Profile: Mark Fox – An Outstanding Canadian in the American AI Scene

David Fisher

Networks for Artificial Intelligence at the National Research Council

William H. Henneker

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- Artificial skin/muscle, vision and scene analysis
- Character and object recognition
- Process control (process monitoring, quality control, generation of flexible manufacturing schedule)
- Expert systems (diagnosis, control expert system) and automated knowledge acquisition
- Voice recognition
- Signal processing (intelligent noise filtering, signal formatting)
- Radar clutter elimination
- Risk analysis for credit authorization
- Prediction and detection of explosives
- Autonomous vehicles (sensory and control processes, map generation, map interpretation, navigation and maneuvering)
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Annonces de Conférences
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President/Président: Dick Peacocke, Bell-Northern Research, Box 3511, Station C, Ottawa, Ont K1Y 4H7. 613-765-2629. BITNET: richard@bnr.ca
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Canadian Artificial Intelligence is published quarterly by CSCSI/SCEIO and is a benefit of membership in the society. Canadian AI solicits contributions in English or French on any matter related to artificial intelligence, including: articles of general interest; descriptions of current research and courses; reports of recent conferences and workshops; announcements of forthcoming activities; calls for papers; book reviews and books for review; announcements of new AI companies and products; opinions, counterpoints, polemic, controversy; abstracts of recent publications, theses, and technical reports; humour, cartoons, artwork; advertisements (rates upon request); anything else concerned with AI. Paper or electronic submissions are welcome. Electronic submissions are preferred and should be unformatted. Canadian AI is published in January, April, July, and October. Material for publication is due six weeks before the start of the month of publication.

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Intelligence Artificielle au Canada

SCS/SCEIO Newsletter
Contributions :
L’Intelligence artificielle au Canada est publiée trimestriellement par la CSCSI/SCEIO, et est offerte gratuitement aux membres. L’IA au Canada encourage les contributions, en français ou en anglais, portant sur l’intelligence artificielle. Ceci comprend: des articles d’intérêt général; des descriptions de recherche courante et de cours; des rapports de conférences récentes et d’ateliers; l’annonce d’activités à venir, et des requêtes d’articles; des critiques de livres ainsi que des livres à critiquer; l’annonce de nouvelles compagnies en IA et de leurs produits; des opinions, des répliques, tout ce qui est polémique; des résumés de publication récentes, de thèses et de rapports; des trucs humoristiques ou artistiques, de bandes dessinées; des annonces (s’enquérir des frais); tout autre matériel touchant à l’IA. Contributions, sur papier ou par courrier électronique, sont bienvenues. Nous préférons le courrier électronique mais les soumissions ne doivent pas avoir un format. L’IA au Canada apparaît en janvier, en avril, en juillet, et en octobre. Toute communication à publier doit nous parvenir au moins six semaines avant le début du mois de parution.

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or to / ou à: Graeme Hirst, Canadian Artificial Intelligence
Department of Computer Science, University of Toronto
Toronto, Ontario, CANADA M5S 1A4
COMMUNICATIONS

Letter to the Editor:

Dear Colleague,

I would like to bring to your attention, and to the attention of your readers, a wonderful opportunity that currently exists to organize high-level international collaboration activities in the field of artificial intelligence applied to instruction. I am referring to NATO’s Programme in Advanced Educational Technology, sponsored by its Scientific Affairs Division.

I have included below an outline of this programme. As one of the panel members of this NATO programme, I would be pleased to provide any further information and comment to anyone interested in it. Other members of the Canadian AI community that are familiar with this programme include Gordon McCalla, Marlene Jones, and Phil Winne.

The latter two are currently organizing an intensive 2-week summer institute in the area of AI and Education, to be held this July in Alberta. I am sure you will be reporting on this interesting event in a future issue of the magazine.

Cordially,

Philippe Duchastel
University of Colorado at Denver
Tel: 303 / 671-2489
pduchastel@enudenver.bitnet

ADVANCED EDUCATIONAL TECHNOLOGY
RESEARCH WORKSHOPS AND SUMMER SCHOOLS

The Science Committee of NATO sponsors the organization of Advanced Research Workshops and Advanced Study Institutes (Summer Schools) on topics in the field of educational technology. The aim of this special programme is to stimulate international collaboration among established and younger scientists in this field of R&D.

Areas of interest (among others) include task analysis, simulation, modelling and diagnosis, tutorial strategies, intelligent tutoring and other interactive technologies, microworlds and interface design, and evaluative methodologies.

Workshops typically involve 20 to 40 experts in their field in a 2 to 5 day meeting with the aim of reviewing the state-of-the-art in the field and establishing collaborative links for future research. Study Institutes are 2-week summer schools where 12 to 15 leading scientists impart knowledge and experience to a group of 60 to 80 younger scientists with the aim of giving them a solid footing in the field. Both types of activity favour professional contact among scientists in the spirit of international co-operation in furthering promising areas of educational technology.

NATO does not organize these activities itself; rather, it sponsors them through funding. Scientists interested in organizing an Advanced Research Workshop or an Advanced Study Institute in their particular specialty should request an application form and information packet from the Scientific Affairs Division (Advanced Educational Technology), NATO, B-1110 Brussels, Belgium. Applications for more modest funding to enable international travel for collaborative research among scientists from different countries, and for research, study, and lecture visits abroad are also available.
NEWS RELEASE

New Member Appointed to the Natural Sciences and Engineering Research Council

OTTAWA, November 17, 1989 — The Honourable William Winegard, Minister of State (Science and Technology), today announced the appointment of Dr. Andrée G. Roberge to the Natural Sciences and Engineering Research Council (NSERC), for a three-year term ending in 1992.

Director General of the Institute Armand Frappier, Dr. Roberge holds a doctorate in biochemistry from the Faculty of Medicine at Laval University. She brings to the Council her vast experience in teaching and research administration in the university milieu. Dr. Roberge has been a professor for several years in the Department of Human Nutrition of the Faculty of Agriculture and Food Science at Laval. She was also responsible for the department’s laboratory of Neurochemistry and nutrition, and served as President of the university’s Commission de la recherche.

Dr. Roberge is past President of the Association canadienne-française pour l’avancement des sciences (ACFAS) and a member of the Conseil de la science et de la technologie.

The Natural Sciences and Engineering Research Council is the largest granting agency supporting university research in Canada. NSERC offers numerous grant programs for university professors, as well as research scholarships and fellowships for the training of new scientists and engineers. NSERC also promotes co-operative research activities between Canadian universities and industries; its budget for the current year is $390 million.

Why Schank Changed His Focus

By Tracy McCurrach

In July of this year, Roger C. Schank left his position as director of Yale University’s Artificial Intelligence project to head the newly established Institute for the Learning Sciences at Northwestern University. The Institute is a unique blend of academic and corporate interests. Its mission is to develop innovative ideas and computer implementations of those ideas in the areas of education and training. In a interview with Roger Schank, we asked why a noted researcher would leave the mainstream of the Artificial Intelligence field to strike out in this new direction.

Roger Schank does not perceive his move to Northwestern University and the development of the Institute as removing him from the mainstream of AI research. Says Schank, “I don’t see this as being a wild career change. I am still working on the same things-learning, memory, reasoning, and understanding—that I have been for the past ten years.”

In fact, the research being conducted at the Institute for the Learning Sciences focuses on the same questions that Schank and his associates have been studying for years. The Institute encompasses both basic and applied research activities, including a major focus on the application of AI to education.

Other key research areas include:

- Scientific problems of language, thought and memory.
- The construction of computer programs that reason, learn, conduct conversations, display characteristics of human memory, plan, and contain realistic models of the world.
- Understanding how children learn language, learn to think, plan and reason.
- The development of effective teaching methods.
- Computer vision.
• Models of emotion, human problem-solving, and decision-making.

The difference in the direction of Schank's work today lies in the goal of transferring AI technologies into the hands of people with specific, real-world problems. The application of his research and theories to the areas of corporate training and education provides an important grounding for the research. As Schank stated, "We are interested in learning, both human learning and computer learning. We are researchers in human cognition. The most important part of AI is cognitive modeling. But now we will have a realistic use for our research, instead of just asking 'How do people learn', we are asking 'How do people learn x?'".

But why leave one university to form a new organization at another institution? Schank believes that move was necessary to create a new environment, an interdisciplinary institute that would redefine the approach to solving problems and transferring technology in an innovative manner. The Institute for the Learning Sciences is an organization that's neither purely university nor business. Schank intends to create a very intellectually exciting place to be. The Institute will pursue leading-edge research and offer academic programs that cut across established disciplines.

For example, the Institute coordinates a graduate program leading to a Ph.D. in any of three fields: Computer Science, Psychology, or Education. First year graduate students will follow a core curriculum designed by the Institute, which is independent of the particular Ph.D. they have decided to pursue. In general, three to six quarter courses will be taken in the second year. The majority of the second year and remainder of the graduate career are dedicated to research under the direction of the faculty of the Institute.

However, the Institute will not stop at the traditional boundaries of academia. The organization also includes professional programmers, as well as representatives of the corporations who are partners in the Institute. By merging this "business" side of the Institute with the academic interests, software products that address current problem areas will be produced and implemented. In addition, some of the people involved with the progress will return to their sponsoring organizations when the products are complete, thus ensuring the transfer of technology and the ongoing development of the products.

In the long term, Schank intends to take these applications even further by using them as a catalyst for change in the public school systems. By developing, testing, implementing, and thus proving this ideas within the corporate training arena, Schank hopes to successfully apply and gain acceptance of his concepts in the schools.

Has Roger Schank left the mainstream of AI? Few people would disagree that Schank has chosen an unconventional approach for creating his vision of the future. Then again, those who know Schank realize he has never been one to worry about convention. As Schank says, "A pure researcher need not be 'unsullied' by real world problems. The state of the schools today is a serious issue. So is tech transfer. Why shouldn't we take on these tasks?"

Thank you, Marlene

The new magazine team would like to thank you and Brian, Chris, Doug, Farran, Greg, Julia, Kar-Ling, Kevin, Lynn, Meg, Paul, Ruby, Saul and Sheila for your dedication and your efforts.
THIRD INTERNATIONAL SYMPOSIUM ON ARTIFICIAL INTELLIGENCE: 
APPLICATIONS OF ENGINEERING DESIGN & MANUFACTURING IN
INDUSTRIALIZED AND DEVELOPING COUNTRIES

October 22-26, 1990
ITESM, Mexico

The Third International Symposium on Artificial Intelligence will be held in Monterrey, N.L., Mexico on October 22-26, 1990. The symposium is sponsored by the IITESM (Instituto Tecnológico y de Estudios Superiores de Monterrey) in cooperation with the International Joint Conferences on Artificial Intelligence Inc., The American Association for Artificial Intelligence, The Sociedad Mexicana de Inteligencia Artificial and IBM of Mexico.

