INSTITUTE FOR COMPUTING, INFORMATION AND COGNITIVE SYSTEMS •I•C•I•C•S•

ICICS FOCUS

THE UNIVERSITY OF BRITISH COLUMBIA

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Applying Hybrid Control Theory

Electrical engineering professor Meeko Oishi models complex hybrid systems for safety and biomedical applications.

- Aircraft Autolander
- Simplified User Interfaces
- Faulty Feedback Mechanisms in Parkinson's Disease

Most engineered systems involve both continuous and discrete processes, such as position changes and flap adjustments, respectively, in aircraft. Since the interplay between the two can be so complex, especially when a human operator is involved, detecting problems in these hybrid systems can be extremely difficult. ICICS member Meeko Oishi has developed verification techniques to identify such problems at the design stage. Her expertise in hybrid control theory has also led to collaborations with other ICICS researchers investigating biomedical problems.

Improving Pilot–Autopilot Interaction in Commercial Jet Aircraft

The constant subtle adjustments made by an airliner in the final stages of landing often make us wonder whether a human or a machine is at the controls. The answer is that both are: the pilot has control over the flaps, slats, and landing gear, and the autopilot everything else. Ideally, the

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ICICS

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ICICS Director's Corner

Over the past three months, our Planning Committee and membership have conducted a strategic planning review that will set the direction of ICICS over the next five years. I would like to thank all involved. The Strategic Plan we have produced belongs to the ICICS membership, and I look forward to your support in implementing its goals.

On another front, I am investigating various untapped funding opportunities for ICICS researchers, some of whose recent work we profile in this issue.

In our cover story, **Meeko Oishi** (ECE) brings her expertise in hybrid control theory to bear on improving aircraft safety and helping to control the symptoms of Parkinson's disease.

We rely on both visual and auditory information to converse with one another. **Eric Vatikiotis-Bateson** (Linguistics) probes the limits of this coherence in relation to human–computer interaction.

Sun Vuong (CS) explores applications of peer-to-peer networking such as watching movies on the Internet, enhancing social-networking websites, and making virtual classrooms seem more real.

Researchers in the **Laboratory for Computational Intelligence** continue to add to a long list of innovations in, for example, computer vision, machine learning, mobile robotics, human–computer interaction, and the basic principles underlying programming languages.

Finally, **Xiaodong Lu** (ME) is developing an ultrafast cutting-tool mechanism that will lead to significant improvements in precision optics manufacture.

We hope you enjoy this issue of FOCUS.

Nimal Rajapakse, ICICS Director

Applying Hybrid Control Theory: *Continued from page 1*

pilot should always know what mode the autopilot is in and how his or her actions will affect the aircraft. However, most flight-management systems are designed by addressing known problems, which can lead to "automation surprises" in which the automation behaves in ways that the pilots do not expect.

As part of her PhD work at Stanford and in subsequent research, Meeko Oishi modelled the discrete pilot inputs involved in an autolander sequence for a Boeing 777. The human inputs in a semi-autonomous system had not been modelled before, and it made sense to do so with pilots, since they're trained to enact certain procedures in certain situations. Oishi developed an algorithm that abstracts segments of the autolander sequence that, given no pilot input, are mathematically guaranteed to be safe, or within flight-envelope constraints on variables such as air speed and flight-path angle. The effect of the pilot's actions within these regions—either safe or unsafe—can then be determined.

When Oishi tested her model on Boeing's simulator, it generated two possible "flare" modes, the final stage of landing where the nose of the aircraft is pulled up. In one mode, an aborted landing initiated by the pilot was considered safe, and in the other may have led to a stall. "The whole point of verification," Oishi says, "is that these sorts of tests can elucidate problems you might not have thought to test." She is now looking at applying her verification techniques to a smart powered wheelchair being developed by ICICS/CS computer-vision specialists Jim Little and Alan Mackworth, and others.

Simplifying User Interfaces

Since a modern commercial jet aircraft is so complex, the amount of information to display for the pilot about its underlying state is problematic. "If you give a pilot too much information," Oishi points out, "it effectively becomes useless." This can lead to "mode confusion," where the pilot is unsure of the effect of his or her actions upon the system. Oishi is using her verification technique to abstract only that information regarding aircraft mode and safety that is essential for the pilot at given points in the landing sequence, which can then be used to design a simplified user interface. Safer user interfaces for other human–automation systems can also be designed using this technique.

