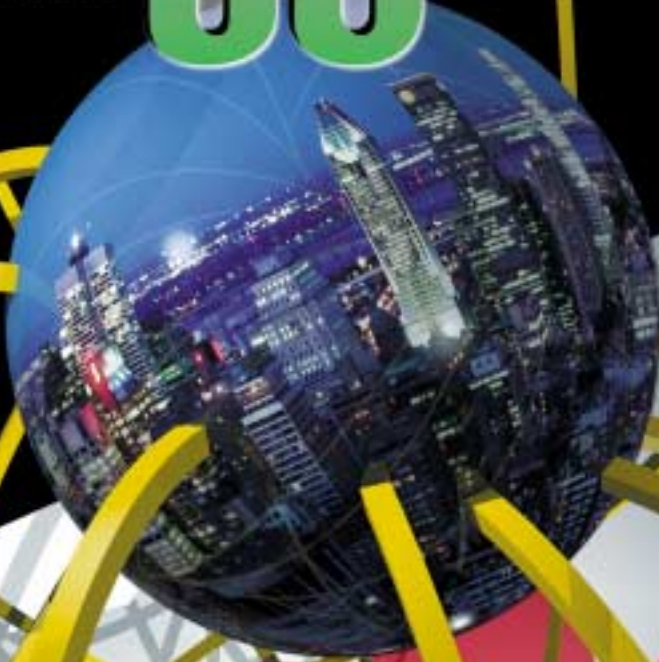


# IJCAI

Montréal  
International Joint  
Conference on  
Artificial Intelligence

# 95

Registration Brochure  
August 19-25, 1995



# MONTRÉAL

## Introduction

IJCAI-95, the Fourteenth International Joint Conference on Artificial Intelligence, is sponsored by the International Joint Conferences on Artificial Intelligence, Inc. (IJCAI), the American Association for Artificial Intelligence (AAAI), and the Canadian Society for Computational Studies of Intelligence/Société Canadienne pour l'Étude de Intelligence par Ordinateur (CSCSI/SCEIO).

IJCAI sponsors biennial conferences on artificial intelligence, which are the main forums for presenting AI research results to the international AI community. Previous conference sites were Washington D.C., USA (1969), London, England (1971), Stanford, California, USA (1973), Tbilisi, Georgia, USSR (1975), Cambridge, Massachusetts, USA (1977), Tokyo, Japan (1979), Vancouver, British Columbia, Canada (1981), Karlsruhe, Germany (1983), Los Angeles, California, USA (1985), Milan, Italy (1987), Detroit, Michigan, USA (1989), Sydney, Australia (1991), and Chambéry, Savoie, France (1983). Future conferences are scheduled for Yokohama, Japan (1997) and Stockholm, Sweden (1999).

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## IJCAI-95 Awards

The IJCAI awards are made by the IJCAI Board of Trustees, upon recommendation by the IJCAI Awards Committee, which consisted this year of Wolfgang Bibel (Darmstadt, Chair), Daniel Bobrow (Palo Alto), Barbara Grosz (Cambridge, Mass), Hirochika Inoue (Tokyo), and Wolfgang Wahlster (Saarbrücken). Each winner will receive a \$2,000 prize and deliver an invited lecture at IJCAI-95.

### IJCAI Award for Research Excellence

The IJCAI Award for Research Excellence is given to «a scientist who has carried out a program of research of consistently high quality, yielding several substantial results.»

The winner of the 1995 IJCAI Research Excellence Award is Herbert A. Simon, University Professor of Computer Science and Psychology at Carnegie-Mellon University. Professor Simon, a participant in the 1956 Dartmouth Conference, is one of the founding fathers of AI. His 1942 PhD thesis develops the notion of bounded rationality, which remains a focal point of much current research in AI. His collaboration with the late Allen Newell produced many of AI's best-known developments: the Logic Theorist, the language IPL, the General Problem Solver, and the physical symbol system hypothesis. He has made major contributions to computer chess and to the study of the process of scientific discovery. His work in AI, economics, psychology, and cognitive science has brought him many major awards, including the Nobel Memorial Prize in Economics, the ACM Turing Award (with Newell), and the National Medal of Science. The title of Herbert Simon's presentation is *Explaining the Ineffable: AI on the Topics of Intuition, Insight and Inspiration*.

### IJCAI Computers and Thought Award

The IJCAI Computers and Thought Award is given to an outstanding young scientist in the field of Artificial Intelligence. The recipients of the 1995 Computers and Thought Award are Sarit Kraus and Stuart Russell. The title of Stuart Russell's presentation is *Rationality and Intelligence*. The title of Sarit Kraus' presentation is *Negotiation and Cooperation in Multi-Agent Environments*.

Sarit Kraus is Senior Lecturer at Bar Ilan University, Israel. She is also a regular visitor and contributor to research at the Institute for Advanced Computer Studies at the University of Maryland. As part of her doctoral research, she wrote a program that plays the game «Diplomacy». This led her to investigate the application of game theory and non-classical logics to automated negotiations. She has also made contributions to both theoretical and practical aspects of nonmonotonic reasoning.

Stuart Russell is Associate Professor of Electrical Engineering and Computer Science at University of California, Berkeley. His early work was in machine learning, particularly on analogical reasoning and on inductive bias. A major contributor to the field of resource-limited reasoning, he proposed a set of reasoning control strategies, showing their use in a variety of applications from computer chess to automatic traffic surveillance. He was the recipient of a Presidential Young Investigator Award in 1990.

## IJCAI-95 Support Programs

### US Scholarship Program

AAAI and IJCAI are pleased to announce the continuation of their Scholarship and Volunteer Programs for students interested in attending the International Joint Conference on Artificial Intelligence in Montréal, Canada, August 20-25, 1995. The U.S. Scholarship Program provides partial travel support and a complimentary technical program registration for students who: (a) are full time undergraduate or graduate students at U.S. colleges and universities; (b) are members of AAAI; (c) submit papers to the technical program or letters of recommendation from their faculty advisor; and (d) submit scholarship applications to AAAI by April 15, 1995. In addition, repeat scholarship applicants must have fulfilled the volunteer and reporting requirements for previous awards.

In the event that scholarship applications exceed available funds, preference will be given to students who have an accepted technical paper, and then to students who are actively participating in the conference in some way. However, all eligible students are encouraged to apply.

All student scholarship recipients will be required to participate in the Student Volunteer Program to support IJCAI organizers in Montréal. The Volunteer Program is an essential part of the conference and student participation is a valuable contribution.

After the conference, an expense report will be required to account for the funds awarded. For further information about the U.S. Scholarship Program, or to obtain an application, please contact AAAI at [scholarships@aaai.org](mailto:scholarships@aaai.org), or 445 Burgess Drive, Menlo Park, Ca, 94025. (415)328-3123.

### International Travel Award Program

Separate travel award programs are available for international students and junior researchers through IJCAI and other national societies. In addition, IJCAI will continue its Eastern European travel award program. For information regarding any of these international programs, please write Priscilla Rasmussen at [rasmusse@cs.rutgers.edu](mailto:rasmusse@cs.rutgers.edu), or IJCAI-95, c/o Priscilla Rasmussen, PO Box 5490, Somerset, NJ 08875, USA. Phone/fax: 908-445-3003.

The original and three copies of a letter of request should be submitted to Priscilla Rasmussen no later than May 1, 1995. This application should state 1) the status of the applicant (student, junior faculty, etc.), 2) type of planned participation in the IJCAI-95 program, 3) an estimate of attendance costs, 4) whether any other sources of support are available to the applicant and whether the local AI Society has been approached for support, 5) plus a letter of support (for students only) from the applicant's advisor. A post-conference report and original receipts totaling the award amount will be required after the conference in order to receive the award.

Students not requiring travel assistance should only apply for the Volunteer Program, which provides complimentary registration to full time students, including conference proceedings, in exchange for assisting IJCAI-95 organizers in Montréal. This program does not provide any scholarship funds, and is designed for local students or students who have other sources for travel funds. For further information regarding the Student Volunteer Program, please contact the Student Volunteer Coordinator, Simon Lacroix at [simon@lass.fr](mailto:simon@lass.fr). The deadline for volunteer applications is May 31, 1995.



## Conference Program Description

The IJCAI-95 Conference is composed of various complementary Programs:

- the Technical Program, including 249 paper presentations, 13 invited lectures, 2 panels, 3 conference reports, a special philosophical encounter, and a video program
- the Tutorial Program (19 tutorials)
- the Workshop Program (37 workshops)
- the Exhibition, including the Robot Competition (3 days)
- the Robot Building Laboratory, RBL-95 (additional registration fee)

### Collocated Conferences:

- the Seventh Conference on Innovative Applications of Artificial Intelligence, IAAI-95 (additional registration fee)
- the First International Conference on Knowledge Discovery and Data Mining, KDD-95 (additional registration fee)

The Technical Program will consist of paper presentations by top scientists in the field. Parallel sessions will be held from Tuesday, August 22 to Friday, August 25. IJCAI-95 received 1112 paper submissions and 249 papers were selected for presentation. The Technical Paper Program will be available electronically or by fax/hardcopy. Please contact AAAI at [ijcai@aaai.org](mailto:ijcai@aaai.org) to request the program by fax or hardcopy, and the World-Wide Web at <http://ijcai.org> to access the program electronically.

## Conference Events

(Venues and times are subject to change)

### IJCAI-95 Official Opening Ceremony and Reception

The Opening Ceremony and Reception will be held at the Palais de Congrès de Montréal on Monday, August 21, from 6:30pm to 9:00pm. The Opening Ceremony will be chaired by C. Raymond Perrault, the Conference Chair of IJCAI-95.

### Conference Banquet

Site to be determined  
 Wednesday, August 23, 7:00 - 10:00 pm  
 (Subject to modification)  
 Cost: US\$50.00/CAN\$70.00

IJCAI-95 attendees may choose to participate in this special evening, which will include aperitif, dinner, wine and entertainment. The cuisine will undoubtedly reflect the multicultural flavor of Montréal. Register early as space is limited.

## Conference at a Glance

	Morning	Afternoon	Evening
Saturday, August 19	Registration Workshops		
Sunday, August 20	Registration Workshops Tutorials KDD-95 RBL-95		KDD-95 Opening Reception
Monday, August 21	Registration Workshops Tutorials IAAI-95 KDD-95 RBL-95		IJCAI-95 Opening Ceremony and Reception
Tuesday, August 22	Registration IJCAI-95 Technical program, Invited Talks, Panels, Videos Exhibition IAAI-95 RBL-95 Robot Competition		Computers and Thought Lecture
Wednesday, August 23	Registration IJCAI-95 Technical program, Invited Talks, Panels, Videos. Exhibition IAAI-95 RBL-95 Robot Competition		Conference Banquet
		Tours	
Thursday, August 24	Registration IJCAI-95 Technical program, Invited Talks, Panels, Videos Exhibition RBL-95		Research Excellence Lecture
Friday, August 25	Registration IJCAI-95 Technical program, Invited Talks, Panels, Videos RBL-95		

## Invited Speakers

**Robert J. Aumann, The Hebrew University of Jerusalem**  
*Cooperation between Game-Playing Machines*

In many games, fully rational play between players who wish to maximize their payoffs may yield results that are bad for all. Computers have inherent limitations on computing capacity; interestingly, it is precisely these limitations that may lead to cooperation between machines, when cooperation is impossible for fully rational players.

**Eugene Charniak, Brown University**  
*Language Comprehension as Abduction, Abduction as Reasoning Under Uncertainty*

Consider the common situation where causal events in the world bring about occurrences of which a reporter writes a description. As readers we do abduction, reasoning backwards from effects (sentences) to causes (world events). Programs for other forms of abduction (medical diagnosis) typically use some kind of reasoning under uncertainty, e.g., Bayesian networks. We approach language understanding in the same way.

**Yuval Davidor, Schema - Evolutionary Algorithms Ltd.**  
*Do Evolutionary Algorithms Need Intelligence?*

The growing use of evolutionary algorithms, random based blind search algorithms, as efficient solvers of complex problems exhibits a growing use of classical, more deterministic, AI paradigms. Is this a message from nature, or a programmers choice made possible only in the artificial world of the computer?

**Michael P. Georgeff, Australian AI Institute**  
*Agents and Their Plans*

This talk examines the way in which intelligent agents form, choose among, and carry out plans of action so as to best accomplish the various tasks that are considered important for survival. It lays a framework for this wider perspective on the role of plans in rational activity and discusses some of the major unresolved difficulties.

**Barbara Hayes-Roth, Stanford University**  
*Agents on Stage: Advancing the State of the Art of AI*

**Patrick Hayes, Beckman Institute and Kenneth Ford, University of Western Florida**

*Turing Test Considered Harmful*

Passing the Turing Test is still widely cited as defining the ultimate goal or driving vision of AI. We argue that this is a mistake, and should be explicitly rejected by both AI engineers and cognitive scientists. The Test is a poor experimental design; but more seriously, it is misconceived, and this misconception has done considerable harm to the field. Other technologies began by attempting to imitate nature, but made progress only by abandoning this naive idea. We describe an alternative view of what AI is about and what its aims should be, which fits better with the actual direction of most AI research and bypasses many of the philosophical attacks on the subject.

**Judy Kay, University of Sydney**  
*Vive la difference: Adaptive Interaction with Users as Individuals*

To build systems that can deal with the individual differences of users, we need to represent a model of the user. Such a user model can support interpretation of user actions and drive the system's actions. The talk overviews the directions in user modelling, its applications and the fundamental issues for building and maintaining user models.