Objectives:
- Promote the development and use of AI technology in the solution of real world problems in the application areas of engineering design & manufacturing.
- Analyze the state-of-the-art of AI technology in different countries and its potential use and transfer from universities and research institutions to industries for the solution of problems.
- Evaluate efforts made in the use of AI technology in all countries. Provide general guidelines for the use and spread of AI technology in all countries, and assess them in the next annual IASI meeting.

ISAI Format:
ISAI consists of a tutorial and a conference.
The tutorial is a set of seminars on relevant AI topics given in two days (Oct. 22-23). The conference is a set of lectures given during three days (Oct. 24-26). It consists of invited papers and selected papers from the “Call for Papers” invitation.

Areas of Application Include:
- Production Planning • Resource Management • Quality Management
- Automated Assembly • Machine Loads • Inventory Control • Computer Aided Product Design • Computer Aided Product Manufacturing • Human Resources Management
- Forecasting • Client/Customer Support • Process Control and ES • Automatic Process Inspection • Use of Industrial Robots • Market and Competition Analysis • Strategic Planning of Manufacturing • Technology Management and Social Impact of AI Technology in Industrial Environments

AI Techniques Include:
- Knowledge Acquisition and Representation • Natural Language processing
- Robotics • Speech Recognition • Computer Vision • Neural networks and Genetic Algorithms • Parallel Architectures • Automated Learning • Automated Reasoning
- Search and Problem Solving • Knowledge Engineering Tools and Methodologies
- Uncertainty Management and AI Programming Languages

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Suc. de Correos "J", C.P. 64849 Monterrey, N.L. México
Tel: (52-83) 58-20-00 Ext. 5132 or 5143
Telefax (52-83) 58-07-71, (52-83) 58-69-31
Net Address: isai@tecmtyvm.bitnet or isai@tecmtyvm.mty.itesm.mx
Profile: Mark Fox
- An Outstanding Canadian in the American AI Scene

by David Fisher

Né à Toronto, Mark Fox est un chercheur en IA qui a émigré aux États-Unis et a joué un rôle très important au niveau de l’implantation de l’IA dans ce pays. Il a été le directeur du laboratoire de recherche sur les systèmes intelligents de l'Institut de Robitique à l’Université Carnegie Mellon. Il est présentement à la tête du Centre pour les Systèmes intelligents de décision de fabrication intégrée qui comprend 60 membres du personnel employés à plein temps. M. Fox est considéré par plusieurs comme étant un meneur dans le domaine de la résolution de problèmes basés sur des contraintes. A travers son entrevue avec David Fisher, Mark nous fait réfléchir sur le passé et futur de l'IA.

Mark Fox is a Toronto born AI researcher who has migrated to the United States and has been one of the key players in establishing AI in that nation. He has been the head of the Intelligent Systems Laboratory of the Robotics Institute at Carnegie Mellon University, and currently heads the Centre for Integrated Manufacturing Decision systems, employing a full time staff of 60. Considered by many in his field as the leader in constraint based problem solving, Mark gives some exciting insights into the past and future of AI through this interview with David Fisher.

Canadian AI: You're a Canadian citizen that has spent most of your career developing AI in the United States. Why not Canada?

Mark: As you know, I did my undergraduate degree at the University of Toronto. At that time, there were only 4 good places in the world to do a graduate degree, three of them in the States and one in Edinborough, so I pursued my Ph.D. at Carnegie Mellon. By the time I had finished my degree, I had already secured a job there, and that momentum has kept me here ever since.

Is this still the case for those pursuing an AI education?

No. There are a number of excellent institutions now. University of Toronto and University of British Columbia are two good examples. The people involved in these programs are excellent. Canada has a number of the world’s leading AI researchers, and that makes the nation as attractive as anywhere else.

AI was really hot five years ago. Some say it's dying. What's your opinion?

I think that is a complete misconception. There are a

David Fisher is a freelance writer from Calgary, Alberta.
Instead of having just a few AI guru’s in your company you should teach all of your application builders a little bit about AI. If you don’t make it a big deal, just make it another tool for the programmers to use, no more exotic than database technology, then it will get applied in the right places. We have to diffuse the technology if it’s going to be applied successfully.

However, traditionally you had to know LISP if you were going to do AI, and LISP is just too exotic for typical systems departments. LISP based systems are just not acceptable to mainstream programmers.

So how will we address this problem?

Well, we have to migrate to acceptable platforms, both in hardware and software. But regardless of the hardware, we have to use mainstream tools like C and C++. That is being done by a number of the Expert system shell companies.

What then does the future hold for LISP?

Well, accept for being an academic curiosity, LISP is dead. Except for LISP libraries that will run on C++, within 10 years, LISP will be gone. AI has got to come to the mainstream, not the other way around. Yes, we can now say it, LISP is Dead!

Al has got to come to the mainstream, not the other way around. Yes, we can now say it, LISP is Dead!

Government has played a major role in supporting AI. Is it still the major player, or is industry getting more involved?

Industry is getting more involved, but down here the military still plays a major role in the funding of our research.

What can be done to make AI more successful?

We need to do a lot more educating about AI. I don’t think that there has been near enough books written about AI. I just wrote a book about the Myths of AI, and I am amazed at how many people have called me to say “I always thought those were the truths about AI”. The problem is there are not a whole lot of people that can do the educating, so I think that can have got to do a lot more.

Tell us about what you’re doing in AI.

I have two interests, one is manufacturing and engineering and the other is in research of constraint problem solving. In the manufacture, production, and distribution cycles of things and all of the issues involved in that process, I’ve been working on a number of areas such as mechanical design, alloy design, project management, factory scheduling, etc. As a result we have built systems to help solve problems in those areas.

From the research side, I have been looking at scheduling problems and design problems and how to satisfy all the constraints involved in those processes, and I’m happy to report that we are having great success in applying our algorithms to a number of similar problems. In fact, the results have been far better than we expected in terms of the application of the research.

You’ve been involved in robotics and its use of AI. Are there real applications for AI in robotics, an area that is still struggling itself to leave the research stages and find cost effective applications in industry?

Well typically, little work has been done in terms of the cognitive area of robotics. Robots these days aren’t very smart. There’s been work done on the perceptual and acting parts of robotics, but is has mostly been analytical in nature, where the approach is to do a lot of analysis on a lot of information rather than using reasoning to make decisions. There will have to be a lot more work done on applying artificial intelligence to robotics for the field to become more useful, and there are a number of projects such as the NASA projects that are addressing the need for the cognitive portion of robotics.

Tell us about some of the success stories of the Intelligent Systems Lab that you set up in the 80’s.

We worked closely with industry to adapt our research to real applications, and a number of the prototype systems went into use by companies. Digital for example, use a machine configuration system that originated for our research there, as well as a truck scheduling system called National Dispatch. Westinghouse used a system to do steam turbine diagnostics based upon research we did for them. I think we were pretty successful in getting some real value out of our research.

What are you involved in now?

I currently head the Centre for Integrated Manufacturing Decision systems. It employs about 60 people in the work of applying decision making systems to the manufacturing industry. In just the one year we have been operating, we’re tackling is the ability to coordinate the decision making of large corporations to optimize the use of the resources of that corporation. This issue affects all sizes of corporations, from small all the way to governmental size. I think this is one of the most exciting applications of AI.

There are rumors of a University of Toronto sabbatical.

Well, I have always had a desire to return to Toronto and establish some ties there, so I’m exploring the opportunities.

Will we see the same types of exciting activities here that have been occurring down there?

I think so. I’m committed to getting industry involvement in our research, and at the same time I’m a firm believer that
academia needs to be guided by industrial problems so that our research takes on real problems. That’s where I think the best research comes from.

Will Mark Fox always be in AI? Is it big enough to consume all of your interests?

Absolutely! I can’t imagine not doing AI. I don’t know if people 10 years from now will say that what I’m doing is AI, but in my heart of hearts, I’ll always be doing what I think is AI.

What prophetic statement could you make about the future of AI.

I think the future is very bright, and the challenge of managing large complex organizations is what will keep us going for decades to come, and I believe that AI is at the heart of it.

Networks for Artificial Intelligence at the National Research Council

by William H. Henneker

Laboratory for Intelligent Systems, Division of Electrical Engineering, National Research Council of Canada, Ottawa, K1A 0R8.

![NRC LAN Network Diagram]

Tel que discuté dans le numéro du mois de janvier 1988 de ce magazine, le focus du programme en intelligence artificielle appliquée du Conseil National de Recherche (CNR) est la Section de Technologie d’Information (STI). Cette section fait partie du laboratoire de recherche sur les systèmes intelligents à l’intérieur de la division d’ingénierie électrique.

Ce programme est, entre autre, responsable de l’approvisionnement constant de ressources informatiques (logiciel et ordinateurs) n’ cessaires au bon déroulement d’une variété de projets impliquant la représentation, l’acquisition et l’application des connaissances. Ceci à créer, par le fait même, le besoin de développer un réseau local d’information (local area network LAN). Ce réseau est formé par l’interconnexion de stations de travail SUN, de microordinateurs Macintosh, d’ordinateurs personnel IBM, d’une machine LISP Symbioles 3620 et d’un supermimi ordinateur Data General MV/8000.

The Information Technology Section (ITS) of the Laboratory for Intelligent Systems in the Division of Electrical Engineering is the focus for the National Research Council (NRC) programme in applied artificial intelligence discussed in the January 1988 issue of this magazine. An important supporting activity within the programme is the provision of the computing resources (both hardware and software) necessary to a variety of projects involving the representation, acquisition and application of knowledge. This has involved the development of a local area network (LAN) interconnecting SUN workstations, Macintosh microcomputers, IBM PCs, a symbols 3620 LISP machine and a Data General MV/8000 supermini computer.

The ITS has experience with time-sharing systems that extends back to 1968 when one of the first PDP-10 computers (subsequently referred to as DECSYS-10) was purchased from Digital Equipment Corporation to be the centre of a network permitting remote collaborators to participate actively in the NRC’s programme in computer-aided learning. In 1982, the DECSYS-10 was retired and a 32-bit supermini computer (MV/8000 of Data General) became the focus of the section’s software development activities in computer-aided learning and computer-aided design/computer-aided manufacturing. In early 1986, the first SUN workstation - a SUN-3/75 - was purchased to support a collaborative project in intelligent computer-aided learning.

