



IEEE NEWSLETTER

KITCHENER - WATERLOO SECTION



September 1996

MEETINGS

Mark these dates on your calendar:

September 4th: Leonard Chow on Radio Astronomy and its Telescopes, Past, Present and the Near Future, University of Waterloo, Davis Centre, Room 1302, 7:30 p.m. (see page 3).

September 19th: Khaled Hassanein on Neural Networks for Speech Recognition, University of Waterloo, Davis Centre, Room 1304, 5:30 p.m. (see page 3).

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The Kitchener-Waterloo Section of the Institute of Electrical and Electronics Engineers serves all members whose mailing address is in Bruce, Grey, Perth, Waterloo or Wellington Counties.

NEW EXECUTIVE ELECTED AT THE AGM

The Annual General Meeting of the Kitchener-Waterloo Section was held on May 23rd. The slate presented by the nominating committee (chaired by Prof R.H. MacPhie) was returned unopposed. The only changes from last year's executive were: David Wang replaces Raafat Mansour as Chair, Wai-Cheung Tang becomes Vice-Chair, Raafat Mansour replaces Len Chow as chair of the Antennas and Propagation/Microwave Theory and Techniques chapter and George Freeman chairs the Student Activities at the University of Waterloo. See the left side of page 2 for a complete listing.

WINNERS OF OUR SURVEY CONTEST

Of the 33 readers who returned the survey form in our May 1996 issue, 5 lucky ones each won a prize - a copy of "Electricity, the Magic Medium". They were: Rick Kovak, Maurice Battler, Ming Yu, Fred Grossman and Dave Merchant.

The answers to the questions can be summarised as follows:

Meetings attended over three years?

0-2	28
3-5	3
>10	2

How do you know about the meetings?

Newsletter	33
(none others mentioned)	

Are you getting the newsletter regularly?

at least 3 per year	29
less	1

What type of presentations would you like at meetings?

Highly technical	11
General interest with some technical	26
General interest	1

Which day/time is convenient?

Weekday 3-5 pm	5
Weekday 5-7 pm	9
Weekday 7-9 pm	20
Saturday morning	3
Saturday evening	2

Which night of the week?

Mon 12	Tues 15	Wed 16	Thurs 16	Fri 1
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Interested in watching video rather than live presentation?

Yes 16	No 16
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Facility tours? Yes 28 No 5

These statistics, and the very thoughtful and helpful comments entered on the forms, will be considered by the section executive. Actions decided on will be reported in a later issue of this newsletter. Thanks to all who took the trouble to reply.

LEONARD CHOW ON RADIO ASTRONOMY AND ITS TELESCOPES

Time: September 4, 1996 at 7.30 pm
Place: University of Waterloo Davis Centre, Room DC 1302
Speaker: Dr. Y. Leonard Chow
Subject: Radio Astronomy and its Telescopes, Past, Present and the Near Future.

Information was received rather late for this newsletter. Hopefully you were notified by e-mail in time to plan to attend.

KHALED HASSANEIN ON NEURAL NETWORKS FOR SPEECH RECOGNITION

Time: September 19, 1996 at 5.30 pm
Place: University of Waterloo Davis Centre, Room DC 1304
Speaker: Dr. Khaled Hassanein
Subject: A Neural-Predictive Hidden Markov Model Architecture for Speech and Speaker Recognition
Dinner: Meet the speaker for dinner after the presentation if you wish. Contact Slawo Wesolkowski for details (519-884-1710 ext 5130)

Subject: A speech recognition system has been developed utilizing a Neural Predictive Hidden Markov Model (NP-HMM) architecture. Multi-layered feed-forward neural networks were employed to implement accurate non-linear speech frame prediction. A Markov chain was used to control changes in the network's weight parameters.

The speaker will introduce the problem of speech recognition, and describe the general architecture of the NP-HMM. Analysis and experiments suggest that when both nonlinear and linear prediction are jointly performed within the hidden layer of the neural network, the model is better at capturing long-term speech data correlations, consequently, improving speech recognition accuracy.

