Welcome to ijcai 99

IJCAI-99, the Sixteenth International Joint Conference on Artificial Intelligence, is sponsored by the International Joint Conferences on Artificial Intelligence, Inc. (IJCAII), and the Scandinavian AI societies: Danish AI Society (DAIS), Finnish AI Society (FAIS), Norwegian AI Society (NAIS), and the Swedish AI Society (SAIS). To organize IJCAI-99 a Nordic IJCAI Scientific Advisory Committee (NISAC) has been established.

IJCAII 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)
Chambery, Savoie, France (1993)
Montreal, Quebec, Canada (1995)
Nagoya, Japan (1997)

The 2001 conference is scheduled for Seattle, Washington, USA, August 3-10.

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CITY ON WATER
The noblest part of Stockholm is built on a few small islands. The picture shows Stockholm's old town facing Lake Mälaren. Below is a glimpse of the roof of the Royal Palace with its flag. Towards the right you can see the towers of the church "Storkyrkan" and "Riddarholm's church" furthest to the right.

PHOTO: JAN ASPLUND

IJCAI-99 Awards

The IJCAI Award for Research Excellence and the Computers and Thought Award are made by the IJCAII Board of Trustees, upon recommendation by the IJCAI Awards Selection Committee, which consists this year of

Daniel Bobrow (Palo Alto, USA)
C. Raymond Perrault (Palo Alto, USA)
Ross Quinlan (Sydney, Australia)
Erik Sandewall (Linköping, Sweden)
Wolfgang Wahlster (Saarbruecken, Germany, Chair)

The IJCAI Awards Selection Committee receives advice from members of the IJCAI Awards Review Committee, who comment on the accuracy of the nomination material and provide additional information about the nominees. The IJCAI Awards Review Committee is the union of the former Trustees of IJCAII, the IJCAI-99 Advisory Committee, the Program Chairs of the last three IJCAI conferences, and the past recipients of the IJCAI Award for Research Excellence and the IJCAI Distinguished Service Award, with nominees excluded.

IJCAI AWARD FOR RESEARCH EXCELLENCE

The IJCAI Award for Research Excellence is given at the IJCAI conference to a scientist who has carried out a program of research of consistently high quality, yielding several substantial results. Past recipients of this award are John McCarthy (1985), Allen Newell (1989), Marvin Minsky (1991), Raymond Reiter (1993), Herbert Simon (1995), and Aravind Joshi (1997).

The winner of the 1999 IJCAI Award for Research Excellence is Judea Pearl, Professor at the Computer Science Department of the University of California Los Angeles, USA. Professor Pearl is recognized for his fundamental work on heuristic search, reasoning under uncertainty, and causality. He will deliver a lecture entitled *Reasoning with Cause and Effect* in the evening of August 5, 1999.

IJCAI COMPUTERS AND THOUGHT AWARD

The Computers and Thought Award is presented at IJCAI conferences to outstanding young scientists in artificial intelligence. The award was established with royalties received from the book "Computers and Thought", edited by Edward Feigenbaum and Julian Feldman; it is currently supported by income from IJCAII funds.

Past recipients of this honor have been Terry Winograd (1971), Patrick Winston (1973), Chuck Rieger (1975), Douglas Lenat (1977), David Marr (1979), Gerald Sussman (1981), Tom Mitchell (1983), Hector Levesque (1985), Johan de Kleer (1987), Henry Kautz (1989), Rodney Brooks (1991), Martha Pollack (1991), Hiroaki Kitano (1993), Sarit Kraus (1995), Stuart Russell (1995), and Leslie Kaelbling (1997).

The winner of the 1999 IJCAI Computers and Thought Award is Nicholas R. Jennings, Professor at the Department of Electronic Engineering of the Queen Mary & Westfield College, University of London, UK.

Professor Jennings is recognized for his contributions to practical agent architectures and his applied work in the field of multi-agent systems. He will deliver a lecture entitled *Agent-Based Computing: Promise and Perils* in the evening of August 3, 1999.

THE DONALD E. WALKER DISTINGUISHED SERVICE AWARD

The IJCAI Distinguished Service Award was established in 1979 by the IJCAII Trustees to honor senior scientists in AI for contributions and service to the field during their careers. Previous recipients have been Bernard Meltzer (1979), Arthur Samuel (1983), Donald Walker (1989), Woodrow Bledsow (1991) and Daniel G. Bobrow (1993).
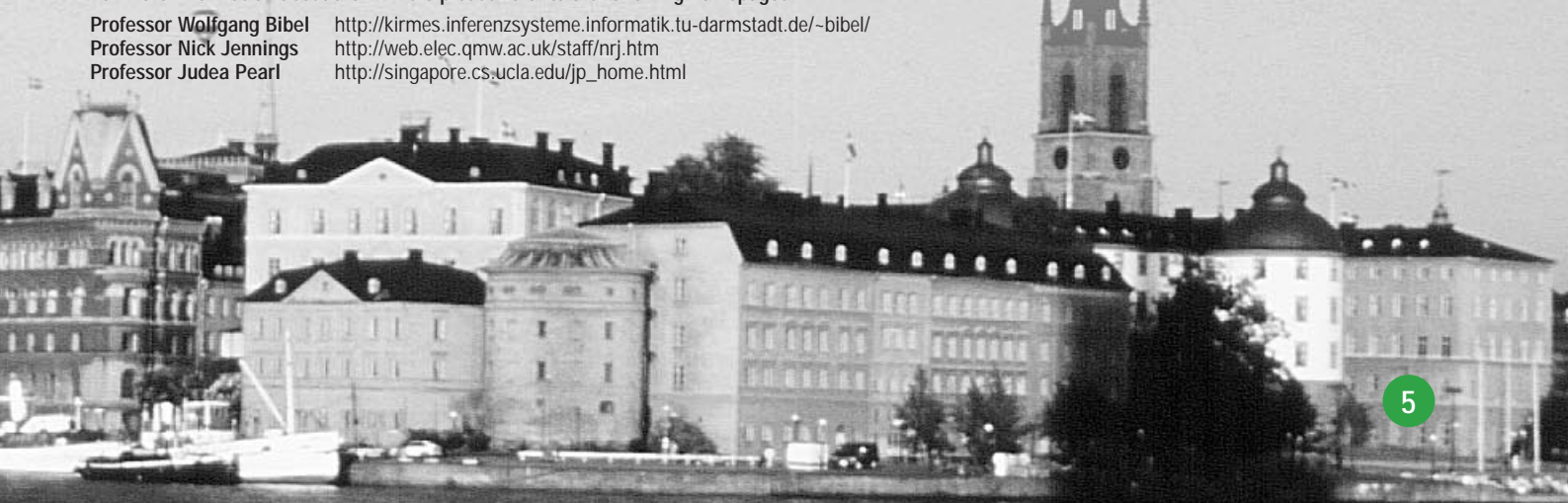
In 1994, the IJCAI Distinguished Service Award was renamed the Donald E. Walker Distinguished Service Award in memory of the late Donald E. Walker, who shaped the IJCAII organization as a Secretary-Treasurer.

At IJCAI-99, the Donald E. Walker Distinguished Service Award will be given to Wolfgang Bibel, Professor for Intellectics at the Department of Computer Science of the Darmstadt Institute of Technology in Germany. As a pioneering researcher in automated deduction, Professor Bibel is recognized for his outstanding contributions and service to the international AI community including his creation of ECCAI, which has operated since 1982 as an umbrella organization of 27 European societies for Artificial Intelligence.

For more information about the winners please refer to the following homepages:
Professor Wolfgang Bibel   http://kirmes.inferenzsysteme.informatik.tu-darmstadt.de/~bibel/
Professor Nick Jennings   http://web.elec.qmw.ac.uk/staff/nrj.htm
Professor Judea Pearl   http://singapore.cs.ucla.edu/jp_home.html

IJCAI -99 Support Programs

IJCAII is pleased to announce the continuation of its Travel Awards Program for students, junior scientists and scientists from Eastern Europe and other countries with unstable currency interested in attending IJCAI-99. ECCAI will also provide travel funds for young members of an ECCAI Member Society. The Conference Fee Waiving Program will help some of the participants from Eastern Europe and developing countries. Additionally, the Student Volunteer Program continues to provide limited support to those students willing to help make IJCAI-99 a success.

IJCAII TRAVEL AWARD PROGRAM

Travel awards are available for students and junior researchers through IJCAII and other national societies. Due to limited availability of IJCAII Travel Award Program funds, it is highly recommended that applicants, especially students, approach their local AI Society first for possible support. For information regarding the IJCAI-99 Travel Award Program, please contact:

IJCAI-99
c/o Priscilla Rasmussen
75 Paterson Street, Suite 9
New Brunswick, NJ 08901 USA
Phone: +1-732-342-9100
Fax: +1-732-342-9339
E-mail: rasmusse@ijcai.org

The original and three copies of a letter of request should be submitted to Priscilla Rasmussen no later than May 1, 1999. This application should state:

- the status of the applicant (student, junior faculty, etc.)
- type of planned participation in the IJCAI-99 program (accepted technical session or workshop paper, etc.)
- an estimate of attendance costs

- whether any other sources of support are available to the applicant and whether the local AI Society has been approached for support
- a letter of support (for students only) from the applicant's advisor.

A post-conference report and receipts totaling the award amount will be required after the conference in order to receive the award.

In the event that travel award 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 or those having unstable currency problems.

ECCAI TRAVEL AWARD PROGRAM

The European Coordinating Committee for Artificial Intelligence (ECCAI) has a small number of Travel Grants with a value of 400 Euros each, available for young members of an ECCAI member society. Priority will be given to authors of papers accepted for the technical program over papers for workshops. Recipients should play an active role in IJCAI-99 as a presenter, chair, panelist, etc. In exchange for support, a report for publication will be required. Deadline for applications is May 4, 1999.

For full details and the application procedure, see the ECCAI web site at http://www.eccai.org, or e-mail.

Dr. Robert Milne
ECCAI Travel Grants Officer
Intelligent Applications
1 Michaelson Square
Livingston, W. Lothian
Scotland, UK
Tel: +44 1506 47 20 47
Fax: +44 1506 47 22 82
Email: rmilne@bcs.org.uk

THE CONFERENCE FEE WAIVING PROGRAM

Limited funds are available to cover the conference participation fee of participants from Eastern Europe as well as from developing countries.

In order to apply, submit a letter of application and a short CV electronically or by post to:

Diana Molero
Electrum 204
KTH/Teleinformatik
164 40 Kista
Sweden
e-mail: diana@it.kth.se

The deadline for applying is April 1, 1999.

STUDENT VOLUNTEER PROGRAM

Students not requiring travel assistance should apply only for the Student Volunteer Program, which provides complimentary registration, including conference proceedings, to full time students in exchange for assisting IJCAI-99 organizers in Sweden.

This program does not provide travel award funds, and is designed for local students or students who have other sources for travel funds. The deadline for volunteer applications is May 10, 1999.

For further information regarding the Student Volunteer Program, please refer to the IJCAI-99 Web pages or contact the Student Volunteer Coordinator:

Åsa Rudström
SICS
P.O. Box 12 63
SE-164 29 Kista
Sweden
E-mail: asa@sics.su.se

STOCKHOLM'S MANY BRIDGES
Several bridges connect the islands and areas of land which comprise the city of Stockholm. One of the longest is "Västerbron" (West Bridge) which is an important link between the northern and southern central parts of town.

PHOTO: JAN ASPLUND

Conference Program Description

IJCAI-99 is composed of various complementary programs

- the Technical Program, including technical paper presentations by top scientists in the field and invited speakers
- the Tutorial Program (20 tutorials)
- the Workshop Program (30 workshops)
- the Exhibition (3 days)

RoboCup-99 will be held from July 27 to August 6 at the same venue as IJCAI-99.

Additional affiliated conferences and workshops are described on page 23.

IJCAI-99 OFFICIAL OPENING CEREMONY AND RECEPTION

The Opening Ceremony will start at 5 pm August 2, and be held at City Conference Centre followed by a Reception in the City Hall of Stockholm.

The Opening Ceremony will be chaired by Luigia Carlucci Aiello, the Conference Chair of IJCAI-99. The Reception will be hosted by the City of Stockholm.

Please mark on the registration form if you intend to participate in the Reception.

Conference Dinner

The Dinner will be at Vaxholm Fortress on August 4 to a cost of 600 SEK including VAT. Boats will take you from the City's center at 6 pm for a one-hour cruise through the Stockholm Archipel-

ago, ending at the Vaxholm Fortress. Upon arrival you will be served a traditional Nordic dinner in ancient, historic surroundings. The boats will then take you back to Stockholm starting at around 10 pm.

Informal dress is recommended. Please register early, as space is limited.

DETAILED CONFERENCE PROGRAM

For the latest information about the Conference, please see:

http://www.ijcai.org/ijcai-99

There you can also find details about technical sessions, latest May 1999.

CONFERENCE AT A GLANCE

	MORNING	AFTERNOON	EVENING
Friday, July 30		Registration	
	RoboCup		
Saturday, July 31	Registration		
	Workshops		
	RoboCup		
Sunday, August 1	Registration		
	Workshops		
	Tutorials		
	RoboCup		
Monday, August 2	Registration		Opening Ceremony, Reception
	Workshops		
	Tutorials		
Tuesday, August 3	Registration		Computers and Thought Lecture
	Technical Sessions		
	RoboCup Semifinals		
	Exhibition		
Wednesday, August 4	Registration		Dinner
	Technical Sessions		
	RoboCup Finals		
	Exhibition		
Thursday, August 5	Registration		Research Excellence Lecture
	Technical Sessions		
	Exhibition		
Friday, August 6	Registration		
	Technical Session		

Morning sessions 8.30 am – 12.30 pm, Afternoon sessions 2 – 6 pm, except for August 2 when sessions start at 8 am.

Business Meeting 12.30 – 2 pm, open to all attendees.