The Information Technology LAN is connected to an ethernet backbone cable maintained by the Division of Informatics and extending the breadth of the NRC’s Montreal Read Campus in Ottawa. Connections to this backbone are
made by several divisions which operate multiple LANs local to their respective buildings. Figure 1. shows a schematic of this backbone and some connections via long-haul networks using the X.25 data communications standard to remote laboratories across Canada. IRAPnet is a network developed for the Industrial Research Assistance Program. Router-a implements data link and network layer protocols proprietary to Digital Equipment Corporation and supports DECnet communication over leased lines. When installed, router-b will support TCP/IP communication over leased lines and will be the Ottawa link to Onet (Ontario network, an ARPA Internet style network, linking various centres involved in the Information Technology Research Centres of Excellence programme). The VM/CMS machine operated by the Division of Informatics offers the principal electronic mail connection to the external world because of its access to the BITNET network. The diagram shows repeaters (R in a circle) permitting end-to-end communication on the ethernet to extend upwards to 1.5 kilometres and bridges (B in a circle) which filter out unwanted ethernet device addresses and help to reduce frame traffic along certain portions of the ethernet.

The current workstation resources connected to the network are shown in figure 2. Each SUN workstation is licenced to operate version 4.0.1 of SUN's operating system. The software packages SUN Common Lisp (version 2.1.2), Quintus Prolog (version 2.4.2) and Inference Corporation's ART (version 3.1) form the basic toolkit from which AI applications are developed. GoodNeWS, obtained through a collaborative arrangement with the Turing Institute of Glasgow, United Kingdom, is an application built on top of NeWS (Network Extensible Window System) developed by SUN Microsystems. Laboratory personnel are exploring its use in constructing interfaces to expert systems applications developed using LISP and Prolog.

Support of network software based upon the application level protocols of remote login, file copy and electronic mail across the network has been a principal objective of this development. These applications form an integral part of the TCP/IP layered protocols implemented in SUN microsystems' version (BSD 4.3) of UNIX. SUN also provides network software based upon its application level file-sharing protocol called Network File System (NFS) permitting the user to access files on remote workstations as if those files resided on a local disk. Where possible, additional software and hardware have been acquired to allow the LISP machine, the IBM PCs, the Macintosh microcomputers and the MV/8000 to have this basic application functionality.

Each SUN workstation has a minimum of 8MB bytes of main memory (most have 24MB bytes) and a small local disk. The large main memories are particularly appropriate for AI applications using LISP, Prolog and LISP-based technologies such as ART (Automated Reasoning Tool). The disk capacity local to each workstation permits local paging and effectively frees the LAN from such activity. The installation procedure of ART suggests a disk-based virtual memory allocation (swap space) of at least 60 MB bytes so the local disk space is particularly attractive for such applications. The newly-acquired SUN-4/280 file-serving workstation has approximately 1.8 GB bytes of disk space for user and third party application software and two dual density (6250/1600 bpi) magnetic tape drives. The SUN workstation subnetwork is closely-coupled in the sense that a user has access to all resources on the network independent of the particular host to which he/she is connected. On the other hand, there is limited duplication of network resources so that each SUN workstation may function in a minimal stand-alone configuration if file- or print- serving resources are unavailable or if the workstation must be transported to a remote site for a demonstration. The SUN 3/160 machine acts as a gateway to the NRC ethernet backbone and the GatorBox bridge acts as a LocalTalk/ethernet gateway allowing IBM-PCs, Macintosh and SUN workstations to form a distributed file-serving network operating under the TOPS software package.

The computing environment provided by this LAN is intended to be reasonably flexible and to support the workstation equipment of multiple vendors. This flexibility will be verified in the near future by the installation of a SUN-4/60 with 16 MB bytes of memory, 208 MB bytes of local disk space and a colour monitor to support expert systems development for engine health monitoring. In the medium term future, there are tentative plans to install TCP/IP-based Digital Equipment Corporation workstations in support of real-time expert systems development.

This network is the principal computing resource of the programme in applied artificial intelligence at NRC. It is used primarily by NRC staff but is available to external collaborators in both government and the private sector who are participating with NRC in joint projects.
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BOO K S  R E E C E I V E D

Books listed below that are marked with a + will be reviewed in a future issue. Reviewers are still sought for those marked with a *. Readers who wish to review books for Canadian AI should write, outlining their qualifications, to the book review editor, Graeme Hirst, Department of Computer Science, University of Toronto, Toronto, Canada M5S 1A4. Obviously, we cannot promise the availability of books in anyone’s exact area of interest.

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Proceedings, Speech and natural language workshop

Defense Advanced Research Projects Agency

+Distributed artificial intelligence II


*A general explanation-based learning mechanism and its application to narrative understanding
Raymond J. Mooney

+Automated generation of model-based knowledge-acquisition tools
Mark A. Musen
[Stanford University]

*The use of knowledge in analogy and induction
Stuart J. Russell
[University of California, Berkeley]

An introduction to programming in Prolog
Patrick Saint-Dizier
[Université Paul Sabatier]

Semantic structures: Advances in natural language processing
David Waltz (editor)
[Thinking Machines Corp and Brandeis University]

+Readings in qualitative reasoning about physical systems
Daniel S. Weld and Johan de Kleer (editors)

BOOK REVIEWS

L'intelligence artificielle et le langage
Volume 1: Représentations des connaissances
Gérard Sabah [CNRS]

Compte rendu par
Guy Lopal, Université de Montréal
Ces deux volumes constituent sans contredit une synthèse magistrale de l'ensemble des domaines du traitement de la langue naturelle.

Le premier volume (représentations des connaissances) est dédié à la description des diverses connaissances nécessaires à un programme de compréhension du langage nature; on y présente différents modèles linguistiques: grammaires formelles, grammaires de cas, grammaires systémiques et finalement les relations entre les grammaires et le lexique. On passe ensuite aux modes de représentations procédurales. Finalement, une troisième partie précise comment le contexte influe sur la compréhension d’un énoncé: on y voit les modes de représentation du contexte et leur application dans la gestion de dialogues.

On constate donc l'ampleur du programme que l'auteur s'est donné et dont il se tire honorabllement. Chaque formalisme est présenté avec des exemples en français et avec un souci de synthèse et de clarté exemplaires. Il a su trouver le juste niveau entre le survol rapide et une description trop fine des formalismes qui aurait allongé l'ouvrage déjà très volumineux et qui aurait "caché la forêt derrière les arbres". Nous avons d'ailleurs fait l'expérience de lire des chapitres sur des domaines que nous connaissions déjà assez bien où nous avons constaté le bon niveau d'abstraction. Toute les grandes idées y sont, en plus de références appropriées (chaque volume dispose d'une bibliographie de 20 pages). Sur des domaines qui ne nous étaient pas familiers, nous avons apprécié le grand souci pédagogique de l'auteur qui nous a donné le goût d'en savoir plus.

Le deuxième volume traite des mécanismes informatiques mis en jeu pour le traitement des langues. Il est divisé en trois parties: l'analyse des phrases où on retrouve l'analyse morphologique, l'analyse syntaxique avec les réseaux de transition, l'analyse dirigée par le lexique et les analyseurs déterministes. Il y a également un chapitre sur le traitement des "erreurs" pudiquement appelées "non-attendus". La deuxième partie traite de la structuration du discours au niveau des inférences, des références et de la modélisation des textes et des dialogues. La troisième partie présente les aspects de structure et de formes de surface dans le cadre de la génération.

Ici encore le domaine est très vaste et l'auteur a dû choisir certaines approches quitte à en laisser tomber d'autres. D'ailleurs, il l'avoue lui-même (p. 14) "Nos sources essentielles se trouvent dans les travaux et les publications de notre équipe". C'est peut-être pourquoi on ne trouve aucune trace
de l’utilisation des grammaires logiques; elles sont esquissées aux pages 81-82 du volume 1 où on nous promet d’en avoir plus dans le volume 2 mais il n’y a plus aucune référence à ce formalisme pourtant maintenant très utilisé dans le domaine.
Les chapitres de ce volume reflètent le même souci de clarté et de synthèse que ceux du premier volume. La bibliographie est également bien étoffée mais on y retrouve beaucoup de références d’œuvres non publiées, des rapports de DEA, des stages de fin d’études; ces documents étant souvent assez difficiles d’accès, le lecteur risque de reste sur sa faim.
En résumé, ces deux volumes marquent sûrement une étape dans le domaine du traitement de la langue naturelle. Il n’existe à notre connaissance aucun équivalent de ce texte en anglais (sauf peut-être le “premier” volume de Winograd) et il serait sûrement intéressant pour les anglophones de disposer d’une telle synthèse dans le domaine. C’est un peu le “Handbook of AI” mais spécialisé pour le traitement de la langue naturelle, tout en étant beaucoup plus unifié car ces volumes ont été écrits par une seule personne.
Je recommande donc fortement ce texte à toute personne intéressée par le traitement de la langue naturelle que ce soit pour s’initier au sujet ou pour appréhender un domaine connexe. Je félicite encore l’auteur pour cette somme de travail de synthèse.

Guy Lapalme est professeur au Département d’informatique et de recherche opérationnelle de l’Université de Montréal. Il est co-auteur du livre Prolog pour l’analyse automatique de la langue naturelle publié chez Eyrolles. Il s’intéresse en particulier à la génération de texte et il est auteur d’une dizaine d’articles dans le domaine du traitement de la langue naturelle.

Knowledge-based programming
Enn Tyugu
(Institute of Cybernetics, Estonian Academy of Sciences,
Tallinn, USSR)
Glasgow: Turing Institute Press and Addison-Wesley,
1987, xii+243 pp (Turing Institute Press knowledge
ingineering tutorial series)

Reviewed by
Gabriele Scheler
University of Heidelberg

Tyugu’s book proposes a language for knowledge representation and provides a number of application examples as well as a sound theoretical background on logic, program synthesis, and semantics of programming languages. The language itself, UTOPIST, is classified as “object-oriented” on the back cover of the book, but the author himself describes it as a form of semantic network or set of frames. It is designed particularly for the representation of basic knowledge in mathematics and physics. The idea is that this knowledge is contained in special UTOPIST packages that a high-level programmer uses. The UTOPIST project has obviously been much inspired by Newell and Simon’s GPS in the seventies, when the first version of UTOPIST was also created.
The book is divided into six chapters: Chapters 1 and 2 provide the theory underlying the UTOPIST language; chapter 3 contains a specification and some operational semantics of UTOPIST; chapters 4 to 6 give examples of applications: symbolic mathematics and physics (4), database management systems (5), stochastic modelling, optimization problems, and “simulation” (6). There are two appendices containing proofs concerning the intuitionistic logic used in the first chapter.
I liked the theoretical sections, because difficult subject matter (such as proof theory and program synthesis) was laid out clearly and comprehensibly. The theoretical definition of a conceptual model (essentially a procedural semantic network) I found also inspiring. Conceptual models are “procedural” graphs for the representation of a problem that are implemented in UTOPIST. The construction of an algorithm for the solution of the problem thus represented is performed by a program synthesis component that transforms the conceptual model (in the implemented form of a set of UTOPIST statements) into a logic representation, generating a proof tree, which is essentially used as the algorithm for program execution, certain improvements in efficiency notwithstanding.
There is a certain relation to logic programming and Prolog here, though the author’s own work is apparently independent. The implementation of the conceptual graphs is not so ideally declarative. UTOPIST allows a number of “action” statements to be included in the problem description to guide the algorithm construction process.