**Jeff Kephart, IBM T.J. Watson Research Center**  
*Biological Warfare: The Battle Against Computer Viruses*

Today's anti-virus technology is just barely able to keep pace with the half dozen new viruses that are written every day. In a few years, highly connected networks and intelligent agents navigating through them are likely to form an extremely fertile medium for a new breed of viruses. At IBM, we are developing biologically inspired anti-virus techniques designed to thwart both today's and tomorrow's viruses, including a computer immune system and a neural network virus detector.

**Pattie Maes, MIT Media Laboratory**  
*Software Agents that Assist and Entertain*

**Stephen Muggleton, Oxford University Computing Laboratory**  
*Inductive Logic Programming: Inverse Resolution and Beyond*  
Inductive Logic Programming (ILP) involves construction of first-order Horn clauses from examples and background knowledge. This paper will explain the driving forces within a particular line of development within ILP, from the inversion of resolution proofs, via relative least general generalisation to inversion of semantic entailment.

**Bart Selman, AT&T Bell Laboratories**  
*Stochastic Search and Phase Transitions: AI Meets Physics*  
Significant progress has been made recently in our understanding of the nature of computationally hard problems. In addition, new stochastic methods have been discovered for solving such problems. I'll discuss these developments and also a surprising connection to phase transition phenomena studied in physics.

**Stuart Shieber, Harvard University**  
*The Graphically Articulate Computer*

Human beings have been using natural language for perhaps millions of years, but symbolic graphical languages date from only the late 18th century, providing some basis for the hope that building a graphically articulate computer may be much more practical than building a linguistically articulate one.

**Demetri Terzopoulos, University of Toronto and Canadian Institute for Advanced Research**  
*The Modeling of Living Systems and Computer Vision*

This talk will present computer vision research that draws upon advanced physical modeling and artificial life. Topics will include: 1) the development of active vision systems for the sensorimotor control of artificial animals in realistic virtual worlds, and 2) facial image analysis using functional models of human heads conformed to individuals.



## Conference Reports

### **A Conference Report on IJAR (International Conference on Logic Programming and Automated Reasoning)**

*Andrei Voronkov, St Petersburg, Russia*

### **A Report on QR '94 (The Eighth International Workshop on Qualitative Reasoning about Physical Systems)**

*Toyoaki Nishida, Nara Institute of Science and Technology, Japan*

### **A Report on ICMAS-95 (The First International Conference on MultiAgent Systems)**

*Victor Lesser, University of Massachusetts, USA*

## Panel Program

### **Systematic Versus Stochastic Constraint Satisfaction**

**Organizer:** Eugene Freuder, University of New Hampshire

**Panelists:** Rina Dechter, University of California, Irvine; Matthew L. Ginsberg, CIRL, University of Oregon; Bart Selman, AT&T Bell Laboratories; Edward Tsang, University of Essex

Faced with choices in a problem solving process, systematic solution methods will, if necessary, try every option. Stochastic methods can make choices, sometimes random choices, without the assurance of eventually being able to consider all the alternatives. The panel will debate these two approaches in the context of constraint satisfaction.

### **VERY Large Knowledge Bases - Architecture vs Engineering**

**Organizer:** James Hendler, University of Maryland

**Panelists:** Jaime Carbonell, Carnegie-Mellon University; Douglas Lenat, Cycorp; Riichiro Mizoguchi, Osaka University; Paul Rosenbloom, ISI;

The particular topic of this panel is to explore WHERE such very large knowledge bases are to come from. The panel will focus on the issue of whether it is more imperative to be collecting knowledge, as is being done in the CYC project, or to be developing architectures that are intended to learn the knowledge or to glean the knowledge bases from existing data repositories. Contrasted with Lenat's CYC project will be approaches including focused knowledge engineering (Mizoguchi), SOAR (Rosenbloom), learning (Carbonell), and high performance computing architectures (Hendler).

### **A Philosophical Encounter: An Interactive Presentation of Some of the Key Philosophical Problems in AI and AI Problems in Philosophy.**

**Aaron Sloman, The University of Birmingham**

This is a highly interactive presentation of philosophical issues that are central to AI (construed as the general science of mind), including: whether and how machines can have minds, the role of consciousness and the architectural prerequisites for emotions. Some distinguished AI theorists are likely to join in.

## IJCAI-95 Videotape Program

As a medium, videotapes are better suited than written papers to illuminate the efficacy of AI research, especially in the emerging and exciting areas of AI in Education, Art, Music, Entertainment, Hypermedia, 3-D Animation, Artificial Life, Network-Based tools like Mosaic, etc.

If a picture is worth a thousand words, then a (3-D) movie will certainly enhance the illustration of behaviors of these systems that are based on AI principles, methods, and tools.

Recognizing this potential of video presentations to demonstrate and augment AI research results, a Video Track has been designated since IJCAI-89 to be an integral part of the Technical Programs of IJCAI Conferences.

The IJCAI-95 Video Track is designed to demonstrate the current levels of usefulness of AI tools, techniques, and methods for a variety of practical and theoretical problems arising in industrial, commercial, government, space, and educational areas.

The IJCAI-95 Video Track will serve as a forum to showcase the best AI research results through:

- special video sessions, organized and timetabled as part of the conference, giving authors an opportunity to present and briefly discuss their videos;
- abstracts of accepted videos (published in the conference proceedings); and videotapes containing the entire video program (published by IJCAI Inc.).

We look forward to your participation and contribution to the success of the IJCAI-95 Video Track.

*Ramasamy Uthurusamy, Video Track Chair*

## Tutorial Program Overview

The IJCAI tutorial program for 1995 features 19 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. Tutorials designated «SA» will be held Sunday, August 20, from 9:00am–1:00pm. «SP» tutorials will be held Sunday, August 20, from 2:00–6:00pm. «MA» tutorials will be held Monday, August 21, from 9:00am–1:00pm. «MP» tutorials will be held Monday, August 21, from 2–6pm.

### Case-Based Reasoning: Issues and Applications (SA2)

Kevin Ashley and Evangelos Simoudis

### Constraint Directed Scheduling: Theory and Practice (MA4)

Mark S. Fox and Monte Zweben

### Constraint Satisfaction and Constraint Programming (SA5)

Eugene C. Freuder and Pascal Van Hentenryck

### Cooperative Information Systems (MA5)

Michael N. Huhns and Munindar P. Singh

### Foundations of Logic & Inference (SA1)

Stuart C. Shapiro

### Genetic Algorithms and Genetics-Based Machine Learning (MA3)

David E. Goldberg and John R. Koza

### Hybrid Intelligent Systems (MP3)

Larry R. Medsker

### Inductive Logic Programming and Applications (MP4)

Stan Matwin and Francesco Bergadano

### Information and Knowledge Base Management (SP5)

John Mylopoulos and Thodoros Topaloglou

### Intelligent Multimedia Interfaces (MP5)

Mark T. Maybury

### Knowledge Discovery in Databases (MA1)

Usama Fayyad and Evangelos Simoudis

### Knowledge Engineering Environments for Reusable Knowledge Components (MP2)

Henrik Eriksson and Angel R. Puerta

### Large-Scale Chaos in Intelligent Systems (SP4)

Kazuyuki Aihara, Hiroaki Kitano and Jun Tani

### Machine Learning and Knowledge Acquisition: Integrated Approaches (SA3)

Gheorghe Tecuci

### Planning and Learning (MA2)

Manuela Veloso and Daniel Borrajo

### Principles of Perception and Action in Mobile Robotics (SP1)

Gregory Dudek and Michael Jenkin

### Probabilistic Machine Learning: Putting Theory into Practice (SP2)

Wray L. Buntine and Padhraic Smyth

### Representation of Spatial Knowledge (SA4)

Amitabha Mukerjee and Daniel Hernández

### Temporal Reasoning in AI (SP3)

Han Reichgelt and Lluís Vila

## Tutorial Descriptions

### SA1:

#### Title: Foundations of Logic and Inference



*Speaker: Stuart C. Shapiro, State University of New York at Buffalo, USA*

This tutorial is intended for AI students, teachers, practitioners and researchers who feel they have less than a firm grip on the foundations of logic and inference as used in AI. Logic is the study of correct reasoning, not a particular knowledge representation language. Various logics (systems of logic) have been designed to capture different applications and different notions of «correct reasoning.» and AI'ers must be able to design their own. We will describe what needs to be specified to define a logic - syntax, semantics, syntactic inference, and semantic inference- and will do this for several different logics, including the standard logics and clause-form logics. We will explain the notions of domains, interpretations, theoremhood, validity, argument, consistence, soundness and completeness, and discuss their relevance to AI systems. We will explain the proper contexts for understanding: direct vs. refutation proofs; resolution and unification; the ANSWER predicate. Concrete examples will be used to ground these usually abstract notions in easily understood situations. The style of explanation of this material has been honed over thirty years of study and twenty-four years of teaching, and is not duplicated in any text.

Prerequisite knowledge: Basic familiarity with computational methods and with symbolic logic. A reading knowledge of Lisp will be helpful.

Stuart C. Shapiro (Ph.D., 1971, computer sciences, U. Wisconsin) is professor of computer science at the State University of New York at Buffalo, outgoing Chair of ACM/SIGART (1991-95), and a Fellow of AAAI. His research is in knowledge representation, reasoning and natural language processing. He is the editor-in-chief of the Encyclopedia of AI, and author or co-author of three books and over 150 technical articles and reports.

### SA2:

#### Title: Case-Based Reasoning: Issues and Applications



*Speakers: Kevin Ashley, University of Pittsburgh, USA and Evangelos Simoudis, Lockheed AI Center, USA*

Case-Based Reasoning (CBR) has matured as a subdiscipline of AI research and as an AI applications methodology. Researchers are making new strides in using CBR to capture and apply knowledge to guide machine learning. Case-based planning systems are applying databases of thousands of cases to solve new planning problems. The CBR research community is now addressing questions characteristic of a more mature science, such as appropriate evaluation standards. Applications engineers, meanwhile, are developing a second generation of CBR applications in the areas of Help Desks, automated assistants for design and diagnosis, and forging new links between CBR applications systems and on-line databases. Successful commercial applications with demonstrable gains in efficiency are becoming more and more frequent.

This tutorial showcases recent developments in CBR research and applications and focuses on a set of current important issues listed below. The tutorial is designed primarily for professionals already familiar with basic CBR concepts and programs. Our brief introduction to CBR should, however, enable beginners to understand and participate in the discussion of the issues:

- What are the comparative advantages and costs of implementing industrial systems using commercially available CBR shells rather than developing them from scratch?
- Does adaptation in CBR really work?
- What are the latest developments in CBR applications for diagnosis and design?
- How can CBR techniques be used to provide knowledge that can utilized during inductive learning operations?



- How can CBR systems explain their advice?
- How should CBR programs be evaluated?

Dr. Kevin Ashley is a Co-Director of the Graduate Program in Intelligent Systems at the University of Pittsburgh, an Associate Professor of Law and a Research Scientist at the Learning Research and Development Center. His book, *Modeling Legal Argument: Reasoning with Cases and Hypotheticals*, (The MIT Press/Bradford Books), based on his dissertation work at the University of Massachusetts, describes his CBR system, HYPO, which argues by analogy to past legal cases and poses hypothetical cases. His research interests include case-based and analogical reasoning, argumentation and explanation and designing computer systems for assisting attorneys in law teaching and practice. He is an NSF Presidential Young Investigator and was a Visiting Scientist at the IBM Thomas J. Watson Research Center. He received a B.A. in philosophy from Princeton University in 1973 and a J.D. from Harvard Law School in 1976. Prior to his graduate work in AI, he was an associate attorney at White & Case, a large Wall Street law firm.

Dr. Evangelos Simoudis is a Group Leader of the Data Comprehension Group at the Lockheed AI Center where, since 1991, he leads research on knowledge discovery in databases, machine learning, case-based reasoning and their application to financial, retail, and fraud detection problems. Simoudis is also an adjunct assistant professor at the Computer Engineering department of the Santa Clara University where he teaches graduate courses on machine learning and case-based reasoning. Dr. Simoudis holds a Ph.D. in Computer Science from Brandeis University, and an M.S. in Computer Science from the University of Oregon, a B.S. in Electrical Engineering from the California Institute of Technology, and a B.A. in Physics from Grinnell College. Prior to joining Lockheed, Dr. Simoudis was a principal software engineer at Digital Equipment Corporation's Artificial Intelligence Center where he led work on case-based reasoning, learning, and distributed AI. Dr. Simoudis is the North American editor of the *Artificial Intelligence Review Journal*.

Drs. Ashley and Simoudis are collaborating on a book entitled *Case-Based Reasoning: Issues and Applications*.

### SA3:

#### Title: Machine Learning and Knowledge Acquisition: Integrated Approaches



**Speaker: Gheorghe Tecuci, George Mason University, USA and Romanian Academy, Romania**

Knowledge Acquisition and Machine Learning represent two complementary approaches to the acquisition and organization of knowledge for knowledge-based systems. Knowledge Acquisition has focused on improving and partially automating the acquisition of knowledge from human experts by knowledge engineers. In contrast, Machine Learning has focused on developing autonomous algorithms for acquiring knowledge from data and for knowledge compilation and organization. Currently, both fields are moving toward an integrated approach, using machine learning techniques to automate knowledge acquisition from experts, and knowledge acquisition techniques to guide and assist the learning process. This is one of the central and fastest growing research directions in AI because of its applicability to a wider range of practical problems. This tutorial will present an overview of integrated machine learning and knowledge acquisition methods, systems and applications. It will first review the Machine Learning and Knowledge Acquisition fields, including basic machine learning strategies and basic knowledge acquisition methodologies. Then it will present the main approaches to the integration of machine learning and knowledge acquisition, such as, case-based reasoning; apprenticeship learning; example-guided knowledge base revision; interactive inductive logic programming; integration of repertory grid elicitation and empirical inductive learning; integration of systematic elicitation of knowledge and explanation-based learning; and integration of multistrategy learning, knowledge elicitation and experimentation. It will also discuss their application to such areas as planning, scheduling, manufacturing, design, medical diagnosis, mechanical diagnosis, control, information retrieval and robotics. Finally, it will present current and prospective research directions and provide a comprehensive bibliography.