A discriminative training technique based on the maximum mutual information criterion for training this class of models will then be presented. It shows a marked improvement over the maximum likelihood non-discrimination training criterion.

The NP-HMM architecture was successfully used to implement an accurate and robust fixed-text speaker identification system.

Speaker: Dr. Hassanein is a member of Technical Staff with the advanced development group of the Recognition and Archive Department at NCR, Waterloo. He received a B.Sc. in electrical engineering from Kuwait University, and M.A.Sc. and Ph.D. degrees also in electrical engineering from the University of Toronto and the University of Waterloo respectively. His current research focus is in the areas of automated financial document processing and accurate optical character recognition. He also has research interest in the areas of electronic commerce, financial predictive models and biometrics. Dr. Hassanein has published several papers in the areas of speech recognition, speaker identification and financial document processing.

CONFERENCES IN CANADA

1996

- Sep 27 World Progress in Photonic systems in telecommunications. Ottawa. Dianne Dinsdale 613-592-9211 ext 253, e-mail: ddinsdale@trio.ca website <http://www.TRIO.ca>
- Oct 17-20 2nd IEEE Symposium on Planning and Design of Broadband Networks. Montebello, Que. Ihor Gawdan 613-763-9926, e-mail: igawdan@bnr.ca
- Oct 21-25 ICECCS 96 Second IEEE Int'l Conf on Eng. of Complex Computer Systems. Montreal. A. Stoyenko 201-596-3366, e-mail: alex@vulcan.njit.edu
- Oct 23-25 15th IEEE Symp. on Reliable Distributed Systems. Niagara-on-the-Lake. W.K. Fuchs e-mail: fuchs@crhc.uiuc.edu

1997

- Feb 23-26 1997 MTT-S International Topical Symposium on Technologies for Wireless Applications. Vancouver. Richard A. Sparks 617-862-3000, e-mail: r.sparks@ieee.org
- May 20-22 IEEE Instrumentation & Measurement Technology Conference IMTC 97. Ottawa. R. Myers 301-287-1463, e-mail: bob.myers@ieee.org
- May 25-28 1997 Canadian Conference on Electrical and Computer Engineering. St. John's Nfld. Paper deadline 97 Feb 21. R. Venkatesan 709-737-7962, e-mail: venky@engr.mun.ca
- Jun 2-6 IEEE International Conference on Multimedia Computing and Systems. Ottawa. Nicolas D. Georganas e-mail: georgana@mclab.uottawa.ca URL: <http://www.mclab.uottawa.ca/ICMCS97.html>
- Jun 8-12 ICC'97 - IEEE International Conference on Communications. Montreal. Celia Desmond 905-615-6507, e-mail: c.desmond@ieee.org
- Jun 8-12 1st IEEE Enterprise Networking Mini-Conference (ENM-97) in Conjunction with ICC'97. Montreal. Vijay Bhagavath e-mail: bhagavath@bell-labs.com
- Jun 16-19 DCSVII - 1997 IEEE Digital Cross-Connect Systems Workshop VII. Banff. Richard Hamley 613-781-7969, e-mail: hamleyrd@stentor.ca
- Jul 14-18 IEEE AP-S International Symposium and URSI Radio Science Meeting. Montreal. Stanley Kubina 514-848-3093, or G. Delisle 514-765-8202, e-mail: delisle@inrs-telecom.quebec.ca
- Jul 21-23 1997 IEEE Signal Processing Workshop on Higher Order Statistics. Banff. Keh-Shin Lii 909-787-3836, e-mail: ksl@ucrstat.ucr.edu
- Oct 6-9 OCEANS'97. Halifax. Ms. Michael Ellis 908-562-5362, e-mail: m.ellis@ieee.org
- Oct 7-10 IEEE Ultrasonics Symposium. Toronto. S. Foster e-mail: stuart@owl.sunnybrook.utoronto.ca