Conceptual models
I found conceptual models an interesting alternative to existing knowledge representation schemes like KRL, FRL, KL-ONE, because of the emphasis on total modularity and on computability as the essential feature of a problem.
Tyugu defines computational models as “computational frames containing knowledge about computability” (p. 35). They contain only efficiently implementable relations, the relations that can be used for computations. A computational node is a set of variables (input variables, output variables) bound by an unambiguous (with respect to sequence) set of operators; that is, the operators applied to a set of input variables will produce the same set of output variables independent of the order in which they are applied. Tyugu calls these “partial relations”. Simple computational models are equivalent to operator models, where each partial relation is a single operator. Partial relations are just a convenient shortcut.
Full computational models allow one to specify conditions on the applicability of operators. In addition to variables (nodes) and relations (edges) there are new nodes: control nodes and nodes representing a problem. There are three types of control node: concatenation, condition, and subproblem. With the subproblem node, any recursive function may be represented, which makes computational
models Turing-equivalent. Computational models can be represented as a set of axioms (logical representation). They can also be considered as a form of data-flow schema.

Programs built on simple computational models are sequences of operators, and it can be proven that any program constructed from a simple model is input-output equivalent to any other program constructed from the same model. Efficiency improvements concern elimination of redundant operators only. Programs thus constructed have linear time complexity, i.e. they are proportional in length to the size of the network.

Simple computational models are themselves partial relations, and are used as the building blocks of full computational models, especially in the implemented form of the programming language — the primitives of UTOPIST (simple computational models) are very fast. Every model \( M \) has at least one program, and every program for \( M \) produces the same values for output variables. This means that computational models define a correct and (if finite) finite method of computing. For any solvable problem there is a certain sequence of operations that can in principle be used as a program, efficiency considerations aside. There is an associated algorithm for checking whether a problem is solvable and for the building of a sequence of operators for a solvable problem for every computational model. Checking solvability on an arbitrary computational model (with subproblems) is a \( \text{P} \)-space complete problem and equivalent to theorem proving in intuitionistic propositional calculus.

The transformation of computational models into statements of the UTOPIST language as an abstract problem-solving and representation technique, and again the implementation of UTOPIST via transformation into logical axioms and program synthesis is not presented. It is simply stated that “computational models are transformed into programs via a correspondence to axioms and an application of the structural synthesis method, producing a set of executable operations and finally a program”.

**UTOPIST**

The value of a programming language can only be judged by using it, and although Tyugu provides many examples, I cannot say much about the use of UTOPIST as a high-level programming language. I will try to explain the special features of UTOPIST and sketch some of its applications in the hope that a clear picture emerges.

UTOPIST in principle relies on a static problem description (in the nature of a computational model) and converts this into a set of instructions that are executed in order to compute certain results on certain input variables. But it also offers, and in many cases requires, a procedural element; namely “action” and “control” statements that allow an explicit flow control.

A UTOPIST program (program module) consists of four kinds of statement — a problem goal (output variables), a problem description (set of objects and relations), action statements, and control statements. Action statements and control statements are procedural statements, the former telling a program which steps to perform in order to solve a problem (splitting a problem into parts), the second for combining actions into larger parts of a program. A program module may be also seen as a kind of object (in the sense of object-oriented languages), containing a name, a set of relations describing the object, and possibly actions executed when the object is used in program. The attractiveness of the language is said to lie in the emphasis that is put on both modularity and a form of strict inheritance, which may be either “simple” (copy the relations of a problem statement) or with “amendments”, i.e., variable bindings.

UTOPIST is designed as a user interface to the formal description of problems in the form of computational models. Syntactic sugaring can be used with macros.

In Tyugu’s view, his form of knowledge representation has links to the evolution of “abstract data types” in programming as well as to frames encoded in semantic networks in “conceptual”, AI-style approaches. Computational models are based on a generalization of the abstract data type, which makes it possible to construct functions automatically using structural synthesis of programs. UTOPIST is thus an attempt to combine a user-oriented form of problem specification with efficiency of implementation.

**Applications**

Approximately half of the book is devoted to examples and applications of the conceptual model approach. They comprise such matters as a language for differential equations (DIF), a database management system, and a specification of basic concepts of physics, with an extended discussion of electricity. I will present a single example, namely the representation of Coulomb’s law:

```plaintext
let Coulomb’s law;
(q1,q2: charge;
F: force;
epsilon: electrical_conductivity;
r: distance;
*Comment: r is distance between the electric charges q1 and q2
F = q1 * q2 / (r * pi * epsilon * eps0 * r & 2);)
```

This piece of code allows the expression “Coulomb’s law” to be meaningfully included into some other problem specification.

**Conclusion**

References are not always up-to-date with respect to international AI; for example, object-oriented languages and KL-ONE are not mentioned, but KRL and FRL are. There is also only a passing remark on logic programming and Prolog. This book is based on an earlier (1984) Russian version, and some of the selection of Soviet work cited is good and interesting to an international audience — for example, Apresyan and Narinianin on semantics of natural languages.

I think computational models are a significant contribution to the formal aspects of knowledge representation and deserve a wide audience. I am not so confident concerning the practical possibilities of UTOPIST as a programming language. The gap between a person’s specification of a problem and the kind of statements UTOPIST accepts is very wide. It is not a language that helps in program analysis, but it is a fair achievement in converting the analysis of a problem into an executable program.
Gabriele Scheler's research concerns problems of disambiguation in natural language understanding. She has a special interest in Slavic languages and in AI in the Soviet Union.

**Raisonnements sur des informations incomplètes en intelligence artificielle: Comparison de formalismes à partir d’un exemple**

Léa Sombé (pseud.)
Toulouse: Teknéra, 1989, 221 pages
Livre broché, ISBN 2-87717-010-1, FF150

Compte rendu par
Jean-François Lamy
University of Toronto

Dans cet ouvrage, les neuf membres du groupe Léa Sombé se proposent de combler une lacune importante dans la littérature pédagogique en Intelligence Artificielle, à savoir l'absence d'un comparais oignée et à jour des différentes techniques qui ont été proposées pour raisonner à partir d'informations incomplètes. Ces techniques permettent à un agent ne disposant pas d'informations complètes d'en arriver à une conclusion, qui pourra éventuellement s'avérer fausse, sans pour autant que le système soit indisposé par cette incohérence, ce qui serait le cas en logique classique.

On retrouve dans cette catégorie toute une gamme d'influences du genre "si tout ce que je sais est que X est un oiseau, alors je suis prêt à croire que X vole" (même si X est en fait une autre chose) ou "tout oiseau qui n'est pas anormal vole", ou encore "typiquement, les oiseaux volent". L'exploration des nuances entre toutes ces formes d'énoncés est devenue un des sujets principaux des recherches récentes en représentation formelle des connaissances.

L'apport le plus important de ce livre est de présenter en un seul endroit une vingtaine d'approches différentes, et de les comparer sur le même exemple. On ne doit pas sous-estimer l'apport que cela représente, car chacune des approches a en général été concue pour exprimer correctement une nuance spécifique, et en conséquence, les exemples "classiques" utilisés pour illustrer une approche sont souvent inappliquables à une autre approche. L'exemple choisi par Léa Sombé concerne les relations typiques entre les notions de jeunesse, de célibat, de concubinage et parentage, par exemple "les jeunes sont en général célibataires ou concubins". Cet exemple est utilisé pour examiner la vingtaine d'approches selon dix critères. Il serait trop long de les énumérer ici, mais par exemple on se demandera si l'exemple a une seule traduction possible, si les disjonctions présentes dans l'exemple peuvent être exprimées, si certaines des relations de l'exemple peuvent êtres traduites, ou encore si en utilisant différentes parties de l'exemple on peut en arriver à des conclusions qui sont contradictoires. Ce dernier point est passablement important, car il soulève le problème de choix d'une interprétation privilégiée, autre sujet de prédilection en représentation des connaissances.

Les approches examinées sont essentiellement de trois types: extensions aux logiques classiques, approches possibilitistes ou probabilistes, et systèmes de revision ou de maintien de la cohérence. Parmi les logiques non-classiques examinées on retrouvera la logique des défaits, plusieurs logiques modales (logique du conceivable, auto-épistémique, du "tout-ce-que-crois") ou conditionnelles, et une étude de la circonscription. On traite également de logique floue, de logique possibiliste, de fonctions de croyance, et de probabilités conditionnelles et d'approches Bayésiennes. Finalement, la dernière partie du livre traite du frame problem, de raisonnement temporel, et de révision des connaissances.

La couverture est complète et couvre des approches toutes récentes, et est raisonnablement uniforme quant à la profondeur de l'analyse technique. Le fait d'avoir été écrit par neuf chercheurs œuvrant dans la plupart des domaines a sans doute été un net avantage. Les auteurs admettent cependant en conclusion que le dernier tiers du livre (qui traite de revision et de théories de raisonnement sur les actions) est nettement moins bien servi par l'exemple qui sert de trame au livre. En fait, si j'ai un reproche à faire au livre, c'est justement que cette dernière section semble nettement plus découverte que le reste parce que l'exemple doit être étendu au point d'être méconnaissable afin de pouvoir inclure ce matériau. L'intention est louable (il y a effectivement de fort liens techniques avec certaines des sections précédentes), mais l'unité présente dans les deux premières parties fait défaut.

Par contre, je n'hésiterais pas à recommander les deux premiers tiers du livre pour tout chercheur sérieux. Avec un apport complémentaire de mathématiques (notamment en logique modale) le livre pourrait servir de référence pour un cours avancé en représentation formelle des connaissances: la présentation assez succinte qui est faite de chaque approche n'est pas nécessairement suffisante en elle-même, mais permet cependant de lire avec profit les articles originaux car l'exposition permet alors de se concentrer sur les aspects fondamentaux de l'approche. Le simple fait d'avoir une notation cohérente pour les exemples d'un bout à l'autre du livre est en soi un bénéfice pour le lecteur.

En résumé, ce livre comble un vide important dans la littérature en I.A. (même en Anglais), et à ce titre mérite amplement une recommandation.

Jean-François Lamy est un candidat au doctorat à l'Université de Toronto, où il est en congé de son poste de chargé d'enseignement à l'Université de Montréal.