**Prerequisite knowledge:** The tutorial is addressed to persons with basic computer science or cognitive science background, who are interested in the prospects of building advanced learning and knowledge acquisition systems, and/or applying them to various practical domains. Basic knowledge in artificial intelligence at the level of an introductory course is highly desirable.

Gheorghe Tecuci is Associate Professor of Computer Science at George Mason University, USA and a Member of the Romanian Academy. Dr. Tecuci has published over 70 papers and is known for his research on multistrategy learning and the integration of machine learning and knowledge acquisition, being credited with the development of some of the first systems in these areas. He has coedited the books «Machine Learning: A Multistrategy Approach» (Morgan Kaufmann, 1994) and «Machine Learning and Knowledge Acquisition: Integrated Approaches» (Academic Press, 1995). He has also edited several conference proceedings and journals and coorganized the first international workshops in these areas.

### SA4:

#### Title: Representation of Spatial Knowledge



**Speakers: Amitabha Mukerjee, Indian Institute of Technology, Kanpur, India and Daniel Hernández, Technische Universität München, Germany**

This tutorial is aimed at AI researchers and engineers interested in representing and reasoning with spatial knowledge, i.e., shape, size, relative position, connectivity, etc.

The need to represent spatial knowledge explicitly arises in applications as diverse as Geographical Information Systems, Image Analysis, Robot Navigation, Natural Language Understanding, and Visual Modeling.

In this tutorial, we highlight the progress that has been made in representing space at different levels of abstraction, with particular emphasis on applications. We will first compare traditional quantitative approaches with recent qualitative and hybrid approaches. We will then cover interval algebras and present a 2D application for block-based image structures such as documents. Next we shall give an overview of extant approaches to the representation of arrangement, topology, orientation, size, distance, and shape together with the corresponding reasoning mechanisms. Along the way we shall discuss general representational aspects (frames of reference, points vs. extension, granularity, vagueness) and illustrate these with particular applications such as extended spatial query languages for GIS and a hybrid model for conceptual design involving shapes in 2D and 3D. We will provide extensive course notes covering a broader swath of material, with the presentation focused on issues of greater audience interest.

**Prerequisite knowledge:** The tutorial is reasonably self-contained; the equivalent of an introductory AI course should be sufficient.

Amitabha Mukerjee: Ph.D., University of Rochester, 1986. Taught in the Computer Science Department at Texas A&M University until '91. Currently at the Center for Robotics, IIT Kanpur, India, Dr. Mukerjee has been investigating models of space and time since 1987, and has written several papers in IJCAI/AAAI on temporal and spatial reasoning. He uses spatial reasoning in mechanical design and vision applications.

Daniel Hernández received his Ph.D. in computer science from the Technische Universität München (1992). He leads (since 1991) the AI/Cognition Group at TUM (Prof. Brauer). His current research focuses on qualitative approaches to the representation of temporal and spatial knowledge, a subject on which he has published several papers and a book (Vol. 804 of Lecture Notes in Artificial Intelligence, Springer).

## SA5:

### Title: Constraint Satisfaction and Constraint Programming



**Speakers:** Eugene C. Freuder, University of New Hampshire, USA and Pascal Van Hentenryck, Brown University, USA

Constraint satisfaction is a powerful artificial intelligence problem-solving paradigm with many applications. These include configuration and design problems, planning and scheduling,

machine vision and language understanding, temporal and spatial reasoning, defeasible and causal reasoning, qualitative and diagnostic reasoning. The ideal of describing a constraint problem domain in natural, declarative terms and then letting general deductive mechanisms synthesize individual problem solutions, has been to some extent realized, and even embodied in programming languages.

In this tutorial you will see how a wide variety of problems can be expressed in terms of constraints. You will be introduced to basic search and constraint propagation techniques and learn the rudiments of constraint logic programming. A number of applications and case studies will be presented. Both symbolic and numeric constraints will be considered. The tutorial will present material at several levels, providing you with a sense of the paradigm's potential, as well as a basic technical background.

**Prerequisite knowledge:** The tutorial should be accessible to anyone with a rudimentary knowledge of computer science, though attendees with more experience with algorithms or programming languages will be better prepared to absorb some of the more technical material.

Eugene C. Freuder is a professor at the University of New Hampshire. He is coeditor of the *Artificial Intelligence Special Volume: Constraint-Based Reasoning*, and editor of the *IEEE Expert* Special Track on Constraint Satisfaction. His many publications on constraints include multiple contributions to the AAAI and IJCAI conferences and the AI and JACM Journals.

Pascal Van Hentenryck is an assistant professor at Brown University. He is one of the designers of the CHIP language and the designer of the constraint languages cc (FD) and Newton. He is the author of *Constraint Satisfaction in Logic Programming*, and a guest editor of a special issue of the *Journal of Logic Programming* on Constraint Logic Programming.

## SP1:

### Title: Principles of Perception and Action in Mobile Robotics



**Speakers:** Gregory Dudek, McGill University, Canada and Michael Jenkin, York University, Canada

In the last few years, mobile robotics matured significantly and can be used to send autonomous vehicles to environments ranging from the Polar Icecaps to the bottom of undersea trenches, to

indoor office environments. Although individual robots may have wildly different external appearances, different mechanisms of locomotion, and different missions or goals, many of the underlying computational and perceptual principles are similar. These computational tasks are characterized by a unique blend of methodologies drawn from Artificial Intelligence, spatial data acquisition and data interpretation. This tutorial presents an overview of the key computational issues involved and the state of the art in mobile robotics. It covers fundamental issues related to sensing and sensor modelling, spatial data representation and reasoning, and actual existing systems. Specific topics include alternative methods for representing spatial information such as occupancy grids, potential fields and multi-scale elevation maps, algorithms for estimating a robot's position within a (partially) known environment from sensor data and for limiting uncertainty during data acquisition, and algorithms for exploring and mapping space.

**Prerequisite knowledge:** This presentation will be directed at researchers from either academia or industry with limited prior background in mobile robotics. A solid background in mathematics and computer science will be assumed including, specifically, a knowledge of linear algebra, programming and software design. Undergraduate course work in computer vision, computer graphics, or spatial data representation would assure a solid background but is not required.

Gregory Dudek is an Assistant Professor with the School of Computer Science and a member of the Centre for Intelligent Machines, McGill University. He has published refereed articles in Mobile Robotics and Computer Vision, including papers at IJCAI, IEEE/RSJ IROS (Intelligent Robots and Systems), IAS (Intelligent Autonomous Systems), IEEE R&A (Robotics and Automation), and IEEE Transactions on Robotics and Automation. He was also an invited presenter at the 1992 Robotics and Automation workshop «Sensing and Spatial Reasoning for Mobile Robots». He has taught undergraduate and graduate courses including «Computer Graphics» and «Mobile Robotics» at McGill University.

Michael Jenkin is an Associate Professor with the Department of Computer Science, York University. He has published refereed articles in Mobile Robotics and Computer Vision, including papers at IJCAI, IEEE/RSJ IROS (Intelligent Robots and Systems), IAS (Intelligent Autonomous Systems), IEEE R&A (Robotics and Automation), IEEE Transactions on Robotics and Automation, CVGIP: IU, IEEE Transactions on Systems, Man and Cybernetics, and the International Journal of Pattern Recognition and AI. He was also an invited presenter at the 1992 Robotics and Automation workshop «Sensing and Spatial Reasoning for Mobile Robots» and with Laurence Harris was the co-editor of *Spatial Vision in Humans and Robots*, published by Cambridge University Press. He has taught undergraduate and graduate courses including «Computer Graphics» and «Computer Vision» at York University.

## SP2:

### Title: Probabilistic Machine Learning: Putting Theory into Practice



**Speakers:** Wray L. Buntine, RIACS & NASA Ames Research Center, USA Padhraic Smyth, Jet Propulsion Laboratory, California Institute of Technology, USA

This Tutorial is intended for both AI researchers and practitioners interested in machine learning,

particularly for those seeking a thorough and quantitative overview of the field. The large variety of learning algorithms and approaches presented in the machine learning literature can often appear as a random collection of widely different methods. Consequently, when faced with a practical learning application (such as in text understanding, image analysis, data mining, robotics, and so forth) it can be difficult to match the application with a particular learning method. The goal of this tutorial is to impart to the attendee the idea that many seemingly disparate learning methods can often be understood at a first principles level within a common framework. In this tutorial we will present a unified probabilistic framework for learning. This framework will provide a clear and *systematic* understanding of the basic principles which underlie many learning models (including maximum likelihood and Bayesian techniques) and the application of these principles in algorithmic form. The tutorial will focus in particular on the interrelationships which exist among popular learning models such as decision trees, neural network models, and exemplar-based methods. We will present the basic motivation and concepts behind each model with particular emphasis on successful real-world applications.

**Prerequisite knowledge:** An understanding of basic concepts in probability, computing and elementary calculus is required.

Padhraic Smyth received his Ph.D. in electrical engineering from the California Institute of Technology in 1988. Since then he has been working at the Jet Propulsion

Laboratory, Pasadena, CA, where he is principal investigator of several projects investigating the applications of machine learning and pattern recognition to problems of interest to NASA. He is also a lecturer in the Computation and Neural Systems Department at Caltech, co-editor of a forthcoming book on knowledge discovery in databases, and general chair for the next AI and Statistics Workshop.

Wray L. Buntine received his Ph.D. (1992) in computer science from University of Technology, Sydney. He is currently a scientist at Research Institute for Advanced Computing Science at NASA Ames Research Center. His research interests focus on algorithms for data analysis. He has taught courses at Stanford University and University of California, Berkeley. He has published over thirty technical articles on learning and uncertainty in machine learning, neural networks, statistics, and their applications, and distributed the IND Tree Software Package.

### SP3:

#### Title: Temporal Reasoning in AI



*Speakers: Han Reichgelt, University of the West Indies and Lluís Vila, Institute for Research in Artificial Intelligence (IIIA), Bellaterra, Spain,*

The notion of time is central in AI. A whole range of intelligent tasks require reasoning about time. Examples include Prediction, Diagnosis, Scheduling and Planning, Process Supervision and Natural Language Understanding. It follows that the representation of time and reasoning about time is of crucial importance for AI systems. This tutorial introduces the various issues involved in the construction of a temporal reasoning systems, and provides a progressively detailed analysis of each of these discussing the advantages and shortcomings of the different approaches in the literature. In particular, we will discuss different ontologies and theories of time, temporal constraint satisfaction algorithms, temporal logics, different ways of combining the latter two. We will also discuss the use of temporal logics in planning, paying particular attention to the increasingly important issue of temporal planning.

Prerequisite knowledge: The tutorial will assume some basic understanding of first-order predicate calculus. However it will assume no in-depth knowledge of the field of temporal reasoning. It is our intention to present both introductory and in-depth material. The tutorial will therefore be suitable both to complete novices in the field and those with some background in the area. This tutorial will be of interest both for those interested in knowledge representation from a theoretical perspective, and for those who are involved in building intelligent systems.

Han Reichgelt received his first degree from the University of Nijmegen, Holland, and his Ph.D. from the University of Edinburgh. He is currently Professor of Computer Science at the University of the West Indies, Mona, Jamaica. His research interest include planning and theorem proving for non-standard logics.

Lluís Vila received a Ph.D. in computer science (AI Program) from the Technical University of Catalonia, where he also lectured graduate students. He has been working at the Institute for Research in Artificial Intelligence (IIIA), Bellaterra, Catalonia, Spain, taking part in several national and European (ESPIRIT I-II) projects on research and application of AI techniques for industrial processes. He is the author of several papers on different aspects of representation and reasoning about time in AI, including two survey papers, the first of which appeared in *AI Communications* [7 (1), March 1994] and the second of which is available as IIIA report 94/14. He is currently a postgraduate fellow at the University of California, Irvine.

### SP4:

#### Title: Large-Scale Chaos in Intelligent Systems



*Speakers: Kazuyuki Aihara, University of Tokyo, Japan, Hiroaki Kitano and Jun Tani, Sony CSL, Japan*

We firmly believe that we are in an age when we need to seriously

investigate the value of chaotic dynamics even for artificial intelligent systems. Redescribing «intelligence» in the language of nonlinear dynamics is a challenging and important trial.

This tutorial will introduce the basic concept of *Large-Scale Chaos in Intelligent Systems*. Initially, the mathematical basis of chaos theory will be reviewed briefly. Then, we will look into chaos in the biological brain in single neural activities, in collective network behavior, and also in the morphogenesis of neural development. Next we will explain how large-scale chaos generates intelligent activities from the computational viewpoint. We introduce the concept of symbolic dynamics, chaotic PDP by chaos neural networks and complex adaptive system in order to relate chaotic dynamics to intelligent computations. Next we describe an experiment using an autonomous robot in an attempt to apply the theory and the modeling to the physical world. Finally, the tutorial will elucidate the problems and opportunities ahead of us.

Prerequisite knowledge: No prior knowledge of chaos theory is required. Some knowledge of dynamical systems would be helpful, though not required.

