS Researcher at the French National Laboratory LAAS (Laboratory for Automation and Systems Analysis) working on qualitative reasoning techniques for dynamic systems supervision applications in Toulouse, France. She has a Ph.D. from INSA (Toulouse, France).

MP2 (Monday, 2 PM – 6 PM, July 12)

Mobile Robots II: Architectures for Reaction & Deliberation

R. James Firby, University of Chicago; and Reid G. Simmons, Carnegie Mellon University

This tutorial will introduce concepts in architectures for controlling autonomous mobile robots. We will begin by presenting factors that influence modern robotic architectures: actuator and sensor control, complex changing environments, and the desire to perform a wide variety of tasks. The tutorial will quickly make the connection with the reactive (behavior-based) concepts detailed in Mobile Robots I and examine them further through case studies that illustrate specific architecture design principles. We continue with case studies that describe alternative deliberative (hierarchical) and hybrid architecture designs. The strengths and weaknesses of each methodology will be analyzed in terms of the types of tasks and environments it readily supports. Particular attention will be paid to the problems of dealing with uncertainty, complexity, and resource constraints. Finally, we will discuss techniques to guarantee properties of architectures, such as hard real-time response, consistency, or absence of resource deadlock.

Prerequisite Knowledge: This tutorial is intended for those developing or evaluating realistic mobile robotic systems. No previous experience with robotics is required but a basic understanding of AI planning concepts is essential. Mobile Robots I is recommended but not required.

R. James Firby is an Assistant Professor of Computer Science at the University of Chicago. He received his Ph.D. from Yale University. His main interest is the construction of systems that interact with complex, changing environments.

Reid G. Simmons is a research scientist in the School of Computer Science and Robotics Institute at Carnegie Mellon University. He received his Ph.D. from MIT. His research has focused on developing self-reliant robots that can autonomously operate over extended periods of time in unknown, unstructured environments.

MP3 (*Monday, 2 PM – 6 PM, July 12*)

Genetic Algorithms and Genetics-Based Machine Learning

David E. Goldberg, University of Illinois at Urbana-Champaign; and John R. Koza, Stanford University

This tutorial will introduce participants to the ideas and applications of genetic algorithms (GAs)—computer search procedures based on the mechanics of natural genetics and natural selection—and genetics-based machine learning (GBML)—machine learning techniques that use genetic algorithms and their derivatives. GAs and GBML are receiving increased attention in practical yet difficult search and machine learning problems across a spectrum of disciplines. We review the mechanics of a simple genetic algorithm and consider the implicit parallelism that underlies its power. A parade of current search applications is reviewed as are more advanced GA techniques such as niching and messy GAs. The two most prominent techniques of GMBL, classifier systems and genetic programming, are also surveyed.

Prerequisite Knowledge: Knowledge of genetic algorithms or biological concepts is not assumed. A general familiarity with computers and programming is required.

David E. Goldberg is an Associate Professor of General Engineering and the Beckman Institute at the University of Illinois at Urbana-Champaign. He received his Ph.D. from the University of Michigan and has written papers on the application and foundations of genetic algorithms. He is the author of *Genetic Algorithms in Search, Optimization, and Machine Learning.* His recent studies have considered the theory of deception, the role of noise in GA convergence, and the theory and development of messy GAs.

John R. Koza is a Consulting Professor of Computer Science at Stanford University. He received his Ph.D. in Computer Science from the University of Michigan in the field of machine learning and induction. He currently is investigating the artificial breeding of computer programs and has recently completed *Genetic Programming,* a book that surveys these efforts. Between 1973 and 1987 he was chief executive officer of Scientific Games Incorporated in Atlanta, and he is currently a principal in Third Millennium Venture Capital Limited in California.

MP4 (*Monday, 2 PM – 6 PM, July 12*)

Experimental Methods in AI

Paul Cohen, University of Massachussetts at Amherst; and Bruce Porter, University of Texas at Austin

This tutorial will introduce, through case studies, designs for exploratory and confirming experiments, a few statistical techniques for analyzing results, and techniques for evaluating what results mean to one's research and development program. Our objective is to provide methods by which researchers and practitioners can test hypotheses and substantiate claims of system performance. We will focus on experiments in knowledge-based systems, machine learning and planning, although much of our discussion will apply to broader areas of AI. The case studies illustrate techniques for measuring and comparing levels of performance, analyzing the effects of adding knowledge to a system, finding interactions between components of systems, and isolating causes of poor performance. We will discuss some tricky problems, including designing representative test sets and getting representative samples of data; and we will describe some open problems, for which convincing techniques are not yet available, such as generalizing results from one system to others.

Prerequisite Knowledge: Some familiarity with knowledge-based systems and basic machine learning and planning techniques is helpful but not essential. No knowledge of statistics is assumed.

Dr. Paul Cohen is an Associate Professor at the University of Massachusetts at Amherst, where he directs the Experimental Knowledge Systems Lab. His research concerns planning in uncertain, real-time environments. Cohen has been involved in the development of research methods for AI and computer science in general for several years. Cohen received his Ph.D. from Stanford University, and was an editor of *The Handbook of Artificial Intelligence,* Volumes III and IV.

Bruce Porter is an Associate Professor of Computer Sciences at the University of Texas at Austin. His current research is developing large knowledge bases and methods for generating coherent explanations to answer questions using them. His earlier research with Ray Bareiss produced the Protos knowledge acquisition system and a comprehensive evaluation of its performance. Porter received his Ph.D. from the University of California at Irvine, and was honored with a Presidential Young Investigator Award from the National Science Foundation in 1988.

MP5 (*Monday, 2 PM – 6 PM, July 12*)

Probabilistic Causal Modeling

Judea Pearl, UCLA

Probabilistic causal models provide effective tools for combining evidence, generating explanations and predicting the effect of actions in uncertain environments . This tutorial will cover graphical models as a language for encoding probabilistic causal knowledge; methods of inducing causes-effect relationships from statistical data; inference methods of interpreting multiple evidence, given a probabilistic causal model; and symbolic methods of reasoning with causal rules, observations and actions, using order-of-magnitude abstractions of probabilities.

Prerequisite Knowledge: The tutorial is designed for statisticians and data-analysts interested in newly developed graphical techniques of model selection for prediction and policy analysis, machine learning researchers exploring methods of uncovering stable relationships and action-related theories in data, and researchers in automated reasoning seeking a coherent framework for analyzing abduction, diagnosis, belief revision, belief updating, counterfactual queries, temporal prediction, attention management, actions, persistence and causation.

Judea Pearl is a Professor of Computer Science at UCLA where he is the Director of the Cognitive Systems Laboratory. He received his Ph.D. in Electrical Engineering from the Polytechnic Institute of Brooklyn, Brooklyn, NY. His current interests include: knowledge representation, probabilistic reasoning, constraint processing, nonstandard logics, distributed computation, and learning. Pearl is the author of *Heuristics* and *Probabilistic Reasoning In Intelligent Systems,* and the editor of S*earch and Heuristics,* and *Readings in Uncertain Reasoning* (with G. Shafer).