Non-Invasive Control of Parkinson's Disease Symptoms

Certain visual cues are thought to interrupt faulty brain feedback mechanisms responsible for impaired motor skills in Parkinson's disease (PD) patients. For example, horizontal lines placed in their field of view can help PD patients walk normally who otherwise cannot. An ICICS research team led by Martin McKeown (Neurology/Pacific Parkinson's Research Centre) plans to use EEG sensors to associate abnormal brain signals with abnormal movement in PD patients, then try to control these symptoms by exposing patients to different visual cues through a wearable augmented-reality headset. If successful, this treatment should lengthen the period of time over the course of the disease in which dopamine-replacing medication is effective.

Oishi's role is to develop the control laws governing the EEG signal feedback loop that determines when to display the cues, and which are most effective. "What we're trying to do," she explains, "is design a control law to keep the user's mobility in a good range for as long as possible."

With the ever-increasing prevalence of human–automation systems, a hybrid control theorist like Meeko Oishi should never be out of work.

Meeko Oishi can be reached at 604.827.4238 or moishi@ece.ubc.ca

Quantifying Audio–Visual Coherence in Speech Production and Perception

Linguist Eric Vatikiotis-Bateson explores the correspondences between auditory and visual components of speech, with implications for human–computer interaction

- **Audio–visual coherence**
- **Animated talking head**
- **Robotic jaw**

Before coming to UBC as a Tier 1 Canada Research Chair in 2003, Eric Vatikiotis-Bateson spent 12 years at the Advanced Telecommunications Research Institute (ATR) in Japan. There he developed an elaborate animated talking head model based on motions made by the face, head, jaw, lips, and tongue in producing speech. By altering the auditory and visual components of the talking head, Vatikiotis-Bateson was able to demonstrate strong correspondences between these elements in subjects' ability to perceive speech; being able to see even a severely degraded version of the speaker's head and face aided their comprehension of degraded speech.

In humans, this "coherence" has developed through evolution. It has not yet been considered in human–computer interaction (HCI), however, and will become an issue as interfaces become more "human." Vatikiotis-Bateson is addressing this problem by using artificial devices such as the ATR talking head, a robotic jaw, and a gesturally-based speech synthesizer to quantify the range of audio–visual distortions involved in speech that humans can tolerate. "The idea," Vatikiotis-Bateson explains, "is to probe the strength of the glue that holds these things together. How far can you go in one direction before it falls apart?"

The ATR talking head is based on the motions of 300 talking subjects, and lends itself to exploring structural distortions related to age, gender, and emotion, as well as kinetic variations such as head motion. Subjects will evaluate the effect of combinations of these and audio distortions on their ability to perceive speech seeming to emanate from the head.

Vatikiotis-Bateson will conduct similar tests using a robotic jaw he developed in collaboration with ICICS colleague Sid Fels (ECE) and Fels' student, Edgar Flores. The jaw has six degrees of freedom and can achieve distortions beyond the range of human jaw motion. "As you degrade the auditory," Vatikiotis-Bateson says, "people are forced to use the visual. We know that this is true for humans, but what if it's a mechanical object that's going through the motions?" He and Fels have recently obtained a grant for an anthropomorphic face covering for the jaw that will enable exploring the effect of exaggerated facial movements on speech perception.

GRASSP (Gesturally Realized Audio, Speech, and Song Performance) is a glove-based synthesizer designed by ICICS music professor Bob Pritchard (see *FOCUS*, Fall 2007) and Fels that allows the user to generate speech or song through hand gestures. Vatikiotis-Bateson will use GRASSP to assess whether being able to see a unique source of speech and song—gesturing hands rather than the face and vocal tract—enhances listener perception. If so, future HCI systems may be able to achieve coherence through means other than those we're accustomed to.

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Sabbatical No Rest for Protocol Pioneer

Computer Science professor Son Vuong pushes Internet evolution

- **Social Networking**
- **P2P Networking**
- **Virtual Learning**

When ICICS member Son Vuong went on sabbatical last September, it was to put the finishing touches on one project that promises a home-entertainment revolution and to further expand and develop others which could have even more far-reaching and fundamental effects.