Kazuyuki Aihara received his Ph.D.(1982) in electronic engineering from the University of Tokyo. He is currently an associate professor of mathematical engineering at the University of Tokyo, chairman of Biochaos Research Committee in JEIDA and Chaos Engineering Research Committee in JTTAS, and member of editorial board of «Neural Networks» and governing board of JNNS. His research interests include mathematical modeling of biological neurons and chaotic PDP by spatio-temporal complex dynamics of chaotic neural networks.

Hiroaki Kitano is a researcher at Sony Computer Science Laboratory. He graduated from International Christian University in 1984 (B.A. in Physics), and received a Ph.D. in computer science from Kyoto University in 1991. From 1984-1993, he was a researcher at NEC Corporation. Since 1988, he has been a visiting researcher at Carnegie Mellon University. In 1993, he received the Computers and Thought Award from IJCAI. Dr. Kitano has been working on various aspects of massively parallel AI research, genetic algorithm, evolutionary large-scale chaos.

Jun Tani is an associate researcher in Sony Computer Science Laboratory. He recently proposed a theory called adaptive symbolic dynamics which is intended to bridge the gap between symbols and patterns using chaos theory. He is conducting a project introducing an autonomous robot which can learn, as a practical application of the theory. He received Ph.D. in Electrical Engineering from Sofia University in 1995.

## SP5:

### Title: Information and Knowledge Base Management



*Speakers: John Mylopoulos, University of Toronto, Canada and Thodoros Topaloglou, University of Toronto, Canada*

Acknowledgment: The material to be presented was compiled by the Knowledge Base Management group, consisting of John Mylopoulos, Vinay Chaudhri, Igor Jurisica, Dimitris Plexousakis, Adel Shrufi, Thodoros Topaloglou and Haiqing Wang.

Many advanced information system applications in CAD, Software Engineering, Real-time Systems and Electronic Libraries, require the construction of large knowledge bases, including millions of knowledge items inference mechanisms, ranging from temporal, spatial and terminological to general-purpose reasoning.

Building such knowledge bases is well-beyond the state-of-the-art of existing tools. The purpose of the tutorial is to examine current technologies, including expert system shells and advanced database management systems (object-oriented, deductive etc.) and assess their usefulness in building large knowledge bases. In addition, the tutorial reviews current research on new implementation techniques that address issues of physical storage management, query optimization, concurrency control, constraint enforcement and others. The tutorial concludes with two case studies involving implementations of large knowledge bases in terms of existing database management tools.

The tutorial is intended to be of interest to practitioners who are interested in developing large knowledge based systems using existing commercial products, and also to researchers who are interested in research problems and research directions.

John Mylopoulos is professor of Computer Science at the University of Toronto. His research interests include knowledge base management and the application of knowledge representation techniques to databases and software engineering. Mylopoulos is a AAAI fellow, recipient of the Outstanding Services Award of the Canadian Society for the Computational Studies of Intelligence and served as programme co-chair for IJCAI'91.

Thodoros Topaloglou is a Ph.D. candidate in the Department of Computer Science at the University of Toronto. Over the last six years he has conducted research on implementation issues of knowledge representation languages, and storage management and query processing for knowledge bases. His research interests also include spatial reasoning, temporal reasoning and genome databases.

## MA1:

### Title: Knowledge Discovery in Databases



*Speakers: Usama Fayyad, Jet Propulsion Laboratory, California Institute of Technology, USA and Evangelos Simoudis, Lockheed AI Center, USA*

Knowledge Discovery in Databases (KDD) (also known as Data Mining) is a new AI field that combines techniques from machine learning, pattern recognition, statistics, databases, and visualization to automatically extract knowledge (or information) from lower

level data (databases). This knowledge is subsequently used to support human decision-making, e.g., prediction and classification tasks, summarize the contents of databases, or explain observed phenomena. The use of KDD systems alleviates the problem of manually analyzing the large amounts of collected data which decision-makers face currently. Successful KDD systems have been implemented and are currently in use in finance, fraud detection, market data analysis, astronomy, diagnosis, manufacturing, and biology.

This tutorial presents a comprehensive picture of current research paradigms in the field of KDD. The tutorial will provide an introduction to KDD, present methods for data preparation and preprocessing, describe major KDD techniques from the fields of AI, pattern recognition, databases, and visualization, discuss major KDD systems from

academia and industry and provide a guide for developing a KDD system. In the process, the tutorial addresses such issues as:

- Why KDD is necessary;
- What are the most appropriate representations of the extracted knowledge;
- The use of prior knowledge to improve and control the discovery process;
- Characteristics of domains and tasks that make them appropriate for KDD approaches;
- Core issues for KDD systems such as data problems, information content of the data, selecting the appropriate KDD technique;

Dr. Usama Fayyad is Supervisor of the Machine Learning Systems Group at the Jet Propulsion Laboratory, California Institute of Technology. He is also an adjunct assistant professor in the Computer Science Department at the University of Southern California (USC). At JPL, he is Principal Investigator of the Science Data Analysis and Visualization Tasks and other tasks involving machine learning applications. He holds the following degrees: B.S.E. in E.E., B.S.E. in Computer Engin., M.S.E. in Computer Engin., M.Sc. in Mathematics, and Ph.D. in Computer Science and Engineering (1991) from the University of Michigan. He is a recipient of the 1993 Lew Allen Award for Excellence, the highest honor JPL awards to researchers in the early years of their professional careers. He serves on the program committees of several major conferences, has co-chaired the Eleventh SPIE Applications of AI Conference (1993), and the 1994 Knowledge Discovery in Databases Workshop at AAAI-94. He is co-chair of the First International Conference on Knowledge Discovery and Data Mining (KDD-95).

Dr. Evangelos Simoudis is a Group Leader of the Data Comprehension Group at the Lockheed AI Center where, since 1991, he leads research on knowledge discovery in databases, machine learning, case-based reasoning and their application to financial, retail, and fraud detection problems. His work on knowledge discovery in databases has resulted in the Recon KDD system that is sold commercially by Lockheed. In 1994 he and his team were awarded a Lockheed Pursuit of Excellence Award for their work on the Recon system. Simoudis is also an adjunct assistant professor at the Computer Engineering department of the Santa Clara University where he teaches graduate courses on machine learning and case-based reasoning. Dr. Simoudis holds a Ph.D. in Computer Science from Brandeis University, and M.S. in Computer Science from the University of Oregon, a B.S. in Electrical Engineering from the California Institute of Technology, and a B.A. in Physics from Grinnell College. Prior to joining Lockheed, Dr. Simoudis was a principal software engineer at Digital Equipment Corporation's Artificial Intelligence Center where he led work on case-based reasoning, learning, and distributed AI. Dr. Simoudis is the North American editor of the Artificial Intelligence Review Journal.

## MA2:

### Title: Planning and Learning



*Speakers: Manuela Veloso, Carnegie Mellon University, USA and Daniel Borrajo, Universidad Politécica de Madrid, Spain*

Planning involves generating sequences of actions to achieve multiple goals. Some of the issues addressed in computational planning are:

acquiring and representing the action model, generating plans efficiently and of good quality, and integrating planning and execution in dynamic environments. Examples of planning tasks include logistics transportation, manufacturing, and information navigation.

Most planning algorithms can achieve good overall performance, after the developer laboriously handcodes the planning knowledge. Instead machine learning can be integrated with planning to automatically improve the planner's performance with experience. A few systems use this combined approach, and have been shown empirically to scale well in domain and problem complexity.

In this tutorial we will: overview several planning algorithms; discuss their learning opportunities; present methods to combine planning and learning to acquire domain

and strategy knowledge, and to generate good quality plans; and introduce how the interleaving of planning and execution can be used to gather information that leads to increasingly more informed planning.

This tutorial is targeted at planning and learning researchers, AI practitioners, and technology managers interested in building robust planning systems. Commercialized planners do not yet use machine learning techniques. The tutorial will present integrated planning and learning algorithms, which have the potential to be of great impact in real-world applications.

Prerequisite knowledge: Familiarity with basic representation and search methods will be helpful.

Manuela Veloso received her Ph.D. in 1992 in computer science from Carnegie Mellon University, where she is currently an assistant professor. Dr. Veloso's research interests include planning, analogical reasoning, and the combination of analytical and inductive learning methods. She also investigates methods in which perception and learning are combined to address jointly high-level and low-level reasoning tasks. She is the author of a book on planning and analogical reasoning and she has published over thirty papers.

Daniel Borrajo received his Ph.D. in Computer Science from Universidad Politécnica de Madrid (UPM) in 1990. He is currently an Associate Professor at the School of Computer Science (UPM). Dr. Borrajo's main research interest is the integration of Artificial Intelligence techniques, specially concerning machine learning and planning.

### MA3:

#### Title: Genetic Algorithms and Genetics-Based Machine Learning



**Speakers:** David E. Goldberg, University of Illinois at Urbana-Champaign, USA and John R. Koza, Stanford University, USA

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 GBML, classifier *systems* and *genetic programming*, are also surveyed.

Tutorial Level: Beginning

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 Professor of General Engineering at the University of Illinois at Urbana-Champaign. He holds a Ph.D. from the University of Michigan and has written papers on the application and foundations of genetic algorithms. His book *Genetic Algorithms in Search, Optimization, and Machine Learning* (Addison-Wesley, 1989) is widely used and his recent studies have considered an integrated approach to the fast solution of difficult problems using non-traditional GAs.

John R. Koza is 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 in 1972. He currently is investigating the artificial breeding of computer programs and has completed two books, *Genetic Programming: On the Programming of Computer by Means of Natural Selection* (MIT Press 1992) and *Genetic Programming II* (MIT Press 1994), that describe these ongoing 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.

### MA4:

#### Title: Constraint Directed Scheduling: Theory and Practice



**Speakers:** Mark S. Fox, University of Toronto, Canada and Monte Zweben, Red Pepper Software Co., USA

Over the last 15 years the field of Knowledge-Based Scheduling has explored a variety of techniques for the creation of realistic schedules.

During the last five years, a convergence of approaches has occurred. At the core of this convergence lies the ability to represent and reason about the plethora of constraints that exist in scheduling environments. The goal of this tutorial is to convey the core concepts of Constraint-Directed Scheduling. We will first explore the complexities of the environments in which scheduling systems operate in order to understand why scheduling is difficult. Next the theoretical foundation of constraint-directed scheduling will be described. This will include basic concepts in constraint satisfaction/optimization and generative and repair-based search techniques. Methods and examples will be selected based on their relevance to the scheduling problem. This will be followed by a review of the two major classes of scheduling problems: flow and job shops, with examples of systems in production use today. The tutorial will then explore how these problems are exacerbated by domain uncertainty and how uncertainty forces scheduling to reconsider planning decisions. Lastly, we will review current directions in distribution scheduling decisions among agents. Throughout the tutorial examples will be drawn from real scheduling systems, including GERRY, KBLPS, REDS, and LMS.

Target Audience: This tutorial is intended for a wide audience likely to include AI practitioners and researchers, industrial operations managers, production managers, and Operations Research (OR) experts. The tutorial participant does not require any prerequisite knowledge but familiarity with basic search methods is helpful.

Mark S. Fox received his B.Sc. in Computer Science from the University of Toronto in 1975 and his Ph.D. in Carnegie Mellon University in 1983. Research interests include enterprise integration, business process re-engineering, concurrent engineering, supply chain management, constrain directed reasoning and common sense modeling. Dr. Fox has published over 50 papers, and is a Fellow of AAAI and CIAR/PRECARN, and a member of AAAI, ACM, IEEE, IIE, SME, CSCSI and TIMS.

Monte Zweben is President and CEO of the Red Pepper Software Company. Red Pepper produces commercial planning and scheduling systems for manufacturing and large scale operations. Prior to founding Red Pepper, Mr. Zweben was the Deputy Branch Chief of the Artificial Intelligence Research Branch at NASA Ames Research Center. At NASA, Mr. Zweben managed the Space Shuttle Ground Processing Scheduling (GPSS) project which is operationally used at the Kennedy Space Center to coordinate Space Shuttle repairs, maintenance, and refurbishment.

### MA5:

#### Title: Cooperative Information Systems



**Speakers:** Michael N. Huhns and Munindar P. Singh, Microelectronics and Computer Technology Corporation, Austin, TX, USA

Cooperative Information Systems (CIS) are concerned with the problems of constructing complex distributed systems of users, applications, and information resources, problems made more urgent by the rapid expansion of the infrastructure for wide area computing. CIS embodies a collection of powerful agent-based paradigms for constructing open information systems. Importantly, CIS are a generation beyond client-server computing, and they provide a way to incorporate legacy systems into modern information environments.

This tutorial will introduce the CIS paradigms, focusing on key unsolved problems, especially those where AI may best be applied. It presents theories, architecture's, languages, and techniques for achieving coordinated behavior among a decentralized group of providers, gatherers, and consumers of information, as well as the information flows that exist among them. It will describe successful applications in telecommunications, manufacturing automation, and information retrieval, and discuss upcoming applications over the world-wide web. This tutorial will guide practitioners seeking new ways to attack the problems engendered by heterogeneity and distribution, and access to external information. It will introduce graduate students and other researchers to a new area of agent-based technology, with lots of exciting and important problems. Prerequisite knowledge: No special background is assumed.

Michael N. Huhns received the Ph.D. (1975) in E.E. from the University of Southern California. He is a senior researcher at MCC and an adjunct professor in CS at U. Texas. He is the author of over 100 papers and two books in DAI and enterprise information integration.

Munindar P. Singh received the Ph.D. (1992) in CS from the University of Texas (Austin). He is a researcher at MCC, and an adjunct assistant professor in CS at U. Texas. His research is in CIS, DAI, NLP, and agent programming, and he has authored a book on Multiagent Systems.