**Inside case-based reasoning**

Christopher K. Riesbeck and Roger C. Schank
[Northwestern University]
Hardbound, ISBN 0-89859-767-6, us$34.50

Reviewed by
Janice Glasgow,
Queen's University

This book provides a comprehensive introduction to the area of case-based reasoning. Case-based reasoning is an alternative to rule-based reasoning in that it relies on past
experience rather than a set of rules. The authors suggest that case-based reasoning offers two main advantages over rule-based approaches: it supports knowledge transfer and explanation; and it provides case solutions to problems whose real-world domains are too complex to specify fully in terms of rules. An underlying theme of this book, which is common in most of Schank’s publications, is the theory of understanding through explanation.

The book is aimed at an audience whose interests fringe on areas of cognitive science, but who are not necessarily knowledgeable in the technical aspects of artificial intelligence. Similar to a previous book by the same authors, Inside computer understanding, the approach to the subject supports the view that artificial intelligence is best understood through programming. Towards this understanding, the book includes Lisp programs that describe the concepts that are introduced.

Case-based reasoning is described in the book primarily in terms of applications. Four programs for case-based reasoning and their implementations are presented by the original authors of these systems. The first system presented, called Judge, is a program created by W.M. Bain to model the behaviour of judges who sentence criminals. Case-based reasoning was used in this project to examine sentencing as a representative example of legal reasoning. The program Chef, described by its implementer K.J. Hammond, is an instance of a case-based planner. Hammond points out that planning from cases relies on remembering and acting based on previous successes and failures. Chef is a case-based planner that works in the domain of Szechuan cooking; it creates new recipes based on old ones and requests for dishes with particular tastes or ingredients. A program for plan creation is presented by G.C. Collins. The focus of this research has been on debugging and repairing stored plans. To illustrate these concepts, Collins describes the program Coach which generates new football plays by improving old plays. Lastly, the subject of case-based parsing is described by C.E. Martin. Research in this area is aimed at recognizing which memory structures are most relevant to natural language understanding. As such, case-based parsing can be considered primarily as a recognition process.

As well as describing applications, the book briefly overviews issues related to memory-based learning and intelligence. In particular, it focuses on the concept that “intelligence is characterized by the ability to get reminded”.

Although the book is slightly disjointed, resulting from it being a collection of ideas written by several authors, it provides a readable introduction to the issues involved in case-based reasoning. A criticism may be that there is less theory than there are examples in the book; case-based reasoning appears to be a research field that is being defined in terms of cases!

Janice Glasgow is an associate professor at Queen's University. Her current research interests include reasoning about spatial imagery and modal logics. Dr. Glasgow is also involved with the Queen's University Nial project.
BRIEFLY NOTED

expectation-based learning

note—that is, all the states that can be reached from the current state by a single operator application.

expectation-based filtering A process that selects training instances that contribute the hypothesis in H. The hypotheses in H are used to filter out those instances that are expected to be true because those that are not consistent with H, in order that the learning program can focus its attention on those instances to which its current hypotheses break down.

expectation-driven processing A method of looking for things that are expected based on the context one thinks one is in. Preferences provide a structure, a framework, within which new data are interpreted in terms of concepts acquired through previous experience.

expectation-driven reasoning A control procedure that uses current data and decisions in order to formulate hypotheses about events not yet observed but predictable from current. The procedure also serves to confirm, disprove, or monitor expected events.

experience A deep case in case grammar that indicates the entity that receives, accepts, experiences, or undergoes the effect of an action.

experiential knowledge Knowledge that results from actual experience. In contrast to deep knowledge of formal principles or theories, experiential knowledge typically consists of specific facts and surface knowledge rooted therein.

experiment planning. See instance space.

expert A knowledge engineering language for rule-based representation that is used often for medical applications. It features a forward chaining control scheme designed for diagnosis or classification type problems, certainty handling methods, and efficient and transparent code. A sophisticated user interface provides facilities for exploration, acquisition, and consistency checking implemented in FORTRAN. EXPERT can be run on both DEC and IBM computers. It was developed at Rutgers University.

Expert (in PSI) A mobile type of the PSI system. The system has eight experts: parser/interpreter, dialogue moderator, explainer, examples/text inference, task domain, program model builder, coding, efficiency.

Expert Agriculture Information System An expert system developed for the National Agriculture Library USDA for commercial use. It helps library users find references. First Class is the development software.

EXPERT NAVIGATOR An expert system that monitors, manages, and reconfigures navigation sensors aboard tactical aircraft. The program confirms the ability of navigation sensors such as radio aids, inertial navigation systems, and digital terrain aids to support the aircraft's primary mission. It also issues remedial advice when the primary mission is threatened. Rules operating within a blackboard architecture constitute the program's knowledge. Implemented in LISP. EXPERT NAVIGATOR runs on the Symbolics 3600 workstation. It was developed at the Analytic Sciences Corporation.

expert system A computer program with a knowledge base of expertise capable of reasoning at the level of an expert in some given domain. A computer program that can perform at, or near, the level of a human expert. Evaluations of MYCIN judge its competence at or near that of highly specialized physicians. Configuration systems like XCON (90) may well exceed human competence. The term is often used to refer to any computer system that was developed by means of a large collection of facts.

The Facts On File dictionary of artificial intelligence

Raoul Smith (editor) [Northeastern University]
[cdrn$32.95]

Smith's dictionary gives brief definitions over 2,000 terms in AI. A sample page is shown above. The dictionary is fairly comprehensive; most of the important AI terms I could think of were listed. (Among those missing were determinism and non-determinism.) The definitions are generally brief but clear — to someone who already has a good grounding in the relevant area of AI. Sometimes, they are too brief. For example, the original Marcus parser PARSIFAL is described simply as a natural language system, with no hint as to why it merits special attention (and there is no separate entry for Marcus parsers or deterministic parsing).

Many entries, however, are of questionable utility, with perhaps one in every six of them being the names of particular AI systems, most of them obscure. Certainly, any such book needs to mention STRIPS and MYCIN and ELIZA, names often used in the AI literature in a manner that assumes the reader's familiarity with them. But the same cannot be said of most of the systems that are included here.

The dictionary is limited, in that, while not pretending to be an encyclopedia of artificial intelligence like Shapiro's (1987), it contains no names or references for anyone who needs to look further. Often, one may as well go straight to Shapiro.—G.H.


Expert systems 1990: An assessment of technology and applications

Terril C. Walker and Richard K. Miller

There's no need to write your own expert system. Over 1500 already available are catalogued here by application area, from Aerospace to Welding.

WORLD WATCH

1.0 Theoretical Aspects

Bao Tsingpin, Lin Xueyin (Dept. of Comput. Sci. & Techno., Tsinghua Univ., Beijing, China).

The authors describe a novel method for solving the path-planning problem in two dimensions. The method generates a network called the safe path network (SPN) for a known polygonal environment. The nodes of the SPN are the minimal safe areas in which a moving object can turn around without collision. The arcs of the network are connections between these nodes with information for the safe navigation of the object along either a straight or a curved path. Once the SPN is established the path-planning problem, taking account of the shape and orientation of a moving object, becomes a network-search problem. The method can solve many difficult path-planning problems with reduced computational complexity. (6 refs.)

1982 A three dimensional fuzzy intelligent controller.
Li Shiyong, Hu Hengzhang, Sheng Andong (Dept. of Control Eng., Harbin Inst. of Techno., China).
A three-dimensional fuzzy intelligent controller (FIC) that combines a three-dimensional fuzzy controller with a human controller is proposed. Simulation results indicate that the performance index of the FIC is better than that of a general fuzzy controller or of a conventional PID (proportional-integral-derivative) controller. The FIC is less sensitive to noise and changing parameters. The control algorithm is relatively simple and easy to implement in real time, using a microcomputer. This controller has been applied in a paper-making control system, with good results. (9 refs.)

1986 An expert system project in the accelerator domain.
E. Malandain, P. Skarek (CERN, Geneva, Switzerland).
IASTED International Conference, Geneva, Switzerland,

The CERN PS complex, comprising particle accelerators, storage rings and beam transfer lines is controlled through a large computer network of about 20 minicomputers and 150 microcomputers interfaced by CAMAC to the components of the accelerators. There are about 4000 electronic interface modules installed and the application programs represent 150 man-years of software. This complex and changing system puts a heavy load on the maintenance and fault finding team. Therefore, modern methods are tried out to cope with the problem. The design prototype and the pilot cover a small but representative area of hardware and software problems. The aim is knowledge representations suited for extensions to other tasks like beam setup; installation help and operation planning. It is based on deep knowledge about the structure and function of the components of the control system and includes a simulation model and heuristic rules. Some sub-projects are discussed: automatically generating a frame-structured knowledge base from information in existing databases; interfacing the expert system online to existing software on the conceptual level, in an object-oriented fashion. The expert system will probably run on a LISP machine linked via Ethernet to the NORSKDATA computer control network and to an IBM main-frame as ORACLE host. (12 refs.)

2213 Programming in possibilistic logic.

Mathematical modeling of uncertainty is a central issue in artificial intelligence in general, and in designing intelligent knowledge systems in particular. Computational methods for reasoning with inexact and vague knowledge are therefore of importance both from a theoretical and a practical point of view. A new programming language, PROLOG/P, based on possibilistic, instead of standard, first-order logic, is presented. The theoretical basis of possibilistic logic and its procedural interpretation and the main features of PROLOG/P supporting possibilistic reasoning are described. (27 refs.)

2219 Neural networks for artificial intelligence?
R.M. Debenham, S.C.J. Garth (Dept. of Eng.,
Cambridge Univ., UK). IEE Colloquium on 'Current
Issues in Neural Network Research' (Digest No.83),
p.6/1-4

In recent years there has been a lot of research into artificial neural networks, which offer a number of potential advantages over conventional artificial intelligence methods. Neural networks can easily be trained, they fail 'gracefully' and they are more amenable to implementation in VLSI. On the other hand, they suffer from a number of limitations which must be overcome if they are ever to be of widespread use: their capacity for generalization if often poor; training time increases rapidly with the size of the network and it is often difficult to understand the resulting encoding of data. The authors suggest some possible directions for future research to overcome these problems, and present the results of some experiments which show that training time may be reduced by structuring the training of such networks.

(3 refs.)

2221 Formal logics for commonsense reasoning.
P. Besnard (Inst. de Recherche en Inf. et Syst. Aleatoires,
Rennes, France). Ann. Telecommun. (France), vol.44,
no.5-6, p.242-50 (May-June 1989). In French.

The subfield of artificial intelligence devoted to the formalization of reasoning is presented through a review of significant works aiming at modelling commonsense reasoning by means of a formal logic. All the formalisms investigated in the text are founded upon classical logic, which, unlike them, formalize a monotonic form of reasoning. Supposition-based logic, default logic, autoepistemic logic, circumscription are given an introductory account as instances of the nonmonotonic logics approach to the formalization of commonsense reasoning. (15 refs.)