IAAI–93
Preliminary Program

(Subject to change)

Monday, July 12

8:30 – 9:00 am
Opening Remarks
Phil Klahr, IAAI Conference Chair
"What Makes an AI Application Innovative?"

9:00 – 9:30 am
Computer Aided Parts Estimation
Adam Cunningham, Ford Motor Company and Robert Smart, Inference Europe Ltd.

9:30 – 10:00 am
Expanding the Utility of Legacy Systems: MPSA–The Master Production Scheduler's Assistant. COLES–The Customer Order Loading Expert System
Joseph McManus, AT&T Network Systems and Teresa Garland, Inference Corporation

10:00 – 10:20 am
Break

10:20 – 10:50 am
The Application Software Factory: A Knowledge Based Approach to Software Engineering
Stu Burton, Celite Corporation; Kent Swanson and Lisa Leonard, Andersen Consulting

10:50 am – 11:50 pm
Invited Talk
How to Market AI. . . . . . . NOT! Or…If AI is a Wireless Telegraph, What Is a Radio?
Joe Carter, Andersen Consulting

11:50 – 12:20 pm
Meet the Authors

12:20 – 2:00 pm
Lunch

2:00 – 3:30 pm
AI-on-Line Panel
"What's Next on KBS Technology for Industrial Use"
Organized by Herb Schorr, USC Information Sciences Institute

3:30 – 3:50 pm
Break

3:50 – 4:20 pm
ESDS: Materials Technology Knowledge Bases Supporting Design of Boeing Jetliners
Mark A. Dahl, The Boeing Company

4:20 – 4:50 pm
Managing Product Quality By Integrating Operations Research And Artificial Intelligence Technologies
Charles S. Moon, Thomas M. Moore and Suheil M. Nasser, IBM Industrial Sector Division

4:50 – 5:20 pm
COMPAQ QuickSource: Providing the Consumer with the Power of Artificial Intelligence
Trung Nguyen and Mary Czerwinski, Compaq Computer Corporation

5:20 – 5:50 pm
Meet the Authors

6:00 – 7:00 pm
IAAI Opening Reception

7:30 – 8:30 pm
Invited Talk: "Tiger in a Cage: The Applications of KB Systems"
Edward Feigenbaum, Stanford University

Tuesday, July 13

8:30 – 10:00 am
AAAI Keynote Address
Herbert Simon, Carnegie Mellon University

10:00 – 10:30 am
Break

IAAI Invited Talk

How to Market AI. . . . . . . NOT! Or…If AI is a Wireless Telegraph, What Is a Radio?

Joe Carter, Andersen Consulting

There are eight billion people in the world and most of them are under employed. The AI community has spent the last three decades trying to emulate those under-employed resources. What businessperson in his or her right mind would invest in an artificial substitute for a surplus commodity? AI is a bomb looking for a war that doesn't exist outside the laboratory.

But amongst all the chaff of AI hype, there is plenty of wheat. In fact, the early hype may actually understate the value of the underlying AI technology. The AI community set out to build a wireless telegraph and ended up producing a radio. Can the AI equivalent of the television be far behind?

Based on a decade of experience in successfully commercializing the output of the AI community, Mr. Carter will share his thoughts on packaging AI technology for prime-time consumption.

Joe Carter has worldwide responsibility for Andersen Consulting's practice in multimedia, imaging, and knowledge management technologies. Andersen Consulting's personnel under Mr. Carter's direction provide specialized training, R&D, Methodology, Marketing, and System Development services for Andersen's clients and 25,000 regional consultants around the world.

10:30 – 11:00 am
Tennessee Offender Management Information System
David Reynolds and Tim Beck, Andersen Consulting

11:00 – 11:30 am
OPERA: A Highly Interactive Expert System for Outside Plant Engineering
Gary Lazarus, Lien Tran and Marty Baade, NYNEX Science & Technology

11:30 am – 12:00 pm
A Knowledge-Based Configurator that Supports Sales, Engineering, and Manufacturing at AT&T Network Systems
Jon R. Wright, Elia S. Weixelbaum, Gregg T. Vesonder, Karen E. Brown, Stephen R. Palmer, Jay I. Berman and Harry H. Moore, AT&T Bell Laboratories

12:00 – 12:30 pm
Meet the Authors

12:30 – 2:00 pm
Lunch

2:00 – 3:30 pm
AI-on-Line Panel
Emerging AI Technologies
Organized by Neena Buck, New Science Associates

3:30 – 3:50 pm
Break

3:50 – 4:20 pm
Digitized Expert PICTures (DEPICT) An Intelligent Information Repository
George Gallant and Janet Thygesen, IBM Corporation

4:20 – 4:50 pm
Diagnostic Yield Characterization Expert (DYCE) A Diagnostic Knowledge Based System Shell for Automated Data Analysis
Donald D. Pierson and George J. Gallant, IBM Corporation

4:50 – 5:20 pm
Pitch Expert: A Problem-Solving System for Kraft Mills
A. Kowalski, D. Bouchard, L. H. Allen, Y. Larin and O. Vadas, Pulp and Paper Research Institute of Canada

5:20 – 5:50 pm
Meet the Authors

6:00 – 7:00 pm
Join in on the AAAI Opening Reception!

Wednesday, July 14

8:30 – 9:00 am
The DRAIR Advisor: A Knowledge-Based System for Material Deficiency Analysis
Brian L. Robey, Pamela K. Fink, Sanjeev Venkatesan and Carol L. Redfield, Southwest Research Institute; Jerry W. Ferguson, US Air Force

The Jefferson Memorial

9:00 – 9:30 am
Dodger, an Expert System for Eddy Current Evaluation
Arthur J. Levy, Jane E. Oppenlander, David M. Brudnoy, James M. Englund, Kent C. Loomis and Arnold M. Barsky, General Electric Co.

9:30 – 10:00 am
GCESS: A Symptom Driven Diagnostic Shell and Related Applications
Peter Holtzman, Inference Corporation

10:00 – 10:20 am
Break

10:20 – 10:50 am
PI-in-a-Box: A Knowledge-based System for Space Science Experimentation
Richard Frainier and Nicolas Groleau, RECOM Technologies, Inc.; Lyman Hazelton, Laurence Young and Peter Szolovits, Massachusetts Institute of Technology; Silvano Colombano and Irving Statler, NASA Ames Research Center; Michael Compton, Sterling Software.