1998

May 4-7 1998 IEEE/IAS Industrial and Commercial Power Systems Technical Power Conference (I&CPS). Edmonton. M. Bince 403-468-6673

1999

Jul 18-22 1999 IEEE Power Engineering Society Summer Meeting. Edmonton. D. Fraser 403-448-3554

RAYTHEON CANADA WINS LARGE RADAR CONTRACT

Raytheon Canada may benefit to the tune of over \$300M (Can) from a major contract for Digital Airport Surveillance Radars (DASR) in the USA. The US Department of National Defence has placed an order with Raytheon Electronics Systems in Massachusetts worth \$20M US for three airport surveillance radars: however, this should be only the beginning. The contract could extend through 2007 and require up to 213 radars, for a total value of \$619.9M US. The schedule would call for 36 radars per year. Raytheon Canada will provide the primary radars (value about 41% of the contract) and Raytheon Cossor of UK the secondary radars. DND is acting on behalf of the US Air Force, US Navy and the Federal Airways Administration. The primary radars will be a new version of the 62 solid state radars which Raytheon Canada has sold to Canada and 11 other countries.

DAVID DILTS ON THE INTERNET AND ENGINEERING

In a lively address preceding the section AGM, Prof. David Dilts gave an overview of the impact of the Internet on engineering and commerce generally. Tens of millions of people access the Internet, for e-mail, information, advertising, commerce and just to chat.

Even if one does not have access through place of work, it is possible for a modest monthly fee to become connected to one of the "servers" in Waterloo and to communicate round the world without paying long distance charges.

e-mail is sent and received using e-mail addresses. But for browsing for the information which others have placed on the 'net you need a browser (it may be included with the server's fee). According to Prof Dilts, Gopher is "nearly dead", WAIS is "old", Mosaic follows a UNIX standard, but Netscape went ahead with its own protocol and the standards followed afterwards: "Netscape is the number one browser in the world".

The standard method of accessing a "site" is to enter its URL (universal resource locator) which is an address. For example, Prof, Dilts' home page is at <http://mansci1.uwaterloo.ca/~ddilts> However, if you don't know the URL, Open Text of Waterloo and others have a system by which you enter key words to access information. Open Text's home page is <http://www.opentext.com>

Security can be a problem. Your company owns your e-mail (why were you sending out your resume to a competitor?). The Pentagon and the Canadian Defence non-classified computers are broken into hundreds of thousands of times a year: it is claimed that classified information is on a different system and is secure. Prof. Dilts says there are no viruses on the Internet yet, "but watch out!".

STEFAN LEUE DESCRIBED SDL FOR SOFTWARE

Professor Stefan Leue gave us a fascinating outlook on software in a talk on June 6th. Software has become a major and expensive part of the telecommunications world - for example, the NorTel DMS-100 switching system contains 25 million lines of code and involved 2000 people.

Transformational software accepts a set of inputs and cranks out a set of outputs. Reactive software has an ongoing interaction with the environment. For the latter, some order has been brought into the sometimes chaotic situation by ITU international standard SDL - Specification and Description Language, which is a way of formalising the process of developing interactive software.

Prof. Leue illustrated the principles by describing a "finite state machine" such as a vending machine: it goes through various states, such as waiting for a customer, having accepted money, pouring a drink. For each state, the reaction to a stimulus may be different. The whole process can be documented in a Message Sequence Chart (MSC).

DAVE ALLAN DESCRIBED USE OF DSP IN MOTOR DRIVES

On June 27, Dave Allan of SAF Drive Systems, Kitchener gave us an account of the way Digital Signal Processing is used to control the electrodes in arc furnaces, and large electric motors in industrial processes such as paper mills, steel rolling mills, wire drawing and hoists.

The speed of an induction motor is nearly proportional to the supply frequency, so to vary its speed, AC is synthesized by solid state devices. The sophisticated controllers which SAF designs and manufactures sense the state of the process and adjust the speed accordingly.