He says if he and his small team of grad students are successful, one project would allow the increasingly popular social networking sites to include "a geographic component" (meaning users will be able to just "point and click" when they want to find their friends) and another will make the so-called virtual classroom much more real.

P2P Networking

Vuong, who fled Vietnam in 1969, specialized in protocol engineering (the rules or "syntax and semantics" governing computer-to-computer communication) for his 1982 PhD from the University of Waterloo. When he joined ICICS (then the Centre for Integrated Computer Systems Research) as one of its first members in 1985, he began research that today is pointing the way to the next step in the Internet's evolution.

The server/client architecture of the original networks became and remains the dominant structure of the evolving Internet. However, in recent years there has been the realization that the excess capacity of the computers on a network can be used as the "server", a concept known as peer-to-peer (P2P) networking.

"Typically [to expand a network] people would need a very powerful server or a cluster of far more servers and that leads to scalability problems and very high costs. But with the peer-to-peer concept, the more users that come in [to the network] the more resources they bring—they're not just using the service, they're contributing to it as well," explains Vuong.

Virtual Meeting, Learning

Vuong's work with fellow ICICS members and Electrical and Computer Engineering professors Robert Donaldson and Mabo Ito and with others over the years lead to BitVampire, a P2P video streaming application that makes it just as easy to locate and access (for download or streaming) movies on the 'Net as music.

But the research that has him excited today is an extension of his P2P work to an application he calls LE Plaza and another dubbed Millennial Learning.

LE Plaza—"L for location-based, E, just like in e-commerce, and Plaza, essentially a place where you meet people"—will enhance current social networking sites such as Facebook and MySpace by adding location to the inventory of the attributes of a user's friends. With LE Plaza one of those attributes will be geographical location regularly updated, either automatically or manually, through a GPS-equipped device such as a cell phone or PDA.

Meanwhile, Millennial Learning would provide high definition, streaming video and other tools to create a distributed classroom that is much more "real" and flexible for both teacher and student than similar applications currently extant.

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The Laboratory for Computational Intelligence: Linking Perception to Action

The fourteen faculty members of the Laboratory for Computational Intelligence (LCI), an ICICS research group, work on different aspects of the perception/reasoning/action cycle characterizing intelligent agents.

- **Artificial Intelligence**
- **Computer Vision**
- **Machine Learning**

Computational intelligence (CI), more commonly known as artificial intelligence, involves studying the design of intelligent agents. The agent perceives its environment through some mode such as vision or touch (haptics), reasons about what to do, then acts, either physically or virtually. The overall goal of the LCI is to identify the constraints and define the computations that make this cycle possible, and in so doing, better understand how humans do it.

The LCI has been investigating various facets of these problems since the 1970s. Its members include ICICS and Computer Science faculty members Jim Little, Alan Mackworth, Kevin Murphy (CS/Stats), Nando de Freitas, David Poole, Kevin Leyton-Brown, Holger Hoos, David Lowe, Bob Woodham, Karon MacLean, Dinesh Pai, Cristina Conati, and Giuseppe Carenini, as well as Arnaud Doucet (CS/Stats). Their research encompasses computer vision, mobile robotics, machine learning, decision theory, empirical algorithms, haptics, adaptive user interfaces, and natural language processing, among other areas.

Advances in Computer Vision

The LCI focuses on computer vision as the perceptual mode in its CI research, and has made significant advances in this area. Jim Little devised a stereo-vision mapping system that gives a robot better depth perception and the ability to gather more data while mapping its surroundings and identifying landmarks. David Lowe developed the Scale Invariant Feature Transform (SIFT) algorithm, now widely used in computer vision. SIFT breaks up an image into many small overlapping components that are described in such a way that their "appearance" remains constant, despite variations in scaling, rotation, brightness level, etc. These invariant parts are then matched to those in a file, and the object is reassembled by classifiers and identified. AIBO, the robotic dog created by Sony, uses SIFT.