10:50 – 11:50 am
Invited Talk
Bob Kahn

11:50 am – 12:20 pm
Meet the Authors

12:20 – 2:00 pm
Lunch Break

2:00 – 3:00 pm
AI-on-Line Panel
Transitioning AI Technology into Government Information Systems
Organized by Ted Senator, Department of the Treasury

AAAI Preliminary Program

Tuesday, July 13

8:30–9:50 am
Keynote Address
Herbert A. Simon, Carnegie Mellon University

9:50 – 10:15 pm
Break

10:15 – 11:55 am
Session 1
Diagnostic Reasoning

10:15 – 10:40 am
Hybrid Case-Based Reasoning for the Diagnosis of Complex Devices
M. P. Feret and J. I. Glasgow, Queen's University

10:40 – 11:05 am
An Epistemology for Clinically Significant Trends
Ira J. Haimowitz, MIT Laboratory for Computer Science and Isaac S. Kohane, Harvard Medical School

11:05 – 11:30 am
A Framework for Model-Based Repair
Ying Sun and Daniel S. Weld, University of Washington

11:30 – 11:55 am
Multiple Dimensions of Generalization In Model-Based Troubleshooting
Randall Davis and Paul Resnick, MIT AI Laboratory

10:15 – 11:55 am
Session 2
Intelligent User Interfaces

The White House

10:15 – 10:40 am
Generating Explanations of Device Behavior Using Compositional Modeling and Causal Ordering
Patrice O. Gautier and Thomas R. Gruber, Stanford University

10:40 – 11:05 am
Building Synthesis Models to Support Early Stage Product and Process Design
R. Bharat Rao and Stephen C-Y. Lu, University of Illinois at Urbana-Champaign

11:05 – 11:30 am
A Conversational Model of Multimodal Interaction
Adelheit Stein and Ulrich Thiel, German National Center for Computer Science

11:30 – 11:55 am
Generating Natural Language Descriptions with Examples: Differences between Introductory and Advanced Texts
Vibhu O. Mittal and Cécile L. Paris, USC/ISI

10:15 – 11:55 am
Session 3
Search—1

10:15 – 10:40 am
Conjunctive Width Heuristics for Maximal Constraint Satisfaction
Richard J. Wallace and Eugene C. Freuder, University of New Hampshire

10:40 – 11:05 am
Decomposition of Domains Based on the Micro-structure of Finite Constraint-Satisfaction Problems
Philippe Jégou, Université de Provence

11:05 – 11:30 am
Innovative Design as Systematic Search
Dorothy Neville and Daniel S. Weld, University of Washington

11:30 – 11:55 am
Time-Saving Tips for Problem Solving with Incomplete Information
Michael R. Genesereth and Illah R. Nourbakhsh, Stanford University

11:55 am-1:30 pm
Lunch

1:30 – 3:10 pm
Session 4
Reasoning about Physical Systems—I

1:30 – 1:55 pm
CFRL: A Language for Specifying the Causal Functionality of Engineered Devices
Marcos Vescovi, Yumi Iwasaki and Richard Fikes, Stanford University; B. Chandrasekaran, Ohio State University

1:55 – 2:20 pm
Model Simplification in Fluid Mechanics
Kenneth Man-Kam Yip, Yale University

2:20 – 2:45 pm
Numerical Behavior Envelopes for Qualitative Models
Herbert Kay and Benjamin Kuipers, University of Texas at Austin

2:45 – 3:10 pm
A Qualitative Method to Construct Phase Portraits
Wood Wai Lee, Dowell Schlumberger and Benjamin J. Kuipers, University of Texas

1:30 – 3:10 pm
Session 5

Natural Language Sentence Analysis

1:30 – 1:55 pm
Having Your Cake and Eating It Too: Autonomy and Interaction in a Model of Sentence Processing
Kurt P. Eiselt and Kavi Mahesh, Georgia Institute of Technology; Jennifer K. Holbrook, Albion College

1:55 – 2:20 pm
Efficient Heuristic Natural Language Parsing
Christian R. Huyck and Steven L. Lytinen, University of Michigan

2:20 – 2:45 pm
Machine Translation of Spatial Expressions: Defining the Relation between an Interlingua and a Knowledge Representation System
Bonnie J. Dorr and Clare R. Voss, University of Maryland

2:45 – 3:10 pm
Towards a Reading Coach that Listens: Automated Detection of Oral Reading Errors
Jack Mostow, Alexander G. Hauptmann, Lin Lawrence Chase and Steven Roth, Carnegie Mellon University

1:30 – 3:10 pm
Session 6

Search—II

1:30 – 1:55 pm
Depth-First Versus Best-First Search: New Results
Weixiong Zhang and Richard E. Korf, University of California, Los Angeles

1:55 – 2:20 pm
Pruning Duplicate Nodes in Depth-First Search
Larry A. Taylor and Richard E. Korf, University of California, Los Angeles

2:20 – 2:45 pm
Iterative Weakening: Optimal and Near-Optimal Policies for the Selection of Search Bias
Foster John Provost, University of Pittsburgh

2:45 – 3:10 pm
Generating Effective Admissible Heuristics by Abstraction and Reconstitution
Armand Prieditis and Bhaskar Janakiraman, University of California, Davis

3:10 – 3:30
Break

3:30 – 5:10 pm
Session 7

Reasoning about Physical Systems—II

3:30 – 3:55 pm
Ideal Physical Systems
Brian Falkenhainer, Xerox Corporation/Cornell University

3:55 – 4:20 pm
Intelligent Model Selection for Hill Climbing Search in Computer-Aided Design
Thomas Ellman and John Keane, Rutgers University

4:20 – 4:45 pm
Sensible Scenes: Visual Understanding of Complex Structures through Causal Analysis
Matthew Brand, Lawrence Birnbaum and Paul Cooper, Northwestern University

4:45 – 5:10 pm
Understanding Linkages
Howard E. Shrobe, MIT and Symbolics, Inc.

3:30 – 5:10 pm
Session 8

Natural Language Generation

3:30 – 3:55 pm
Corpus Analysis for Revision-Based Generation of Complex Sentences
Jacques Robin and Kathy McKeown, Columbia University

3:55 – 4:20 pm
Generating Argumentative Judgment Determiners
Michael Elhadad, Ben Gurion University of the Negev

4:20 – 4:45 pm
Bidirectional Chart Generation of Natural Language Texts
Masahiko Haruno, Yasuharu Den and Yuji Matsumoto, Kyoto University

4:45 – 5:10 pm
Communicative Acts for Generating Natural Language Arguments
Mark T. Maybury, The MITRE Corporation

3:30 – 5:10 pm
Session 9

Plan Generation

3:30 – 3:55 pm
Granularity in Multi-Method Planning
Soowon Lee and Paul S Rosenbloom, University of Southern California

3:55 – 4:20 pm
An Average Case Analysis of Planning
Tom Bylander, Ohio State University

4:20 – 4:45 pm
Postponing Conflicts in Nonlinear Planning
David E. Smith, Rockwell International and Mark A. Peot, Stanford University

4:45 – 5:10 pm
Threat-Removal Strategies for Nonlinear Planning
Mark A. Peot, Stanford University and David E. Smith, Rockwell International

6:00 – 7:00 pm

AAAI Opening Reception

Wednesday, July 14

8:30 – 9:50 am
Presidential Address
Pat Hayes

9:50 – 10:15 am
Break

10:15 – 11:55 am
Session 10
Trainable Natural Language Systems

10:15 – 10:40 am
A Case-Based Approach to Knowledge Acquisition for Domain-Specific Sentence Analysis
Claire Cardie, University of Massachusetts