2224 An optimistic rule for accumulation of evidence.
P. Lingras, S.K.M. Wong (Dept. of Comput. Sci., Regina
Univ., Sask., Canada).
Methodologies for Intelligent Systems, 3.
Proceedings of the Third International Symposium,
Turin, Italy, 12-15 Oct. 1988 (New York, NY, USA:

Dempster-Shafer's theory of evidence (A. Dempster, 1967,
G. Shafer, 1976) provides an attractive method for calculating
the degrees of belief based on imprecise and incomplete
information. The belief functions and Dempster's rule of
combination in this theory represent the pessimistic view in
decision making. The optimistic view, on the other hand, is
represented by credibility functions (also known as upper
probabilities) which are the dualities of belief functions. The
authors propose a new rule of combination for constructing
credibility functions consistent with the accumulation of
knowledge. This rule, called optimistic rule of combination,
is the duality of Dempster's rule and corresponds to the
disjunction of evidence. The optimistic rule of combination can be useful for dealing with bodies of evidence which disagree with (sometimes even contradict) each other. Such an apparent contradiction may be a result of incomplete information and cannot be ruled out in practice. (8 refs.)


In an artificial intelligence (AI) planning system, the planner generates a sequence of actions to solve a problem. Similarly, the controller in a control system produces inputs to a dynamical system to solve a problem, namely the problem of changing a system's behavior into a desirable one. A mathematical theory of AI planning systems that operate in uncertain, dynamic, and time-critical environments is not nearly as well developed as the mathematical theory of systems and control. In this paper relationships and a detailed analogy between AI planning and control system architectures and concepts are developed and discussed. These results are fundamental to the development of a mathematical theory for the modeling, analysis, and design of AI planning systems for real-time environments. (65 refs.)


An intermediate representation of stereo image data in terms of 3D line segments is used to extract visible surfaces and their parameters. Methods and algorithms for recovering planar, cylindrical, conical, and spherical surfaces are described, and some test results are presented. The essence of the approach is testing of small sets of 3D line segments for compatibility with a particular type. Maximal sets of segments of supporting different surfaces are then identified. Some of the algorithms involve a novel use of the dual space representation. In the domain of polyhedral scenes initially restricted to blocklike objects and spaces, the planar surfaces are combined, using connectivity, to create 3D boxes, that correspond either to simple (i.e. convex) objects or spaces, or to convex parts, which are further combined to create composite objects and spaces. (21 refs.)


A generic iterative model is presented for a wide variety of artificial neural networks (ANNs): single-layer feedback networks, multilayer feed-forward networks, hierarchical competitive networks, and hidden Markov models. Unifying mathematical formulations are provided for both the retrieving and learning phases of ANNs. Based on the unifying mathematical formulation, a programmable universal ring systolic array is derived for both phases. It maximizes the strength of VLSI in terms of intensive and pipelined computing and yet circumvents the limitation on communication. Hardware implementation for the processing units based on CORDIC techniques is discussed. (16 refs.)

2.0 Systems and Techniques


RESCU (Real-time Expert System Club of Users) is the first of the community clubs set up to promote advanced information technology within the UK. It consists of 23 industrial companies and three universities interested in the application of knowledge-based system (KBS) techniques to real-time process control. The main objective of the club is to increase awareness of KBS technology and to demonstrate the viability of these techniques on a practical real-time application. The authors describe the RESCU demonstrator project, intended to study the possibility of assisting operators with quality control in a chemical batch process plant. The project was developed as a demonstration of the expert system approach and to gain practical experience with an operational expert system. Some aspects of the knowledge acquisition undertaken for the expert system are covered. The basic structure of the knowledge base is described, and some features within it are discussed. Problems encountered during the project are highlighted. (6 refs.)


EMERGE is a rule-based medical expert system designed to run on a microcomputer, and to provide rapid decision making capabilities for the emergency room environment. The EMERGE rule base is organized in a hierarchical manner, to facilitate rapid focus of attention. EMERGE was originally designed with two user interfaces: a question mode and a data-driven mode. During testing, it was determined that a
third menu-driven interface was desirable to accommodate the wishes of the end users, who were medical personnel with little computer experience. The menu-driven interface was added, along with a menu generation facility which permits menus to be produced automatically for new rule bases when the application area is changed. EMERGE is written in standard Pascal making it machine-independent. At the present time, it is implemented on the Apple II series of micro-computers and the IBM PC series of microcomputers, along with the VAX 11/750 minicomputers, and the CYBER 720 mainframe. (20 refs.)


Personal computers are delivering greater power. Therefore, domains traditionally reserved for larger computers are migrating to smaller machines. One such domain is the expert systems field of artificial intelligence. Building expert systems for personal computers requires careful management of resources. Several techniques are available to the knowledge programmer for controlling search time and space in rule based systems. Some techniques are language dependent, others have wider applications; Prolog exemplifies both cases. As several techniques are explored in detail, numerous examples are presented. (21 refs.)


Introduces a strategy for the construction of object-oriented knowledge frameworks. Global control programs, which are traditionally used for manipulating structured representations, have been replaced by domain-specific resources. This new approach offers increased efficiency and simplified development of knowledge-based expert systems for problem domains that deal with a variety of complex structured information. A theoretical foundation is laid for the representation of knowledge, starting with the adoption of a simple scheme for structuring stereotyped information. Data and method abstraction is achieved by installing knowledge frames into part of an object-oriented class system that supports procedural attachment and object communication. This allows frame specialization using domain-specific resources and subsequent construction of modular systems with these specialist frames. Editors are introduced for the alteration of data primitives used in declarative representation. Algorithms, which operate on these data primitives, are given for frame instantiation, data access, and user-directed inference. Examples from structural engineering are used throughout the paper to illustrate the practical application of object-oriented knowledge frameworks. (17 refs.)


The first generation of expert systems (e.g. MYCIN, DENDRAL, R1) is often characterized as only using shallow methods of representation and inference, such as the use of production rules to encode empirical knowledge. First-generation expert systems are often dismissed on the grounds that shallow methods have inherent and fatal shortcomings which prevent them from achieving problem solving behaviors that expert should possess. Examples of such desirable behaviors include graceful performance degradation, the handling of novel problems, and the ability of the expert system to detect its problem-solving limits. This article analyzes the relationship between the techniques used to build expert systems and the behaviors they exhibit to show that there is not sufficient evidence to link the behavioral shortcomings of first-generation expert systems to the shallow methods of representation and inference they employ. There is only evidence that the shortcomings are a consequence of a general lack of knowledge. Moreover, the article shows that the first generation of expert systems employ both shallow methods and most of the so-called deep methods. It shows that deeper methods augment but do not replace shallow reasoning methods; most expert systems should possess both. (43 refs.)
2291 Contribution to the achievement of a syntax in knowledge engineering.

After briefly discussing the lack of theory in knowledge engineering, the article stresses the need for basic definitions in that field. It focuses on structured expert systems which use categories of abstract types to embody a part of the knowledge. Following an abstraction process, from real systems to abstract systems, the article exposes algebraic formalisms to give a general frame for knowledge representation. It leads to a formal definition for the notion of attribute: a classification of attributes is tried and the notion of induced attributes is introduced. By using these results and system analysis a classification of classes is tried. Then the notion of link is studied and it is shown they have also to be classified. The given examples show how a rigorous syntax allows an increasing mastership on knowledge representation. (33 refs.)

2483 Patterns of inductive reasoning in a parallel expert system.
[received: 24 Jul 1989]

The general characteristics of an expert system shell which fires rules in parallel rather than sequentially are briefly reviewed. Particular reference is made to the management of uncertainty, ambiguities and contradictions and truth maintenance through fuzzy systems theory. Within this context, the overall organization of parallel expert system programs is discussed. The basic element of such programs is the rule block, a collection of concurrently fireable rules which are fired effectively in parallel. The rules in such a block may be fired once, or fired repetitively until no more rule instances are fireable. Each rule block firing then constitutes a completely non-procedural step. However, the firing order of rule blocks tends to be procedurally controlled. In the simplest case, the rule blocks are fired sequentially in order; in more complex cases, a flow chart may be used to describe the flow of control among rule blocks, with conditional firing of certain rule blocks. In a blackboard system programs written in procedural languages may be called within the non-procedural rule blocks to execute tasks for which an expert system is unsuitable, such as number crunching or searching large external files. (7 refs.)

2490 Knowledge acquisition for expert system development.

The recent proliferation of expert system development projects has focused the attention of the AI community on the problem of knowledge acquisition. Traditional programming skills possessed by the majority of knowledge engineers are found to be of little use when faced with the problem of extracting potential knowledge base information from a human expert. This paper deals with those topics and situations which have so often been described as the 'bottleneck' of expert system development. The concepts of expert and expertise are explored; the paradox of expertise is examined. Those interviewing methods found to be most effective for knowledge acquisition are discussed. A broad gamut of knowledge acquisition considerations are covered in detail including knowledge base structure, conversion of knowledge into rules, and refinement of the knowledge base. (25 refs.)

2507 The pragmatic application of the KADS methodology.

KADS is a methodology for building commercial knowledge-based systems (KBS). It has been developed under the aegis of the ESPRIT programme, the first project starting in 1983. Since its inception KADS was not meant to be a prescription for system development, in recognition of the many serious technical problems that would need to be overcome if it were so. However, such has been the progress within the current project, that it is now confident that KADS offers a set of methods and techniques, encapsulated within a theoretical framework, that will enable competent knowledge engineers and systems analysts to build quality knowledge-based systems with a degree of confidence that matches conventional systems development. In this sense KADS is truly a methodology. The paper presents the main ideas contained within it. (10 refs.)

2508 Applying quality assurance to expert systems.

A working group of the Computing Services Association, under the chairmanship of the author, has recently published a set of guidelines for quality assurance of expert systems. The paper summarises the guidelines. Emphasis is placed on the prototyping cycle and means for controlling the process. Documentation and change control are discussed in detail. The paper concludes with a description of checklists for prototyping and the use of prototyping in systems development.
3.0 Applications

2053 ESMAN: an expert system for manufacturing site selection.
Sunduck Suh (Dept. of Urban & Regional Planning, Illinois Univ., Urbana-Champaign, IL, USA), Moonja Park Kim, T.J. Kim.

Describes the design of an expert system for site selection, particularly for manufacturing establishments funded by foreign investors. A prototype expert system. ESMAN: an expert system for manufacturing site selection, is developed using Personal Consultant Plus. It is demonstrated that not only can the knowledge and expertise of an urban and regional planner be codified in a system that can advise less experienced planners, but also that such a system can become an educational tool that benefits urban and regional planning students. (14 refs.)

2066 Artificial intelligence and expert systems: financial applications and progress.

The increased role of AI and expert systems in the financial 'domain' is discussed and the reasons for the increased interest and involvement in AI by financial institutions identified. The level of activity and the progress made is reviewed on a worldwide basis with particular emphasis on the key players in the US, UK and Europe. The paper includes a comprehensive listing of the financial AI applications being investigated, designed, developed and implemented in insurance, banking, dealing, financial services and other financial markets.

