KITCHENER-WATERLOO SECTION

May 2006

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Upcoming Events

Check http://kw.ieee.ca/activities.html for updated information.

Presentation On Reginald Fessenden
Friday 2nd June 2006, 7.30 pm*.
Luther Village Sunshine Centre, 141 Father David Bauer Drive, Waterloo

Dr. Thomas East will give a talk, followed by a short play, on the life of Reginald Fessenden. The Canadian inventor was the first person to broadcast speech and music, but he invented much more, such as microfilming, sonar, and depth sounders. He struggled to achieve recognition and rewards.

The play will represent some of the events in his life, including a re-enactment of the first broadcast in 1906.

Dr. East has a B.A. from Cambridge and a Ph.D. from McGill University, Montreal. He worked on radar in World War 2, and on weather radar at McGill. From 1958 to 1987, he was with Raytheon Canada Limited in Waterloo, working on air traffic control radar, navigational aids and telecommunications. He is co-author of "Satellite Communication Fundamentals".

*Enter at 139-141 Father David Bauer Drive and drive round the back of the main building to the Sunshine Centre. Or enter the Recreation Complex at 101 Father David Bauer Drive, park in the C-D lot and walk over the footbridge to the Sunshine Centre.

Tour of Robarts Imaging Lab
IEEE EMB event
Date: June 2nd, 2006
Time: 9:00 Am EST, Bus Stop at Davis Centre
Fee: $20
Refreshments will be served

Visit University of Western Ontario's Robarts Research Institute: One of the World Leading Institutes in the Field of Biomedical Research
The tour takes about 2 hours plus ride from U of W to UWO and back
and covers:
Lung imaging with MRI, Vascular imaging with MRI and ultrasound, Small animal imaging, Functional MRI and CT, Image guided surgery and therapy.

The number of seats is very limited and it will be first come, first served.
To book your place contact
nezam@ieee.org
IEEE-EMB society chapter – KW section

The Quantum and the Cosmos
Perimeter Institute Public lecture, June 7, 7:00pm

Long before the emergence of planets, stars, or galaxies, the universe consisted of an exploding quantum soup of "elementary" particles. Encoded in this formless, shapeless soup were seeds of cosmic structure, which over billions of years grew into the beautiful and complex universe we observe today. The lecture will explore the connection between the "inner space" of the quantum and the "outer space" of the cosmos. The inner space/outer space connection may hold the key to the nature of the dark matter holding together our galaxy and the mysterious dark energy pulling apart our universe.
http://www.perimeterinstitute.ca/activities/community/generalpublic/publiclectures.php

Tickets available May 23. See also the related article in Engineers and the World

Recent Events

Myoelectric Control of Artificial Limbs
IEEE seminar, reported by Tom East

At a presentation of the newly formed Engineering, Medical and Biology (EMB) Chapter on 18th April, Dr. Englehart of the University of New Brunswick covered the work of its Institute of Biomedical Engineering. The institute has 5 professionals, 12 staff and 20 graduate students.

The institute concentrates on sensing nerve signals picked up in the surviving part of a limb and uses them to command the powering of the prosthesis. For example, one patient is a man who lost both arms in an industrial accident. A band is placed round the stump containing 16 sensors, the signals from which are processed in a neural network to give the commands. Various pattern recognition techniques, such as Fourier transform and wavelet transform were tried, with more or less equally good results. Equally good results were obtained when the number of sensors was reduced from 16 to 8 or even 4.

One problem is that the arm and wrist may have to perform two or even three actions at the same time: for instance gripping a key and turning it in a lock.

ASIC Design Challenges
IEEE Solid State Circuit Seminar by Mr. Vincent J. Ross from ATI Technologies

Look at ASIC design challenges as experienced within ATI and touch on what part of a typical ASIC design flow is impacted by those challenges.

Similarity Matching and Semantic Based Image Retrieval
Systems, Man & Cybernetics Society Lecture by Professor Prabir Bhattacharya

Canada Research Chair Concordia University, Montreal, Quebec

The exponential growth of image data in various formats has created a compelling need for innovative tools for managing, retrieving, presenting, and analyzing information from image databases. Most applications such as digital libraries, image search engines, medical diagnostic, require effective and efficient image retrieval techniques to access the images based on their contents, commonly known as content-based image retrieval (CBIR). Early CBIR systems used low-level visual features without any semantic interpretation of images and as a result, contributed to the well known semantic-gap problem. New concepts are gaining popularity to improve image understanding and retrieval in the form of semantic image classification, adaptive similarity matching, and relevance feedback (RF). In this talk, we present common techniques and issues related to CBIR and some of our own approaches towards semantic-based image retrieval by utilizing machine learning, pattern recognition and information retrieval techniques.