Invited Speakers

Minoru Asada, Osaka University and Henrik I. Christensen, The Royal Institute of Technology in Stockholm and Centre for Autonomous Systems
Robotics in the Home, Office, and Playing Field

Robots are moving into our everyday life for tasks like entertainment, cleaning, and delivery. To arrive at such systems, a number of key scientific questions must be answered and technological breakthroughs must be accomplished. The areas of service robotics and the RoboCup each define common tasks that allow evaluation of systems promoting integration of robotics and AI. In this talk the application domains are introduced, recent results are reviewed, and issues for future generations are outlined.

Luca Console, Universitá di Torino and Oskar Dressler, Technical University of Munich
Model-based Diagnosis in the Real World: Lessons learned and Challenges remaining

Model-based diagnosis techniques have started to enter industrial applications and commercial tools. We focus on pointing out the reasons behind these successes, in terms of both technical solutions and industrial needs. The lessons learned and open problems hampering wider application suggest future theoretical and practical research.

Neil Gershenfeld, Physics and Media Group at the MIT Media Lab
Natural Intelligence

While the study of machine intelligence has focused on the programming of general-purpose computers, digital logic represents a small subset of the latent capability of natural systems to manipulate information. I present some of the remarkable computational tasks that can be performed by the evolution of simple classical and quantum systems, and consider the implications for inference and interfaces of bringing rich sensory information into more conventional computing environments.

Stig B. Hagström, Stanford University
From Teaching to Learning: The Role of AI in an Educational Paradigm Shift

Simultaneously with the information "explosion" in the last few decades there has been a corresponding "explosion" in higher education in most countries. This growth in number of students has essentially followed an "extrapolation" of traditional teaching modes.

There have, however, been a number of attempts to apply modern electronic tools to promote a change described as "from teaching to learning".

In a joint effort Stanford University and selected Swedish universities are promoting a shift towards learning through Learning Laboratories. The talk will illustrate some basic ideas and concepts behind this collaboration and the Learning Laboratories.

David Heckerman, Microsoft Research
Learning Bayesian Networks

For two decades, Bayesian networks constructed by experts have been used in intelligent systems with a fair amount of success. More recently, researchers have developed techniques for constructing Bayesian networks (both parameters and structure) from a combination of expert knowledge and data. These techniques can significantly reduce the cost of building an intelligent system and can be used to identify causal relationships from non-experimental data – an important breakthrough for science. I will describe some of these techniques, concentrating on methods borrowed from Bayesian statistics, and discuss real-world applications.

John Hooker, Carnegie Mellon University
Unifying Optimization and Constraint Satisfaction

The optimization methods of operations research and the constraint satisfaction methods of artificial intelligence have a unifying theme: both fields exploit the fundamental and related dualities of search vs. inference and strengthening vs. relaxation. This allows the two fields to be seen as special cases of a more general approach and suggests new methods that fit into neither OR nor AI.

Radu Horaud, CNRS and INRIA Rhone-Alpes
Non-Metric Dynamic Vision: A Paradigm for Representing Motion in Perception Space

The representation of motion is of central importance in many artificial intelligence-related fields such as robotics, computer graphics, virtual reality, neurophysiology, and so forth. A crucial and not yet completely understood issue is, however, the measurement of motion. Computer vision has proposed a paradigm called "dynamic vision". Within this paradigm, the vast majority of solutions consider a single camera. In this talk we advocate that a pair of uncalibrated cameras should be preferred.

The motion measurement and representation issued from such a camera pair are more tractable from a mathematical point of view and can be used in a wider range of applications, such as visual guidance of robots and vehicles, visual surveillance, and virtualized reality.

The picture shows the main entrance to KTH, Royal Institute of Technology. KTH was founded in 1827 and is the largest of Sweden's six universities of technology. Since 1917 KTH has been housed centrally in Stockholm in beautiful buildings. Today these buildings have monument status. KTH has 11,000 undergraduate students, and a staff of 2,900 people.

Lydia Kavraki, Rice University
Computational Approaches to Drug Design

The rational approach to pharmaceutical drug design begins with an investigation of the relationship between chemical structure and biological activity. Information gained from this analysis is used to aid the design of new or improved drugs. Computational chemists involved in rational drug design routinely use an array of programs to compute geometric and chemical characteristics of molecules. In this talk I describe areas of computer-aided drug design that are important to computational chemists but are also rich in algorithmic problems and have attracted the attention of computer scientists.

Robert Schapire, AT&T Labs – Research
Theory and Practice of Boosting

Boosting is a general method for producing a very accurate classification rule by combining rough and moderately inaccurate "rules of thumb." While rooted in a theoretical framework of machine learning, boosting has been found empirically to perform rather well. In this talk, I will introduce the Boosting algorithm AdaBoost and explain the underlying theory of boosting, including an explanation of why boosting often does not suffer from overfitting. I also will describe some recent applications of boosting.

Donia Scott, University of Brighton
The Multilingual Generation Game: Authoring Fluent Texts in Unfamiliar Languages

This talk presents Multilingual Natural Language Generation (M-NLG), which is proving successful in its attempts to achieve the same goals as machine translation (the more familiar alternative technology for automating multilingual document production) while avoiding many of its pitfalls.

Oliviero Stock, IRST, Istituto per la Ricerca Scientifica e Tecnologica
Was the Title of This Talk Generated Automatically? Prospects for Intelligent Interfaces and Language

Language processing has a large practical potential when we realize that, for instance, it can be integrated with other modalities made available by a computer. Intelligent interfaces are artifacts that (often) practically embody these concepts. Some prototypes are presented and challenges for the future are discussed.

Moshe Tennenholtz, the Technion Israel Institute of Technology
Realizing Electronic Commerce: From Economic and Game-Theoretic Models to Working Protocols

Mechanism design is the branch of economics and game theory that deals with the design of economic settings and protocols. In this talk we review some of the mechanism design literature and discuss some essential steps in the adaptation of economic mechanisms to non-cooperative computational environments, such as the Internet.

A view of Stockholm University and the Frescati Campus area. The campus is situated in the world's first national city park, an area rich in natural beauty yet close to the heart of the capital. Stockholm University's roots date back to 1878. The University moved from the central part of the city to Frescati in 1970. Stockholm University has 4 faculties: Natural Sciences, Humanities, Social Sciences and Law. With 34,000 students and 3,800 permanent employees, Stockholm University one of Sweden's largest educational establishments.

PER BERGSTRÖM

Tutorial Program

The IJCAI-99 Tutorial Program features 20 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. The tutorials will be organized in five main themes A–E with four tutorials in each theme. The themes are A) Multiagent Systems, B) Situated Artificial Intelligence, C) Planning and Scheduling, D) Basic Technologies, and E) Knowledge Extraction and Discovery.

Sunday, August 1	
9.00 am – 1.00 pm	**2.00 pm – 6.00 pm**
A1 Agents and Multiagents in the Internet and Intranets Michael N. Huhns, Munindar P. Singh	**A2** Ontological Engineering Asunción Gómez-Pérez
B1 Robotic Soccer: The Research Challenges and the Concrete Simulation and Real Robot Platforms Peter Stone, Manuela Veloso	**B2** Intelligent Multimedia Interface Agents Wolfgang Wahlster, Elisabeth Andre
C1 Practical Planning Systems Steve Chien, Brian Drabble	**C2** Knowledge-based Scheduling Steve Chien, Stephen Smith
D1 Neural Networks for Data Structures: Principles and Applications Paolo Frasconi, Alessandro Sperduti	**D2** Probabilistic Argumentation Systems Jurg Kohlas, Rolf Haenni
E1 Evaluating Machine Learning and Knowledge Discovery Foster Provost, David Jensen	**E2** Practical Text Mining Ronen Feldman

Monday, August 2	
8.00 am – 12.00 am	**1.00 pm – 5.00 pm**
A3 Collaborative Multiagent Systems Barbara Grosz, Charlie Ortiz	**A4** Principles of Agents and Multiagent Systems: Social, Ethical, and Legal Abstractions and Reasoning Michael N. Huhns, Munindar P. Singh
B3 Behavior-based Robotics Maja Matarić, Ronald Arkin	**B4** User-Adaptive Systems: An Integrative Overview Anthony Jameson
C3 Recent Advances in AI Planning: A Unified View Subbarao Kambhampati	**C4** Economically Founded Multiagent Systems Tuomas W. Sandholm
D3 Learning Bayesian Networks from Data Nir Friedman, Moises Goldszmidt	**D4** Solving AI Problems with Satisfiability Ian Gent, Toby Walsh
E3 Automatic Text Summarization: Methods, Systems and Evaluation Udo Hahn, Inderjeet Mani	**E4** Introduction to Information Extraction Technology Douglas E. Appelt, David J. Israel

Tutorial Descriptions

A1 Agents and Multiagents in the Internet and Intranets
Sunday, AM

Michael N. Huhns   Munindar P. Singh

Agents and multiagent systems or multiagents have been gathering an increasing amount of attention lately in the research community, from funding agencies, and even in the lay press. This is because of the expansion of information-rich environments, not only in the Internet at large, but also in intranets and virtual private networks. Key applications include telecommunications management, virtual enterprises, logistics, healthcare, and manufacturing automation, to name but a few. Successful agent applications in such domains will depend not only on AI techniques but also on a solid understanding of the underlying database issues.

Information-rich environments inherently involve both (a) existing, heterogeneous components within an enterprise and (b) independently designed, autonomous components that must interoperate in separate enterprises. Therefore, developing agents and multiagents in such environments requires synthesizing AI and database techniques for capturing and using semantics through abstractions such as datamodels, ontologies, transactions, relaxed transactions, and workflows.

This tutorial presents the essential background – in AI, databases, and distributed computing concepts, architectures, theories, and techniques – for anyone planning to learn about and contribute to the principles and applications of agent technology. It includes a

comprehensive overview of the state of the art in several agent applications, involving not only the retrieval of information, but also its update.

This tutorial will guide practitioners by describing implemented, tested agent-based approaches to large-scale information access and management. It will introduce graduate students and others to a new area with lots of exciting and important open problems.

PREREQUISITE KNOWLEDGE:
The background concepts in AI, databases, and distributed computing are covered within the tutorial. Thus, the tutorial is self-contained.

THE PRESENTERS have a long trackrecord in the theory and practice of multiagent systems in open, information-rich environments. They have given a number of tutorials at international AI, database, and distributed computing conferences. They coedited the book "Readings in Agents," published by Morgan Kaufmann in 1998 and now in its second printing.

PROFESSOR HUHNS (Ph.D., USC, 1975) edited the books "Distributed Artificial Intelligence", volumes 1 and 2, and authored over 100 papers and reports. He is serving or has served on numerous program committees, conference advisory boards, and journal editorial boards, including two IEEE magazines and one ACM transactions.
Homepage: www.ece.sc.edu/faculty/Huhns/

PROFESSOR SINGH (Ph.D., Texas, 1993) authored a book "Multiagent Systems" and several papers on agents and databases. He is Editor-In-Chief of IEEE Internet Computing. Dr. Singh has also chaired conferences on co-operative information systems and agents.
Homepage: www.csc.ncsu.edu/faculty/mpsingh/

A2 Ontological Engineering
Sunday, PM

Asunción Gómez Pérez

The aims of this tutorial are to present the theoretical foundations of the field of ontological engineering, methodologies and software environments for building ontologies, and the uses of ontologies in commercial and research applications.

The tutorial will provide answers to the following questions:

- What is an ontology?
- What principles should I follow to build an ontology?
- What types of ontologies already exist?
- How are ontologies organized in libraries?
- What are the relationships between ontologies and knowledge bases?
- What methodology/steps should I use to build my own ontology?
- Which techniques are appropriate for each step?
- How do software tools support the process of building and using ontologies?
- What are the most well-known ontologies? Can I use existing ontologies to build my ontology? What are the uses of ontologies in applications?

After the three hours tutorial, participants will be familiar with the theoretical foundations of this field, will be table to build ontologies and identify potential applications for this technology.

PREREQUISITE KNOWLEDGE:
Participants need to have background knowledge on Knowledge Engineering and Artificial Intelligence.

ASUNCIÓN GÓMEZ PÉREZ is B.A. in Computer Science (1990), M.S.C. on Knowledge Engineering (1991), Ph.D. in Computer Sciences (1993) by Universidad Politécnica de Madrid, Spain. She also is MS.C. on Business Administration (1994) by Universidad Pontificia de Comillas, Spain. She has visited (1994-1995) the Knowledge Systems Laboratory at Stanford University. She is Associate Professor (1995-) at the Computer Science School at Universidad Politécnica de Madrid, Spain. She also is the Executive Director (1995) of the Artificial Intelligence Laboratory at the School. Her current research activities include, among others: Theoretical ontological foundations, Methodologies for building ontologies, Ontological Reengineering, Evaluation of ontologies, Uses of ontologies in applications, Knowledge Management on the web, etc. She has published more than 20 papers on the above issues. She has lead 5 projects funded by various institutions and/or companies. She is author of one book on Ontological Engineering and co-author of a book on Knowledge Engineering. She has been co-organizer of the workshops and conferences on ontologies at ECAI-98, SSS-97 and ECAI-96. She has taught tutorials on Ontological Engineering at ECAI-98, SEKE-97 and CAEPIA-97.
E-mail: asun@fi.upm.es

A3 Collaborative Multiagent Systems
Monday, AM

Barbara Grosz   Charlie Ortiz

Systems that are able to act as collaborative partners on joint tasks have the potential to greatly improve human-computer interactions and productivity. Such collaborative systems are within reach thanks to progress in our understanding of rationality, both collective and individual.

This tutorial will describe both the major theoretical advances that can support the principled designs of such systems as well as describe implementations based on these theories.

The tutorial will begin with an overview of rationality: What it means for an agent to be rational and how this can be reflected in agent designs. This will include a brief review of models of mental state: for example, the representation and role of intentions and the relation of intentions to other attitudes such as that of belief.