10:40 – 11:05 am
Automatically Constructing a Dictionary for Information Extraction Tasks
Ellen Riloff, University of Massachusetts

11:05 – 11:30 am
Learning Semantic Grammars with Constructive Inductive Logic Programming
John M. Zelle and Raymond J. Mooney, University of Texas

11:30 – 11:55 am
KITSS: A Knowledge-Based Translation System for Test Scenarios
Van E. Kelly and Mark A. Jones, AT&T Bell Laboratories

10:15 – 11:55 am
Session 11
Distributed Problem Solving—I

10:15 – 10:40 am
Solving the Really Hard Problems with Cooperative Search
Tad Hogg and Colin P. Williams, Xerox PARC

10:40 – 11:05 am
A Fast First-Cut Protocol for Agent Coordination
Andrew P. Kosoresow, Stanford University

11:05 – 11:30 am
A One-shot Dynamic Coordination Algorithm for Distributed Sensor Networks
Keith Decker and Victor Lesser, University of Massachusetts

11:30 – 11:55 am
An Implementation of the Contract Net Protocol Based on Marginal Cost Calculations
Tuomas Sandholm, University of Massachusetts

10:15 – 11:55 am
Session 12
Qualitative Reasoning

10:15 – 10:40 am
Qualitatively Describing Objects Using Spatial Prepositions
Alicia Abella and John R. Kender, Columbia University

10:40 – 11:05 am
Efficient Reasoning in Qualitative Probabilistic Networks
Marek J. Druzdzel, Carnegie Mellon University and Max Henrion, Rockwell International Science Center

11:05 – 11:30 am
Numeric Reasoning with Relative Orders of Magnitude
Philippe Dague, Université Paris Nord

11:30 – 11:55 am
Generating Quasi-symbolic Representation of Three-Dimensional Flow
Toyoaki Nishida, Kyoto University

11:55 am-1:30 pm
Lunch

1:30 – 2:45 pm
Session 13
Discourse Analysis

1:30 – 1:55 pm
An Optimizing Method for Structuring Inferentially Linked Discourse
Ingrid Zukerman and Richard McConachy, Monash University

1:55 – 2:20 pm
A Methodology for Development of Dialogue Managers for Natural Language Interfaces
Arne Jönsson, Linköping University

2:20 – 2:45 pm
Mutual Beliefs of Multiple Conversants: A Computational Model of Collaboration in Air Traffic Control
David G. Novick and Karen Ward, Oregon Graduate Institute of Science and Technology

1:30 – 3:10 pm
Session 14
Distributed Problem Solving—II

1:30 – 1:55 pm
IPUS: An Architecture for Integrated Signal Processing and Signal Interpretation in Complex Environments
Victor Lesser, Izaskun Gallastegi and Frank Klassner, University of Massachusetts; Hamid Nawab, Boston University

1:55 – 2:20 pm
Overeager Reciprocal Rationality and Mixed Strategy Equilibria
Edmund H. Durfee and Jaeho Lee, University of Michigan, Piotr J. Gmytrasiewicz, Hebrew University

2:20 – 2:45 pm
Agents Contracting Tasks in Non-Collaborative Environments
Sarit Kraus, Bar Ilan University Ramat Gan

2:45 – 3:10 pm
Quantitative Modeling of Complex Computational Task Environments
Keith Decker and Victor Lesser, University of Massachusetts

1:30 – 3:10 pm
Session 15
Automated Reasoning—I

1:30 – 1:55 pm
The Breakout Method For Escaping From Local Minima
Paul Morris, IntelliCorp

1:55 – 2:20 pm
Towards an Understanding of Hill-climbing Procedures for SAT
Ian P. Gent and Toby Walsh, University of Edinburgh

2:20 – 2:45 pm
An Empirical Study of Greedy Local Search for Satisfiability Testing
Henry A. Kautz and Bart Selman, AT&T Bell Laboratories

2:45 – 3:10 pm
Experimental Results on the Cross-Over Point in Satisfiability Problems
James M. Crawford and Larry D. Auton, AT&T Bell Laboratories

3:10 – 3:50 pm
Break

3:30 – 4:45 pm
Session 16

Statistically-Based Natural Language Processing

3:30 – 3:55 pm
Equations for Part-of-Speech Tagging
Eugene Charniak, Curtis Hendrickson, Neil Jacobson and Mike Perkowitz, Brown University

3:55 – 4:20 pm
Using an Annotated Language Corpus as a Virtual Stochastic Grammar
Rens Bod, University of Amsterdam

4:20 – 4:45 pm
Estimating Probability Distribution Over Hypotheses with Variable Unification
Dekai Wu, Hong Kong University of Science and Technology

3:30 – 5:10 pm
Session 17

Vision Processing

3:30 – 3:55 pm
Learning Object Models from Appearance
Hiroshi Murase and Shree K. Nayar, Columbia University

3:55 – 4:20 pm
Polly: A Vision-Based Artificial Agent
Ian Horswill, MIT AI Laboratory

4:20 – 4:45 pm
On the Qualitative Structure of Temporally Evolving Visual Motion Fields
Richard P. Wildes, SRI David Sarnoff Research Center

4:45 – 5:10 pm
Range Estimation From Focus Using an Active Non-frontal Imaging Camera
Arun Krishnan and Narendra Ahuja, University of Illinois

3:30 – 5:10 pm
Session 18

Automated Reasoning—II

3:30 – 3:55 pm
On Computing Minimal Models
Rachel Ben-Eliyahu, University of California, Los Angeles and Rina Dechter, University of California, Irvine

3:55 – 4:20 pm
Reasoning With Characteristic Models
Henry A. Kautz, Michael J. Kearns and Bart Selman, AT&T Bell Laboratories

4:20 – 4:45 pm
Rough Resolution: A Refinement of Resolution to Remove Large Literals
Heng Chu and David A. Plaisted, University of North Carolina

4:45 – 5:10 pm
On the Adequateness of the Connection Method
Antje Beringer and Steffen Hölldobler, Technische Hochschule Darmstadt

Thursday, July 15

8:30 – 10:10 am
Session 19

Machine Learning

8:30 – 8:55 am
Finding Accurate Frontiers: A Knowledge-Intensive Approach to Relational Learning
Michael Pazzani and Clifford Brunk, University of California, Irvine

Photo courtesy Washington Convention and Visitor's Bureau.

The Lincoln Memorial.