Uncertainty and Machine Learning

Machine learning techniques play a crucial role in CI systems. Nando de Freitas, Kevin Murphy, and Arnaud Doucet work in this area, which uses Bayesian inference to map out cause and effect between a large number of key variables, based on prior knowledge. As new situations are encountered, the system "learns" and updates itself. In computer vision, Jim Little says, Bayesian inference is necessary because "we can't completely describe or envision the world in any simple way, but have distributions that are possible. Machine learning gives you a way to put your assumptions about what's out there concretely into the reasoning system." Instead of telling a robot what an object specifically looks like so it can find it later, the machine-learning technique teases out what's common to a number of objects in the same category, and then uses this "fingerprint" to subsequently identify objects in that category. Machine learning enables CI systems to function in uncertain environments. It also has applications in bioinformatics, such as cancer detection.

Managing Complexity

As CI becomes more complex, understanding the system's behaviour at the level of individual algorithms becomes infeasible. To handle such complexity, Holger Hoos has developed an empirical approach where adjustments are based on observation and experiment rather than theory. The parameters involved in complex CI systems are set by running experiments, gathering statistics, and learning the right operating points. "It's like tuning a car," Little says, "testing a model of it under different conditions and making particular settings to see how it behaves." Equipped with these sets of possible solutions, the right strategies for highly complex situations can be derived.

Soccer-Playing Robots

LCI founding director Alan Mackworth is also known as the "founding father" of robotic soccer, for suggesting it as a research test-bed for multi-agent systems and building the first soccer-playing robots. He saw it as a way to ground abstract CI research in real systems involving action and the constraints of physical robots in a multi-agent environment. The idea caught on, and since 1994 the World Cup has been shadowed by RoboCup, played by virtual and physical robots in various categories—"four-legged" (e.g., AIBOs), "humanoid", etc. The goal is to have a robotic soccer team that can beat the World Cup winning team by 2050. In the meantime, RoboCup has become the primary platform for multi-agent robotics research. Search-and-rescue robots now being tested in disaster scenarios emerged from this competition.

(upper L-R): Alan Mackworth, Bob Woodham, Jim Little, Giuseppe Carenini

(lower L-R): Kevin Leyton-Brown, David Lowe, Cristina Conati

The LCI occasionally competes in RoboCup, and is heavily involved in the underlying science. Most teams, for example, operate on the basis of the constraint-based systems pioneered by Mackworth. These systems provide the constraints that the system must satisfy to solve a problem, rather than telling it how to solve it. In soccer, a constraint might be for a player to find the ball if it hasn't seen it for a specified period, or for the player with the best view of the field to suggest action to other players. The constraints change as situations change, so the system evolves. According to Little, constraint-based computing "has shown itself to be very pervasive in setting up and solving real-world problems," including scheduling of NFL games, airline flights, and equipment maintenance. In robotics, constraints can be used to specify behaviour, which will be essential as humans and robots increasingly interact. Many programming languages now use a constraint-based approach.

Smoothing Human–Computer Interaction

Giuseppe Carenini wants to make human–computer interaction more natural. He and CS/ICICS colleague Raymond Ng are using a Google Research Award to, in their version of the Google mission statement, "summarize the world's text and make it more universally accessible." Their work is distinguished by its focus on evaluative text (e.g., hotel reviews) rather than factual text (e.g., news reports); in other words, a form of knowledge extraction. The process involves extracting relevant sentences from search results, and assigning numerical values to the strength and polarity of the evaluations. The results are sorted and converted back into natural language for presentation to the user, who has specified certain search criteria. Few other systems generate natural language.

Curious George

Much of the LCI's work coalesced last summer when their robot won the Semantic Robot Vision Challenge (SRVC) held at the annual conference of the Association for the Advancement of Artificial Intelligence. Competing teams' robots were given a text list of 15 objects—including a red bell pepper, a DVD, and a banana—to search for on the Internet. They then had to locate and photograph the real objects lying on tables and chairs in a small arena. Curious George correctly identified 7 of the 15 objects by building a classification database for the objects retrieved from the Internet search, based on similarities such as shading. Explorer George Vancouver's namesake then navigated and mapped the arena with Little's stereo-vision mapping system, and used David Lowe's SIFT algorithm to locate and identify the objects.