A SAFphire system consists of rack mounted hardware modules, and software modules which analyse sensor data and calculate required motor drive currents. The DSP runs at 50 MHz.

The cost of shutting down a production line is so horrendous that the controller, like every part of the process, must be extremely reliable.

ALI ATIA OUTLINED THE MICROWAVE SYSTEMS IN SATCOMS

On July 26th, Dr. Ali Atia, president of CTA International of Rockville, Maryland, gave us the inside story on Communications Satellites.

The present generation of Satcoms are geostationary: rotating with the earth on an orbital radius of 42164.2 km, a satellite can illuminate a specific area of the ground, by means of an offset reflector and a group of feeds: the antenna is kept pointing correctly either by momentum wheels which counteract rotation of the body of the spacecraft, or by spinning part of the body. The solar cells of a typical satellite supply 8-9 kw. The useful life, 10-15 years, is limited by the supply of fuel to the station-keeping jets, which overcome perturbations of the orbit by the moon and sun. A few satellites contain simple signal processing which can redirect signals between service areas - the "switchboard in the sky". Earth stations have fixed directional antennas which point at the satellite.

A new generation of satellite systems uses many satellites in low earth orbit (LEO): an example is the Motorola Iridium system which will have 66 satellites. The advantage is the shorter distance - the earth stations can use non-directional antennas, like cellphones. A disadvantage is that traffic has to be frequently handed over from one satellite to another.

Dr. Atia described the microwave circuitry which goes in the satellites and the earth stations. Future developments include the use of higher frequencies in the 20-30 GHz Ka band, intersatellite links, scanning spot beams and of course larger space platforms.

[Notice of this event was received too late to be included in the May Newsletter - Ed.]

JOHN REEVE RETIRES WITH IEEE MEDAL

Professor John Reeve is one of the 338 University of Waterloo people who is leaving under the Special Early Retirement Program. He was a professor of electrical and computer engineering, and has been a faculty member since 1967.

The Power Engineering Society of the IEEE has awarded him the 1996 Uno Lamm HVDC Award, consisting of a medal, certificate and honorarium. He is the first Canadian to receive this award. It is named after Uno Lamm, who was chiefly responsible for the management and technical direction of the research and development in Sweden that resulted in the first practical application of HVDC transmission.

John Reeve's work in electrical power systems has been mainly involved with the control, analysis and simulation of high power electronic systems, in particular, high voltage direct current transmission. He has contributed to the planning and design of a number of HVDC projects, including the James Bay scheme that transmits power from Quebec to Boston.

Prof. Reeve has also served on many technical committees and working groups of the IEEE, and was named a Fellow in 1981.

ROBERT MACPHIE AND LEN CHOW RETIRE

Besides John Reeve, two other IEEE members are retiring from the Department of Electrical and Computer Engineering at Waterloo.

Professor Y. L. Chow obtained a degree in Engineering Physics from McGill University, and M.A. and Ph.D. from the University of Toronto. He was involved in the design of a Very Large Array for radio astronomy in Charlottesville, Virginia, and joined the University of Waterloo as an assistant professor in 1966, where he has been ever since. He holds several patents and has contributed to two books. His subjects include antennas, and software for modelling microwave integrated circuits and grounding systems. He has been Chair of the antennas and propagation/microwave theory and techniques/circuits and systems/electron devices chapter of this section for 17 years.

Professor R.H. MacPhie obtained a B.A.Sc. at the University of Toronto, and M.Sc. and Ph.D. at the University of Illinois, all in Electrical Engineering. He joined the University of Waterloo in 1963 and has been here ever since. He has been very active in administration in the Department of Electrical Engineering. He also spent some time in Charlottesville, Virginia, and in Stanford, California and Meudon and Marseille, France. He specialised in dipole antennas, arrays, radio astronomy and scattering. He is a Fellow of the IEEE.