**MP2:**

**Title: Knowledge Engineering Environments for Reusable Knowledge Components**



*Speakers: Henrik Eriksson, Linköping University, Sweden and Angel R. Puerta, Stanford University, USA*

This tutorial will develop a comprehensive view of the most important principles and practical issues in knowledge engineering and knowledge acquisition. We will present the theoretical

foundations of these fields to establish a framework in which the attendee can understand and analyze how theories are put to practice. We will concentrate on illustrating problems with computer-based tools, covering examples from early expert systems to the new generation of knowledge-based systems based on reusable knowledge components. Throughout the tutorial, we will emphasize particular issues such as human-computer interaction, that affect the design and development of knowledge-engineering software environments, and will address the specific tradeoffs created by conflicting design requirements. After the tutorial, the attendee should have a good understanding of the principles and design tradeoffs involved in the construction of knowledge-engineering environments for reusable components, a solid background on existing environments, and a clear grasp of the research issues that affect knowledge engineering and knowledge acquisition within the context of knowledge sharing. The course will be especially helpful to knowledge engineers involved in the development of knowledge-based systems to research scientists who work with knowledge bases, and to anyone who desires a detailed overview of the advances in knowledge-engineering and knowledge-acquisition tool design and development. Newcomers to the field of artificial intelligence benefit from an up-to-date introduction to knowledge-engineering and knowledge-acquisition techniques.

Prerequisite Knowledge: This tutorial is suited for an audience with an introductory background in artificial intelligence and knowledge engineering.

Angel R. Puerta is a Research Scientist at the Knowledge Systems Laboratory, Medical Computer Science Group, Stanford University. He received his Ph.D. degree in Computer Science from the University of South Carolina in 1990. His dissertation work studies the uses of machine learning in intelligent interfaces. His current research interest include model-based user-interface development, and knowledge-engineering environments for knowledge sharing. His work concentrates on *Mecano*, a user-interface development environment where software tools manipulate shareable models of user interfaces to produce executable interface designs.

Henrik Eriksson is an assistant professor in Computer Science at the Department of Computer and Information Science, Linköping University, Linköping, Sweden. He received a Ph.D. in Computer Science from Linköping University in 1991. His dissertation work was concerned with computer-based tool support for knowledge acquisition. He is currently working on various aspects of knowledge-acquisition for knowledge based systems, primarily the generation of custom-tailored knowledge acquisition tools from high-level specifications. Between 1991 and 1994, he was a visiting scholar at the Knowledge Systems Laboratory, Stanford University, where he developed techniques for the construction of knowledge-based systems from reusable components, and for domain-oriented knowledge acquisition.

**MP3:**

**Title: Hybrid Intelligent Systems**



*Speaker: Larry R. Medsker, The American University, USA*

Hybrid intelligent systems are now part of the repertoire of computer systems developers and important research mechanisms in the study of artificial intelligence. The integration of neural networks and expert systems has proven to be a way to develop useful real-world applications, and hybrid systems involving fuzzy logic, genetic algorithms, and case-based reasoning are also currently receiving substantial attention. Participants in this tutorial will gain a timely update on the status of hybrid intelligent systems and learn how to choose and develop appropriate applications. Examples and case studies will be used to illustrate principles and development techniques, giving insight into how actual applications work.

The tutorial starts with a summary of the individual intelligent technologies, and subsequent sections give detailed discussions of different combinations of these intelligent technologies, along with examples and case studies. After this tutorial, the participants should be able to

- describe the important concepts, strengths, and limitations of each technology
- recognize and analyze problems appropriate for hybrid system solutions
- choose appropriate hybrid intelligent technology solutions
- understand how applications are designed with any of the approaches covered
- choose appropriate commercial development shells or tools
- identify methods for testing and validating application implementations

Prerequisite Knowledge: This tutorial will be of interest both to practitioners and to researchers in intelligent systems. Neither prior knowledge nor experience with all of these intelligent technologies is required, but some understanding of at least one of the technologies will be helpful. Relevant research and development backgrounds and disciplines include computer science, information systems, management and decision science, and electrical and industrial engineering.

Larry R. Medsker is a professor of computer science and information systems at The American University. His research and teaching focus on expert systems, neural networks, and the integration with other intelligent technologies. He has published three books and over 100 scientific papers. He earned the Ph.D. degree from Indiana University and has held positions at the Purdue School of Science and Bell Laboratories.

**MP4:**

**Title: Inductive Logic Programming and Applications**



*Speakers: Stan Matwin, University of Toronto, Canada and Francesco Bergadano, University of Messina, Italy*

Inductive Logic Programming (ILP) is a new, burgeoning field of AI, combining machine learning and logic programming. ILP learns relational (first order logic) concept descriptions from facts. ILP can also be viewed as a technique of developing logic programs from known instances of their input-output

behavior. ILP reaches beyond the limitations of inductive learning systems based on attribute-value representation of examples and concepts. The tutorial will clarify the goals and the motivations of ILP in a simplified problem setting. Classical bottom-up and top-down methods for learning Horn clauses from examples will be described in a simplified form. We will describe the principles behind the successful ILP systems: GOLEM, FOIL, and PROGOL. We will discuss how ILP systems are capable of «creative» learning, going beyond the language in which the examples and the background knowledge are expressed. We will then survey the recent, successful applications of ILP in areas such as pharmaceuticals design, music, protein folding, CAD, natural language processing, software tools etc. The tutorial does not assume any advanced background beyond the basic concepts in logic.

F. Bergadano is Professor of Computer Science at the University of Messina, Italy. He has published more than 60 papers in international Computer Science conferences and journals. He was on the program committee of major AI meetings including IJCAI and the Int. Machine Learning Conference, and was co-chairman of the 1994 European Machine Learning Conference. He has taught previous tutorials at IJCAI-91 and AAAI-94. He is currently interested in Inductive Logic Programming, Machine Learning and Discovery in Databases.

S. Matwin is Professor of Computer Science at the University of Ottawa, Canada, where he teaches machine learning, ILP, AI, and compiler construction. His research interests are in machine learning and its applications, with the special emphasis on ILP and applications in software engineering and text analysis. Stan has published more than 70 papers in journals and refereed international conferences. Member of the program committee of a number of conferences in machine learning, he is also the president of the Canadian Society for Computational Studies of Intelligence, member of the Editorial Board of IEEE EXPERT, and vice-chair of IFIP Working Group 12.2 (Machine Learning). He has taught an ILP tutorial at AAAI-94.

#### MP5:

##### Title: Intelligent Multimedia Interfaces



*Speaker: Mark T. Maybury, The MITRE Corporation, USA*

Multimedia communication is ubiquitous in daily life. When we converse with one another, we utilize a wide array of media to interact, including spoken language, gestures, and drawings. We exploit multiple sensory systems or modes of communication including vision, audition, and taction. Although humans have a natural facility for managing and exploiting multiple input and output media, computers do not. Consequently, providing machines with the ability to interpret multimedia input and generate coordinated multimedia output would be a valuable facility for a number of key application such as information retrieval and analysis, training, and decision support.

The purpose of this tutorial is to introduce the emerging literature and set of techniques for building multimedia and multimodal interfaces, i.e. those interfaces that interpret and generate multiple media, e.g., spoken and written natural language, graphics, non-speech audio, maps, animation. A multimedia lecture presentation will be augmented with video demonstrations of state of the art systems from the US, Europe, and Japan that support integrated multimedia input and/or coordinated multimedia output. Attendees will be provided with copies of all presentation slides, a research bibliography, and an overview article of the field.

Prerequisite Knowledge: No prerequisite knowledge is required, although general knowledge of user interfaces and artificial intelligence will enhance the value of this course for participants.

Mark Maybury received his BA in Mathematics from the College of the Holy Cross in 1986. As a Rotary Scholar at Cambridge University, England he received his M.Phil in Computer Speech and Language Processing in 1987 and his Ph.D. in Artificial Intelligence in 1991 for his dissertation, «Generating Multisentential Text Using Communicative Acts». Mark was awarded an MBA from RPI in 1989. He currently is the Director of the Bedford Artificial Intelligence Center and Department Head of Advanced Information Systems Technology at the MITRE Corporation, where he directs and conducts research in advanced information systems. His current work focuses on intelligent human computer interfaces, tailored information presentation, and narrated animation. Dr. Maybury has published over fifty technical and tutorial articles in the area of language generation and multimedia presentation. He chaired the AAAI-91 Workshop on Intelligent Multimedia Interfaces and edited the international collection, Intelligent Multimedia Interfaces (AAAI/MIT Press, 1993).

## Workshop Program

(Preliminary dates; by invitation only)

### **Adaptation and Learning in Multiagent Systems (W1)**

Contact: *Sandip Sen; sandip@kolkata.mcs.utulsa.edu*

Monday, August 21

### **Agent Theories, Architectures, and Languages (W2)**

Contact: *Mike Wooldridge; M.Wooldridge@doc.mmu.ac.uk*

Saturday, August 19–Sunday, August 20

### **AI in Distributed Information Networks (W3)**

Contact: *Suhayya Abu-Hakima; suhayya@ai.iit.nrc.ca*

Saturday, August 19

### **Anytime Algorithms and Deliberation Scheduling (W4)**

Contact: *Louis J. Hoebel; hoebel@ALRLAEMIL*

Sunday, August 20

### **Applications and Implementations of Nonmonotonic Reasoning Systems (W5)**

Contact: *Rachel Ben-Eliyahu; rachelb@cs.Technion.AC.IL*

Monday, August 21

### **Artificial Intelligence and Music (Specialized topic: AI Models of Structural Music Understanding) (W6)**

Contact: *Gerhard Widmer; gerhard@ai.univie.ac.at*

Monday, August 21

### **Artificial Intelligence and Prediction (W7)**

Contact: *Steven Kim;*

*shk2m@poe.acc.virginia.edu/kims@virginia.edu*

Saturday, August 19

### **Artificial Intelligence and the Environment (W8)**

Contact: *Cindy L. Mason; mason@ptolemy.arc.nasa.gov*

Saturday, August 19

### **Basic Ontological Issues in Knowledge Sharing (W9)**

Contact: *Doug Skuce; doug@csi.UOttawa.ca*

Saturday, August 19–Sunday, August 20

### **Building Probabilistic Networks: Where Do the Numbers Come From? (W10)**

Contact: *Linda van der Gaag; linda@cs.ruu.nl*

Monday, August 21

### **Computational Auditory Scene Analysis (W11)**

Contact: *Hiroshi G Okuno; okuno@nuesun.ntt.jp*

Saturday, August 19–Sunday, August 20

### **Connectionist-Symbolic Integration: From Unified to Hybrid Approaches (W12)**

Contact: *Ron Sun; rsun@cs.ua.edu*

Saturday, August 19–Sunday, August 20

### **Context in Natural Language Processing (W13)**

Contact: *Lucja Iwanska; lucja@iwanska.cs.wayne.edu*

Saturday, August 19

### **Data Engineering for Inductive Learning (W14)**

Contact: *Peter Turney; peter@ai.iit.nrc.ca*

Sunday, August 20

### **Developing AI Applications for Disabled Persons (W15)**

Contact: *John Aronis; aronis@cs.pitt.edu*

Saturday, August 19

### **Entertainment and AI/Alife (W16)**

Contact: *Hiroaki Kitano; kitano@csl.sony.co.jp*

Saturday, August 19

### **Executable Temporal Logics (W17)**

Contact: *Michael Fisher; M.Fisher@doc.mmu.ac.uk*

Sunday, August 20

### **Formal Approaches to the Reuse of Plans, Proofs, and Programs (W18)**

Contact: *Jana Koehler; koehler@dfki.uni-sb.de*

Saturday, August 19–Sunday, August 20 (morning only)

### **Fuzzy Logic in Artificial Intelligence (W19)**

Contact: *Anca Ralescu; anca@fuzzy.or.jp*

Saturday, August 19 and Monday, August 21

### **Intelligent Manufacturing Systems (W20)**

Contact: *Norman Sadeh; norman.sadeh-*

*konicopol@cimds3.ri.cmu.edu/sadeh@cs.cmu.edu*

Saturday, August 19

### **Intelligent Multimedia Information Retrieval (W21)**

Contact: *Mark T. Maybury; maybury@linus.mitre.org*

Saturday, August 19

### **Machine Learning and Comprehensibility (W22)**

Contact: *Claire Nedellec; Claire.Nedellec@Iri.fr*

Saturday, August 19–Sunday, August 20

### **Machine Learning in Engineering (W23)**

Contact: *Julien Benoit; julien@magnum.crim.ca*

Monday, August 21

### **Modelling Context in Knowledge Representation and Reasoning (W24)**

Contact: *Patrick Brezillon; brezil@laforia.ibp.fr*

Sunday, August 20

### **Multilingual Text Generation (W25)**

Contact: *Richard Kittredge; kittredg@IRO.UMontreal.CA*

Sunday, August 20–Monday, August 21

### **New Approaches to Learning for Natural Language Processing (W26)**

Contact: *Stefan Wermter; wermter@nats2.informatik.uni-hamburg.de*

Monday, August 21

### **Nonmonotonic Reasoning, Action and Change (W27)**

Contact: *Mary-Anne Williams; maryanne@frey.newcastle.edu.au*

Sunday, August 20

### **On Reflection and Meta-Level Architectures and their Applications in AI (W28)**

Contact: *Mamdouh Ibrahim; mibrahim@rcsuna.gmr.com*

Monday, August 21

### **Parallel Processing for Artificial Intelligence (W29)**

Contact: *James Geller; geller@vienna.njit.edu*

Sunday, August 20–Monday, August 21

### **Practical development strategies for industrial strength case-based reasoning (CBR) applications (W30)**

Contact: *Michael Manago; ACKNOWLEDGE@AppleLink.Apple.COM*

Monday, August 21

### **Representation and Processing of Spatial Expressions (W31)**

Contact: *Patrick Luke Olivier; plo@aber.ac.uk*

Saturday, August 19



### Representing and Reasoning with Device Function (W32)

Contact: *Dean Allemang*; [allemang@vptt.ch](mailto:allemang@vptt.ch)

Saturday, August 19

### Second Engineering Problems for Qualitative Reasoning Workshop (W33)

Contact: *Marcos Vescovi*; [vescovi@HPP.Stanford.EDU](mailto:vescovi@HPP.Stanford.EDU)

Sunday, August 20

### Spatial and Temporal Reasoning (W34)

Contact: *Frank Anger*; [fdang@dcs106.dcsnod.uwf.edu](mailto:fdang@dcs106.dcsnod.uwf.edu)

Monday, August 21

### The Next Generation of Plan Recognition Systems: Challenges for and Insight from Related Areas of AI (W35)

Contact: *Mathias Bauer*; [bauer@dfki.uni-sb.de](mailto:bauer@dfki.uni-sb.de)

Sunday, August 20

### Third Workshop on AI and Software Engineering «Breaking the Toy Mold» (W36)

Contact: *Chris Welty*; [weltyc@cs.vassar.edu](mailto:weltyc@cs.vassar.edu)

Sunday, August 20 (afternoon only)–Monday, August 21

### Validation & Verification of Knowledge-Based Systems (W37)

Contact: *R.E. Gamble*; [gamble@tara.mcs.utulsa.edu](mailto:gamble@tara.mcs.utulsa.edu)

Saturday, August 19

## The Robot Competition

This year's IJCAI will include several events showing off the community's work in intelligent robotics. Events will cover both research and applied robot systems.