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Re-inventing the Servo

- **Precision Optics Manufacturing**
- **Fast Tool Servos**
- **Integrated Mechatronics**

Precision and speed are often thought to be mutually exclusive. But in the manufacture of precision optics such as contact lenses, speed is an essential ingredient. Mechanical engineering professor Xiaodong Lu and his students in the Precision Mechatronics Lab are aspiring to unheard-of speeds for optics cutting tools by building a servomechanism (servo) based on an integrated mechatronics approach.

Lu was awarded the F.W. Taylor Medal in 2007 by the International Academy for Production Engineering, for realizing work of outstanding merit in his field while still under the age of 35. He won for the fast tool servo (FTS) he built at MIT, with bandwidth and acceleration capabilities far beyond those of existing servos. But Lu was just getting started.

Orchestrating Precision Tooling

Fast tool servos orchestrate the complex dynamics involved in cutting rotationally asymmetric surfaces. Symmetric surfaces such as cylinders are straightforward to manufacture. Asymmetric surfaces, on the other hand, are problematic because the cutting tool must remove different depths of material through each rotation of the work-piece. For example, the brightness-enhancing film used in flat-screen display panels consists of hundreds of micro-lenses positioned in front of each pixel. They are formed from an aluminum or copper mold cut from a sheet wrapped around a spinning drum. The diamond cutting tool moves in and out at high speeds, and slowly across the sheet, to cut individual lens molds as the drum rotates. Since each indentation is so small, roughly 100 microns across, the diamond tool tip must accelerate, make a cut, and withdraw at precisely the right times. A similar process is used to cut molds for contact lenses, except the molds are cut one at a time on the end of a much smaller spindle.

Lu's award-winning FTS achieved an acceleration of 500 g and a control bandwidth of 23 kHz, the number of cycles per second that the tool can accurately attain (1 Hertz equals 1 cycle per second). His goal now is to produce an FTS capable of 2000 g acceleration and a bandwidth of 40 kHz. Lu has attracted significant industrial sponsorship for this endeavour.

Marshalling Forces for Precision and Speed

Most FTSs are based on piezoelectric materials, which produce a small displacement with considerable force when an electrical current is applied. The process, however, generates mechanical and electrical energy losses that limit

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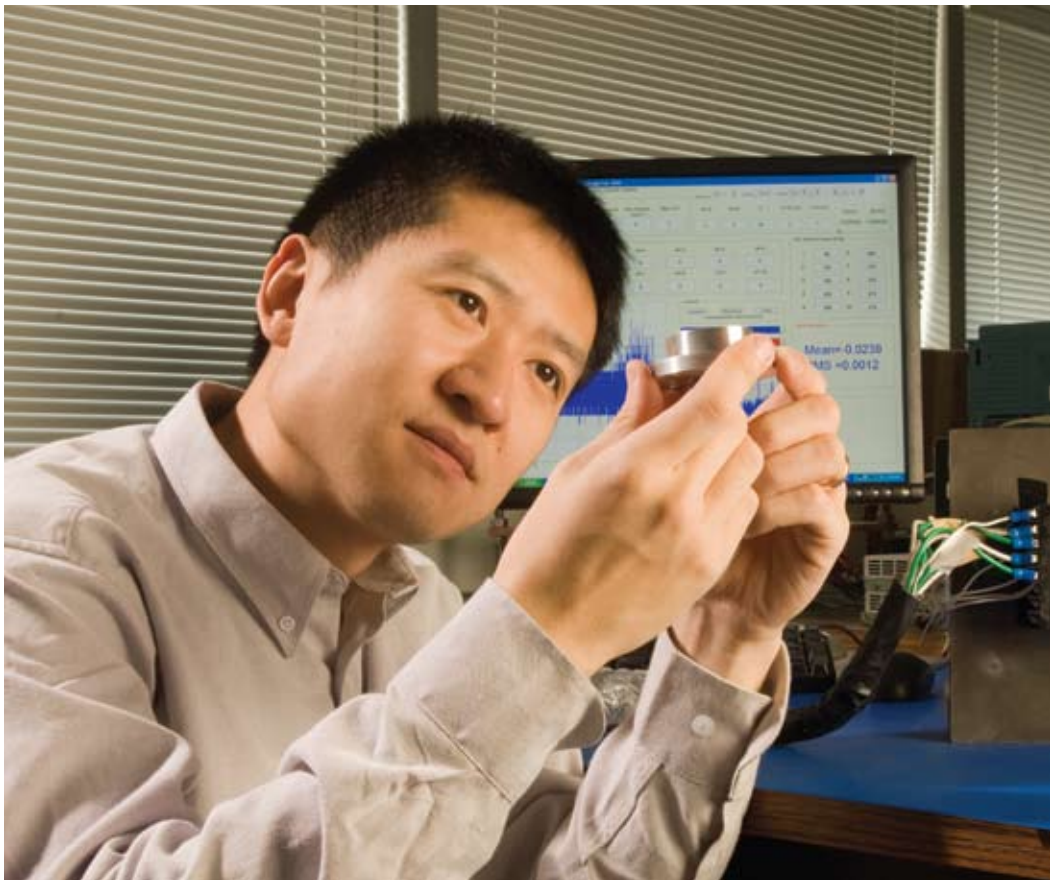
"My design is based on a completely different working principle. It's electromagnetically driven."