8:55 – 9:20 am
OC1: A Randomized Algorithm for Building Oblique Decision Trees
Sreerama K. Murthy, Simon Kasif and Steven Salzberg, Johns Hopkins University; Richard Beigel, Yale University

9:20 – 9:45 am
Probabilistic Prediction of Protein Secondary Structure Using Causal Networks
Arthur L Delcher, Loyola College in Maryland, Simon Kasif, Harry R. Goldberg and William H. Hsu, Johns Hopkins University

9:45 – 10:10 am
Learning Non-Linearly Separable Boolean Functions With Linear Threshold Unit Trees and Madaline-Style Networks
Mehran Sahami, Stanford University

8:30 – 10:10 am
Session 20
Large Scale Knowledge Bases

8:30 – 8:55 am
Automated Index Generation for Constructing Large-Scale Conversational Hypermedia Systems
Richard Osgood and Ray Bareiss, Northwestern University

8:55 – 9:20 am
Case-Method: A Methodology for Building Large-Scale Case-Based Systems
Hiroaki Kitano, Hideo Shimazu and Akihiro Shibata, NEC Corporation

9:20 – 9:45 am
Matching 100,000 Learned Rules
Robert B. Doorenbos, Carnegie Mellon University

9:45 – 10:10 am
Massively Parallel Support for Computationally Effective Recognition Queries
Matthew P. Evett, William A. Andersen and James A. Hendler, University of Maryland

8:30 – 10:10 am
Session 21
Real-Time Planning and Simulation

8:30 – 8:55 am
Real-Time Self-Explanatory Simulation
Franz G. Amador, Adam Finkelstein and Daniel S. Weld, University of Washington

8:55 – 9:20 am
Task Interdependencies in Design-to-time Real-time Scheduling
Alan Garvey, Marty Humphrey, Victor Lesser, University of Massachusetts

9:20 – 9:45 am
Planning With Deadlines in Stochastic Domains
Thomas Dean, Leslie Kaelbling, Jak Kirman and Ann Nicholson, Brown University

9:45 – 10:10 am
A Comparison of Action-Based Hierarchies and Decision Trees for Real-Time Performance
David Ash and Barbara Hayes-Roth, Stanford University

8:30 – 10:10 am
Session 22
Representation for Actions and Motion

8:30 – 8:55 am
Towards Knowledge-Level Analysis of Motion Planning
Ronen I. Brafman, Jean-Claude Latombe and Yoav Shoham, Stanford University

8:55 – 9:20 am
The Semantics of Event Prevention
Charles L. Ortiz, Jr., University of Pennsylvania

9:20 – 9:45 am
EL: A Formal, Yet Natural, Comprehensive Knowledge Representation
Chung Hee Hwang and Lenhart K. Schubert, University of Rochester

9:45 – 10:10 am
The Frame Problem and Knowledge-Producing Actions
Richard B. Scherl and Hector J. Levesque, University of Toronto

10:10-10:30 am
Break

10:30 am-11:45 pm
Session 23
Novel Methods in Machine Learning

10:30 – 10:55 am
Learning Interface Agents
Pattie Maes and Robyn Kozierok, MIT Media-Lab

10:55 – 11:20 am
Learning from an Approximate Theory and Noisy Examples
Somkiat Tangkitvanich and Masamichi Shimura, Tokyo Institute of Technology

11:20 – 11:45 am
Scientific Model-Building as Search in Matrix Spaces
Raúl E. Valdés-Pérez, Jan M. Zytkow and Herbert A. Simon, Carnegie Mellon University

10:30 am-12:10 pm
Session 24
Case-Based Reasoning

10:30 – 10:55 am
Projective Visualization: Acting from Experience
Marc Goodman, Cognitive Systems Inc., and Brandeis University

10:55 – 11:20 am
A Framework and an Analysis of Current Proposals for the Case-Based Organization and Representation of Procedural Knowledge
Roland Zito-Wolf and Richard Alterman, Brandeis University

11:20 – 11:45 am
Case-Based Diagnostic Analysis in a Blackboard Architecture
Edwina L. Rissland, Jody J. Daniels, Zachary B. Rubinstein and David B. Skalak, University of Massachusetts

11:45 am-12:10 pm
Representing and Using Procedural Knowledge for Doing Geometry Proofs
Thomas F. McDougal, Kristian J. Hammond, University of Chicago

10:30 am-12:10 pm
Session 25
Rule-Based Reasoning

10:30 – 10:55 am
Exploring the Structure of Rule Based Systems
C. Grossner, A. Preece, P. Gokul Chander, T. Radhakrishnan, C. Y. Suen, Concordia University

10:55 – 11:20 am
Comprehensibility Improvement of Tabular Knowledge Bases
Atsushi Sugiura and Yoshiyuki Koseki, NEC Corporation; Maximilian Riesenhuber, Johann Wolfgang Goethe-University

11:20 – 11:45 am
Supporting and Optimizing Full Unification in a Forward Chaining Rule System
Howard E. Shrobe, MIT and Symbolics, Inc.

11:45 am-12:10 pm
The Paradoxical Success of Fuzzy Logic
Charles Elkan, University of California, San Diego

10:30 am-12:10 pm
Session 26
Representation and Reasoning

10:30 – 10:55 am
All They Know About—Preliminary Report
Gerhard Lakemeyer, University of Bonn

10:55 – 11:20 am
Nonmonotonic Reasoning with Many Agents
Joseph Y. Halpern, IBM Almaden Research Center

11:20 – 11:45 am
Conditional Belief Revision: Model-Based and Syntactic Approaches
Craig Boutilier, University of British Columbia; Moisés Goldszmidt, Rockwell International

11:45 am-12:10 pm
Abduction As Belief Revision: A Model of Preferred Explanations
Craig Boutilier and Veronica Becher, University of British Columbia

12:10 – 1:30 pm
Lunch

1:30 – 3:10 pm
Session 27
Plan Learning

1:30 – 1:55 pm
Permissive Planning: A Machine Learning Approach to Linking Internal and External Worlds
Gerald DeJong and Scott Bennett, University of Illinois

1:55 – 2:20 pm
On the Masking Effect
Milind Tambe, Carnegie Mellon University; Paul S. Rosenbloom, USC/ISI

2:20 – 2:45 pm
Relative Utility of EBG based Plan Reuse in Partial Ordering Versus Total Ordering Planning
Subbarao Kambhampati and Jengchin Chen, Arizona State University

2:45 – 3:10 pm
Learning Plan Transformations from Self-Questions: A Memory-Based Approach
R. Oehlmann, D. Sleeman, P. Edwards, King's College

1:30 – 3:10 pm
Session 28
Constraint-Based Reasoning—I

1:30 – 1:55 pm
Nondeterministic Lisp as a Substrate for Constraint Logic Programming
Jeffrey Mark Siskind, University of Pennsylvania; David Allen McAllester, MIT AI Laboratory

1:55 – 2:20 pm
Arc-Consistency and Arc-Consistency Again
Christian Bessière, University of Montpellier II; Marie-Odile Cordier, University of Rennes I

2:20 – 2:45 pm
On the Consistency of General Constraint-Satisfaction Problems
Philippe Jégou, Université de Provence

2:45 – 3:10 pm
Extending Deep Structure
Colin P. Williams and Tad Hogg, Xerox PARC

1:30 – 3:10 pm
Session 29
Nonmonotonic Logic—I

1:30 – 1:55 pm
Generating Explicit Orderings for Nonmonotonic Logics
James Cussens, King's College; Anthony Hunter, Imperial College; Ashwin Srinivasan, Oxford University

1:55 – 2:20 pm
Minimal Belief and Negation as Failure: A Feasible Approach
Antje Beringer and Torsten Schaub, Technische Hochschule Darmstadt

2:20 – 2:45 pm
Algebraic Semantics for Cumulative Inference Operations
Zbigniew Stachniak, University of Toronto

2:45 – 3:10 pm
Subnormal Modal Logics for Knowledge Representation
Grigori Schwarz, Stanford University; Miroslaw Truszczynski, University of Kentucky

3:10 – 3:30 pm
Break

3:30 – 5:10 pm
Session 30
Complexity in Machine Learning

3:30 – 3:55 pm
Cryptographic Limitations on Learning One-Clause Logic Programs
William W. Cohen, AT&T Bell Laboratories

Photo courtesy Washington Convention and Visitor's Bureau.