He was Chair of this section from 1988 to 1989 and co-editor of the newsletter: he was Secretary-Treasurer of the Central Canada Council in 1989-1990.

MEGAVOLT POWER SUPPLY DEVELOPED BY JAMES CROSS

Dr. James Cross of the University of Waterloo Electrical and Computer Engineering Department has developed a compact power supply which gives out one million volts. It is claimed to be several times smaller than any other power supply of that voltage in the world. It could drive particle accelerators used to produce gamma rays in devices for detecting explosive chemicals in baggage at airports, or other applications.

The power supply uses a radically new principle - a transformer in which the secondaries are spiral tracks on printed circuit boards. Dr. Cross received funding from NSERC (Natural Sciences and Engineering Research Council) and has founded a company, ERDL, to exploit the technology. Two models will be supplied to CERN in Geneva, Switzerland.

IEEE AWARD TO TOM EAST

On May 28th at an IEEE banquet at the University of Calgary, Dr. T.W.R. East was presented with the Outstanding Service Award with medal, "in recognition of his efforts and commitments to IEEE activities". He worked on radar in World War II, came to Canada in 1951 to do weather radar research and to teach at McGill University, and worked on radar, nav aids and communications at Raytheon Canada from 1958 to his retirement in 1987. He has been a member of IEEE since 1957: he was Chair of the KW Section twice and has been Editor of the newsletter since 1985.

MASTERS DEGREE IN SOFTWARE OFFERED BY UNIVERSITY CONSORTIUM

ConGESE (Consortium for Graduate Education in Software Engineering) is a four year, part-time course offered to employees whose companies pay for the course. The course is run by a consortium of Ontario Universities: Carleton, Ottawa, Queen's, Toronto, Waterloo and Western. NorTel and IBM Canada are also members of the consortium. Lecturers from consortium members travel to sites at or near the employees' place of work to give the course. The outcome is a Master's degree in Electrical Engineering (Software Engineering).

NEWS FROM INDUSTRY

ComDev Ltd. has been awarded a contract worth nearly \$4M for fine error sensors by the Canadian Space Agency. The sensors will use solid state cameras to guide a NASA spacecraft called FUSE (Far Ultraviolet Spectroscopic Explorer).

Waterloo Company Dalsa offered shares on the Toronto Stock Exchange and raised over \$20 million for expansion and for research and development in its line of CCD light sensors used in industrial TV cameras.

Electrohome of Kitchener has signed an agreement with Texas Instruments under which it will manufacture projection displays using TI Micro-mirror chips. These devices contain thousands of individually moveable mirrors and can be used in projection displays instead of CRTs.

Open Text Corporation has acquired the technical development operations of Nirv Centre. Both bodies have been involved in Intranets - networks like the Internet but confined to a particular organization. Open Text has also signed an agreement with Hookup Communications Corp., a Canadian Internet provider in which Hookup will incorporate Open Text software in its Internet service.

RIM (Research In Motion) has received an Award of Merit from the Ontario Chamber of Commerce for business excellence and accomplishments. The company expects to double its sales and staff this year. Its main products are wireless modems for Personal Digital Assistants and PCs.

Virtek Vision has a contract to supply equipment to Lockheed Martin, the US aircraft company, for use in laying up composite material for aircraft parts. This follows two systems being supplied to Dussault Aviation in France.

Local software company Waterloo Maple has signed an agreement with the US Navy for new recruits to use Maple V, a mathematical software program. Waterloo Maple has also licensed the same program to the French Ministry of Education for use in schools.

CANADA FIRST 1996 NATIONAL ROBOTIC GAMES

The Games were held at Centennial College, Scarborough, Ontario: they were organised by Canada FIRST (For Inspiration and Recognition of Science and Technology). The initial Games in 1994 attracted entries from 9 schools, this year's from 18.