Quantifying Audio–Visual Coherence in Speech Production and Perception: *Continued from page 3*

When we communicate with others, we involuntarily adapt our speaking style, vocabulary, grammar, and body language to the other party. By using different tracking systems to measure motions of the face and head, and force plates to determine body sway, Vatikiotis-Bateson plans to quantify some of these adjustments for different levels of speech and song, both within and between subjects. Such measurements will provide a baseline for incorporating behavioural adjustments into human–machine interaction.

Establishing the limits of distortion for the things that help us understand one another is as important for what it says about human communication as it is for its HCI potential. In this respect, Eric Vatikiotis-Bateson bridges the humanities/technology divide in his current research.

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Sabbatical No Rest for Protocol Pioneer: *Continued from page 4*

Vuong, who will be co-chair of the prestigious ACM International Conference on Multimedia in Vancouver next October, says as excited as he is about his work, he finds the meditation that he has been doing for a quarter of a century "even more exciting."

"I find the research into the inner self is quite enjoyable. There are two sides and we need a balance between our everyday life and our spirituality.

"My research domain has gone beyond protocol engineering, which was my PhD work, and gotten more and more practical.

"I'm working on very cool technology that can have a strong impact on industry and society as a whole."

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The Laboratory for Computational Intelligence: Linking Perception to Action: *Continued from page 6*

The SRVC was designed to merge computer-vision and mobile-robotics research. Competitors published their source code afterward and participated in a one-day workshop to exchange ideas. Robots that "understand" their surroundings, rather than just the objects and scenes they've been programmed with, could have almost limitless applications, such as assistive technologies for the elderly and disabled. Little, Mackworth and colleagues are currently working on an intelligent wheelchair that uses this technology. More immediately, Internet searches based on what images actually look like, instead of the text attached to them, could provide much more accurate search results.

CI research is inherently multidisciplinary, and the LCI draws upon expertise in computer science, mechanical engineering, psychology, neuroscience, linguistics, statistics, and logic. Being part of ICICS therefore makes a lot of sense, especially since the LCI focuses more on the science than the engineering side of CI. In the Collaborative Robotics Lab, for example, Elizabeth Croft (ICICS/ME) works on robotic arms in conjunction with LCI members. Point Grey Research emerged from the LCI to become a highly successful computer-vision hardware company. As Jim Little acknowledges, "The LCI provides us with a community where we can bring a number of different perspectives to bear on problems in computational intelligence."

Laboratory for Computational Intelligence members can be reached at www.cs.ubc.ca/labs/lci

Re-inventing the Servo: *Continued from page 7*

performance. Lu knew that achieving his performance targets would require a different approach. "My design is based on a completely different working principle," he says. "It's electromagnetically driven."

By designing an electromagnetic servo in which the forces operating on components are all linear in the direction of the tool motion, Lu was able to maximize force while minimizing inertia and distortion. Lightweight materials further help minimize inertia, and a control algorithm provides feed-forward control based on the desired cutting shape. Lu's algorithm, which also processes feedback information, runs in real time on an ultra-fast computer he built. "It's like riding a bicycle," he explains. "You need to keep looking, since there's always a little bit of error you need to correct."

Lu seems to be on the right track. While conventional motors might accurately achieve accelerations of 10 g, his prototype has achieved 750 g, the highest in the literature to date. Further refinements should lead to his stated bandwidth and acceleration goals, and result in more precise and efficient optics manufacture.