Then we will consider information flow within agent architectures, emphasizing considerations of resource-boundedness and the ways this affects formalizations and system designs.

The tutorial will then examine a range of approaches to modeling the collaborative behavior of a group of agents on a joint task. Several formal computational models will be presented and examined in the light of major philosophical approaches. The formal models require the introduction of new notions of intention, ability, and helpful behavior. These new notions will be examined, as will ways to model stages of partiality in joint planning processes. The relationship of this work to work in distributed AI will be discussed briefly. Finally, applications to human-computer communication and planning will be discussed.

PREREQUISITE KNOWLEDGE:
This tutorial is suitable for a general AI audience. Knowledge of AI planning would be helpful. It should be of interest to: researchers in distributed AI; those interested in the theoretical aspects of collaboration; and those interested in designing and building collaborative information systems, user interfaces, and planning systems.

BARBARA GROSZ is Gordon McKay Professor of Computer Science at Harvard University and is a past president of AAAI. Her research addresses fundamental problems in modeling collaborative activity and in developing computer systems able to collaborate with each other and their users. She is one of the developers of the SharedPlans model of collaboration. She is extending this model and using it to construct collaborative interfaces and computer agents that work together in teams.

CHARLIE ORTIZ is a computer scientist in the Artificial Intelligence Center at SRI International where he has also served as director of the Applied AI Technology Program. While a post-doctoral fellow at Harvard, he conducted research on collaborative planning systems and rational agency. He holds an S.B. in physics from MIT and an M.S. in computer science from Columbia University. His Ph.D. in computer science from the University of Pennsylvania was for his work on causation.
E-mail: ortiz@ai.sri.com

A4 Principles of Agents and Multiagent Systems: Social, Ethical, and Legal Abstractions and Reasoning
Monday, PM

Michael N. Huhns   Munindar P. Singh

The agent metaphor comes packaged with a number of powerful abstractions. These include traditional AI abstractions, such as beliefs, knowledge, and intentions as well as the newer and more interesting social, ethical, and legal abstractions.

Traditional AI considers stand alone entities, and studies actions merely in terms of their causes and effects, and simplistic obligations and constraint reasoning over them. In contrast, agents are social, their actions involve the ethical concepts of right and wrong, and they may engage in a variety of legal relations. The latter themes are emphasized in this tutorial.

Agent applications are drawing increasing attention from researchers, practitioners, and even users. All too often, however, current agent-based systems neither support nor use the abstractions that make agents interesting in the first place. Some developers are aware of these limitations, but necessarily come up with ad hoc solutions. However, the applica-

tions will benefit from a principled usage of the above abstractions, which enable true agent functionality.

This tutorial includes some historical background, but emphasizes conceptual and technical material relating to the above abstractions. It provides a comprehensive survey, and describes how the above abstractions are being used in some upcoming multiagent systems. This tutorial introduces AI practitioners and students to multiagent systems. It is especially useful for those transitioning from traditional agent systems and applications to multiagent systems proper.

PREREQUISITE KNOWLEDGE:
The tutorial is self-contained; it assumes only some familiarity with AI.

THE PRESENTERS have a long trackrecord in the theory and practice of multiagent systems. They have given a number of tutorials at international computer science conferences. They coedited the book "Readings in Agents", published by Morgan Kaufmann in 1998 and now in its second printing.

PROFESSOR HUHNS (Ph.D., USC, 1975) edited the books "Distributed Artificial Intelligence", volumes 1 and 2, and authored over 100 papers and reports. He is serving or has served on numerous program committees, conference advisory boards, and journal editorial boards, including two IEEE magazines and one ACM transactions.
Homepage: www.ece.sc.edu/faculty/Huhns/

PROFESSOR SINGH (Ph.D., Texas, 1993) authored a book "Multiagent Systems" and several papers on agents and databases. He is Editor-In-Chief of IEEE Internet Computing. Dr. Singh has also chaired conferences on cooperative information systems and agents.
Homepage: www.csc.ncsu.edu/faculty/mpsingh/

B1 Robotic Soccer: The Research Challenges and the Concrete Simulation and Real Robot Platforms
Sunday, AM

Peter Stone   Manuela Veloso

Robotic soccer is a multi-agent domain consisting of teams of agents that need to collaborate in a real-time, noisy, adversarial environment. As such, this exciting

domain provides a myriad of AI research opportunities related to multi-agent systems, machine learning, real-time planning, opponent modeling, intelligent robotics, and several other AI topics.

At IJCAI-97, conference attendees had the opportunity to witness the first robotic soccer world cup (RoboCup) competitions. Another competition will be held at IJCAI-99. Competitions are held within both simulation and real platforms. This tutorial is an opportunity to learn the full range of research that has been going on behind the competitions.

This tutorial will be of interest to AI researchers and practitioners concerned with real-time multi-agent systems, including entertainment domains. The tutorial will also be particularly relevant to current and potential robotics researchers. It will help summarize the current state of the art in a coherent framework so that they can build upon past accomplishments and identify future research opportunities.

The tutorial will specifically introduce the RoboCup simulator and robotic platforms and the algorithms developed for multi-agent control learning, teamwork architecture, and distributed robotic perception and action. In addition, we plan to take special care to identify the generality of the techniques developed within RoboCup for researchers interested in other domains similar to robotic soccer.

PREREQUISITE KNOWLEDGE:
Participants in this tutorial need not have previous familiarity with robotic soccer.

PETER STONE is a Ph.D. candidate in Computer Science Department at Carnegie Mellon University. He received his M.S. in Computer Science from Carnegie Mellon University in 1995 and his B.S. in Mathematics from the University of Chicago in 1993. His research interests include planning and machine learning, particularly in multi-agent systems. Mr Stone has been a central figure in the creation of the RoboCup initiative, currently serving as the chair of the RoboCup-99 simulator committee.
E-mail: pstone@cs.cmu.edu

MANUELA M. VELOSO is Associate Professor of Computer Science at Carnegie Mellon University. She received her Ph.D. in Computer Science from Carnegie Mellon University in 1992. Prof. Veloso researches in the area of artificial intelligence. Her long-term research goal is the effective construction of systems of multiple agents where cognition, perception, and action are combined to address planning, execution, and learning tasks. Prof Veloso is the U.S. representative and founding member of the International Committee for the RoboCup International Federation.
E-mail: veloso@cs.cmu.edu

B2 Intelligent Multimedia Interface Agents
Sunday, PM

Wolfgang Wahlster   Elisabeth Andre

The objective of the tutorial is to provide a survey of a new generation of highly personalized agent-based or assistant-like interface agents which have gained considerable interest both in academia and industries. Personalization refers to the ability of an interface to adapt its behavior to the information needs, interaction styles, and media preferences of individual users in particular situations.

In the context of the World Wide Web it wouldn't make sense to delegate the task of personalizing presentations to the information providers. One reason is that information providers would have to anticipate all possible users and situations in order to provide adequate presentation formats.

In the tutorial, we will discuss recent developments in the design of intelligent multimedia interfaces that go beyond the standard canned text, predesigned graphics and prerecorded images and sounds typically found in commercial multimedia systems of today. We will show that it is possible to adapt many of the fundamental concepts developed to date in computational linguistics in such a way that they become useful for multimedia presentations as well. We will address key applications such as communication assistants for the Internet, multimedia helpware, information retrieval and analysis, authoring, training, monitoring, and decision support.

There is also a peripheral aspect of personalizing user interfaces. By peripheral personalization, we mean that the system personifies itself audiovisually, e.g. as an animated life like character. The tutorial will introduce the technology for the development of animated interface agents which play the role of a communication assistant who explains, comments and highlights the material to be presented. The tutorial will be augmented by numerous videos and interactive demos.

PREREQUISITE KNOWLEDGE:
The tutorial is designed for both researchers interested in the basic concepts underlying the development of interface agents and practitioners seeking a thorough overview of the key issues in applications. The tutorial assumes no prior knowledge on multimedia interface agents, but a basic knowledge of AI concepts will enhance the value of this course for participants.

PROF. DR. WOLFGANG WAHLSTER is the Director of the German Research Center for Artificial Intelligence (DFKI GmbH) and a Professor of Artificial Intelligence in the Department of Computer Science at the University of Saarbruecken. He is a AAAI Fellow and a recipient of the Fritz Winter Award. In 1998 he was awarded the degree of Doctor Honoris Causa by the Institute of Technology at Linköping University, Sweden. He serves as a Trustee of IJCAII and a member of the Executive Board of the AI section of the German Informatics Association (GI). Prof. Wahlster was the Conference Chair for IJCAI-93, the Chair of the Board of Trustees of IJCAII from 1991–1993, the ECAI-96 Program Chair and the Program Co-Chair of ACL/EACL-97. He is currently the Chair of ECCAI and the Vice-President of ACL. He is the Co-Editor of the new Readings in Intelligent User Interfaces.

DR. RER NAT. ELISABETH ANDRE is a project leader at the German Research Center for Artificial Intelligence (DFKI GmbH). Since February 1997, she has been the Chair of the ACL Special Interest Group on Multimedia Language Processing (SIGMEDIA). Dr. Andre is on the editorial board of AI Communications and the area editor for Intelligent User Interfaces of Electronic Transactions on Artificial Intelligence (ETAI). Furthermore, she has been editing a special issue on Animated Interface Agents of the Applied Artificial Intelligence Journal and a special issue on Information Agents of the German Artificial Intelligence Journal.

Both presenters have been actively involved in numerous industrial projects dealing with various applications of intelligent user interface technology.

B3 Behavior-based Robotics
Monday, AM

Maja Matarić   Ronald Arkin

Behavior-based robotics has, in the last decade, emerged as one of the leading approaches to mobile robot control and has been effectively applied in a variety of domains, ranging from modeling biological systems, to studying difficult robotics problems, to real-world applications. Behavior-based control addresses the fundamental AI issues of sensing, thinking and acting in realtime and presents a successful approach to solving situated AI problems.

In this tutorial we present a brief history of intelligent robotics, describe the interdisciplinary origins of behavior-based control, and place it in historical context relative to classical deliberative approaches, reactive control, and the currently most popular hybrid control. We illustrate the basic principles of behavior-based control, and methods for system synthesis and analysis. We present an overview of relevant biological inspirations and models of robot control, from a neuroscientific, ethological, and psychological perspective. Key issues in perception for behavior-based systems, including active, action-oriented, and modular perception, are covered. We conclude by surveying the current state-of-the-art in research and applied control, and outline the outstanding problems and current directions, including robot learning and multi-robot control. Numerous videotapes of robots in action are used to illustrate and evaluate the presented concepts.

The target audience is the general AI community; the tutorial ties behavior-based robotics to general AI methods, principles and goals. It gives a clear idea of the current state of a major area in robotics, thus making many of the talks in the robotics sessions, as well as the IJCAI and AAAI Robotics contest and Exhibition demonstrations, more interesting and accessible.

PREREQUISITE KNOWLEDGE:
The tutorial will not require any robotics background on the part of the audience. A general AI background (at the level of an undergraduate AI course) will be sufficient to follow all of the material in the tutorial.

MAJA MATARIĆ is an assistant professor in the Computer Science Department and the Neuroscience Program at the University of Southern California, and Director of the USC Robotics Research Labs. She received her PhD in Computer Science and AI in 1994 and her MS in 1990, both from MIT. She is on the editorial board of JAIR and Adaptive Behavior. Her research interests include multi-robot and multi-agent control and learning, and modeling imitation. She is a member of AAAI and ISAB.

RONALD ARKIN is a Professor in the College of Computing at Georgia Tech and is Director of the Mobile Robot Laboratory. His interests include behavior-based reactive control and action-oriented perception for mobile robots and unmanned aerial vehicles, robot survivability, multi-agent robotic systems, and learning in autonomous systems. He recently completed a textbook entitled "Behavior-Based Robotics" (MIT Press) and is the Series Editor for the book series Intelligent Robotics and Autonomous Agents. He is a Senior Member of the IEEE, and a member of AAAI and ACM.

B4 User-adaptive Systems:
An Integrative Overview
Monday, PM

Anthony Jameson

This tutorial deals with the broad class of systems that adapt to properties and behaviors of individual users. These systems perform many different functions, including information retrieval and presentation, product recommendation, instruction, intelligent help, interface adaptation, automated execution of the user's routine tasks, and support for collaboration. The AI techniques used include machine learning methods, probabilistic and decision-theoretic approaches, logic-based techniques, and various more or less application-specific methods.

Research on user-adaptive systems has been unnecessarily fragmented, with specialized communities focusing on particular types of application or particular implementation techniques. This tutorial aims to further cross-fertilization among these communities by providing a unifying conceptual framework as well as pointers to major developments throughout the area.

The tutorial will consider in turn six questions that can be asked about any user-adaptive system:

1. What function is served by the adaptation?
2. What (if any) properties of the user are modeled?
3. What input data about the user are obtained?
4. What techniques are employed to make inferences on the basis of the data?
5. What techniques are used to determine the appropriate system adaptation?
6. What is the empirical basis of the application of these techniques?

For each question, we will compare and evaluate the contributions that have been made so far. The entire presentation will be illustrated with concrete examples of existing systems.

PREREQUISITE KNOWLEDGE:
This tutorial will be accessible to persons with no previous knowledge of user-adaptive systems. It is also aimed at experienced researchers in this area who want to make better use of relevant research that has been conducted outside of their own research communities.

ANTHONY JAMESON is a senior project director and lecturer at the University of Saarbruecken who also participates in industrial projects at the German Research Center for AI (DFKI). He has published on various aspects of user-adaptive systems since the early 1980's and was program co-chair of UM97, the Sixth International Conference on User Modeling.
E-mail: Jameson@cs.uni-sb.de

C1 Practical Planning Systems
Sunday, AM

Steve Chien   Brian Drabble

Automated planning is the generation of a sequence of actions (potentially to a level that can be executed) to achieve some desired world state while obeying the constraints of the domain. Planning systems can be used to automate procedure generation problems in a wide range of areas such as: data analysis, distribution logistics, systems engineering, process flow, crisis response, and space payload operations.