Area Attractions

US Capitol

National Mall (East End). 202-224-3121; 202-225-6827
See the Rotunda, Statuary Hall with two statues from each state, the House of Representatives, the Senate, and the original Supreme Court Chamber. Open daily, 9 AM through 8 PM. Tours 9 AM through 3:45 PM. Free.

The Smithsonian Institution

202-357-1729
This is the world's largest museum complex with fourteen museums, including the National Air and Space Museum and the National Zoo. All museums are open daily, 10 AM through 5:30 PM. Admission is free to all Smithsonian Museums. Free walk-in "highlights" tours available to the public in most museums.

The White House

1600 Pennsylvania Avenue, NW. 202-456-2200 or 202-456-7041
This is the home of every US President since 1800. Five of the mansion's 132 rooms are open to the public: the East Room, the Green Room, the Blue Room, the Red Room, and the State Dining Room. Open Tuesday-Saturday, 10 AM to noon. No tickets are needed Labor Day to Memorial Day. Congressional guided tours are available through your Congressperson or Senator; to arrange a tour, call your Representative or Senator's local office.

The Library of Congress

10 First Street, SE. 202-707-6400
The Library of Congress offers tours every Monday through Friday, 9 AM TO 4 PM. Free.

Washington, DC Visitor Information Center

1455 Pennsylvania Avenue, NW. 202-789-7038
The Visitor Information Center is located one block from the White House. Visitors can pick up a variety of free literature and maps and receive advice on what to see and do while in the nation's capital. Operated by the Washington, DC Convention and Visitors Association. Open Monday through Saturday, 9 AM through 5 PM. Closed Sundays and major holidays.

Tech 2000

800 K St., NW, #60 (located within the Tech World Complex). 202-842-0500
Tech 2000 is the world's first permanent gallery of interactive multimedia containing more the 60 "hands-on" exhibits. Open Tuesday – Sunday, 11 AM – 5 PM. Admission: $5 adult; $4 student; $3 children under 12 and senior citizens.

3:55 – 4:20 pm
Learnability in Inductive Logic Programming: Some Basic Results and Techniques
Michael Frazier and C. David Page Jr., University of Illinois

4:20 – 4:45 pm
Complexity Analysis of Reinforcement Learning
Sven Koenig and Reid G. Simmons, Carnegie Mellon

4:45 – 5:10 pm
Pac-Learning a Restricted Class of Recursive Logic Programs
William W. Cohen, AT&T Bell Laboratories

3:30 – 5:10 pm
Session 31

Constraint-Based Reasoning—II

3:30 – 3:55 pm
A Constraint Decomposition Method for Spatio-Temporal Configuration Problems
Toshikazu Tanimoto, Digital Japan

3:55 – 4:20 pm
Coping With Disjunctions in Temporal Constraint Satisfaction Problems
Eddie Schwalb and Rina Dechter, University of California, Irvine

4:20 – 4:45 pm
Integrating Heuristics for Constraint Satisfaction Problems: A Case Study
Steven Minton, NASA Ames Research Center

4:45 – 5:10 pm
Slack-Based Heuristics for Constraint Satisfaction Scheduling
Stephen F. Smith and Cheng-Chung Cheng, Carnegie Mellon University

3:30 – 5:10 pm
Session 32

Nonmonotonic Logic—II

3:30 – 3:55 pm
Propositional Logic of Context Extended Abstract
Sasa Buvac and Ian A. Mason, Stanford University

3:55 – 4:20 pm
A Context-based Framework for Default Logics
Philippe Besnard, IRISA; Torsten Schaub, TH Darmstadt

4:20 – 4:45 pm
Reasoning Precisely with Vague Concepts
Nita Goyal and Yoav Shoham, Stanford University

4:45 – 5:10 pm
Restricted Monotonicity
Vladimir Lifschitz, University of Texas at Austin

AAAI–93 Technical Program Registration

July 13-15, 1992

Your AAAI–93 technical program registration includes admission to technical sessions, invited talks, the AAAI–93 / IAAI–93 joint exhibition, AI-on-Line panels, the AAAI–93 opening reception, and the AAAI–93 conference *Proceedings*.

Onsite Registration will be located at the entrance of Exhibit Hall B on the upper level of the Washington Convention Center, 900 Ninth Street, NW., Washington DC.

IAAI–93 Registration

July 13-15, 1992

Your IAAI–93 registration includes admission to IAAI–93, the AI-on-Line sessions, the AAAI–93 / IAAI–93 joint exhibition, the AAAI–93 opening address, the IAAI–93 and AAAI–93 opening receptions, and the IAAI conference *Proceedings*.

IAAI–93 / AAAI–93 Registration Fees

Early Registration (Postmarked by 21 May)
AAAI Members
Regular $260   Student $100
Nonmembers
Regular $305   Student $165

Early Bird Package Registration (Postmarked by 21 May)
AAAI Members
Regular $730   Student $330
Nonmembers
Regular $870   Student $430

Late Registration (Postmarked by 11 June)
AAAI Members
Regular $310   Student $100
Nonmembers
Regular $360   Student $165

On-Site Registration (Postmarked after 11 June or onsite. Hours below.)
AAAI Members
Regular $380   Student $105
Nonmembers
Regular $420   Student $180

AAAI–93 / IAAI–93 Combined Registration

To attend both the AAAI–93 and the IAAI–93 Conferences, and to receive the proceedings of both, please add $100.00 to the appropriate registration fee above.

AAAI–93 / IAAI–93 Early Bird Package Registration

This year, AAAI is offering a special-value Early Bird Package Registration for attendees registering before May 21th. Included in your registration fee are the AAAI–93 Conference Registration, the IAAI–93 Conference Registration, and two tutorials (of your choice). Sorry, no substitutions . Early-bird registrations are non-transferable.

Tutorial Program Registration

July 11–12, 1993

The Tutorial Program Registration includes admission to one tutorial, the AAAI–93 / IAAI–93 Joint Exhibition, the AI-on-Line panels at IAAI–93, and the tutorial syllabus. Prices quoted are per tutorial. A maximum of four may be taken due to parallel schedules.