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PWIAS Major Thematic Grant

The Peter Wall Institute for Advanced Studies has awarded a 3-year, $500,000 Major Thematic Grant to **Dinesh Pai** (CS), **Antony Hodgson** (ME), **Alan Mackworth** (CS), **Martin McKeown** (Neurology), J. Timothy Inglis (Human Kinetics), and John D. Steeves (International Collaboration on Repair Discoveries) for their project, "Sensorimotor Computation." The researchers will model the mechanisms in the brain responsible for our successful interaction with the physical world, for example, how the eyes and head are moved to direct gaze to objects of interest in the environment.

Industrial Research Funding for Computer Science Professor

Information visualization specialist **Tamara Munzner** (CS) has received research funding of US$50,000 from Google for her project, "Session Viewer: A Tool to Visualize and Analyze Search Session Data." Munzner's study, "Visualization of Large Network-Oriented Datasets," has also been renewed by AT&T Research, with a grant of US$50,000.

Diamond Alumni Award for CS Professor

The University of Washington has given **Gail Murphy** a Diamond Alumni Award for Early Career Achievement. This award recognizes outstanding graduates of the UW College of Engineering who have demonstrated exceptional achievement in the first ten years of their engineering career. Murphy is being recognized for her research and teaching excellence in software engineering.

ECE Head's Book on Cognitive Radio Published

Cognitive radio transceivers can adapt to dynamic radio environments and network parameters to maximize utilization of limited radio resources while providing flexibility in wireless access. *Cognitive Wireless Communication Networks*, co-edited by Ekram Hossain (University of Manitoba) and **Vijay Bhargava**, is a comprehensive look at the state-of-the-art in this emerging technology.

Best Paper Award for Sauder School of Business Researchers

A novel approach to capturing knowledge dependencies in business interactions won **Hasan Cavusoglu** (Commerce) and PhD candidate Sameh Al-Natour the best paper award at the 2007 Workshop on Information Technologies and Systems. The two researchers won for their paper, "The Knowledge Dependency Network Diagrams: A Tool for Analyzing Strategic Knowledge Dependencies for Understanding and Communicating."

Sauder School of Business Professor Wins LEO Award

Izak Benbasat (Commerce) has received the LEO Award from the Association for Information Systems. Named after "The Lyons Electronic Office," one of the first commercial computing applications, the LEO Award recognizes seminal contributions to research, theory development, and practice in Information Systems. Benbasat's Canada Research Chair in Information Technology Management has also been renewed.

ICICS Researchers Win NSERC Synergy Awards for Innovation

Mechanical Engineering professors **Martha Salcudean** and **James Olson** have won two of seven 2007 NSERC Synergy Awards for Innovation, in recognition of their outstanding industrial collaborations. Salcudean and partners Paprican, Weyerhaeuser, and Process Simulations Limited won for their modelling and simulation of recovery boilers. Olson, along with partners Advanced Fiber Technologies, Canfor, and BC Hydro, won for their high-performance pulp screens.

Best Student Paper Award

A paper co-written by Computer Science master's student Suling Yang and her supervisor **Alan Mackworth**, entitled "Hierarchical Shortest Pathfinding Applied to Route-Planning for Wheelchair Users," was given the Best Student Paper award at the Canadian Conference on Artificial Intelligence held last summer in Montreal.

New Media Initiative Grant for ICICS Team

Sidney Fels (ECE), **Robert Pritchard** (Music), and **Eric Vatikiotis-Bateson** (Linguistics) have been awarded a 3-year New Media Initiative grant comprising $499,300 from NSERC and $180,000 from the Canada Council for the Arts, for "Visual Voice: Gestural Control of Vocal Expression." The researchers will design a glove-based synthesizer that creates audio-visual speech and song by converting hand gestures to the tongue, jaw, lip, and vocal chord parameters of a 3D vocal tract model.

Former ICICS Director to Receive IEEE Signal Processing Society's Highest Award

Rabab Ward (ECE), ICICS director from 1996 to mid-2007, will receive the 2008 Society Award from the IEEE Signal Processing Society. The award honours outstanding contributions and leadership in a field within the scope of the Society, and will be presented at the IEEE International Conference on Acoustics, Speech, and Signal Processing in Las Vegas in April.