Each team was given 7 months to plan their entry; put together a Presentation Binder which included a preliminary design, a budget, a schedule and profiles of their school and their sponsor; make a verbal presentation to a panel of judges (presentations could be in English or French); and, of course, build a working robot to size, weight and other specifications.

Sponsoring companies such as CAE Electronics, Celestion, FANUC Robotics, Nortel Technologies and SPAR Aerospace provided materials, money and expert engineers to assist (but stay in the background). The KW Section of IEEE is providing financial support.

The 18 teams met at Centennial College in a friendly and lively atmosphere: their robots (which looked like miniature bulldozers) competed in tasks such as capturing balls. The overall winners were the Woburn Celestial Beings.

It is planned to hold another event in 1997 - 24 teams are expected. In addition, "two regional competitions, and competitions for post-secondary institutions are under consideration". For information, phone Canada FIRST at 416-283-3080 or e-mail canfirst@inforamp.net.

IEEE EDUCATIONAL ACTIVITIES DEPARTMENT OFFERS NEW COURSES IN POWER ELECTRONICS, CELLULAR RADIO AND MATH

The Educational Activities Department of IEEE offers the following: (prices are member prices)

Reprint Books:

Recent developments in power electronics
by Muhammad H. Rashid \$39.95 US
-topics include motion control, passive networking techniques, high speed switching devices, protecting power devices by fuse, insulated gate bipolar transistors, DC converters, AC-AC converters, ZVS and ZCS resonant converters

Cellular Radio & Personal Communications Vols. I & II
Theodore S. Rappaport \$74.95 US
-topics include propagation, modulation, channel coding, equalizing and diversity, speech coding, cellular systems, spread spectrum multiple access, simulation, adaptive arrays

Courses:

Applications of Mathematics in Electrical Engineering
Volumes I and II William J. Jamieson \$378 US
-topics include I. solving problems in circuit analysis, voltage and current requirements, filter design CAD II. statistics, stiff differentials, optimization, DSP and FFT
-each course includes textbook, study guide, diskette, final exam.

To order, phone 1-800-678-IEEE, fax 1-908-981-9667,
e-mail: customer.service@ieee.org

ICR FALL 1996 SHORT COURSES

These two day courses are free to employees of Corporate Partners and Corporate Associates of ICR, to ICR members, and to graduate students supervised by an ICR member. For all others the fee is \$500 per course plus GST.

For details contact Jean Webster 519/888-4530, fax: 519/885-1208, e-mail: jrwebste@icr.uwaterloo.ca

September 10-11: CASE tools for Requirements and Design
Joanne Atlee, Ph D, ICR Software Engineering Group

October 9-10: Programming in Java
Mariano P. Consens, Ph D, Member Centre for the New OED and Text Research

November 5-6: Cryptography and Data Security
Gordon B. Agnew, Ph D, Member, ICR Data Encryption Group
Ronald Mullin, Ph D, Member, ICR Data Encryption Group

December 2-3: Introduction to Software Reliability Engineering
Tony Savor, Ph D Candidate, Member Bell Canada Software Reliability Laboratory

THE SORCERER'S VENDING MACHINE

by Tom East

Professor Leue's presentation on SDL reminded me of a vending machine which dispensed coffee, hot chocolate etc in Raytheon Canada many years ago. It was programmed so that if you put in enough money for two or more drinks, it would serve two or more drinks without you having to keep pushing the button.

The vending company decided to give us all a Christmas gift, so on the last day of work before Christmas, their technician programmed the machine to reduce the price of a drink to zero. My colleague Gordon Smith, unaware of this bonus, went to the machine for his morning cup of hot chocolate, inserted the usual quarter, and pushed the button. A drink was served, the processor subtracted the price (zero) from 25 cents, and decided to serve another drink, then another drink, and another... Gordon called for help, and since I was slimmer than him, I was able to squeeze behind the machine and pull the plug before he drowned in hot chocolate.

Stated mathematically, 25 cents divided by zero cents equals infinity. Remember the Sorcerer's Apprentice in Disney's Fantasia?