- **Robot Competition 95:** This contest will test a robot's ability to take direction and navigate through an office environment in order to complete a delivery task. Robots must operate autonomously, but can ask for directions from people they meet in the competition ring. Speech understanding and manipulation are not required abilities, but there will be ample opportunity to show them off if you have them. For more details, contact David Kortenkamp ([korten@mickey.jsc.nasa.gov](mailto:korten@mickey.jsc.nasa.gov)).
- **Intelligent Wheelchair Exhibition:** The focus of this event is on a particular application: robotic mobility assistants for the severely disabled. The competition tasks will include things such as room to room navigation, speed trials down crowded hallways and through doorways, and docking with desks and tables. Each robot must be able to carry a human user, and all communications with the robot must be done by the user (no radios, etc.). The contest goals are to see who can make the most capable chair with the best user interface (if a user could type well, or operate a joystick competently, than an ordinary wheelchair would do!). The point of contact for this event is David P. Miller ([dpmiller@mitre.org](mailto:dpmiller@mitre.org)).
- **Robot Exhibition:** This will be a time and place for some unique robot systems to show off their stuff. The participants in this event should have a demonstration that is dynamic and of wide appeal. Examples might include: bi-pedal walking robots; robot teams playing football (soccer); square dancing LEGO robots, etc. This is meant to be an intelligent and innovative robot show, not an industrial robot show. Product demonstrations should be arranged through the regular exhibit program. Please contact AAAI for further information. For more information about the robot exhibition, contact David Miller or Raja Chatila ([dpmiller@mitre.org](mailto:dpmiller@mitre.org) or [raja@laas.fr](mailto:raja@laas.fr)).

## Exhibition, Robot Competition and the Robot Building Laboratory, RBL-95



The exhibit program will offer exhibits and demonstrations by the leading suppliers of AI software as well as AI consultants and publishers displaying the latest in AI books and periodicals. At the time of publication, 1995 Exhibitors include AAAI Press, Academia Book Exhibits, Academic Press, Inc., Acknosoft, Amzi! Inc., DHR Technologies, Inc., Elsevier Science Publishers, IS Robotics, Kluwer Academic Publishers, Lawrence Erlbaum Associates, Miller Freeman Inc./AI Expert Magazine, The MIT Press, Morgan Kaufmann Publishers, Inc., Portland/Oregon Visitors Association, Prentice Hall, and Talarian Corporation.

## Robot Building Laboratory RBL-95

The RBL began two years ago at AAAI-93 in Washington, DC, and will continue in 1995 in Montréal. Although the RBL will begin with a tutorial, it will be much more than that. It will be total-immersion robotics, the epitome of the «learn by doing» paradigm. Previously targeted at students and researchers without experience in robot construction, RBL-95 will also appeal to the skilled roboticist, with opportunities for open competition and exhibition in conjunction with the larger Robot Competition. These new features, combined with the traditional tutorial and lab offer something for every robot enthusiast. First exposure to the RBL experience comes via the tutorial. Here, attendees learn the principles of LEGO robot construction and control. All topics are presented; gear train design to sensor characteristics, closed-loop control to subsumption.

The tutorial prepares the lab participants for 4 days of intense LEGO building and contests. The lab is a complete robotics workshop; soldering irons, hot glue guns, tools, lots of LEGO, computers, and software are provided for the participants. In addition, round-the-clock teaching assistants offer advice as needed. Advanced concepts are explored in informal meetings scheduled over the 4 lab days; participants are given the opportunity to discuss any problems they are experiencing with their robot, and to learn from other teams. Team progress is measured empirically in a series of contests that build upon each other by requiring some added skill/behavior from the robots. This series culminates in a final contest where autonomous robots exhibit quite intelligent behavior.

Subject to certain constraints, anyone with a «small» robot can register to compete in the new Open Contest (not coincidentally identical to the final Lab contest). By contrasting four day-old LEGO robots with those constructed over time by these experienced roboticists, all participants can share their problems, solutions, and ideas.

For further information regarding the program, please contact Jeffrey Graham, RBL-95 Chair; [jsgraham@cftnet.com](mailto:jsgraham@cftnet.com).

## AAAI Collocated Conferences

### IAAI Conference

#### Please Join Us for IAAI-95!

The Seventh Annual Conference on Artificial Intelligence is collocated with the Fourteenth International Joint Conference on Artificial Intelligence in Montréal, Canada. IAAI-95 highlights deployed AI applications judged to be the most innovative. The organizations honored this year will include Singapore Telecom; Ministry of Agriculture and Land Reclamation, Egypt; Port of Singapore Authority; IBM Corporation, USA; Jet Propulsion Laboratory, USA; VTT Information, Finland; Korea Advanced Institute of Science and Technology; GTE Laboratories, USA; United Technologies Research Center, USA; GE Capital Mortgage Corporation, USA; US Department of the Treasury; General Motors Corporation, USA; Canon USA, Inc.; Mita Industrial Co., Ltd, Japan; US Army AI Center. 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 panels and invited talks. IAAI-95 sessions will be scheduled to allow participants to attend some of the IJCAI activities, including tutorials, workshops, and the conference exhibition. Please join us for a stimulating and rewarding conference!

Jan Aikins, Xerox Corporation, IAAI-95 Program Chair  
Howard Shrobe, ARPA/Massachusetts Institute of Technology, IAAI-95 Cochair

#### IAAI-95 Program Committee:

Bruce Buchanan, University of Pittsburgh (USA)  
Elizabeth Byrnes, Bankers Trust Company (USA)  
Marc Eisenstadt, Knowledge Media Institute (United Kingdom)  
Philip Klahr, Inference Corporation (USA)  
Alain Rappaport, Neuron Data (USA)  
Earl Sacerdoti, Apple Computer (USA)  
Herb Schorr, USC/Information Science Institute (USA)  
Ted Senator, US Department of the Treasury (USA)  
Reid Smith, Schlumberger Cambridge Research (United Kingdom)



#### IAAI-95 Invited Talk

##### *Image Guided Brain Surgery*

**W. Eric L. Grimson, MIT Artificial Intelligence Lab**

High quality 3D medical sensors and new minimally invasive surgical procedures pose an interesting challenge: how best to present relevant information to guide a surgeon. Emerging «enhanced reality» visualization methods are leveraging 15 years of Image Understanding research to provide systems that guide surgeons to extract targeted tissues with minimal collateral damage.

#### Invited Panels (to date):

##### *Politics of Communication*

**Moderator: Randy Davis, MIT AI Laboratory**

##### *Artificial Intelligence in the Capital Markets*

**Organized by Ganesh Mani, LBS Capital Management, Inc.**

##### *SIMNET (Intelligent Simulation in the Military)*

**Moderator: Paul Rosenbloom, University of Southern California/Information Sciences Institute**

### KDD-95 Conference

Please join us for the First International Conference on Knowledge Discovery and Data Mining (KDD-95). With the advances in data acquisition and storage technologies, the problem of how to turn raw data into useful information becomes a significant one. Having reached sizes that defy even partial examination by humans, modern databases and collections of data sets are literally swamping users. This data firehose phenomenon appears in many fields including science data analysis, medical and healthcare, corporate and marketing, and financial markets.

Knowledge Discovery in Databases (KDD) and Data Mining are areas of common interest to researchers in machine learning, machine discovery, statistics, intelligent databases, knowledge acquisition, data visualization, high performance computing, and expert systems. Due to strong demand for participation and the growing demand for formal proceedings, it has become necessary to change the format of the previous KDD workshops to a conference with open attendance. This conference will continue in the tradition of the 1989, 1991, 1993, and 1994 KDD workshops by bringing together researchers and application developers from different areas, and focusing on unifying themes such as the use of domain knowledge, managing uncertainty, interactive (human-oriented) presentation, and applications. The KDD conference also includes invited talks, a demo and poster session, and panel discussions.

Usama M. Fayyad, Jet Propulsion Laboratory, KDD-95 Program Cochair  
Ramasamy Uthurusamy, General Motors Research, KDD-95 Program Cochair

#### KDD-95 Program Committee

Rakesh Agrawal, IBM Almaden Research Center (USA)  
Tej Anand, AT&T Global Information Solutions (USA)  
Ron Brachman, AT&T Bell Laboratories (USA)  
Wray Buntine, NASA Ames Research Center (USA)  
Nick Cercone, University of Regina (Canada)  
Peter Cheeseman, NASA Ames Research Center (USA)  
Greg Cooper, University of Pittsburgh (USA)  
Brian Gaines, University of Calgary (Canada)  
Clark Glymour, Carnegie Mellon University (USA)  
David Hand, The Open University (United Kingdom)  
David Heckerman, Microsoft Corporation (USA)  
Se Jung Hong, IBM TJ Watson Research Center (USA)  
Larry Jackel, AT&T Bell Laboratories (USA)  
Larry Kerschberg, George Mason University (USA)  
Willi Kloesgen, GMD (Germany)  
David Madigan, University of Washington (USA)  
Chris Matheus, GTE Laboratories (USA)  
Heikki Mannila, University of Helsinki (Finland)  
Gregory Piatetsky-Shapiro, GTE Laboratories (USA)  
Daryl Pregibon, AT&T Bell Laboratories (USA)  
Arno Stebes, CWI (Netherlands)  
Evangelos Simoudis, Lockheed Research Center (USA)  
Andrzej Skowron, University of Warsaw (Poland)  
Padhraic Smyth, Jet Propulsion Laboratory (USA)  
Alex Tuzhilin, NYU Stern School (USA)  
Xindong Wu, Monash University (Australia)  
Wojciech Ziarko, University of Regina (Canada)  
Jan Zytkow, Wichita State University (USA)

## Registration Information/Registration

## Fees/Housing/General Information

### Registration

Onsite registration will be located in the Exhibition Hall 100B on the first floor of the Palais de Congrès de Montréal, 201 Viger Avenue West, Montréal, Québec, Canada. Registration hours will be Saturday, August 19–Monday, August 21 from 7:30am–6:00pm, and Tuesday, August 22 through, Friday, August 25 from 8:00am – 6:00pm. (Registration hours are subject to modification). All attendees must pick up their registration packets for admittance to programs.

Note: Workshop onsite registration on Saturday, August 19, will be located in the main entrance hall of the Palais de Congrès de Montréal, 201 Viger Avenue West, Montréal, Québec, Canada. from 7:30am–6:00pm.

Early registration must be postmarked by June 21, 1995.

Late registration must be postmarked by July 26, 1995.

### IJCAI-95 Technical Program Registration

Your IJCAI-95 program registration includes admission to all technical paper sessions, invited talks and panels, the IJCAI-95 Exhibition, the IJCAI-95 opening ceremony and reception, and the IJCAI-95 conference Proceedings.

#### Technical Program Fees

	US \$	CAN\$
Early Regular	\$390	\$550
Early Student	\$125	\$175
Late Regular	\$450	\$635
Late Student	\$160	\$225
Onsite Regular	\$510	\$720
Onsite Student	\$195	\$275

### Tutorial Program Registration

Your Tutorial Program registration includes admission to one tutorial, the IJCAI-95 Exhibition, and one tutorial syllabus. Prices quoted are per tutorial. A maximum of four may be taken due to parallel schedules.

#### Tutorial Fees

	US \$	CAN\$
Early Regular	\$205	\$290
Early Student	\$ 75	\$105
Late Regular	\$245	\$345
Late Student	\$100	\$140
Onsite Regular	\$310	\$435
Onsite Student	\$130	\$185

### Workshop Program Registration August 19-21, 1995

Workshop registration is limited to those active participants determined by the organizer prior to the conference. Note: Individuals must pay the IJCAI technical program registration fee in addition to the workshop fee of US \$50.00/CAN \$70.00.