Tutorial Fee Schedule

Early Registration (Postmarked by 21 May)
AAAI Members
Regular $205   Student $75
Nonmembers
Regular $260   Student $95

Late Registration (Postmarked by 11 June)
AAAI Members
Regular $245   Student $100
Nonmembers
Regular $290   Student $120

On-Site Registration (Postmarked after 11 June or onsite. Hours are listed below.)
AAAI Members
Regular $310   Student $130
Nonmembers
Regular $330   Student $155

Workshop Registration

July 11-12, 1993

Workshop registration is limited to active participants determined by the organizer prior to the conference. Those individuals attending workshops only are subject to a $125.00 per workshop registration fee.

Payment & Registration Information

Prepayment of registration fees is required. Checks, international money orders, bank transfers and traveler's checks must be in US dollars. Amex, MasterCard, Visa, and government purchase orders are also accepted. Registrations postmarked after the June 11 deadline will be subject to on-site registration fees. The deadline for refund requests is June 18, 1993. All refund requests must be made in writing. A $75. 00 processing fee will be assessed for all refunds. Student registrations must be accompanied by proof of full-time student status.

Registration forms and inquiries should be directed to:
AAAI–93 / IAAI–93
445 Burgess Drive
Menlo Park, California 94025-3496 USA
415-328-3123; Fax: 415-321-4457
Email ncai@aaai. org.

On-Site Registration will be located at the entrance of Exhibit Hall B on the upper level of the Washington Convention Center, 900 Ninth Street, NW, Washington, DC.

Registration hours will be Sunday, July 11 through Tuesday, July 15 from 7:30 AM – 6:00 PM. On Wednesday, July 14 and Thursday, July 15, hours will be 8:00 AM – 5:00 PM. All attendees must pick up their registration packets for admittance to programs.

Child Care Services

Child care services are available from Lipton Corporate Child Care Center, 655 15th Street., NW, Washington, DC 20005, (202) 416-6875. Lipton Corporate Child Care Center is located one block from the White House and approximately one mile from the Washington Convention Center. Lipton is a fully licensed child care center used by corporate individuals and conference attendees in the Washington DC area. Rates are $12 per hour. Reservations must be made in advance, and directly with Lipton Corporate Child Care Center.

(This information for your convenience, and does not represent an endorsement of Lipton Corporate Child Care Center by AAAI.)

Housing

AAAI has reserved a block of rooms in Washington DC properties at reduced conference rates. To qualify for these rates, housing reservations must be made with the Washington DC Convention & Visitors Bureau housing office. **The deadline for reservations is June 8, 1993.**

To make housing reservations, no form is required. You must call the Housing Bureau :
Metropolitan Washington Area:
   1-202-842-2930
   US & Canada 1-800-535-3336
International Attendees 1-202-842-2930
Please have the following information available prior to calling for reservations:
1. Name of convention attending
2. 1st and 2nd choice of hotel
3. Arrival/departure dates
4. Number of rooms required
5. Type of room (single, double, triple, quad)
6. Number of persons in party
7. Arrival rime
8. Credit card name, number and expiration date
9. Names of **all** occupants of room(s)
10. Address
11. Telephone number

All changes/cancellations prior to June 8, 1993 should be made directly with the Housing Bureau. After this date, please contact the HOTEL directly with any changes or cancellations. Room cancellations must be received by assigned hotel at least 72 hours prior to arrival for refund.

Confirmation will be sent to you from the Housing Bureau. A deposit is not required if a credit card number has been given. In order to guarantee a reservation without a credit card, send deposit amount indicated on the confirmation form directly to the hotel within 15 days of receipt of the confirmation.

International Attendees

International attendees may call the metro area number listed above or fax reservation requests to 202-789-7037. (*Please, only international fax requests will be honored. US and Canadian attendees must use the metro area or "800" number to make reservations.*)
Mailing address *for International Attendees* **ONLY**:
AAAI Housing Bureau
1212 New York Avenue, NW, 6th Floor
Washington, DC 20005

Confirmation will be sent to you from the Housing Bureau. A deposit is not required if a credit card number has been given. In order to guarantee a reservation without a credit card, send deposit amount indicated on the confirmation form directly to the hotel within 15 days of receipt of the confirmation.

All changes/cancellations prior to **June 8, 1993** should be made directly with the Housing Bureau. After this date, please contact the HOTEL directly with any changes or cancellations. Room cancellations must be received by assigned hotel at least 72 hours prior to arrival for refund.

Headquarters Hotel:

Grand Hyatt-Washington
1000 H Street, NW
Washington, DC 20001
Single: $121.00
Double: $141.00
Triple: $165.00
Quad: $190.00
Distance to Center: Across the street

Holiday Inn Crowne Plaza
Metro Center
775 12th Street, NW
Washington, DC 20005
Single: $105.00
Double: $125.00
Triple: n/a
Quad: n/a
Distance to Center: One block
Hotel rooms are priced as singles (1 person, 1 bed), doubles (2 persons, 2 beds), triples (3 persons, 2 beds) or quads (4 persons, 2 beds).

Student Housing

AAAI has reserved a block of dormitory rooms at George Washington University for student housing during the conference. The University is located within two blocks of a MetroRail station that can take you directly across the street from the Washington Convention Center. Accommodations include linen service.
Rates per person
- Two-three persons per room:
  $25 per person per night

- One person per room:
  $40 per person per night
Additional nights can be reserved upon availability. No meals are included.

Student housing reservations and deposits must be received by the AAAI office no later than June 11, 1993. Prepayment of housing fees is required. Checks, international money orders, bank transfers, and traveler's checks must be in US currency. American Express, MasterCard, and Visa, are also accepted. Refund requests must be made in writing. The deadline for refund requests is June 18, 1993. A $50 processing fee will be assessed for all refunds.

Student housing is restricted to full-time graduate or undergraduate students enrolled in a accredited college or university program. Proof of full-time status must accompany the student housing form. Housing forms and inquiries should be directed to:
   AAAI-93/IAAI-93
   445 Burgess Drive
   Menlo Park, California 94025-3496 USA
   415-328-3123; FAX: 415-321-4457
   email: ncai@aaai.org

Air Transportation and Car Rentals

The American Association for Artificial Intelligence has selected United Airlines as the official airline carrier and Hertz Rental Car as the official car rental agency. You can make your airline and car rental reservations by calling the United Airlines Specialized Meeting Reservations Center directly at 800-521-4041 or through any travel agent. Be sure to specify that you are traveling to the AAAI National Conference and identify our reference # 538AG. By using this reference number, you will also qualify for conference discounts on your Hertz Rental Car. For on-site travel needs, The Grand Hyatt Hotel has airline ticket information available at the concierge's desk located in the hotel lobby.