Diffusive point source localization
IEEE Vehicular Technology Chapter Presentation by Professor Tan Wong
University of Florida

We will discuss about the problem of locating a diffusive point source releasing a chemical substance, based on binary observations (decisions) provided by a distributed sensor network. The inability of the sensors to go beyond a binary resolution of the concentration of the substance can be either due to communication constraints or their inherent low sensitivity. The binary sensor outputs are periodically relayed to a fusion center which uses this information to estimate the location of the source, the time of release and other relevant parameters. We motivate the use of the maximum likelihood (ML) estimator for this scenario by proving that it is consistent and asymptotically efficient, when the density of the sensors becomes infinite. We utilize two different estimation approaches, ML estimation based on all the observations (i.e., batch processing) and approximate ML estimation using only new observations and the previous estimate (i.e., real time processing). The performance of these estimators is compared with theoretical bounds and is shown to achieve excellent performance, even with a finite number of sensors.

Polynomial Equation Solver Integrated into Maplesoft
The Record

Maplesoft will integrate algorithms from a research group in France to extend Maplesoft products to improve handling of problems in robotics, cryptography, coding theory and signal processing.
http://www.maplesoft.com/company/news/html/2006-03-30-salsa.aspx

Immersive Virtual Reality in Scientific Visualization
Seminar by Andries van Dam, Professor of Computer Science, Brown University

Visualization leverages the massively parallel computer that is the human visual system, enabling users to see and understand features, patterns, trends, and anomalies in data. It is an important, but often underappreciated (and underutilized) aspect of computational

simulation. This talk focuses on the applications of visualization in Immersive Virtual Reality (IVR), particularly our four-walled 8x8 foot Cave.

The Cave provides the user with wide field of view, head-tracked stereo to create the illusion of being immersed in a data set or model, whose size can range from nanoscale to cosmic. Body-centric interaction using a variety of input devices enable a far more compelling experience of navigating and interacting with the scene than is possible on a conventional desktop display with a standard
WIMP GUI. Our scientists tell us that they see phenomena more rapidly and more clearly than had been possible before; some assert that they were able to gain new insights that they couldn't have obtained with conventional displays. We are buttressing such anecdotal evidence with controlled user studies.

I will show examples (via monoscopic video) from Brown research in several different scientific areas, including modeling of blood flow through arterial bypass grafts, exploration of the Martian polar ice cap, and biological volume rendering. Finally, I will list some of the research problems in interactive scientific visualization that are common to many of the application domains.

Nano Symposium
UW Media

Canada's Nobel Prize laureate John Polanyi is among the speakers sharing their visions of nanotechnology at the 2006 Ontario Nano Symposium to be held at UW on Friday. The all-day event seeks to build and strengthen local nanotechnology research communities, as well as spawn new collaborations, said Flora Li, one of the graduate student organizers. She added that the event will offer information about UW's new nanotechnology initiatives.

"The Ontario Nano Symposium will provide an excellent opportunity for students and researchers from across the province to present their work in the area of nanoscience and nanotechnology," said Li, who is a member of the Giga-to-Nano Electronics Laboratory at UW. "It will allow for an exchange of ideas and create an environment for collaborative work with fellow researchers."

Converged Networks of the Future
Seminar by Krishan Sabnani, Senior VP, Bell Labs.

It is widely accepted that all circuit switched networks and packet-switched networks will converge into a few networks with an IP/MPLS core. These converged networks will transport best-effort data, voice, video and their blended combinations. Processing for each access technology will be terminated in an access box such as DSLAM. Current cellular networks have complex radio access networks (RANs); these RANs will be replaced by a collection of access boxes. Base Station Router is a promising approach developed at Bell Labs for architecting such access boxes. Building the IP/MPLS cores for these converged networks poses several significant challenges. Current IP networks are best-effort, poorly managed, and not secure. For carrier-grade performance, these

cores will need to provide QoS-support, manageability, and high security. We are working on providing a unique way of building such core IP networks called softrouter. In the softrouter approach, routers are disaggregated into simple forwarding elements and control elements. This approach enables easy addition of new functions to the IP networks. In these converged networks, common application level functions such as single sign-on, personalization, global roaming, and always-on would be provided by a common layer called service enablement layer. I will discuss a unique capability called always-on, which reduces startup time for the applications to a few seconds instead of several minutes.