2087 An inddepth study of an expert system that helps evaluate graduate study programs, and a statistical summary of 25 little expert systems.

The authors present a large expert system, Advice, that has been built to help evaluate the study plans of systems and industrial engineering graduate students. They explain system requirements, program architecture, technical characteristics, and system evaluation. Advice has four components: a knowledge base; a backward chaining inference engine, M.1; a database, dBASE II; and an external interface file. A novel feature of Advice is its use of a voice synthesizer that talks to the user. External functions allow M.1 to communicate with this voice synthesizer as well as with dBASE II files, where the attributes of each course are stored. Verification and validation are performed to ensure the accuracy and reliability of the system. Advice has time for both the students and the professors and has provided more accurate and more comprehensive advice for the students. The authors also present a statistical analysis of 25 small expert systems that were written by undergraduate and graduate students in systems and industrial Engineering at the University of Arizona in partial fulfilment of the requirements of a one semester course in expert systems. From this analysis it is concluded that novice knowledge engineers require three to four hours for each kilobyte of knowledge base.

2092 A program for oriented treatment of essential hypertension.
V. Moreno (Seccion de Farmacologia Clinica, Fac. de Medicina, Univ. Autonoma de Barcelona, Spain), M. Farre, P. Salva.

Treatment of essential hypertension is often a complex task and needs appropriate methodology. A newly developed computer program can help physicians to choose the best pharmacological approach to the treatment of essential hypertension. Based on an oriented clinical history, the program asks the user to give the physiological, pathological and pharmacological antecedents of the patient to be treated. Taking into account these characteristics, 15 antihypertensive drugs are ordered according to their indications and contraindications in the patient. Diet advice based on body-weight and the patient's habits are considered as well. The program is designed to explain why decisions are made, so it can be useful in teaching medical students or postgraduates. (11 refs.)

2101 Computer localization of brain lesions.
C.F. Tremblay (Children's Mercy Hospital, Kansas City, MO, USA), C.F. Lam.

The authors describe the use of a primitive instancing scheme based on geometrical solids to represent typical anatomical components of the nervous system. When the representation is used by a clustering algorithm, neurological lesions can be localized. The system's chief advantages are that it provides a concise way of representing the complex anatomy of the nervous system, and it permits a spatial reasoning problem, that of localization, to be solved computationally. The system's ability to localize multiple simultaneous lesions confers an additional advantage over previous programs for computer-assisted localization in neurology. (8 refs.)
2104 An expert system for the control of depth of anaesthesia.
Expert Systems in Medicine 4 (papers in summary form only received), London, UK, 17-18 March 1987  

Describes an expert system which will help advise an anaesthetist as to whether the current depth of anaesthesia is correct and suggest any measures necessary to regain the desired state. This is carried out in a real time situation. The run time system is extremely easy to use and understand, and it is also as unobtrusive as possible. (2 refs.)

2113 An expert system for searching in full-text.

Expert system technology is applied to the task of searching online full-text documents. The authors are developing an intelligent search intermediary to help end-users locate relevant passages in large full-text databases. The expert system automatically reformulates contextual Boolean queries to improve search results and presents retrieved passages in decreasing order of estimated relevance. It differs from other intelligent database functions in two ways: it works with semantically unprocessed text and the expert system contains a knowledge base of search strategies independent of any particular content domain. The goals for this project are to demonstrate the feasibility of the approach and to evaluate the effectiveness of the system through a controlled experiment. While this work has limited objectives, the system and techniques are general and can be extended to large, real-world databases. (18 refs.)

2138 Expert systems for configuration at Digital: XCON and beyond.
V.E. Barker, D.E. O'Connor, J. Bachant  

The XCON configuration system at Digital Equipment Corporation was the first expert system in daily production use in industry: it is the cornerstone of Digital’s knowledge network vision: a number of expert systems embedded in both the company’s order process cycle and its new product introduction cycle. Digital is continuing to extend the knowledge network, as well as using expert systems technology in many additional aspects of the company’s business. In fact, XCON is only one of several expert systems dealing with hardware and software configuration which are in use or under development at Digital. The configuration systems ‘family’ includes four expert systems in production use. Several additional configuration expert systems are in the research, advanced development, or prototype stage of development. The development of these expert systems has spanned nearly 10 year; Digital’s Configuration Systems Development Group (CSDG) has thereby gained considerable understanding of all phases of the life-cycle of production quality expert systems: design, development, production, and ongoing support. The authors highlight some of the key lessons they have learned. (13 refs.)

2141 A framework for opportunistic problem solving [chemical engineering].

The organization of problem solving computer programs is discussed. An opportunistic control architecture inspired by the Blackboard Model is described. The author addresses the control issue of how to organize a computer program consisting of independent ‘knowledge pieces’ so that they together are capable of problem solving. A very important characteristic of human problem solving is awareness of the solution process, and it is postulated that an ‘expert program’ should have this same ability to monitor the problem solving process and control it in a flexible manner. A computer program attempting to emulate such a ‘global awareness’ of the solution process has been developed and is presented. The program is implemented on top of the development system Knowledge Craft (H.P. Nii, 1986), as a set of CRL schemata (frames), a set of functions (Common Lisp) and an OPS production (rule). Domain problem solving (solving the ‘problem proper’) and control problem solving (deciding what to do next in the problem solving process) is separated into distinct sets of problem solving operators. This framework is applicable to chemical engineering processes. (10 refs.)

2146 An expert system for an automated assembly line design.
In Japanese.

An expert system is proposed for the construction and the scheduling of an automated flexible assembly line. It selects suitable robot hands and arms based on the features of product component parts, determines the robot motion considering various conflicts, estimates the assembly time in a workstation, assigns a criterion for the product input order and for the product dispatching at each workstation, and designs the assembly line by simulation. (5 refs.)

2160 Artificial intelligence applications in the nuclear industry: an international view.
The possibility that artificial intelligence (AI) techniques could be useful to the nuclear industry was realized only a few years ago. Proprietary needs have sometimes kept people from reporting on the progress of AI applications in the nuclear industry. Consequently, some duplicate work is being performed by several groups in different countries. Nevertheless, sharing the knowledge gained from the experience in several countries is still fruitful; success in one country may benefit another. With this view in mind, the author has gathered to the best of his knowledge, what is going on in different countries in the world. (65 refs.)

2162 Alarm filtering and presentation.
M.A. Bray (EG&G Idaho Inc., Idaho Falls, ID, USA).
(April 1989). (ANS Topical Meeting on Artificial
Intelligence and Other

Innovative Computer Applications in the Nuclear Industry,
The author discusses alarm filtering and presentation in the
control rooms of nuclear and other process control plants.
Alarm generation and presentation is widely recognized as a
general process control problem. Alarm systems often fail to
provide meaningful alarms to operators. Alarm generation
and presentation is an area in which computer aiding is
feasible and provides clear benefits. Therefore, researchers
have developed several computerized alarm filtering and
presentation approaches. Approaches to improving the alarm
situation and installation issues of alarm system improvements
are discussed. The impact of artificial intelligence (AI)
technology on alarm system improvements is assessed.
(22 refs.)

2166 Artificial intelligence applications in
accident management.
(ANS Topical Meeting on Artificial Intelligence and
Other Innovtive Computer Applications in the Nuclear
The problems associated with military C4I and nuclear
power plant accident management are starting to be
addressed by researchers who are drawing from advances in
artificial intelligence (AI) computer technologies. The central
focus of this work, is an attempt to invert the information
profile: instead of providing more and more information to
decision makers at faster and faster rates, AI methods are
being investigated for the purposes of analyzing, digesting,
and compiling information to support key decision making
tasks. This reorientation from divergent to convergent
information handling for improved accident management is
the primary driving force for investigations in the use of AI.
(16 refs.)

2194 Conflict resolution of rules assigning values to
virtual attributes.
Y.E. Ioannidis (Dept. of Comput. Sci., Wisconsin Univ.,
Madison, WI, USA), T.K.Sellis. SIGMOD Rec. (USA),
(1989 ACM SIGMOD International Conference on
Management of Data, Portland, OR, USA,
31 May-2 June 1989).

In the majority of research work done on logic
programming and deductive databases, it is assumed that
the set of rules defined by the user is consistent, i.e. that no
contradictory facts can be inferred by the rules. The authors
address the problem of resolving conflicts of rules that assign
values to virtual attributes. They devise a general framework
for the study of the problem, and propose an approach that
subsumes all previously suggested solutions. Moreover, it
suggests several additional solutions, which very often capture
the semantics of the data more accurately than the known
approaches. They also address the issue of how to index
rules so that conflicts are resolved efficiently, i.e. only one of
the applicable rules is processed at query time. (15 refs.)

2315 The DHSS retirement pension forecast and
advice system: an update.
S. Spigel-Sinclair.
KBS in Government 88, Proceedings of the Second
European Conference, London, UK, 1 June 1988
(Pinner, UK: Blenheim Online 1988), p.89-106

At the 1987 KBS in Government conference, the project
managers of the DHSS RPFA project presented details of a
project that had just commenced to replace the existing
manual retirement pension forecast and advice service with
a sophisticated expert system-based application. The resulting
system became operational in April 1988 and, judging by
the public response to the advice they have been given, can
already be deemed to be a success. A further project is now
under way to integrate the stand-alone system with the
central mainframes that hold applicant's National Insurance
contribution data. The paper recap's the history of the project,
describes the RPFA application in detail, and relates some
important lessons learned about implementing an expert
system. (3 refs.)

2327 Knowledge-based instructional gaming: GEO.
P. Duchastel (Laval Univ., Que., Canada).
J. Educ. Technol. Syst. (USA), vol.17, no.3, p.189-203

Games have a fascination for people which make them
ideal vehicles for instruction of an informal nature. Described
is an instructional game (GEO) in which the user learns
elements of Canadian geography as she chases a spy around
the country. The game utilizes artificial intelligence
approaches to represent and put to use various types of
knowledge (knowledge of geography, of tutoring, and of
the student). Experience in designing and refining the game
is discussed, as well as prospects for extending this approach
to other learning situations. (15 refs.)
The paper describes the development of a knowledge based scheduling system for school timetabling, focusing upon the cost and timescale benefits of the particular development methodology used. The system features both advisory and automatic modes of operation, together with adjustable resource smoothing options, and has demonstrated a 15-fold improvement in the time required to produce high quality timetables for large secondary schools. The user acceptance of the system has been very favourable and the techniques used should be directly applicable to other resource scheduling applications.