Automated planning technology can reduce operations costs, decrease manual errors and thus increase consistency, and reduce dependency on key personnel.

This tutorial will cover key issues, problems, and approaches central in fielding automated planning systems with lessons and solutions drawn from the presenters' experience in fielding planning systems for science data analysis, spacecraft payload checkout, and communications antenna operations.

This tutorial will cover the basic concepts in domain-independent artificial intelligence planning including: search, representing planning knowledge, plan and state space planning, operator-based planning and hierarchical task network planning. Advanced concepts such as integrated planning and scheduling, decision theoretic planning, and mixed initiative planning will also be briefly discussed. Important questions relevant to planning will be covered in the tutorial such as:

• Are planning techniques applicable to my problem?

• If so, what are the most appropriate planning representations and

• How can I acquire, verify, and maintain my planning knowledge base?

• How can a planning system be embedded into my operational setting?

PREREQUISITE KNOWLEDGE:
Knowledge of basic concepts from artificial intelligence will be presumed: search, expert systems, logic-like representations. Familiarity with some planning and scheduling systems, basic search strategies, reactive systems, and/or scripting languages would be helpful but not essential.

DR. STEVE CHIEN is Technical Group Supervisor of the Artificial Intelligence Group at the Jet Propulsion Laboratory, California Institute of Technology, where he leads efforts in automated planning and scheduling. His current projects include basic research and deployment of planning systems for automated science analysis, spacecraft mission planning, spacecraft design, maintenance of space transportation systems, and Deep Space Network Antenna operations. Dr. Chien holds B.S., M.S., and Ph.D. in Computer Science, all from the University of Illinois. Dr. Chien is also an Adjunct Assistant Professor with the Department of Computer Science of the University of Southern California. He is a 1995 recipient of the Lew Allen Award for Excellence, the highest honor JPL awards to researchers in the early years of their professional careers.

DR. BRIAN DRABBLE is a member of Artificial Intelligence Applications Institute at the University of Edinburgh and has been actively involved in AI planning and scheduling research over the past 10 years. His current responsibilities include being project leader and co-principal investigator on the O-Plan projects which is part of the $66 million ARPA/Rome Laboratory Planning Initiative. In addition he has worked with a number of clients including Toshiba, Hitachi, European Space Agency, British Government, etc. to bringing AI planning and scheduling into their organizations and products. Dr. Drabble has supervised a number of Ph.D. and M.Sc students from the University's Department of Artificial Intelligence. The topics have included Reactive Execution Agents Models for Plan Based Diagnosis, and Knowledge Aquisition for Planning. He has also presented AIAI's Planning and Scheduling course to a large number of representatives from industry and commerce.

C2 Knowledge-based Scheduling
Sunday, PM

Steve Chien   Stephen Smith

Increasingly, AI and knowledge-based techniques are providing a practical basis for effective solutions to complex scheduling problems. This tutorial will cover the principal concepts and techniques that underlie AI-based approaches to automated scheduling.

We will start by covering basic scheduling concepts such as representation of scheduling knowledge and constraints, search, constraint propagation, conflict resolution, bottleneck analysis, search control heuristics, and basic constructive and iterative approaches to schedule generation.

Next, more advanced scheduling topics will be covered, including scheduling under uncertainty, reactive scheduling, distributed scheduling, mixed-initiative scheduling, machine learning approaches to scheduling, and evolutionary computation approaches. We will conclude with a characterization of the current state of research and practice, and a discussion of the prospects and open issues in the field. The tutorial will be motivated with experiences drawn from real-world scheduling systems which have been or are currently being deployed, and concepts will be illustrated using examples drawn from these systems.

PREREQUISITE KNOWLEDGE:
Knowledge of basic concepts from artificial intelligence will be presumed: search, expert systems, logic-like representations. Familiarity with some planning and scheduling systems, constraint propagation, and basic search strategies would be helpful but not essential.

DR. STEVE CHIEN is Technical Group Supervisor of the Artificial Intelligence Group at the Jet Propulsion Laboratory, California Institute of Technology, where he leads efforts in automated planning and scheduling. His current projects include basic research and deployment of planning systems for automated science analysis, spacecraft mission planning, spacecraft design, maintenance of space transportation systems, and Deep Space Network Antenna operations. Dr. Chien holds B.S., M.S., and Ph.D. in Computer Science, all from the University of Illinois. Dr. Chien is also an Adjunct Assistant Professor with the Department of Computer Science of the University of Southern California. He is a 1995 recipient of the Lew Allen Award for Excellence, the highest honor JPL awards to researchers in the early years of their professional careers.

DR. STEPHEN F. SMITH is a Senior Research Scientist in the Robotics Institute at Carnegie Mellon University where he is Director of the Intelligent Coordination and Logistics Laboratory. Since joining the faculty at CMU/RI in 1982, Dr. Smith's research has focused on frameworks and techniques for flexible planning, scheduling and control in practical domains. Dr. Smith has directed the development of several innovative constraint-based scheduling systems, which have been fielded in numerous application domains spanning semiconductor manufacturing, military airlift and tanker mission management, and communications antenna scheduling. His current research interests include distributed, mixed-initiative and reactive planning and scheduling, reconfigurable and self-organizing scheduling system architectures, and agent-based modeling and analysis of supply chain dynamics.

C3 Recent Advances in AI Planning: A Unified View
Monday, AM

Subbarao Kambhampati

Although planning is one of the oldest research areas of AI, recent years have brought many dramatic advances in both its theory and practice. On the theory side, we now understand the deep connections among AI planning, constraint satisfaction, logic and operations research. On the practical side, we have effective ways of capturing and using domain-specific control knowledge, and have planners that are capable of synthesizing plans with hundred or more actions in minutes. These, in short, are exciting times for AI planning research.

This tutorial will provide a comprehensive overview of the field, placing both the traditional ideas and the recent advances in a unified perspective, and delineating their application potential. Our primary emphasis will be on planning in deterministic domains, although we shall make several connections to scheduling as well as planning in stochastic domains.

PREREQUISITE KNOWLEDGE:
The tutorial should be accessible to anyone with basic computer science and AI background.

SUBBARAO KAMBHAMPATI is an associate professor of computer science at Arizona State University, where he directs the YOCHAN research group. He received his bachelors degree in electrical engineering from Indian Institute of Technology, Madras, and M.S. and Ph.D. degrees in Computer Science from University of Maryland, College Park. He has published over seventy technical articles on planning, learning and related areas of AI. He was a 1994 NSF Young Investigator and a 1996 AAAI invited speaker. He has taught courses and has published several tutorial articles on AI planning, and is the author of a 1997 IJCAI challenge paper on bridging plan-synthesis paradigms.

C4 Economically Founded Multiagent Systems
Monday, PM

Tuomas Sandholm

In multiagent systems – e.g. for agent-mediated electronic commerce – computational agents find contracts on behalf of the real world parties that they represent. This automation saves human negotiation time, and computational agents are often better at finding beneficial deals in combinatorially and strategically complex settings. Applications include electronic trading, manufacturing planning and scheduling among companies, electricity markets, allocating and pricing bandwidth in multi-provider multi-consumer computer networks, digital libraries, vehicle routing among dispatch centers, and resource allocation in distributed operating systems, to name just a few.

A key research goal is to design open distributed systems in a principled way that leads to globally desirable outcomes even though every participating agent only considers its own good and may act insincerely. The tutorial covers relevant topics in AI, game theory, market mechanisms, voting, auctions (also combinatorial auctions), coalition formation, and contract nets. Emphasis is given to rigorous results and algorithms – both classic ones from microeconomics and recent ones from the distributed AI community – that have direct applications to computational agents. Effects of computational limitations, i.e. agents' bounded rationality, are discussed as a key feature that has not

received adequate attention. Implementation experiences will be shared, and real world applications presented.

PREREQUISITE KNOWLEDGE:
The tutorial is targeted to the builder of multi-agent systems that consist of multiple self-interested agents. It also serves to familiarize newcomers and executive level participants with the issues in multiagent systems. No background is required in economics or multiagent systems.

TUOMAS SANDHOLM is Assistant Professor of computer science at Washington University in St. Louis. He received the Ph.D. and M.S. degrees in computer science from the University of Massachusetts at Amherst in 1996 and 1994. Prior to that he earned an M.S. (B.S. included) with distinction in Industrial Engineering and Management Science from the Helsinki University of Technology, Finland. He has nine years of experience building multiagent systems. He has also co-developed two fielded AI systems, and is Chief Scientist of an electronic commerce startup company. He has published over 65 technical papers, and received several academic awards.

D1 Neural Networks for Data Structures Principles and Applications
Sunday, AM

Paolo Frasconi   Alessandro Sperduti

The purpose of the tutorial is to examine the state of the art in the use of connectionist networks for processing data structures and to present a unified view of formalisms and tools for dealing with rich data representations, covering connectionist architectures for data structures, learning algorithms, and applications. In particular, we will show that it is possible to represent and classify structured information very naturally. Moreover, it is possible to formalize several supervised models for classification of structures which stem very naturally from well known models, such as back propagation through time networks, real-time recurrent networks, simple recurrent networks, recurrent cascade correlation networks, and neural trees.

Because many concepts and formal tools are inherited from the theoretical framework of recurrent networks for

sequence processing, the tutorial will begin with a review of basic concepts underpinning recurrent neural networks, for those attendees which are not familiar with such a class of models. Algorithms for training recursive neural networks are presented as generalizations of gradient computation algorithms for recurrent nets, and complexity as well computational issues are discussed. Finally, examples of applications in chemistry, structural pattern recognition, and theorem proving are presented.

PREREQUISITE KNOWLEDGE:
Although we will briefly review the essential concepts for data structure and neural networks, we will assume that the attendants will be familiar with data structures; we also assume basic knowledge of linear algebra and calculus for the treatment of some neural network paradigms.

PAOLO FRASCONI received the M.Sc. degree in Electronic Engineering in 1990 and the Ph.D. degree in Computer Science in 1994, both from the University of Florence, Italy. He is currently Associate Professor with Dipartimento di Ingegneria Elettrica ed Elettronica at the University of Cagliari, Italy. He was Assistant Professor with the Dipartimento di Sistemi e Informatica at the University of Florence, Italy. In 1992 he was a Visiting Scholar in the Department of Brain and Cognitive Science at the Massachusetts Institute of Technology, Cambridge. In 1994 he was a Visiting Scientist at Centro Studi e Laboratori Telecomunicazioni (CSELT), Turin. His current research interests include neural networks, Markovian models, and graphical models, with particular emphasis on problems involving learning about sequential and structured information. Paolo Frasconi is the author of around 50 refereed papers mainly in the areas of graphical models for learning, neural networks, pattern recognition, artificial intelligence.

ALESSANDRO SPERDUTI received his university education from the University of Pisa, Italy ("Laurea" and Doctoral degrees in 1988 and 1993, respectively, all in Computer Science). In 1993 he spent a period at the International Computer Science Institute, Berkeley, supported by a postdoctoral fellowship. In 1994 he moved back to the Computer Science Department, University of Pisa, where he was Assistant Professor, and where he presently is Associate Professor. His research interests include pattern recognition, image processing, neural networks, hybrid systems. In the field of hybrid systems his work has focused on the integration of symbolic and connectionist systems. He contributed to the organization of several workshops on this subject and he served also in the program committee of conferences on neural networks. Alessandro Sperduti is the author of around 50 refereed papers mainly in the areas of neural networks, fuzzy systems, pattern recognition, and image processing.

D2 Probabilistic Argumentation Systems
Sunday, PM

Jürg Kohlas   Rolf Haenni

Probabilistic argumentation systems provide an intuitive and natural approach to non-monotonic reasoning under uncertainty. The basic idea is to find arguments in favor and against certain hypotheses. Arguments are composed of uncertain assumptions, which are used for capturing the uncertainty of the given knowledge. Deriving arguments is a matter of deduction in an appropriate logic. Non-monotonicity is obtained in a natural way by eliminating contradictory arguments.

A quantitative judgement of hypotheses is possible by weighting the uncertain assumptions according to their likelihood or probability. In this way, reliabilities of arguments are obtained and degrees of support and plausibility in the sense of the Dempster-Shafer theory of evidence can be derived for the hypotheses. Probabilistic argumentation systems are therefore based on a novel combination of classical logic (for deduction) and probability theory (for measuring the reliabilities of deductions). The tutorial will present the conceptual foundations of probabilistic argumentation systems. Furthermore, relations to other formalisms (e.g. Bayesian networks, evidence theory, ATMS, probabilistic logic, default logic, etc.) will be elucidated.

The expressiveness of probabilistic argumentation systems permits us to model problems from different domains (e.g. model-based prediction, state estimation and diagnostics, failure trees, project scheduling, sensor fusing, testimonies, public key certification, information retrieval, etc.). This shows its extensive applicability and usefulness for all sorts of problems of reasoning under uncertainty. Several examples of different application fields will be discussed in the tutorial.

Efficient deduction mechanisms are of particular importance for probabilistic argumentation systems. For that purpose, appropriate approximation strategies exist for computing only the most relevant arguments in polynomial time. In this way, the complexity of dealing with logical

deduction can be controlled. Based on these considerations, inference mechanisms for probabilistic argumentation systems will be sketched.

PREREQUISITE KNOWLEDGE
Only elementary knowledge of propositional logic and discrete probability is required.

PROF. JÜRG KOHLAS is professor of theoretical computer science at the University of Fribourg (Switzerland). He has been a partner of the European Basic Research Activity "Defeasible Reasoning and Management of Uncertainty" (1993-1996). He is the leader of the project "Probabilistic Argumentation Systems" (1997-1999) and the initiator of the project "Inference and Deduction: an Integration of Logic and Probability", both sponsored by the Swiss National Foundation for Research.