Your workshop registration includes admission to all technical paper sessions, invited talks and panels, the IJCAI-95 Exhibition, the IJCAI-95 opening ceremony and reception, the IJCAI-95 conference Proceedings, and the workshop working notes.

Workshop registration materials will be sent directly to invited participants.

Workshop onsite registration on Saturday, August 19, will be located in the main entrance hall of the Palais de Congrès de Montréal, 201 Viger Avenue West, Montréal, Québec, Canada, from 7:30am–6:00pm.

#### Workshop Program Fees

Additional fee for all workshop attendees of US \$50.00, CAN \$70.00 per workshop.

### IAAI-95 Program Registration

Your IAAI-95 program registration includes admission to the IAAI sessions, invited talks, IJCAI-95 Exhibition, and the IAAI-95 conference Proceedings.

#### IAAI-95 Conference Fees

	US \$	CAN\$
Early Regular	\$390	\$550
Early Student	\$125	\$175
Late Regular	\$450	\$635
Late Student	\$160	\$225
Onsite Regular	\$510	\$720
Onsite Student	\$195	\$275

### IJCAI-95/IAAI-95 Combined Registration

To attend both the IJCAI-95 and IAAI-95 Conferences, and to receive the proceedings of both, please add US \$150.00/CAN \$210 to the appropriate registration fee above.

### KDD-95 Program Registration

Your KDD-95 program registration includes admission to the KDD sessions, invited talks, IJCAI-95 Exhibition, the KDD-95 opening reception, and the KDD-95 conference Proceedings.

#### KDD-95 Conference Fee

The registration fee for the KDD-95 Conference is US \$200.00/CAN \$280

### RBL-95

The RBL-95 fee is in addition to the IJCAI Technical Program registration fee.

#### RBL-95 Fees

	US \$	CAN\$
RBL-95	\$200	\$280
RBL Tutorial Only*	\$75	\$105
Open Competition Fee	\$20	\$30

No onsite registration.

\* The RBL Tutorial is open to all IJCAI-95 attendees for an additional fee of US \$75 (CAN \$105). The tutorial is included in the RBL-95 registration fee.

## Accompanying persons are entitled to:

Attend the Official Opening Ceremony, the Opening Reception, and visit the IJCAI-95 Exhibition.

The registration fee for accompanying persons is US \$45/CAN \$63

## Payment and Registration Information

Prepayment of registration fees is required. Checks, international money orders, bank transfers and traveler's checks must be in US or Canadian dollars. American Express, VISA, Mastercard, and government purchase orders are also accepted. Registration post-marked after the July 26 deadline will be subject to on-site registration fees. The deadline for refund requests is August 2, 1995. All refund requests must be in writing. A US \$75.00/CAN \$100.00 processing fee will be assessed for all refunds. All refunds will be made at the conclusion of the Conference. Note: In case of Conference cancellation for reasons beyond the control of the IJCAI-95 organizers, the liability of the IJCAI-95 organization is limited to the fees already paid by the registrants and especially it will not be responsible for any personal inconveniences which may arise.

Student registrations must be accompanied by proof of full-time student status.

Registration forms and inquiries should be directed to:

**IJCAI-95**

**AAAI**

**445 Burgess Drive**

**Menlo Park, CA 94025, USA**

**415/328-3123, Fax: 415/321-4457**

**email: [ijcai@aaai.org](mailto:ijcai@aaai.org)**

The registration form and brochure is available online:

**email: [ijcai@aaai.org](mailto:ijcai@aaai.org)**

**world-wide-web: <http://ijcai.org>**

**gopher: <gopher://ijcai.org>**

**FTP: <ftp://ijcai.org/pub/ijcai>**

Email: mail to [info@ijcai.org](mailto:info@ijcai.org) will be answered automatically with instructions on how to use the email server. Questions about the electronic information services can be directed at the IJCAI Electronic Information Director, Chris Welty at [weltyc@ijcai.org](mailto:weltyc@ijcai.org).



## Accommodation



## Hotels

IJCAI-95 has reserved a block of rooms in Montréal properties at reduced conference rates. To qualify for these rates, housing reservations must be made with the Greater Montréal Convention and Tourism Bureau. The deadline for reservations is July 17, 1995. After this date convention rates may not apply and the IJCAI-95 Housing Bureau will be working on an availability basis. To make housing reservations telephone, fax or mail the enclosed Housing Application Form to:

**IJCAI-95 Housing Bureau**  
**1555 Peel Street, Suite 600**

**Montréal**

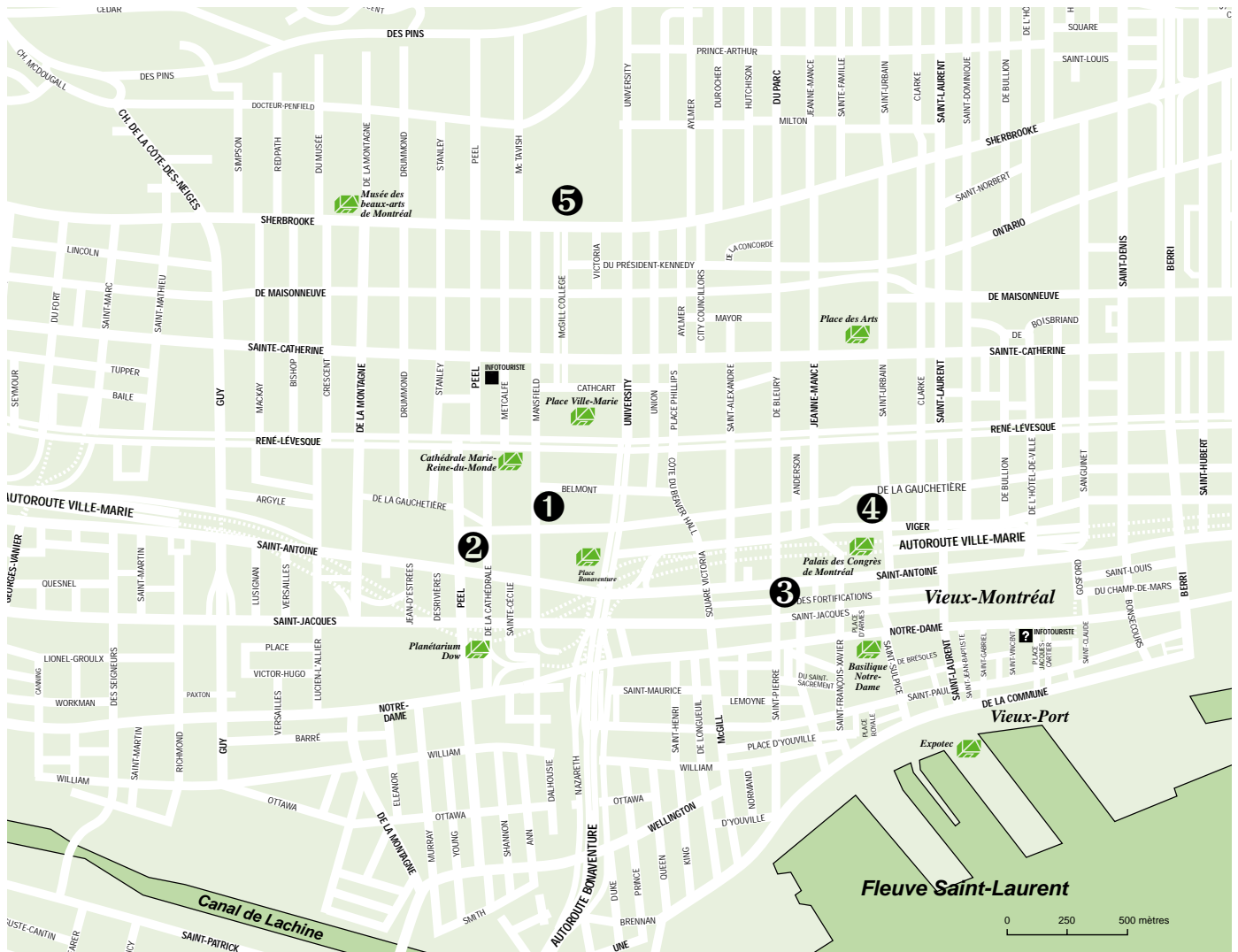
**Québec, Canada H3A 1X6**

**Phone: 514-844-0848**

**Fax: 514-844-6771**

Rooms will be assigned on a first-come, first-served basis. The IJCAI-95 Housing Bureau reserves the right to assign a hotel if your first choice is sold out and other choices are not included. All rooms are subject to a 7% federal and a 6.5% provincial tax. All changes and cancellations should be made directly with the IJCAI-95 Housing Bureau. Changes and cancellations must be made in writing to the Housing Bureau.

Confirmation of your reservation will be sent directly by the hotel. Include a first night deposit in CAN or US funds with your request. A check or credit card number is acceptable. All major credit cards are accepted. If checks are made out in US funds, please use the exchange rate of the day. Please make checks payable to IJCAI Housing Bureau. Refund of deposit will be made up to 72 hours prior to the date of arrival.



## Headquarters Hotel:

### The Queen Elizabeth (1)

900 René-Lévesque Blvd, West  
Montréal, Québec Canada H3B 4A5

Single/double room	CAN\$120.00
Concierge level	CAN\$180.00

Distance to Center: Approximately seven blocks

## Other Hotels:

### Le Château Champlain (2)

1 Place du Canada  
Montréal, Québec, Canada H3B 4C9

Single/double room	CAN\$110.00
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Distance to Center: Approximately eight blocks

### Hôtel Inter-Continental (3)

360 rue St-Antoine Ouest  
Montréal, Québec, Canada H2Y 3X4

Single/double room	CAN\$130.00
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Distance to Center: Two blocks

### Holiday Inn Centre-Ville (4)

99 avenue Viger ouest  
Montréal, Québec, Canada H2Z 1E9

Single room	CAN\$109.00
Double room	CAN\$119.00
Triple room	CAN\$129.00

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).

## Student Housing (5)

LICAI-95 has reserved a block of dormitory rooms at McGill University for student housing during the conference. Accommodations are single rooms with shared male or female washrooms. Linen and towels are provided upon arrival. The location of the McGill's Coed Residences is 3935 University Street, Montréal. Buses from the corner of Pine Avenue and University Street run every 15 minutes to the métro station for transfer to the Palais de Congrès. The ride from the dorms to the Palais de Congrès takes approximately 15 minutes.

Single room rate per person and night: CANS 28.00 (proof of full time student status must be included with the housing reservation form. Reservations must be made by July 18, 1995. A reservation form is enclosed in this brochure. Reservations are confirmed upon receipt of a CANS 28.00 deposit per person, applicable towards the residence fee. Checks, money orders drawn on a Canadian bank, and VISA and Mastercard are accepted. If checks are made out in US funds, please use the exchange rate of the day. This deposit is nonrefundable should you cancel. Please make checks payable to McGill University.

Reservations should be sent to:  
Summer Accommodations  
McGill University Residences  
File AAAI400  
3935 University Street  
Montréal, Québec, Canada H3A 2B4  
Fax: 514-398-6770  
Email: reserve@residences.ian.mcgill.ca

Parking is available on campus and the cost is CAN \$25 per week, or CANS 10.00/day. Please ask at the registration counter for more information.

## Location and Travel

### Airports

There are two airports in Montréal: Dorval and Mirabel. Dorval serves flights from USA and Canada, and Mirabel serves all flights other than North America. Dorval is located 14 miles/22 km from downtown Montréal, and Mirabel is 34 miles/55 km from downtown. It takes 25 minutes to get from Dorval to downtown, and 45 minutes from Mirabel to downtown. There are shuttles and taxis from both airports.

### Air Transportation and Car Rental

#### Montréal – Get there for less – win free travel!

American Airlines and Air Canada are the official co-carriers for IJCAI-95. On American, save 5% on lowest available fares, some restrictions apply. Save 10% on lowest unrestricted coach class fares, with 7 days advance purchase. Travel between August 17-28, 1995. On Air Canada save from 15% to 50% on applicable fares.

For lowest available fares on *any* airline, make your reservations with Conventions in America, the official travel agency for IJCAI-95, at 1-800-929-4242 or 619-678-3600 (fax: 619-678-3699) and ask for Group #428. You will automatically be entered in a drawing for two round trip tickets on American Airlines domestic route. Winner will be drawn at the convention. Plus receive free flight insurance of \$100,000 and another chance to win free travel worldwide in the bi-monthly drawings. If you call direct: 1-800-433-1790 for American, ask for Index #S9272. Air Canada 1-800-361-7575, CV #950223. (Reminder: you must book through Conventions in America to be entered in the drawings).

#### Car Rental

Hertz has been designated as the official rental car company for the IJCAI-95 Conference. Save on Hertz Rent A Car with rates starting as low as \$44.99/day (Canadian dollars). You can book your car through Conventions in America at the same time you book your airline ticket, or call Hertz directly at 1-800-654-2240, and give the code CV #17158.

### Ground Transportation and Airport Connections

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



## Dorval

The airport transfer to downtown costs CAN\$8.75. It leaves Dorval every 20 minutes from Monday to Friday, and every 30 minutes on the weekend. First departure at 7:00am – last departure 12:00 midnight (or with the last flight coming in to Dorval if a delay should occur) every day. The transfer is free of charge for children under 5 years.

## Mirabel

The airport transfer to downtown costs CAN \$14.00. The shuttle leaves the airport every 30 minutes between 12:00pm and 8:00pm. After 8:00pm until 12:00 midnight, the shuttle leaves every hour.

## Taxi

From Dorval Airport to downtown: approximately CAN \$23 + tip.  
From Mirabel Airport to downtown: approximately CAN \$55-60 + tip.