Car Rental Terms and Conditions:

Applicable charges for taxes, optional refueling service, PAI, PEC and LIS are extra. Optional LDW may be purchased at $13 or less per day. Rates are nondiscountable nor usable with any promotion or coupon, with the exception of Hertz gift certificates with PC#27952. Rentals are subject to Hertz minimal rental and driving age of twenty-five, driver's license and credit requirements as well as car availability. Weekend rentals are

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No Housing Form Needed for US Participants. Call the Housing Bureau for your Reservation!

available for pick-up between noon Thursday and noon Sunday and must be returned no later than 11:59 pm Monday. Weekend minimum rentals are as follows: Thursday pick-ups, three days; Friday pick-ups, two days; Saturday and Sunday pick-ups, one day. Weekly rentals are available from five to seven days and must be kept over a Saturday night. Saturday Night Keep rentals are available for pick-up any day of the week and must be kept over a Saturday night.

Ground Transportation

The following information provided is the best available at press time. Please confirm fares when making reservations.

Airport Connections:

Several companies provide service from Washington Dulles Airport and Washington National Airport to downtown Washington, DC. A sampling of companies and their one-way rates are shown below. Contact the company directly for reservations.

Washington Flyer

703/892-6800
Washington Dulles International to downtown Washington, DC
Fare: $15; $24 round trip
Washington National Airport to downtown Washington, DC
Fare: $7; $12 round trip

DC, MD and VA cabs

From Washington National Airport to downtown Washington, DC
Fare: approximately $8 (Local cab listings available at Washington National Airport)

Parking

There is no parking available at the Washington Convention Center. However, parking facilities are available across the street from the Convention Center located at the establishments listed below.

The Grand Hyatt Hotel

1000 H Street, NW
Parking is available for both guests and nonguests of this hotel at $12.00 a day.

Atlantic Garage, Inc.

Techworld 999 Ninth Street
Parking is available at $9.00 a day.

Photo courtesy Washington Convention and Visitor's Bureau.

Bus

The Washington, DC Greyhound/Trailways terminal is located at First & L Streets, approximately eight blocks from the Convention Center. 301/565-2662.

Rail

Amtrak has more than fifty trains daily that link Washington to Baltimore, Philadelphia, New York, and other east coast cities. The Historic Union Station Amtrak depot is located at Massachusetts Avenue and North Capitol Street, approximately ten blocks from the Convention Center. For Amtrak reservations or information, call 800-872-7245.

Metrorail

Washington's modern subway system is known as the Metrorail. Visitors can reach most major attractions in the city on the Metrorail, using the easy-to-follow directional displays at the stations. The system also provides rail links to the Maryland and Virginia suburbs. To travel on the Metrorail, just purchase a farecard at a vending machine in any of the stations. Trains operate every 10 minutes on average from 5:30 am until Midnight, Monday through Friday. Weekend hours are 8 AM until midnight on Saturday, and 10 AM until midnight on Sunday. For Metrorail or Metrobus—providing connecting bus service—information, call 202-637-7000.

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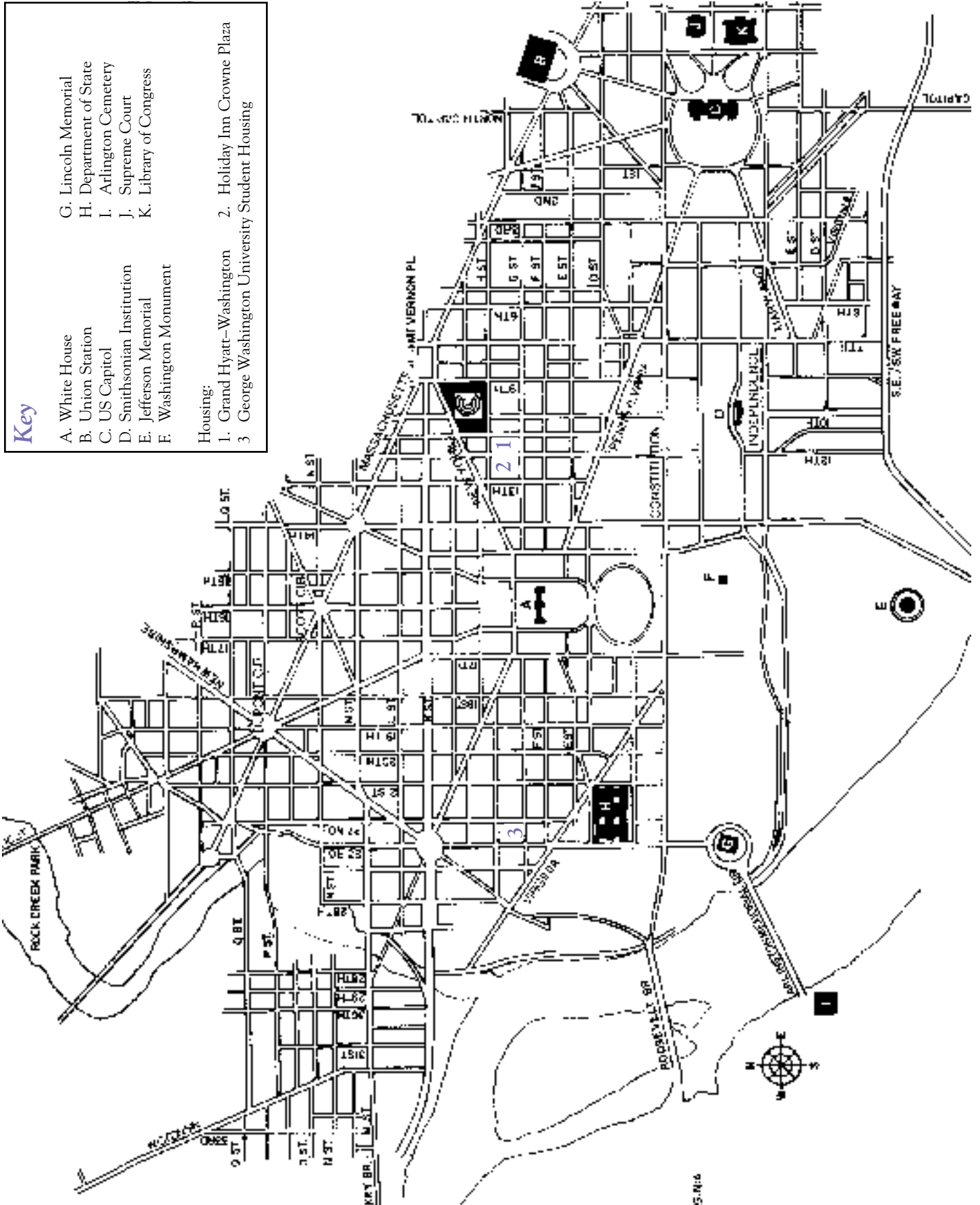
Key

A. White House
B. Union Station
C. US Capitol
D. Smithsonian Institution
E. Jefferson Memorial
F. Washington Monument

G. Lincoln Memorial
H. Department of State
I. Arlington Cemetery
J. Supreme Court
K. Library of Congress

Housing:
1. Grand Hyatt–Washington
2. Holiday Inn Crowne Plaza
3 George Washington University Student Housing