DR. ROLF HAENNI is research scientist at the Institute of Informatics of the University of Fribourg. He has been a partner of the European Basic Research Activity "Defeasible Reasoning and Management of Uncertainty" (1993-1996), and he is the manager of the project "Probabilistic Argumentation Systems" (1997-1999).

Both lecturers are experienced in the tutorial topic for many years.

D3 Learning Bayesian Networks from Data
Monday, AM

Nir Friedman   Moises Goldszmidt

Bayesian networks are compact and computationally efficient representations of probability distributions. Over the last decade, they have become the method of choice for the representation of uncertainty in artificial intelligence. Today, they play a crucial role in modern expert systems, diagnosis engines, and decision support systems.

In recent years, there has been significant progress in methods and algorithms for inducing Bayesian networks directly

from data. Learning these particular models is desirable for several reasons. First, there is a wide array of off-the-shelf tools that can apply the learned models for prediction, decision making and diagnosis. Second, learning Bayesian networks also provides a principled approach for semi-parametric density estimation, data analysis, pattern classification, and modeling. Third, in some situations they allow us to provide causal interpretation of the observed data. Fourth, they allow us to combine knowledge acquired from experts with information from raw data.

In this tutorial we will start by reviewing the basic concepts behind Bayesian networks. We will then describe the fundamental theory and algorithms for inducing these networks from data including learning the parameters and the structure of the network, how to handle missing values and hidden variables, and how to learn causal models. Finally, we will discuss advanced methods, open research areas, and applications of these learning methods, including pattern matching and classification, speech recognition, data analysis, and scientific discovery.

PREREQUISITE KNOWLEDGE
This tutorial is intended for people interested in data analysis, data mining, pattern recognition, machine learning and reasoning under uncertainty. Familiarity with the basic concepts of probability theory will be helpful.

NIR FRIEDMAN received a Ph.D. in computer science from Stanford in 1997, was a postdoctoral scholar in the Computer Science Division at the University of California, Berkeley till late 1998, and is currently a faculty member in the Institute of Computer Science at the Hebrew University, Jerusalem. In recent years, he has been extensively working on inference, planning, and learning with probabilistic representations of uncertainty. This work mainly focuses on using Bayesian networks for concept learning, data mining, reinforcement learning, and more recently computational biology.

MOISES GOLDSZMIDT is a senior computer scientist at SRI International, where he conducts research and directs several projects in the area of learning and adaptive systems. From 1992-1996 he was a research scientist with the Rockwell Science Center in Palo Alto. He received a PhD in Computer Science from the University of California, Los Angeles in 1992. Dr. Goldszmidt has numerous publications on topics related to representation and reasoning under uncertainty, automatic induction of Bayesian networks, decision making, and nonmonotonic reasoning.

D4 Solving AI Problems with Satisfiability
Monday, PM

Ian Gent   Toby Walsh

In recent years, there has been an explosion of research in AI into propositional satisfiability (or SAT). There are many factors behind the increased interest in this area. One factor is the improvement of search procedures for SAT. New local search procedures like GSAT and Walk-SAT are able to solve SAT problems with thousands of variables. At the same time, implementations of complete search algorithms like Davis-Putnam have been able to solve open mathematical problems. Another factor is the identification of hard SAT problems at a phase transition in solubility. A third factor is the demonstration that we can often solve real-world problems by encoding them into SAT. There has also been an improved theoretical understanding of SAT, particularly in the analysis of such phase transition behaviour. This halfday tutorial will review the state of the art for research in satisfiability and discuss applications in which algorithms for satisfiability have proved successful.

PREREQUISITE KNOWLEDGE:
The tutorial will be aimed at the general AI audience, both academic and industrial. In particular, limited prior knowledge will be assumed about logic and computational complexity.

IAN GENT is a lecturer in the Department of Computer Science at the University of Strathclyde. He holds an MA in Mathematics from the University of Cambridge, an MSc in Artificial Intelligence from Edinburgh University, and a Ph.D. in Computer Science from University of Warwick.

TOBY WALSH is a research fellow in the Department of Computer Science at the University of Strathclyde and an honorary fellow at the Division of Informatics at Edinburgh University. He received a BA in Mathematics and Physics from the University of Cambridge, and a MSc and PhD from the Department of Artificial Intelligence at

17

Edinburgh University. He has been a Marie-Curie postdoctoral fellow at INRIA (Nancy, France) and at IRST (Trento, Italy), and a SERC postdoctoral fellow at the Department of Artificial Intelligence in Edinburgh.

Ian Gent and Toby Walsh are founding members of the APES research group, a cross-university group of researchers dedicated to improving the use of empirical methods within artificial intelligence. For more details, see http://www.cs.strath.ac.uk/apes

E1 Evaluating Machine Learning and Knowledge Discovery
Sunday, AM

Foster Provost and
◄ David Jensen

An increasing proportion of AI systems discover and apply new knowledge. Obvious examples are dedicated systems for machine learning and data mining, and further examples include planning, scheduling, problem solving, and robotic systems that embed learning in a larger context. In addition, many AI systems are the result of careful experimentation and tuning by experimenters – a form of inter-active knowledge discovery.

This tutorial examines the central question of how to evaluate discovered knowledge. Such evaluation can be carried out by a researcher or by an AI system itself. In either case, careful evaluation is the key to improving learned knowledge and to using it effectively.

The tutorial will cover four general topics. First, it will examine fundamentals of empirical evaluation of learned knowl-edge, including basic challenges, statistical foundations, useful statistical and visual-ization techniques, and specific pitfalls. Second, it will discuss how to evaluate learned knowledge in the context of the goals and problem characteristics of a specific task, focusing on specific tech-niques for evaluating knowledge in the face of uncertainty about particular task parameters such as error costs and class frequencies. Third, it will examine the specific challenges of evaluating knowl-edge when it is derived inductively, concentrating on unifying ideas from

statistics, computational learning theory, and minimum description length formal-isms. Finally, it will address the challenges faced by open-ended knowledge discovery, surveying insights from a wide body of work ranging from AM, EURISKO, and MetaDENDRAL through more recent work in scientific discovery and data min-ing.

PREREQUISITE KNOWLEDGE:
The tutorial assumes almost no prior background in statistics, though audience members should be familiar with basic machine learning algorithms for classification and reinforcement learning. The tutorial is best suited to researchers who are building systems with a learning component, and to researchers constructing dedicated machine learning and data mining systems.

FOSTER PROVOST studies knowledge discov-ery and machine learning at Bell Atlantic (former-ly NYNEX) Science and Technology. His research has focused on evaluation, scaling up, and using background knowledge, and on applications such as fraud detection and network diagnosis. With Ron Kohavi, Foster coedited a recent special issue of the journal Machine Learning on "Appli-cations of Machine Learning and the Knowledge Discovery Process."

DAVID JENSEN is research assistant professor of computer science at the University of Massa-chusetts, Amherst. His research focuses on learn-ing and knowledge discovery, and he has written and spoken extensively on statistical pathologies of learning algorithms. He is managing editor of Evaluation of Intelligent Systems, a web-accessible resource about statistical evaluation methods for studying AI systems.

Foster and David presented a tutorial on evaluat-ing data mining algorithms at the 1998 Interna-tional Conference on Knowledge Discovery and Data Mining (KDD98).

E2 Practical Text Mining
Sunday, PM

Ronen Feldman

The information age has made it easy to store large amounts of data. The prolifera-tion of documents available on the Web, on corporate intranets, on news wires, and elsewhere is overwhelming. However, while the amount of data available to us is constantly increasing, our ability to absorb and process this information remains con-

stant. Search engines only exacerbate the problem by making more and more docu-ments available in a matter of a few key strokes. Text mining is a new and exciting research area that tries to solve the infor-mation overload problem by using tech-niques from data mining, machine learn-ing, NLP, IR and knowledge management. Text mining involves the preprocessing of document collections (text categorization, term extraction), the storage of the inter-mediate representations, the techniques to analyze these intermediate representations (distribution analysis, clustering, trend analysis, association rules, etc.) and visual-ization of the results. In this tutorial we will present the general theory of text mining and will demonstrate several sys-tems that use these principles to enable interactive exploration of large textual collections. We will present a general architecture for text mining and will out-line the algorithms and data structures behind the systems. Special emphasis will be given to efficient algorithms for very large document collections, tools for visu-alizing such document collections, the use of intelligent agents to perform text min-ing on the internet, and the use of infor-mation extraction to better capture the major themes of the documents. The tutorial will cover the state of the art in this rapidly growing area of research. Several real world applications of text mining will be presented.

PREREQUISITE KNOWLEDGE:
The tutorial is suitable to the general audience. No special knowledge in needed as the tutorial is self-contained. It should be of interest to practi-tioners from data mining, NLP, IR, knowledge management and the general AI audience interested in this fast growing research area.

RONEN FELDMAN is a senior lecturer at the Mathematics and Computer Science Department of Bar-Ilan University in Israel, and the Director of the Data Mining Laboratory. He received his B.Sc. in Math, Physics and Computer Science from the Hebrew University, M.Sc. in Computer Science from Bar-Ilan University, and his Ph.D. in Computer Science from Cornell University. He is the founder and president of Instinct Software, a startup company specializing in development of text mining tools and applications.

E3 Automatic Text Summarization: Methods, Systems, and Evaluation
Monday, AM

◄ Udo Hahn and Inderjeet Mani

Research and development in automatic text summarization has been assuming increased importance with the rapid growth of the Web and on-line information services, which provide access to vast amounts of textual data. The goal of automatic text summarization is to take a partially structured source text, determine its information content, and present the most important content in a manner sensitive to the needs of the user and the task to be accomplished. This tutorial is intended to give an overview of the main methodologies and systems currently available to deal with these challenges, as well as recent evaluation efforts.

The tutorial begins with a discussion of the varieties of text summarization. Naturally occurring human summarization activities are contrasted with strategies underlying professional abstracting. Summarization methods and tasks are differentiated from the closely related ones found in other activities involving text analysis, such as information retrieval (document filtering), information extraction, or text mining. Both shallow approaches, incorporating statistical and linguistic techniques, as well as deeper approaches, where summarization is characterized as an AI reasoning task, are discussed. This leads to the presentation of various system architectures for summarization, including a characterization of key condensation operations involved. Evaluation metrics and current evaluation efforts, including the U.S. Government's TIPSTER SUMMAC evaluation, are discussed in detail. New research areas such as multi-document and multi-media summarization are also treated. In addition, we characterize the state of commercial summarization products and conclude by identifying outstanding problems which remain challenging topics for future Ph.D. theses.

The target audience we address is mainly researchers, students, software developers, and research managers with an interest in sophisticated tools for taming the ever increasing flow of textual data.

PREREQUISITE KNOWLEDGE:
Some familarity with questions relating to natural language processing and information retrieval techniques is considered helpful, but will not be a necessary prerequisite for attending the tutorial. A background in general computer science is required, and prior exposure to artificial intelligence methodologies is desirable.

UDO HAHN is professor for computational linguistics at Albert-Ludwigs-Universität Freiburg, Germany. He works at the intersection of text understanding and information systems, including areas such as text summarization, intelligent text retrieval, acquisition of knowledge from texts, and text mining. He has been involved in the development of a German-language text summarization system (TOPIC). His most recent work aims at the incorporation of condensation operators into the formal framework of description logics. Udo Hahn has (co-)authored four books, thirty-five articles in journals and compiled volumes, and more than ninety proceedings contributions.

INDERJEET MANI is a Principal Scientist in the Artificial Intelligence Laboratory at the MITRE Corporation in Reston, Virginia, where he has led a variety of projects in information retrieval, information extraction, and text summarization. He holds one patent, and is the author of more than thirty refereed papers in the areas of text summarization, information retrieval, machine translation, natural language generation, natural language interfaces, and formal semantics. Dr. Mani's current summarization-related activities include assisting the U.S. Government on the TIPSTER Summarization Evaluation Task (SUMMAC), and co-editing a book on text summarization (Advances in Automatic Text Summarization), to be published by MIT Press).

E4 Introduction to Information Extraction Technology
Monday, PM

Douglas Appelt   David Israel

Information Extraction (IE) Technology is directed at recovering specific, highly structured information from ordinary natural language texts such as newspaper articles, email messages, and other on-line sources of textual information. Recent research has led to advances in IE technology that make this collection of techniques ripe for practical application. In this tutorial, we will discuss (1) the nature of the technology, and what distinguishes it from related areas, (2) the types of applications for which the technology is suitable, (3) techniques for the evaluation of IE system performance (4) an analysis of a typical IE system and its components, (5) an overview of both theoretical and practical techniques relevant to building information extraction systems, (6) where to find public domain resources for building information extraction systems, and (7) limitations of the technology, and productive areas for future research. The tutorial would be suitable for managers who want to understand the technology and what is involved in its application, developers who are interested in getting started in the area of information extraction, and students who are contemplating study or research in the area of information extraction.

PREREQUISITE KNOWLEDGE:
We do not make any assumption about the background of tutorial attendees other than a general familiarity with computing, automata, grammars, and languages that would be typical of an undergraduate computer science major.

DOUGLAS APPELT is a senior computer scientist in the Artificial Intelligence Center of SRI International. He received his Ph.D. in Computer Science in 1981 from Stanford University. Dr. Appelt has conducted research in natural-language generation, speech acts, and spoken language systems. He is affiliated with the Center for the Study of Language and Information at Stanford University, and was president of the Association for Computational Linguistics and has served on the editorial boards of Computational Linguistics and Computational Intelligence.