2354 An expert system for interpretation and diagnosis of ECG signals. 
P. Le Beux, B. Auvert, D. Fontaine. 

Describes an expert system for ECG analysis. The first version using the expert system generator SUPER was developed at the University of Compiègne, France (Fontaine 1985, Le Beux 1986) and a new version has been implemented in Turbo-Prolog. This system is able to generate interpretation and diagnosis of ECG signals by using a knowledge base instead of having an algorithmic approach. This system includes a three stage expert system: the real time acquisition is followed by the initialization of signal parameters which are then used as initial facts for the interpretation expert system. (7 refs.)

2366 Five PC-based expert systems for business reference: an evaluation [library automation]. 
R.G. Vedder, M.G. Fortin, S.A. Lemmemann 
(North Texas Univ., Denton, TX, USA), R.N. Johnson. 
Inf. Technol. Libr. (USA), vol.8, no.1, p.42-54 
(March 1989).

Many libraries are beginning to utilize expert system shells to provide simple directional sources or sophisticated reference service. The authors examine five different PC-based shells used by teams of graduate students with knowledge engineering experience to build a prototype application. The examination demonstrates the strengths and weaknesses of a product for developing expert systems. The expert-system building tools are all commercial shell products and are: EKSYS, 1st-CLASS, GURU, Personal Consultant Easy, and Personal Consultant Plus. Each project team was assigned one package to build a prototype for assisting patrons with basic business-reference questions.

The evaluation design and performance criteria for the shells are presented. (7 refs.)

2377 BLADES: an artificial intelligence approach to analog circuit design. 
F.Ei-Turky (AT&T Bell Lab., Naperville, IL, USA), 

An expert-systems-based automated design approach for analog circuits is presented. The approach uses both formal and intuitive knowledge in the design process. A prototype design environment, BLADES, which uses a divide and conquer solution strategy, has been successfully implemented and is currently capable of designing a wide range of subcircuit functional blocks as well as a limited class of integrated bipolar operational amplifiers. BLADES is believed to be the first successful design expert system in the analog design domain. It uses different levels of abstraction depending on the complexity of the design task under consideration. The importance of abstraction lies in the fact that once design primitives are defined, the problem of extracting the knowledge (design rules) becomes less complex. Two design examples are given to demonstrate the viability and versatility of the knowledge-based design technique as an analog design tool. None of the circuits designed and tested using BLADES were unstable. (39 refs.)

2403 STEELEX: a coupled expert system for integrated design of steel structures. 
[received: 06 Jun 1989]

Presents STEELEX, prototype knowledge-based expert system for integrated design of building structures consisting of moment-resisting steel frames. STEELEX is a coupled system in which AI symbolic processing is combined with conventional numerical processing. STEELEX produces the final detailed design including the beam-column connections ready for fabrication. In addition, it can explain the basis of design and the principles behind the design specification. STEELEX has been developed using a domain-specific tool called SDL (structural design language). Implemented in the INTERLISP environment, SDL provides a design problem-solving environment using a hierarchical cooperating specialists paradigm. STEELEX has a debugging facility and provides a multiwindow graphics interface for drawing isometric as well as orthographic views of the steel frame and beam-column connections (19 refs.)

2414 An expert system for system identification. 
M. Haest, G. Bastin, M. Gevers, V. Wertz 
(Lab. d'Automatique de Dynamique et d'Analyse des Syst., Univ. Catholique de Louvain, Belgium). 
Artificial Intelligence in Real-Time Control. 

An expert system for system identification written with the OPS83 knowledge-based programming language, is
presented. It provides the user with a set of good models for the system under investigation. If the sampling period used to collect the data seems to be unadapted, the expert system modifies it. An intelligent search through the set of all admissible models is made in order to find the best models of the system. Some validation criteria are used to classify the models and a complete set of facilities is at the user's disposal to modify the expert system behaviour at execution time. One advantage of the expert system approach is that one can not only change decision parameters (such as confidence levels) very easily but one can also change existing rules or add new rules at the price of only one more compilation. Finally, some simulations on data from industrial processes show that the expert system behaves just as well as human experts, while on simulated noisy data it finds the true model in the class of ARX or ARAX (also called GLS) models that was used to produce them. (6 refs.)

2424 A design talk advisor.

Systems with embedded computer capabilities provide a natural environment for the application of knowledge-based technology in support of the user. This is particularly true of systems with the design tools used in the application of new methodologies. The National Research Council of Canada in collaboration with Universite Laval, the University of Leeds and SystemOID Inc., has underway the development of an advisor to support the user of computer-based design tools. The advisor is to be capable of three modes of operation. In reactive mode, it will offer meaningful responses to user questions, in proactive mode, it will monitor the user and intervene with suggestions to assist the user achieve the indicated goal; in the tutorial mode it will provide a guided instruction to the system for the neophyte user. The authors discuss the design concepts for each of the modules and the approach to implementation of a prototype applied in the area of database design methodology. (13 refs.)

2434 A model for an intelligent operating system for executing image understanding tasks on a reconfigurable parallel architecture.

Parallel processing is one approach to achieve the large computational processing capabilities required by many real-time computing tasks. One of the problems that must be addressed in the use of reconfigurable multiprocessor systems is matching the architecture configuration to the algorithms to be executed. This paper presents a conceptual model that explores the potential of artificial intelligence tools, specifically expert systems, to design an intelligent operating system for multiprocessor systems. The target task is the implementation of image understanding systems on multiprocessor architectures. PASM is used as an example multiprocessor. The intelligent operating system concepts developed here could also be used to address other problems requiring real-time processing. An example image understanding task is presented to illustrate the concept of intelligent scheduling by the intelligent operating system. Also considered is the use of the conceptual model when developing an image understanding system in order to test different strategies for choosing algorithms, imposing execution order constraints, and integrating results from various algorithms. (23 refs.)

2435 TUNEX: a knowledge-based system for performance tuning of the UNIX operating system.
B. Samadi (AT&T Bell Labs., Holmdel, NJ, USA).

TUNEX, an expert system developed for performance tuning of the UNIX operating system, is described. TUNEX was developed on UNIX System V. It uses the properties, commands and utilities of this version. The tuning activities it is concerned with include: (1) adjusting operating system tunable parameters, such as number of disk buffers; (2) running maintenance routines, i.e. reorganizing file systems; (3) developing operation rules, such as off-peak hour runs of backups; and (4) modifying hardware, buying an additional disk drive. The structure of TUNEX is presented and performance analysis modules which provide quantitative information to the tool are briefly described. The overhead in the resource usage introduced by the performance monitoring and tuning tool itself is discussed; the author points to the areas in which additional resources are required by TUNEX. (9 refs.)

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ASSOCIATION FOR COMPUTATIONAL LINGUISTICS
ACL CONFERENCE INFORMATION

January 1990

Preparations for ACL-90 well under way; 145 papers submitted

The 28th Annual Meeting of the ACL will be held 6-9 June 1990 at the University of Pittsburgh. The physical accommodations are particularly attractive and convenient, with talks, exhibits and registration all in close proximity. Program and registration information will be mailed in late February. The Program Committee is being chaired by Bob Berwick [MIT AI Laboratory, Room 838, 545 Technology Square, Cambridge, MA 02139 USA; (+1 617) 253-8918; berwick@wheaties.ai.mit.edu]. Local Arrangements, including exhibits and demonstrations, are being handled by Rich Thomason [Intelligent Systems Program Cathedral of Learning 1004, University of Pittsburgh, Pittsburgh, PA 15260, USA; (+1 412) 624-5791; thomason@cad.cs.cmu.edu]. Tutorials are being organized by Dan Flickinger [Hewlett-Packard Research Laboratories, 1501 Page Mill Road, Palo Alto, CA 94304, USA; (+1 415) 857-8789; flickinger@hp.com].

Coling-90 in Helsinki this August; New program Structure

COLING-90, the 13th International Conference on Computational Linguistics will take place in Helsinki, Finland, 20-24 August 1990. The conference will be divided into topical papers on crucial issues in computational linguistics and brief reports with software demonstrations. A strong emphasis is placed on controversial proposals and their resolution. Equal time will be given to presenting papers and discussing them. A description of the philosophy of the Program Committee is featured in the forthcoming issue of The FINITE STRING (Volume 15, Number 4) by the Program Committee.
Chair, Hans Karlsgren [KVAL, Skepshbron 26, S-111 30
Stockholm, SWEDEN; (+46 8) 7896683; coling@qzcom.bitnet
or coling@com.qz.se]. Fred Karlsson is responsible for Local
Arrangements [Dept of General Linguistics, University of
Helsinki, Hallituskatu 11, SF-00100 Helsinki, FINLAND; (+358
0) 1911; (+358 0) 6566591; coling@finhu.bitnet]. Conference
management will be handled through Riitta Ojanen [Kaleva
Travel Agency Ltd, Congress Service, Box 312, SF-00121
Helsinki, FINLAND; (+358 0) 602711; (+358 0) 629019 fax].
Registration information should be requested directly form
Ojanen or Karlsson. Proceedings will be available through the
ACL Office after the conference.

5th European Chapter in East Germany in April 1991
The Fifth Conference of the European Chapter of the ACL
will be held 9-11 April 1991 in East Berlin. The Program and
Local Arrangements Committees will be chaired by Juergen
Kunze and Dorothee Reimann [Akademie der Wissenschaften
der DDR, Zentralinstitut fuer Sprachwissenschaft, Prenzlauer
Promenade 149-152, DDR-1100 Berlin, GERMAN
DEMOCRATIC REPUBLIC; (+37 2) 47 97 153 or 47 97 168;
telex: 114713].

Berkeley Site Selected for ACL-91
The 29th Annual Meeting of the ACL will be held 18-21
June 1991 at the University of California in Berkeley. The
Program Committee will be chaired by Doug Appelt [Artificial
Intelligence Center, SRI International, 333 Ravenswood Road,
Menlo Park, CA 94025, USA; (+415) 859-6150; appelt@ai.sri.com]. Responsibility for Local Arrangements
will be shared by Peter Norvig [Division of Computer Science,
University of California, 573 Evans Hall, Berkeley, CA 94720,
USA; (+415) 642-9533; norvig@teak.berkeley.edu] and
Bob Wilensky [Division of Computer Science, University of
California, 517 Evans Hall, Berkeley, CA 94720, USA; (+1
415) 642-7034; wilensky@teak.berkeley.edu].

3rd Applied Conference Set for April 1992 in Italy
The 3rd Conference on Applied Natural Language
Processing of the ACL will be held 1-3 April 1992 in Trento,
Italy. Oliviero Stock is Program CoChair and will be responsible
for Local Arrangements [IRST: Istituto per la Ricerca Scientifica
e Tecnologica, I-38100 Trento, Loc. Pante di Povo, ITALY;
(+39 461) 810105; stock@irst@unet.uu.net]. Lyn Bates will be
Program CoChair [BBN Systems & Technologies
Corporation, 10 Moulton Street, Cambridge, MA 02238,
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