Computer Science Professor an Emerging Leader

Rachel Pottinger has been given the inaugural Denice Denton Award by The Anita Borg Institute for Women and Technology. The award, sponsored by Microsoft, recognizes researchers under the age of 35 who have demonstrated significant leadership capability and had a positive impact on the lives of women through technology. Pottinger's research focuses on management of data that are not easily handled by existing databases.

Career Recognition Award for ECE Professor

The Advanced SAR (Synthetic Aperture Radar) Workshop is organized biennially by the Canadian Space Agency. At the 2007 Workshop, held in Vancouver and sponsored by the CSA and MacDonald Dettwiler, **Ian Cumming** was honoured with a Career Recognition Award for signicant achievements in the area of SAR signal processing and for training a generation of SAR specialists.

Passing Notes:

NSERC Strategic Project Funding Grants Awarded

Sidney Fels (ECE), **Rafeef Abugharbieh** (ECE), **Dinesh Pai** (CS), **Robert Bridson** (CS) and **Eric Vatikiotis-Bateson** (Linguistics) have been granted $606,700 to create a complete computer model of the human mouth, pharynx, and larynx. The 3-year project involves collaborations with other specialists from UBC, University of California, Centre National de la Recherche Scientifique, Harvard Medical School, and support from Zak Technologies, McKesson Medical Image Group, Restore Medical, Northern Digital Inc, Haskins Laboratory, Brock Univ., the National Institutes of Disease and Stroke (USA), John Hopkins Univ., Widener Univ., Waseda Univ., and the Japan Advanced Institute for Science and Technology.

ECE professors **Lukas Chrostowski**, **Nick Jaeger**, and **David Pulfrey**, along with David Plant of McGill University, have been awarded $595,700 over three years for their project "High-speed Transistor-VCSELs for Optical Communications." Supported by PMC Sierra, Crosslight, and Versawave, the researchers aim to develop a new low-cost, high-performance semi-conductor laser-transmitter technology for use in optical communications.

Electrical engineers **Robert Schober** and **Lutz Lampe**, along with co-investigators Steve Hranilovic (McMaster) and Frank Kschischang (U of T), have won a 3-year, $542,919 grant to investigate "Free-Space Optical (FSO) Communication System Design." FSO communication is a line-of-sight technology that uses light to provide optical bandwidth connections up to 1.25 Gigabits per second for voice, video, and data communication. Supporting partners include Bell Canada, fSONA Systems Corp., Plaintree Systems Inc., COM DEV, Rogers Cable Communications Inc., Nortel Government Solutions, Novax Industries Corp., the Canadian Space Agency, and Nanowave Technologies Inc.

Robert Schober (ECE) is a co-investigator on the project "Intelligent Transceiver Design for IMO-OFDM Systems," awarded to Chintha Tellambura of the University of Alberta. The goal of this project, with a 3-year budget of $588,000 supported by Bell Canada and Sierra Wireless, is to develop intelligent signal-processing techniques for next-generation cooperative wireless networks. Schober's Canada Research Chair in Wireless Communications has also been renewed.

Certain proliferative diseases, such as diabetic retinopathy, prevent systemic drugs from entering targeted tissue. **Mu Chiao** (ME), Helen Burt (Pharmaceutical Sciences), **Shahriar Mirabbasi** (ME), and **Robert Rohling** (ECE/ME) have been awarded $348,070 over three years to develop a microelectro-mechanical (MEMS) based device that controls drug release and improves cellular uptake. Their research is support by Vancouver-based QLT Inc.

NSERC Special Research Opportunity Grant

Clarence de Silva (ME) has received a Special Research Opportunity grant of $234,000 from NSERC to carry out research on multi-robot cooperation in the Multidisciplinary University Research Initiative of the United States Department of Defense (DoD). Through separate DoD funding, de Silva will also collaborate with prominent researchers from Harvard, Duke, Purdue, and Penn State universities on "Engineering of Sensor Network Structure for Dependable Fusion." Professor de Silva will receive an honorary Doctor of Engineering degree from the University of Waterloo this spring in recognition of his pioneering contributions to the fields of control, robotics, automation and mechatronics.

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