DAVID ISRAEL is a senior computer scientist in the Artificial Intelligence Center of SRI International. He received his Ph.D. in Philosophy from the University of California at Berkeley in 1974. He has served on the faculty of Tufts University, and as a research scientist at BBN. Dr. Israel has been active in research in natural language semantics, formal logic and knowledge representation, and has been involved in numerous projects at SRI involving the application of information extraction technology. He is on the editorial board of Computational Intelligence.

Workshop Program

(By invitation only)

The workshops will take place July 31 – August 2. They are arranged in nine tracks centered around broad research topics and problem domains. Participation is limited to those determined by the workshop organizers prior to the conference. Additional information on the workshop program can be found in the IJCAI-99 Webpages.

Track	Saturday July 31	Sunday August 1	Monday August 2
Track "KRR" **Knowledge Representation and Reasoning**	**KRR-1:** Practical Reasoning and Rationality John Bell, jb@dcs.qmw.ac.uk	**KRR-2:** Nonmonotonic Reasoning, Action and Change Michael Thielscher, mit@pikas.inf.tu-dresden.de **KRR-4:** Qualitative and Model Based Reasoning for Complex Systems and their Control Robert Milne, rmilne@bcs.org.uk	**KRR-3:** Hot Topics in Spatial and Temporal Reasoning Hans W. Guesgen, hans@cs.auckland.ac.nz **KRR-5:** Ontologies and Problem-Solving Methods: Lessons Learned and Future Trends Richard Benjamins, richard@swi.psy.uva.nl
Track "ML" **Machine Learning**	**ML-1:** Statistical Machine Learning for Large-Scale Optimization Justin Boyan, jboyan@mail.arc.nasa.gov **ML-4:** Learning About Users Åsa Rudström, asa@sics.se	**ML-2:** Neural, Symbolic, and Reinforcement Methods for Sequence Learning C. Lee Giles, giles@research.nj.nec.com Ron Sun, rsun@cs.ua.edu	**ML-3:** Support Vector Machines Craig Saunders, C.Saunders@dcs.rhbnc.ac.uk **ML-5:** Automating the Construction of Case Based Reasoners Sarabjot Singh Anand, ss.anand@ulst.ac.uk Agnar Aamodt, agnar.aamodt@idi.ntnu.no David W. Aha, aha@aic.nrl.navy.mil
Track "IRF" **Information Retrieval and Filtering**	**IRF-1:** Intelligent Information Integration Dieter Fensel, dieter.fensel@aifb.uni-karlsruhe.de	**IRF-2:** Machine Learning for Information Filtering Thorsten Joachims, thorsten@ls8.cs.uni-dortmund.de	**IRF-3:** Text Mining: Foundations, Techniques and Applications Ronen Feldman, feldman@cs.biu.ac.il

Track	Saturday July 31	Sunday August 1	Monday August 2
Track "ABS" **Agent-Based Systems**	**ABS-1:** Agent Mediated Electronic Commerce Alexandros Moukas moux@media.mit.edu Carles Sierra sierra@iiia.csic.es Fredrik Ygge fredrik.ygge@enersearch.se	**ABS-2:** Agent Communication Languages Frank Dignum, dignum@win.tue.nl B. Chaib-draa, chaib@ift.ulaval.ca	**ABS-3:** Learning About, From and With other Agents Jose M. Vidal, vidal@sc.edu
	ABS-4: The Third International Workshop on RoboCup Manuela M. Veloso, veloso@cs.cmu.edu		**ABS-5:** Team Behavior and Plan Recognition Simon Goss, simon.goss@dsto.defence.gov.au
Track "PLAN" **Planning, Scheduling, and Control**		**PLAN-1:** Adjustable Autonomy Systems David Kortenkamp, kortenkamp@jsc.nasa.gov	**PLAN-2:** Scheduling and Planning meet Real-time Monitoring in a Dynamic and Uncertain World Abdel-Illah Mouaddib, mouaddib@cril.univ-artois.fr Thierry Vidal, thierry@enit.fr
Track "ROB" **Robotics**	**ROB-1:** Robot Action Planning Michael Beetz, beetz@cs.uni-bonn.de Joachim Hertzberg, joachim.hertzberg@gmd.de	**ROB-2:** Adaptive Spatial Representations of Dynamic Environments Gerhard Kraetzschmar, gkk@acm.org	**ROB-3:** Reasoning with Uncertainty in Robot Navigation Alessandro Saffiotti, alessandro.saffiotti@ton.oru.se
Track "BUS" **AI and Business**	**BUS-1:** Knowledge Management and Organizational Memory Rose Dieng, Rose.Dieng@sophia.inria.fr Nada Matta, Nada.Matta@sophia.inria.fr	**BUS-2:** Intelligent Workflow and Process Management: The New Frontier for AI in Business Mamdouh Ibrahim, mamdouh.ibrahim@eds.com Brian Drabble, drabble@cirl.uoregon.edu	
Track "NLP" **Natural Language Processing**	**NLP-1:** Knowledge-Based Document Drafting L.Karl Branting, branting@informatik.uni-kl.de James Lester, lester@csc.ncsu.edu		**NLP-2:** Knowledge And Reasoning in Practical Dialogue Systems Jan Alexandersson, janal@dfki.de
Other Topics	**EMP:** Empirical AI Achim Hoffmann, achim@cse.unsw.edu.au	**CASA:** Computational Auditory Scene Analysis Frank Klassner, klassner@monet.csc.vill.edu	**SATIS:** Non Binary Constraints Jean-Charles Regin, regin@ilog.fr Wim Nuijten, nuijten@ilog.fr

Exhibition Program

In conjunction with the conference there will be an exhibition illustrating AI techniques as obvious elements of most technologies today. The exhibition will create a stimulating and supporting supplement to the conference and make an informal meeting place for the participants.

Selected companies and research projects will participate as exhibitors together with some of the most important multinational industrial companies and publishers. The Swedish Research Institute for Information Technology (SITI) is responsible for the exhibition.

Please contact Elisabeth Stahlenius for more information.
E-mail: stahlenius@nybrogatan.se

Robot World Cup Soccer Games
and Conferences 27 July – 6 August, 1999

The Robot World Cup, RoboCup, is an international initiative to foster AI and intelligent robotics research by providing a standard problem, a soccer game, in which a wide range of technologies can be integrated and examined. This is the third RoboCup event, and it will be held in Stockholm, Sweden. The competitions will take place at the City Conference Center, Stockholm, in conjunction with the sixteenth International Joint Conference on Artificial Intelligence (IJCAI-99).

The first Robot World Cup, RoboCup -97, was held in Nagoya, Japan, in August 1997, and included the participation of more than 40 teams. The second Robot World Cup, RoboCup-98, was held in Paris, in July 1998, and more than 50 teams participated.

In order for a team of robot agents to actually play a soccer game, different technologies must be incorporated, including design principles of autonomous agents, multi-agent collaboration, strategy acquisition, real-time reasoning, sensor-fusion, and learning. RoboCup is a task for a team of multiple fast-moving robot agents in a dynamic-nondeterministic, and adversarial environment.

REAL ROBOT SMALL LEAGUE

Teams of up to five real robots of small size (approximately 15 cm in diameter) compete on a 1.525 x 2.74 m field.

REAL ROBOT MEDIUM LEAGUE

Teams of up to five real robots of medium size (approximately 50 cm in diameter) compete on a 4.575 x 8.22 m field.

SIMULATION LEAGUE

Software agents play soccer using the RoboCup soccer server simulator, available from the RoboCup Web page. The RoboCup Simulator League is a part of IJCAI's official Challenge Paper Program, where successful results will be reported at IJCAI-99.

LEGGED ROBOTS

The RoboCup-99 Sony legged robot league will take place in a carpeted field, with landmarks and goals. The game will be 3 on 3 robots using a small ball.

WORKSHOP

The workshop ABS-4 (see page 21) will present and discuss technical details of the robots and software agents that participate in the competition, as well as other research and educational topics related to RoboCup. A post workshop proceedings will be published by Springer-Verlag as a sub-line of Lecture Notes on Artificial Intelligence (LNAI). Details about paper submission will be made available at the RoboCup official Web site.

For additional information please refer to the RoboCup official Web site (http://www.robocup.org/).

Affiliated Events

You can attend workshops in Copenhagen, Linköping, Stockholm and Uppsala prior to the main Conference. In Linköping there are three back-to-back workshops. After IJCAI-99, you can stay and attend a workshop in Stockholm, or you can continue to meetings in Trondheim or Helsinki.

The chair for IJCAI-99 affiliated events is Henrik Eriksson, e-mail her@ida.liu.se. More information about each event can be found in the IJCAI-99 Web pages. As you can see from this overview, there are clusters of workshops before and after IJCAI-99.

Although airfare in Scandinavia can be high if you purchase the tickets separately, it is often possible to find affordable package deals. Also, do not forget about other means of travel. There are excellent train connections between most of the affiliate-event cities. For example, it is possible to get train tickets that include ferry connection for traveling from Copenhagen to Stockholm. There are also affordable cruises between Stockholm and Helsinki.

SATELLITE WORKSHOPS

Ph.D. Summer School: The Visual Animate Engine
July 26-30, 1999 Copenhagen, Denmark

The summer school focuses on models of visual animate engines in the triple point between psychophysics, integral photography, and vision agents in artificial intelligence. The summer school is intended for Ph.D. students and senior researchers who are interested in entering this field.

Jens Arnspang (arnspang@diku.dk)

Workshop on Assembling the Subsystems into a Whole
July 29-30, 1999 Roskilde (near Copenhagen)

The workshop brings together researchers from classical AI, behavioral AI, artificial life, robotics, evolutionary computation and neural networks to discuss the issue of assembling the subsystems into a whole.

Brian Mayoh (brian@daimi.aau.dk)

3rd International Knowledge Retrieval, Use, and Storage for Efficiency Symposium (KRUSE'99)
July 26-28, 1999 Linköping, Sweden

The symposium provides a forum for exploring current research in artificial intelligence, knowledge and databases that pertains to the organization, encoding, inference and retrieval of logical and complex objects derived from knowledge. The event brings together researchers from diverse disciplines as well as practitioners engaged in developing real knowledge-based systems.

Peter Eklund (p.eklund@gu.edu.au)

6th International Workshop on Knowledge Representation Meets Databases (KRDB'99)
July 29-30, 1999 Linköping, Sweden

The workshop is devoted to facilitate cross-fertilization between the fields of knowledge representation and databases.

Enrico Franconi (franconi@cs.man.ac.uk)

International Workshop on Description Logics (DL'99)
July 30-August 1, 1999 Linköping, Sweden

The workshop is devoted to discussing developments and applications of knowledge representation formalisms based on description logics.

Patrick Lambrix (patla@ida.liu.se)

International Workshop on Cooperative Information Agents (CIA-99)
July 31-August 2, 1999 Uppsala, Sweden

The workshop covers all topics in the research area of intelligent and collaborating information agents. Special themes include Information Agents in Uncertain Environments, Mobile Information Agents, and Advanced Human-Agent Interaction and Virtual Information Spaces.

Matthias Klusch (klusch@cs.cmu.edu)

CBR by the Norwegian Fjords: Exploring the Data-Knowledge Axis
August 8-9, 1999 Trondheim, Norway

The workshop brings together researchers interested in case-based reasoning.

Agnar Aamodt (agnar.aamodt@ifi.ntnu.no)

Networks'99
August 8-10, 1999 Helsinki area, Finland

The main theme of the workshop will be practical applications of Kohonen's self-organizing maps, Bayesian models, fuzzy logic, evolutionary computation, and case-based reasoning.

Timo Honkela (timo.honkela@uiah.fi)

3rd International Workshop on Intelligent Agents for Telecommunication Applications (IATA'99)
August 9-11, 1999 Stockholm, Sweden

The workshop provides a forum for discussing different perspectives and requirements for telematics and agent-oriented technology; also, the workshop provides an opportunity for the presentation of state-of-the-art approaches and techniques in the area of agent-based telematics services.

IATA'99 organizers (iata99@dailab.cs.tu-berlin.de)

RELATED CONFERENCES IN THE NORDIC/BALTIC REGION

11th Scandinavian Conference on Image Analysis

June 7-11, 1999 Kangerlussuaq (Søndre Strømfjord), Greenland

The conference covers topics related to image analysis, including computer vision, pattern recognition, neural networks, statistical methods, and remote sensing. The conference will offer internationally acclaimed speakers in plenary talks and parallel sessions with selected oral presentations and posters.

Peter Johansen (peterjo@diku.dk)

Artificial Intelligence and Law (ICAIL-99)

June 14-17, 1999 Oslo, Norway

The conference is concerned with the investigation of legal reasoning and argumentation using computational methods, applications of AI techniques to support tasks in regulated domains, especially legal systems, and the investigation of AI techniques using law as the example domain.

Andrew Jones (a.j.i.jones@filosofi.uio.no)

15th Conference on Uncertainty in AI (UAI-99)

July 30 - August 1, 1999 Stockholm, Sweden

The conference is a primary international forum for exchanging results on the use of principled uncertain reasoning methods in intelligent systems. The scope of the conference covers a broad spectrum of approaches to automated reasoning and decision making under uncertainty.

UAI-99 organizers (uai99@iet.com)

International Congress on Logic Methodology and Philosophy of Science XI

August 20-26, 1999 Cracow, Poland

The congress covers the field of Logic Methodology and Philosophy of Science. There are six logic sections, two sections on general philosophy of science, six sections on philosophical problems related to the sciences, and three sections devoted to ethical, historical, and social perspectives on philosophy of science.

LMPS-99 organizing committee (lmps99@jetta.if.uj.edu.pl)

INDUSTRIAL SIDE EVENT

Seminar on Modeling and Simulation Software for Advanced Training

August 3-4, 1999 Stockholm, Sweden
The seminar addresses next generation modeling and simulation systems for distributed training including intelligent agent technologies, high-level software architectures, management of distributed services and supporting database technology. The seminar, which is organized by SAAB Training Systems Research Council, will be aimed at researchers and practitioners in the area.