## Rail

Amtrak operates from destinations in USA and VIA Rail operates from destinations in Canada. The central station is located at 935 de La Gauchetière Street West, Montréal. Via Rail (Montréal) 514-871-1331  
Amtrak (Montréal) 1-800-835-8725

## Métro (subway)

The métro has a well-deserved reputation for efficiency – frequent (every 3-7 minutes), fast, quiet, and except at rush hour, relatively uncrowded. Most of the major conference hotels are near a Métro entrance. The Palais de Congrès de Montréal is directly accessible by subway. The system consists of 65 stations on 4 color-coded interconnecting lines covering 64 kilometers. The métro runs from 5:30 am to 1:00 am. Métro six-day passes are available for CAN\$18.00. A one way ticket costs CAN \$1.75 regardless of your destination. For information call 514-280-5668, fax: 514-280-5020.

## Parking

There is indoor and outdoor parking available at the Palais de Congrès de Montréal. The weekend fee is CAN \$10.00/day. During the week, the daily rate varies depending on the day, but the highest rate is CAN\$ 11.50 per day.

## Visas

Some foreign travellers require a visa for entry into Canada. Please check your eventual visa requirements with your travel agency, or with a Canadian consular officer. Make your travel plans well in advance to allow enough time for the processing of your visa application, if necessary.

## Child Care

Babysitting and child care services are available from Les Congrès Animés, Inc. at the Queen Elizabeth. Rates are CAN \$5.00 per hour and child. Meals are CAN \$3.00 per meal. Reservations must be made in advance along with a deposit. For more information, please contact Denise Miller, Les Congrès Animés, Inc., phone: 514-938-1397, fax: 514-938-9605. (This information is for your convenience, and does not represent an endorsement of Les Congrès Animés, Inc. by IJCAI-95 sponsors.)

**Disclaimer:** In offering American Airlines, Air Canada, Hertz Car Rental, Les Congrès Animés Child Care, JpDL Multi Management Inc., McGill University and all other service providers, (hereinafter referred to as «Supplier(s)» for the International Joint Conference on Artificial Intelligence, the Innovative Applications Conference, and the Conference on Knowledge Discovery and Data Mining, IJCAI-95 sponsors act only in the capacity of agent for the Suppliers which are the providers of the service. Because the IJCAI-95 sponsors have no control over the personnel, equipment or operations of providers of accommodations or other services included as part of the IJCAI-95, IAAI-95 or KDD-95 program, IJCAI-95 sponsors assume no responsibility for and will not be liable for any personal delay, inconveniences or other damage suffered by conference participants which may arise by reason of (1) any wrongful or negligent acts or omissions on the part of any Supplier or its employees, (2) any defect in or failure of any vehicle, equipment or instrumentality owned, operated or otherwise used by any Supplier, or (3) any wrongful or negligent acts or omissions on the part of any other party not under the control, direct or otherwise, of the IJCAI-95 sponsors.

## General Information

### Montréal – C'est magnifique!



Montréal is a thriving cosmopolitan city full of Latin ambiance and «joie de vivre» rarely found anywhere else. From its roots as a small French colony founded in 1642, Montréal first developed into a bustling trade center at the hands of British merchants. The city subsequently became a multicultural center, enriched by the dedicated work and tradition of immigrants from every continent. Montréal is one of the largest bilingual cities in the world, and the language of the majority is French. Collectively, Montrealers speak 35 different languages and practice 30 different religions. People living here have arrived from at least 80 diverse countries. English is very much in evidence as well.

The downtown core lies between the St. Lawrence River and Mount Royal. Old Montréal was the earliest settled section of the city, but over time the city expanded uphill toward the mountain (Mount Royal). Today, Old Montréal is a virtual outdoor museum of historic buildings and monuments commemorating many events depicting Montréal's three-and-a-half centuries of growth. In honor of the city's 350th birthday, the Old Port waterfront was renovated in the summer of 1992, giving one access to the Lachine Canal with its bicycle path, walking trails and breathtaking scenery. Montréal certainly can boast a rich and colorful history unique in its charm and in its European flavor.

## Climate and dress

At the end of August, the weather is usually very sunny and warm with high temperatures between 70–80 degrees F (22–27 degrees C). A light sweater or jacket might be needed for evenings.

## Language

French and English

## Currency

The Canadian currency units are dollars and cents, with one dollar equalling 100 cents. Approximate rates of exchange in early March 1995 were:

US\$1.00	=	CAN\$1.40
100 Yen	=	AN\$1.47
1 German Mark	=	CAN\$0.97
1 English £	=	CAN\$2.26
1 French Franc	=	CAN\$0.27

All major credit cards are accepted in all hotels, most restaurants and department stores.

## Banking

Banks in downtown Montréal are usually open Monday–Friday from 9:00am–5:00pm. Automatic teller machines are available throughout town.

## Metric Conversion

Canada operates on the metric system of weights and measures. Visitors will find weather temperature reports given in degrees Celsius, gasoline sold by the litre (milk and wine by millilitres and litres) grocery items in grams and kilograms, fabric lengths in metres, and road speeds posted in kilometres per hour.

## Taxes

A federal tax (GST) of 7% is now applied to most goods and services in Canada. A Québec provincial tax of 6.5% is added to all goods and services. Non-residents can apply for a GST rebate on most goods (there are exceptions) purchased for use outside Canada as well as on short-term accommodations. Rebates can be claimed in person at participating Canadian Duty Free Shops at border crossings or airports, or by completing and mailing the rebate form. Refunds of the 6.5% provincial taxes are also available for purchases exceeding CAN\$500. Retailers have forms available.

## Tipping

In general, a tip of 15 percent is given to waiters, waitresses, hairdressers, taxi drivers, etc. Bellhops, doormen, porters, etc., at hotels, airports and railway stations are generally paid CAN \$1.00 per item of luggage.

## Visitor Information

Infotouriste is an international tourist information center in downtown Montréal. This one-stop center provides visitors with tourist information and services such as travel planning, information on activities, and attractions.

### Infotouriste

1001 Square Dorchester  
Montréal, Québec, Canada H3B 1G2  
Phone: 514-873-2015  
Toll free: 1-800-363-7777

## Restaurants

Restaurant category	Breakfast	Lunch	Dinner
Fast Food	CAN\$3-4	CAN\$5-8	CAN\$7-10
Economy	CAN\$5	CAN\$8-12	CAN\$10-20
Deluxe (hotels only for breakfast)	CAN\$15-25	CAN\$15-35	CAN\$25-50

## Excursions



IJCAI-95 has arranged with JpDL Multi Management Inc. to offer IJCAI-95 attendees a special tours program that includes some of the highlights of Montréal, and Québec. Please check the appropriate box on the registration form to receive further information about these exciting tours.

### Wednesday, August 23, afternoon tours

#### *Montréal City Tour – 1/2 Day Overview*

Duration: 3-4 hours

Price: CAN \$34.00 per person

This half-day city tour, ideal for first-time visitors, takes participants past some of Montréal's most important sites, including: Historic Old Montréal, Notre Dame Basilica, The Olympic Park, Mount Royal, the Latin Quarter and more.

#### *Walking tour of Old Montréal: «350 Years of History»*

Duration: 3 hours

Price: CAN \$29.00 per person

Participants will be enchanted with the rich cultural heritage of Old Montréal, which boasts one of the greatest concentrations of 17th, 18th and 19th century buildings on the continent, marked by cobblestone streets, monuments, and historic squares. In small groups of ten to fifteen people and accompanied by an experienced professional guide, participants will explore some of the many historical treasures of one of North America's oldest cities.

#### *Cruise on the St. Lawrence River*

Duration: 3-4 hours (including transfer time)

Price: CAN \$40.00 per person

Aboard the 290 passenger M/V Concordia or the 400 passenger M/V Montréal, participants will enjoy a scenic view of the shores of Montréal and area from the vantage point of the mighty St. Lawrence River. On board, participants will see the sights of the Old Port, the skyline of Old Montréal set against that of the modern downtown core, St. Helen's Island, Man and his World on Notre-Dame Island, site of the 1967 World Fair, and the Jacques-Cartier Bridge, to name but a few.

#### *Hydro Québec's «Electrium»*

Duration: 4 hours

Price: CAN \$42 per person

On the grounds of its research institute, participants will tour Hydro Québec's recently opened electric and magnetic field centre. Located close to a 735-kV line, the centre will offer visitors state-of-the-art knowledge on electric and magnetic fields. The tour will explore electric and magnetic fields; how they are generated, where they are found, how



they behave, and how they might affect health. Is it safe to live near a 735-kilovolt line? The Electricium will provide the answer.

#### **CAE Electronics Tour**

Duration: 4 hours

Price: CAN \$42 per person

Participants will visit one of the world's leading advanced technology companies and Canada's foremost scientific systems and software enterprise. CAE applies sophisticated real-time computer-based technology to complex training, simulation and control tasks across a broad spectrum of commercial and military aviation: hydro and nuclear power generation, transmission and distribution, air traffic control, marine applications, space exploration and submarine detection systems. CAE is renowned for supplying the control systems for the famed CANADARM aboard NASA's space shuttles. The following CAE systems are included in the tour: flight simulators, visual systems, power plant simulators, energy control systems, marine control systems, non acoustic ASW sensors, space programs and air traffic management systems.

#### **Excursions before the conference**

##### **Discover Ottawa By Train – Canada's Capital**

Duration: 2 days, one night

Price: CAN \$189 per person, double occupancy

Canada's Capital Region, Ottawa is a destination with a unique difference. Explore several of the world-class museums: National Gallery of Canada, Canadian Museum of Civilization, National Aviation Museum just to name a few. Enjoy a cruise on the Rideau Canal or on the Ottawa River. Take a guided tour of the Parliament. On summer mornings, visitors can watch the thrilling spectacle of the Changing of the Guard ceremony and the sound and light display.

##### **Eastern Townships Tour (L'Estrie)**

Duration: 7 to 7.5 hours

Price: CAN \$72.00 per person

This daytrip to a lovely region just east of Montréal includes visits to artisan shops, vineyards and outdoor markets located in a stupendous setting of forests, lakes and mountains. Participants will tour the Estrie region, where groups of Amerindians, French Canadians, United Empire Loyalists and Irish immigrants have successively settled. Visitors will see St-Benoit-du-Lac Abbey, a 20th century monastery designed and constructed by Benedictine monks.

#### **Excursion after the conference**

##### **Charming Historic Québec City – by train**

Duration: 2 days, one night

Price: CAN \$229.00 per person/double occupancy

Take a step back in time to visit the only walled city in North America, recognized as a World Heritage Treasure by UNESCO in 1985. See the narrow, cobbled streets, the historic buildings and unique «old world» ambiance that is Québec City. Included are stops at historic buildings, and Le Petit Champlain, the oldest street in North America. Québec City's distinctive French flavour is enhanced by fine restaurants, outdoor cafés, and a lively night life.

## **Future IJCAI Conference Dates**

### **IJCAI-97 Yokohama, Japan**

**August 24-29, 1997**

IJCAI-97, the Fifteenth International Joint Conference on Artificial Intelligence, will be held 24-29 August 1997 in Yokohama, Japan. It is sponsored by the International Joint Conferences on Artificial Intelligence, Inc. (IJCAII), and cosponsored by the Japanese Society for Artificial Intelligence (JSAI). Setsuo Ohsuga, The University of Tokyo is chair of the Japanese National Committee. Koichi Furukawa, Keio University, is responsible for Local Arrangements. Ron Brachman, AT&T Bell Laboratories, the IJCAII Secretary-Treasurer, also serves as Secretary-Treasurer for the conference.

For further information, contact one of the following:

#### **Dr. Michael P. Georgeff**

Conference Chair, IJCAI-97

Australian AI Institute

1 Grattan Street

Carlton, Victoria 3053

AUSTRALIA

Ph: 61-3-663-7922

Fax: 61-3-663-7937

Email: georgeff@aaii.oz.au

#### **Prof. Koichi Furukawa**

Local Arrangements Chair, IJCAI-97

Keio University

Faculty of Environmental Information

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#### **Prof. Martha Pollack**

Program Chair, IJCAI-97

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Computer Science, 202 Mineral Indust.

University Drive

Pittsburgh, PA 15260 USA

Ph: 412-624-9590

Fax: 412-624-5249

Email: pollack@cs.pitt.edu

#### **Dr. Ron Brachman**

Secretary-Treasurer, IJCAI-97

AT&T Bell Laboratories

600 Mountain Ave, 2T-416

Murray Hill, NJ 07974, USA

Ph: 908-582-2269

Fax: 908-582-7550

email: rjb@research.att.com

### **IJCAI-99, Stockholm, Sweden**

**July 31-August 6, 1999**

IJCAI-99, the Sixteenth International Joint Conference on Artificial Intelligence, will be held July 31-August 6, 1999 in Stockholm, Sweden. It is sponsored by the International Joint Conferences on Artificial Intelligence, Inc. (IJCAII), and cosponsored by the Swedish Society for Artificial Intelligence (SAIS), the Norwegian Society for Artificial Intelligence (NAIS), the Finnish Society for Artificial Intelligence (FAIS), and the Danish Society for Artificial Intelligence (DAIS).

For further information, please contact:

#### **Prof. Carl Gustav Jansson**

Local Arrangements Chair

Royal Institute of Technology and

University of Stockholm

Computer and System Sciences

Electrum 230

S-164 40 Kista, SWEDEN

Ph 46-8-161605

Fax: 46-8-7039025

Email: calle@dsv.su.se

(The Conference Chair and Program Chair will not be decided until 1997)