Funds for underwater robot research
UW media

A UW research team has received funding from the Canada Foundation for Innovation to build a laboratory to investigate underwater sampling by using robots. Christopher Clark and Patricia Nieva, professors in the department of mechanical engineering, and Bill Annable, a professor of civil engineering, are the recipients award for a project titled "Facility for the Advancement of Underwater Sampling Technology."

"This infrastructure will be vital for developing, validating and testing our planning, control, mapping and localization algorithms to enable the autonomous control of underwater robots as applied to a large number of new sensing tasks," Clark said. "It will also facilitate the design and fabrication of new MEMS (Micro-Electro-Mechanical Systems)-based sensors required for such tasks. Our students have been eagerly awaiting the arrival of this equipment so that their research can progress."

Underwater robots have traditionally been limited to oceanic research because of their large size and high cost. However, with today's level of personal computing power, intelligent robotics has become accessible to a broad range of people and applications.

Engineers and the World

Twelve Qubit Computer Demonstrated
Various

Theorists and experimentalists at the Institute for Quantum Computing (IQC) and Perimeter Institute for Theoretical Physics (PI) in Waterloo, along with MIT, Cambridge, have presented an operational control method in quantum information processing extending up to 12 qubits. The team's research is available in Physical Review Letters (PRL 96, 170501 week ending 5 May, 2006) and describes the approaches, accuracy and scalability. Despite decoherence, the researchers reached a 12-coherence state and decoded it using liquid state nuclear magnetic resonance quantum information processors.

For comparison, that medium-scale, 12-qubit computer is just "catching up to the speed of a laptop,". Once scientists are able to control more than 40 quantum bits, hold on to your hat. The quantum computer will be more powerful than today's fastest supercomputers.

Perimeter Institute Lectures Available Online

The Perimeter Institute has published video of previous presentations. This would be a way to enjoy these sessions without needing a ticket. See:
http://streamer.perimeterinstitute.ca:81/mediasite/viewer/
and click on the public lecture series on the left side to see the available lectures.

Systems Design Team Advances at Disney
The Record

A team from Systems Design combined an environmental message, technology and ideas to come up with a new ride, Bug Bash. The ideas and presentations will be shown to Disney in June as one of the finalists in the ImagiNations Design contest.

Engineering Humour

http://www.grahamnasby.com/misc/engineering_jokes.shtml

A programmer and an Engineer are sitting next to each other on a long flight from Los Angelos to New York. The Programmer leans over to the Engineer and asks if he would like to play a fun game. The Engineer just wants to take a nap, so he politely declines and rolls over to the window to catch a few winks.

The Programmer persists and explains that the game is real easy and a lotta fun. He explains, "I ask you a question, and if you don't know the answer, you pay me $5. Then you ask me a question, and if I don't know the answer, I pay you $5."

Again the Engineer politely declines and tries to get to sleep.

The Programmer, now somewhat agitated, says "Ok, if you don't know the answer, you pay me $5, and if I don't know the answer, I'll pay you $50!"

This catches the engineer's attention, and he sees no end to this torment unless he plays, so he agrees to the game. The programmer asks the first question: "What is the distance from the Earth to the moon?"

The engineer doesn't say a word, but simply reaches into his wallet, pulls out a five-dollar bill, and hands it to the programmer. Now, it's the engineer's turn. He asks the programmer, "What goes up a hill with three legs, and comes down on four?"

The programmer looks up at him with a puzzled look. He takes out his laptop computer and searches all of his references. He taps into the Airphone with the modem and searches the net and the library of Congress. Frustrated, he sends e-mail to his coworkers - all to no avail. After about an hour, he wakes the engineer and hands him $50. He politely takes the $50 and turns away to try to get back to sleep.

The programmer, more than a little miffed, shakes the engineer and asks, "Well, so what's the answer?" Without a word, the engineer reaches into his wallet, hands the programmer $5, and turns away to get back to sleep.