Sture Hägglund (sth@ida.liu.se)

JAN ASPLUND
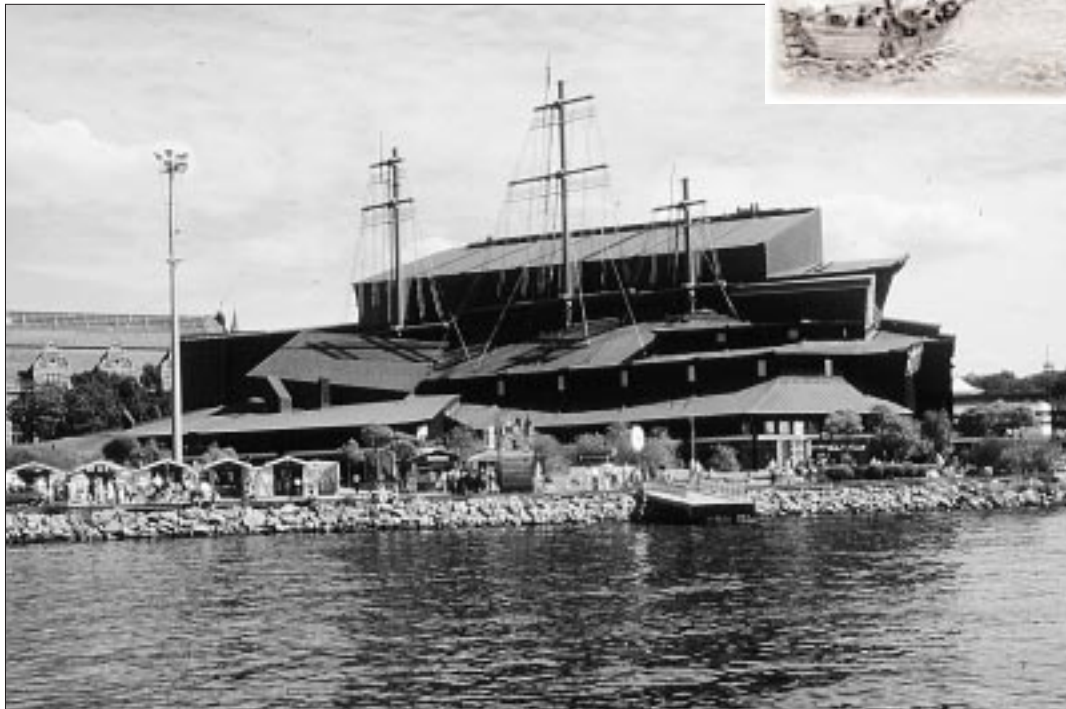
This picture shows the exterior of the Vasa Museum which is, according to a survey made in 1996, rated the best museum in Stockholm. The warship Vasa capsized on her maiden voyage, August 10, 1628. On April 24, 1961, the ship broke the water surface again, after 333 years on the bottom of the sea. In the Vasa Museum's large shiphall stands the carefully restored ship. This is the only remaining ship of its kind in the world still intact from the 17th century .

Registration Information

Registration may be done in advance or onsite. Onsite registration will take place in the City Conference Centre.

Registration hours will be Friday, July 30 from 1.00 pm – 6.00 pm, Saturday July 31 – Friday August 6 from 7.30 am – 6.00 pm. Additional registration hours will be set up for RoboCup participants. Please refer to the IJCAI -99 web pages for further information.

Advance registration can be done either via the web or with the enclosed registration form for the Conference, for the Social Program, and for making hotel reservations in Stockholm during the Conference.

Registration for the City Hall reception must be marked on the form in order to obtain a ticket. The reception is included in the technical program fee. A restriction in the number of participants on certain tours and events might be necessary. Please note that registration for the various tours and events will be confirmed on a first-come-first-served basis as payments are received.

All prices include 25% VAT and are in Swedish crowns, SEK. The VAT will be repaid to foreign enterprises, except companies providing health care, banks and insurance companies. For the recovery of VAT, receipts or other documents of payments must be attached to an application form. Members in the European Union should add a VAT Registration Certificate, members outside the European Union should add a Cooperation Certificate Registration. The VAT application form and information about how to fill it in will be available at the Symposium Secretariat at the registration desk.

Should you require more information about VAT before the Conference, you are welcome to contact:

Deloitte & Touche Sweden AB
TTS Tax Transfer Service
P.O. Box 10152
SE-121 26 Stockholm-Globen
Sweden

IJCAI-99 TECHNICAL PROGRAM

August 3-6, 1999

Your IJCAI-99 technical program registration includes admission to all technical paper sessions, invited talks, the IJCAI-99 Exhibition, the IJCAI-99 opening session and reception at Stockholm City Hall, and the IJCAI-99 Conference Proceedings. 1 USD is approx. 8 SEK.

Technical Program Fees including 25 % VAT

	Early	Late	Onsite
Regular	SEK 4250	SEK 5000	SEK 5750
Student	SEK 1250	SEK 1500	SEK 1750

TUTORIAL PROGRAM

August 1-2, 1999

Your tutorial program registration includes admission to one tutorial, the IJCAI-99 Exhibition, and one tutorial syllabus. Prices quoted are per tutorial. A maximum of four tutorials may be taken. City Hall reception is not included. 1 USD is approx. 8 SEK.

Tutorial Fees including 25 % VAT

	Early	Late	Onsite
Regular	SEK 1850	SEK 2300	SEK 2300
Student	SEK 750	SEK 950	SEK 950

WORKSHOP PROGRAM

July 31 - August 2, 1999

Workshop registration is limited to those active participants determined by the workshop organizer prior to the conference.

Workshop Fees including 25 % VAT

Workshop Fee	SEK 500

Individuals must pay the IJCAI Technical Program registration fee in addition to the workshop fee for each workshop.

ROBOCUP

Participants in RoboCup-99 should register for IJCAI-99 Technical Program. RoboCup team leaders should also register their teams.

The team fees including VAT are

Simulation League	SEK 2500
Real Robot Leagues	SEK 5000

IJCAI-99 DINNER

The fee for the dinner is SEK 600 including VAT. For more information, see page 29.

ACCOMPANYING PERSONS

Accompanying persons are entitled to attend the Opening Ceremony and the Reception and the IJCAI-99 Exhibition.

The registration fee for an accompanying person is SEK 600 including VAT.

ACCOMMODATIONS

A number of rooms in different price categories have been booked in Stockholm at preferential rates for the Conference.

The prices below include VAT and breakfast.

	Single room	Double room
Category A	SEK 1600-2000	SEK 1900-2400
Category B	SEK 850-1600	SEK 1200-1900
Category C	SEK 680-850	SEK 945-1200

Hotel accommodation will be reserved when the registration form, together with the hotel deposit (see form) has been received by Congrex. Congrex reserves the right to book another hotel category if the desired accommodation should be fully booked. The deposit will be deducted from the hotel bill upon presentation of the participants' personal voucher,

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! Early registration fees must be paid by June 1, 1999.
Late registration fees must be paid by July 1, 1999. **!**
From July 1, 1999, onsite registration fees are applied.

which will be issued upon registration in Stockholm. Hotel reservations should be made on the registration form. For payment details, see next section. Hotels in the city are safe, clean and well-kept. This is also true for smaller and cheaper hotels.

IJCAI-99 Headquarter Hotel will be Sheraton, price single SEK 1875, double SEK 2175, executive SEK 2175/2375. Distance to City Conference Centre from Sheraton is about a 7-10 minute walk.

RoboCup-99 Headquarter Hotel will be Wallin Hotel in the same block as City Conference Centre, price single SEK 655, souble SEK 855.

Youth Hostel Accommodation

If you are interested in information about Youth Hostel accommodation, please indicate this on the registration form.

If you wish to book a bed in a youth hostel, please indicate whether you are male or female on the registration form. The price varies between SEK 185-250 per bed. Breakfast, sheets and towels are not included in the price, but can be provided at the youth hostel for a small charge. Youth hostel places will be reserved when the registration form together with a hostel deposit of SEK 200 has been received by Congrex.

PAYMENT INFORMATION

Payment should be made in advance by one of the following means:

- Banker's Draft, which should be sent together with the registration form by ordinary mail. The Banker's Draft should be purchased at your bank and made out in SEK to Congrex, Attn: IJCAI-99. Cross the draft for safety reasons. We regret that we are unable to accept personal, company or Euro cheques.

- Transfer to S-E-Banken (Skandinaviska Enskilda Banken), SE-106 40 Stockholm, Sweden, SWIFT-code: ESSESESS, account No. 5267-10 216 90, in SEK to Congrex, Attn: IJCAI , P.O. Box 5619, SE-114 86 Stockholm, Sweden.

- Holders of American Express, Visa or Eurocard/Mastercard may use their cards for charging all costs. Please indicate card number, expiry date, and precise name of card holder on the registration form.

- Scandinavian residents may pay by bank and postal giro transfer. Bank giro 224-7021, Postal giro 9052-2.

Registration paid after the early registration deadline, June 1 1999 will be subject to late registration fees. Registration paid after the late registration deadline July 1, 1999 will be subject to on site registration fees. Hotels can be reserved during the whole period, also onsite.

Student registration must be accompanied by proof of full-time student status, such as copy of current student ID-card.

Please complete the enclosed registration form and send it together with your payment to:

Congrex Sweden AB
Attn: IJCAI-99
P.O. Box 5619
SE-114 86 STOCKHOLM
SWEDEN
Fax number +46 8 661 91 25

The form is also available on the IJCAI-99 web page. For more information about web registration please refer to

http://ijcai.org/ijcai-99

Note that the instructions for payment are to be applied also when registering via the web.

Tours, events and hotel reservations will be confirmed only when payment has been received by Congrex.

CANCELLATIONS

Cancellations of registration

Notification of cancellation must be sent in writing to Congrex. Cancellations of registrations will be accepted until June 15th 1999, up to which date the total amount will be refunded less SEK 500 for administrative expenses. We regret that no refunds can be made for cancellations received after June 15th 1999.

Cancellation of hotel reservation

Notification of cancellation must be sent in writing to Congrex. Cancellation of any hotel reservation will be accepted until June 15th 1999 with the total amount refunded. We regret that the hotel deposit cannot be refunded after June 15th 1999.

Cancellation of social events

Notification of cancellations must be sent in writing to Congrex (please see address above). Cancellation of social events will be accepted until June 30 1999, and the total amount will be refunded. For cancellations received after June 30, 1999 and up to two days before the start of the Conference, the payments will be refunded less 50%. After that no refund will be given.

Disclaimer

The Organizing Committee and Congrex Sweden AB accept no liability for injuries/losses of any nature incurred by participants and/or accompanying persons, nor for loss or damage to their luggage and/or personal belongings.

IMPORTANT ADDRESSES AND TELEPHONE NUMBERS

Registration, hotel booking, social events and general information

All matters regarding registration, hotel booking, social events and general information are handled by Congrex Sweden AB.

Before and after the Conference:

Congrex Sweden AB
Attn. IJCAI 99
P.O. Box 5619
SE-114 86 STOCKHOLM
Sweden

Phone: +46 8 459 66 00
Fax: +46 8 661 91 25
E-mail: ijcai@congrex.se

During the Conference all inquires to:

City Conference Centre
Attn. IJCAI 99
Barnhusgatan 12-14
SE 107 26 STOCKHOLM
Sweden

Phone: + 46 8 506 166 00
Fax: + 46 8 468 10 90 71

Information about the conference program

Inquiries about the conference program will be handled by the Department of Computer and Systems Sciences, Stockholm University and Royal Institute of Technology (DSV).

Attn. DSV, IJCAI-99
Electrum 230
SE-164 40 Kista
Sweden

Phone: +46 8 16 1612
Fax: +46 8 703 9025
Fax: +46 8 703 9025
E-mail: ijcai99@dsv.su.se

World Wide Web

For the latest information about the Conference, please visit the Conference homepage at: http://www.ijcai.org/ijcai-99

Location and Travel

Airport and Air Transportation

All international flights to Stockholm arrive at Arlanda Airport.

Airport buses leave Arlanda Airport every 5-10 minutes for the City Terminal in central Stockholm. The bus ride takes approximately 45 minutes and costs SEK 60 (January 1999). The City Conference Centre is within a few minutes walking distance from the City Terminal. You will also find taxis just outside the Arrival Hall at Arlanda. Most taxi companies have a fixed rate of SEK 400 (January 1999) from Arlanda Airport to central Stockholm (the price from Stockholm to Arlanda is 435 SEK). It is strongly recommended to ask the price before entering a taxi.

Public Transportation

Stockholm's public transportation system is safe, very efficient and convenient. It consists of buses, trains and underground. In the city, hotels, museums, shops and restaurants are generally within walking distance, which makes Stockholm an ideal city for strolls.

Venue

The 16th International Joint Conference on Artifical Intelligence will be held at City Conference Centre (please see page 26 for complete address). City Conference Centre/Norra Latin, is one of Europe's largest and most beautiful congress and conference facilities. It is located in the center of Stockholm, at walking distance from the Central Railway Station and Air Bus Terminal (see map on brochure cover page).

Norra Latin, the magnificent old grammar school in Florentine Reinassance style from 1880, has recently been renovated. It now offers all conference amenities and provides an excellent setting for IJCAI-99.

Visas

A visa for entering Sweden is required from certain countries. Please check with the Swedish Consulate in your home country for further information.

JAN ASPLUND
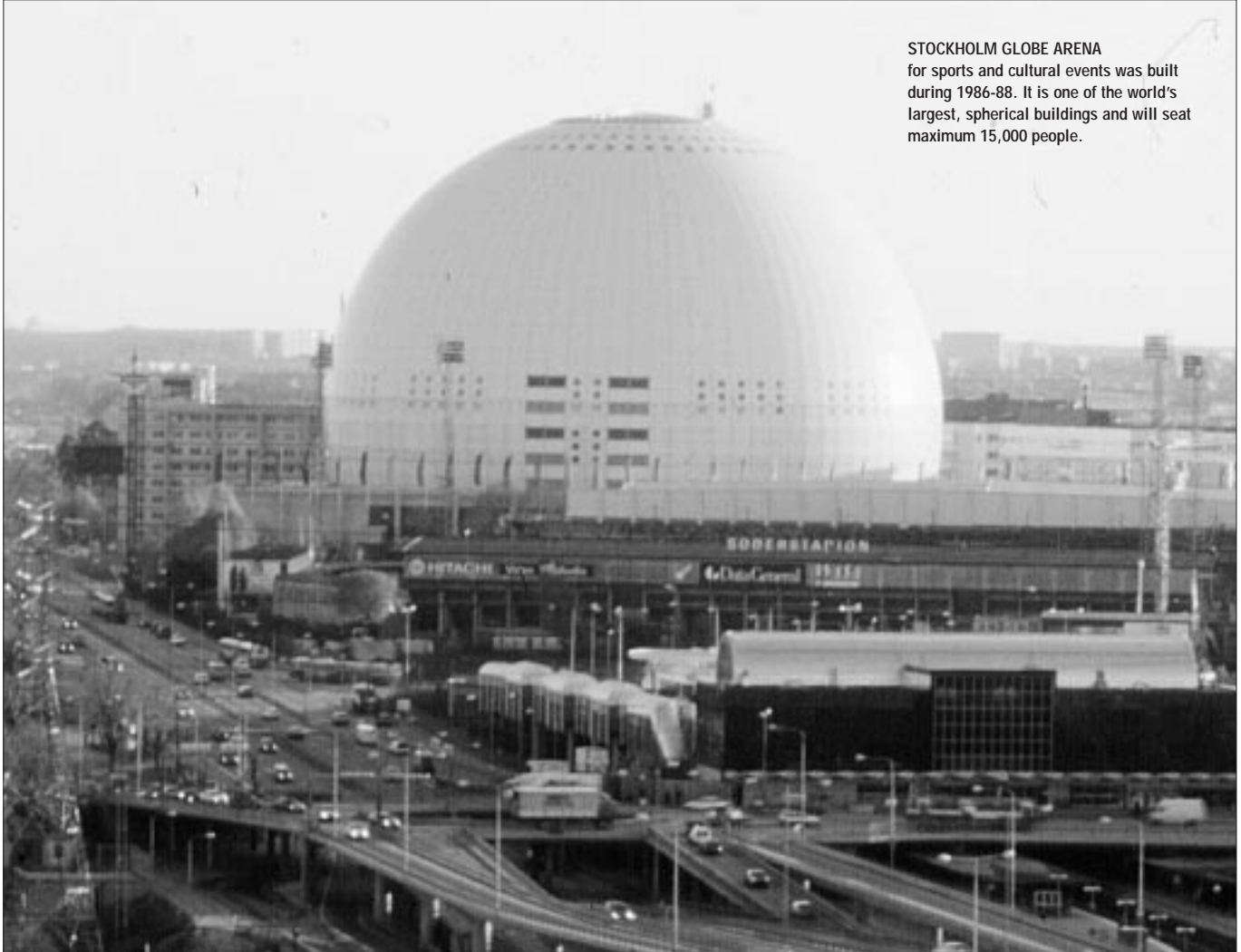
STOCKHOLM GLOBE ARENA
for sports and cultural events was built during 1986-88. It is one of the world's largest, spherical buildings and will seat maximum 15,000 people.

General Information on Venue

STOCKHOLM – BEAUTY ON WATER

Stockholm – the Royal Capital of Sweden – is one of the most beautiful cities in the world. It is situated on 14 islands and laced by water so clean that you can fish and swim in it right in the middle of the city.

Stockholm became the capital of Sweden 700 years ago, and is today a modern city with more than 1 million inhabitants. In the picturesque winding alleyways of the city's medieval Old Town section, the very air is redolent with history. The Old Town is well known for its excellent restaurants and shopping facilities, and within a few minutes' walking distance is the throbbing pulse of a modern city. An optional guided tour will be held August 2.

Since 1901 the city has been the venue of the Nobel Prize Ceremony (see picture on brochure cover), the most prestigious of all meetings – and indeed the city makes a fitting venue. The reasons are basic; facilities and experience are excellent, the city's infrastructure is good and it is a safe place to be.

The city offers many attractive options for visitors. Perhaps the most breathtaking scenery of all awaits visitors to the archipelago, which with 24,000 islands is one of the largest archipelagos in the world. Why not take a steamship trip out there? You can be away all day or just a few hours. If you are interested in history you can visit the famous Open Air Museum or the Wasa Museum. An optional guided tour will be held at the Wasa Museum on August 3. There will be a one hour cruise through the archipelago ending with IJCAI-99 Dinner at Vaxholm Fortress on August 4.

Stockholm is also one of the communication hubs and economical and cultural centres of the Nordic area. Arlanda Airport handles some 200 flights daily to and from 40 countries on 5 continents. There are direct flights from most major cities in Europe and from the large cities in the U.S and easy connections from the rest of the world.

Stockholm is like a Swedish Smörgåsbord – it has everything.

CLIMATE AND DRESS

The weather in Stockholm at this time of the year is usually somewhat sunny with temperatures around 21° C (70° F). An umbrella might be useful as showers can occur. Dress will be informal throughout the Conference.

TIME ZONE

The time zone in Stockholm is GMT + 1 hour.

BANKS AND POST OFFICES

Most banks open at 09.30 and close between 15.00 and 16.30. Post offices are generally open between 09.00 and 18.00

CURRENCY

The official currency is Swedish Krona (SEK). USD 1 = Approx. SEK 8. (December 1998).

TIPPING

When buying services in Sweden such as; restaurants, hotels, sightseeing, etc., tipping is not required.

RESTAURANT COSTS

	Lunch	Dinner
Fast food	35-45	50-100
Economy	55-65	250 (3 dishes)
Deluxe	85-150	400-500 (3 dishes)

Breakfast is normally included in hotel prices.

TAX-FREE

Non-European Union citizens have tax-free shopping privileges for goods that are packed and sealed in the shop, and that are meant for use outside the border of Sweden. You get a form when you make the purchase, and when you leave the country, most of the VAT is refunded.

TOURIST INFORMATION

The Conference Secretariat will be most happy to give you more information about Stockholm, book tour tickets, and make restaurant reservations or assist you in any other way during your stay in Stockholm. You can also contact the Stockholm Information Service:

P.O. Box 7542, SE-103 93 Stockholm, Phone: +46 8 789 24 00, Fax: +46 8 789 24 50. Visiting address in Stockholm: Hamngatan 27, Sweden house.

PROFESSIONAL CONFERENCE ORGANIZER

Congrex Sweden AB has been appointed Professional Conference Organizer. Congrex Partnership is an international group of professional conference management companies with offices in Europe, North America, Latin America and Pacific Asia.

JAN ASPLUND

Social Program

(All prices include VAT)

FOR PARTICIPANTS AND ACCOMPANYING PERSONS

MONDAY 2 AUGUST, 5 PM
Opening Ceremony and Welcome Reception

Opening Ceremony in City Conference Centre followed by Welcome Reception at the Stockholm City Hall hosted by the City of Stockholm. The Ceremony and reception is included in the technical program fee and fee for accompanying persons.

WEDNESDAY 4 AUGUST
Dinner at Vaxholm Fortress
Price per person SEK 600.

Boats will take you from the city's center at 6 pm for a one-hour cruise through the Stockholm Archipelago ending at Vaxholm Fortress. Upon arrival you will be served a traditional Swedish dinner in ancient historic surroundings.

Swedish king Gustav Vasa decided that the Fortress should be built and the work began on the original structure in 1548, but there were many alterations over the centuries. The present-day fortifications date back to 1863, and the mighty walls are built from 30,000 solid granite blocks. The fortress has been attacked twice, by the Danish navy in 1612 and by the Russian navy in 1719.

The courtyard, that was originally the place for military drilling, is now a place for events, theatre and music. Today the Fortress is an exciting and popular tourist attraction.

The number of tickets for the Dinner are restricted and will be distributed on a first-come-first-served basis.

OPTIONAL TOURS

SUNDAY 1 AUGUST
Introduction to Stockholm – A Sightseeing Tour
Price per person SEK 135.

The best way of getting to know a city quickly is to go on a sightseeing tour by bus. This tour gives you an overall view of Stockholm. While passing well-known buildings, museums, and parks, your guide will tell you about shopping facilities, good restaurants and entertainment.

The tour starts at 2 pm and lasts for 1 1/2 to 2 hours.

MONDAY 2 AUGUST
A Walk in Gamla Stan (the Old Town)
Price per person SEK 140.

A guided walk through Gamla Stan, Stockholm's heart. This is the island on which Stockholm was originally built at the beginning of the 13th century. Stroll down the narrow streets and discover breathtaking sights and fascinating buildings. The two most dominant buildings on Gamla Stan are Stockholm Cathedral, built in 1267 and therefore the oldest church in Stockholm, and the Royal Palace where the King and Queen still hold their official receptions and banquets. The tour starts at 2 pm in Gamla Stan at Slottsbacken, by the Obelisk, and lasts for 2 hours.

TUESDAY 3 AUGUST
The Vasa Museum
Price per person SEK 155.

Enjoy a piece of Swedish history at the spectacular Vasa Museum, one of Stockholm's main attractions. The royal warship Vasa sank on her maiden voyage inside Stockholm Harbor, in 1628. After 333 years underwater, she was raised from her watery grave in 1961, and after several years of restoration she has now been moved to her final resting place in the spectacular museum. A guide will give a fascinating account about the Vasa and what life was like onboard a warship in the 17th century. The tour starts at 10 am and lasts for 2 hours.

WEDNESDAY 4 AUGUST
Art Tour
Price per person SEK 275.

This tour will take you to two beautiful art museums in Stockholm.

First Millesgården, with its fountains, terraces and magnificent view of Stockholm, which was the home of the great Swedish sculptor Carl Milles (1875-1955). He is famous for his dramatic and technically daring work. A number of Milles' works are displayed in the beautiful garden overlooking the sea.

Second Waldermarsudde, which was once the home of Prince Eugen, the "Painter Prince". His house, which contains his art collection, is now a museum offering the informal charm of a private home. The tour starts at 9.30 am and lasts for 3 hours.

THURSDAY 5 AUGUST
Drottningholm Palace
Price per person SEK 310.

Drottningholm Palace, just outside Stockholm, dates from the 17th century and is modelled on Versailles. Today, the palace with its magnificent park is The Royal Family's residence. The Court Theatre is one of the oldest in the world still in use. It is the only theatre that uses the original stage scenery from the 18th century. The tour starts at 1 pm and lasts for 3 1/2 hours.

PRE CONFERENCE TOUR TO THE MIDNIGHT SUN, NORTHERN SWEDEN

JULY 28 – JULY 30, 1999
Price, see end of this section.

Wednesday, July 28
Departure from central Stockholm at 8 am for Kiruna, situated 200 km north of the Arctic Circle. Transfer to the small village of Jukkasjärvi. You will then go on to the activity of your choice.

Activity 1 - Historical Tour and a Visit to the Space Centre
Guided tour of the beautiful church in Jukkasjärvi, built in 1608. The next visit is to the Lappish Museum. We close the day by visiting the most northern-situated space centre "Esrange".

Activity 2 - River Rafting (minimum 6 participants)
Coach transfer to Aha-Mukka by the Torne River. Reach Pirtilathi by rubber rafts and return transfer to Jukkasjärvi. After dinner at the Inn in Jukkasjärvi a guided tour along one of Sweden's most beautiful roads, Nordkalottvägen, will follow. The road was inaugurated in 1984 and goes between Kiruna and Narvik in Norway. Although late in the evening, it will be full daylight.

Thursday, July 29

In the morning you will visit the famous photographer Sven Hörnell to see a beautiful slide show showing the eight seasons of Lapland. After lunch we will make a train ride along the old railway constructed between 1898 and 1903. Get off the train at the small mountain station Katterat in Norway to walk one of Scandinavia's most spectacular trails. It is a 2-hours walk (6 km) following the old construction railroad used by the workers at the turn of the century. Arrival at Rombakksbotn. It was in these areas that one of the largest sea battles was fought during World War II. At Rombakksbotn a Norwegian seafood feast has been prepared in the remains of one of the old houses. A chartered boat will pick you up and among other things you will pass a German destroyer sunk by the Allies. Coach transfer back to Hotel Riksgränsen.

Friday, July 30

Departure for Kiruna. When you arrive at Rensjön you will be welcomed by the Laplander Nils-Anders and his family. In the large lap-hut Nils-Anders will tell you about the Lapps, their lives, history, and culture while a light typical lunch is served. After lunch you will continue towards Kiruna for departure to Stockholm. Arrival appr. 3 pm in Stockholm.

PRICE

Price per person in double room SEK 10.500. Single room supplement per night SEK 660.

The price includes: transfer from Stockholm to the airport, air fare (economy class), meals, guides, sightseeing tours, evening entertainment and all arrangements during the tour. Please observe that a limited number of tickets are booked for this tour. Reservation must be received by Congrex no later that April 20, 1998. After this date, reservations will be made upon request.

Please register for the social program on the registration form. Tickets will be distributed on a first-come-first-served basis.

Congrex reserves the right to cancel any of the tours if the number of participants should be too small. Full refund is then made.

Next IJCAI Conference

**IJCAI-2001, SEATTLE, USA
AUGUST 3–10, 2001**

IJCAI-2001, the Seventeenth International Joint Conference on Artificial Intelligence, will be held August 3 through August 10 in Seattle, USA. It is sponsored by the International Joint Conferences on Artificial Intelligence, Inc. (IJCAII) and co-sponsored by AAAI (American Association for Artificial Intelligence).

For further information contact one of the following:

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