$\overbrace{2005/2006}^{\text{Computer Science at the U of C}}$



Computer Science

Today and Tomorrow



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Message from the Head

CPSC 2005/2006

The Department of Computer Science has been extremely active over the 2005/2006 academic years with many exciting new outcomes to report. As you review this document you will see a brief snapshot of our professorial faculty members research activities and a wide range of graduate students projects described. The reporting period includes the activities of over 200 graduate students, reflects the education of over 900 undegraduate students, and represents an enormous amount of work by our support staff including both administrative and technical. This year has also seen the first turn around in the short-term decrease in our undergraduate numbers and we look forward to our numbers returning to levels that will challenge our ability to accomodate all of the many qualified applicants. The Department experienced the first year in a decade where it did not grow substantially but that does not mean we remained static. In fact, several new initiative were begun including recruiting a new iCORE Security Chair, the establishment of at least four new research chairs, and closer relationships with various industrial partners. All of this combines to provide strong indicators that the research intensity in the Department has continued to increase this year as it has over the past few years.

The Department has identified four focus areas and most of the faculty and research groups fit within them. These areas are: Quantum Information Systems, Software Engineering, Distributed Systems and Algorithms, and Visual and Interactive Computing. However, there are also a few individuals that work in areas unrelated to these foci and many work in more than one area or find ways to make these foci truly interdisciplinary. The Department has now begun a review of these focus areas and is actively planning an expansion of these foci to reflect the new excellence developing now.

Unfortunately, any report such as this must be summative in nature so as you read through the activities of the various faculty members, please keep in mind that this is only a subset of the full breadth of our activities. Given the summative nature of the report I would encourage you to contact any of the faculty members about topics related to their areas of interest. I am confident that they will be very interested in establishing new collaborations and sharing their excitement over their research activities.

Ken Barker

Computer Science at the University of Calgary



CPSC 2005/2006

About CPSC

The Department of Computer Science continues to grow and flourish at the University of Calgary. Our fulltime academic staff grew to 45 with the addition of Dr. Zongpeng Li. We provide a stimulating environment for our approximately 150 doctoral and masters graduate students. The faculty, staff and students all strive to make Computer Science at the University of Calgary a great place to work and study.

Research Focus

The University of Calgary is committed in advancing its role as a research university. Computer Science has earned a reputation for high quality research and as new The Department of Computer Science at the University of Calgary cordially invites you to attend its First Annual Symposium

> Computer Science Today and Tomorrow: Collaboration Opportunities for Industry and the University

> > Monday, November 21, 2005 8:00 a.m. – 1:00 p.m. Rozsa Centre

More Information: http://www.cpsc.ucalgary.ca/FutureDay2005 Map: http://www.ucalgary.ca/map/map_big.html

RSVP required by November 14, 2005 rsvp@cpsc.ucalgary.ca or 220-5454

faculty join our department, more and more international collaborations are being forged, placing us among the best worldwide. Our faculty is excited about their research projects, many of which are inter-disciplinary, bringing computer science to fields such as medicine, biology, art and kinesiology.

In 2005/2006, Computer Science held its first annual Symposium Future Day entitled "Computer Science, Today and Tomorrow". This was an opportunity for senior individuals from industry to meet and chat with our faculty about the breath of IT research at the UC, how that research impacts industry and working together on future projects.

Noteworthy

Dr. Jon Rokne has been elevated to the grade of Senior Member of the IEEE - Approximately 7.3% of the 361,000 members have achieved this grade.

Dr. Peter Hoyer and **Dr. John Watrous** received substantial grants again for this academic year from The Canadian Institute for Advanced Research (CIAR) for their research as Scholars in the Quantum Information Processing Program.

Dr. Sheelagh Carpendale and **Donna Fremont** have been awarded funding from the Learning Commons Inquiry Learning Action Group for their Inquiry and Blended Learning Course Proposals Application.

Dr. Denilson Barbosa received an IBM New Faculty Award.

Dr. Sheelagh Carpendale received the Faculty of Science award for Research Excellence.

Ms Pauline Jepp received the Fred A McKinnon award for teaching excellence.

Ms. Stacey Scott received the John Kendall Doctoral Thesis Award for her PhD Dissertation.

Dr. Michael Williams became the President of the IEEE Computer Society.



Research Support

CPSC 2005/2006

Funding research remains an ongoing challenge and although the funding levels have remained relatively stable from industry and the University of Calgary, government grants continue to provide the bulk of these essential funds. A very large one time government grant of \$9M in 2003/2004 was removed from this graph so the funding trends could be highlighted. The challenge posed by decreased funding from government indicated by the decline in 2005/2006 is of greater concern. Although operational grants from NSERC decreased countrywide, the Department's research funding has remained relatively stable over the last three years. Increased competition for government grants and proportionally decreasing government dollars will continue to challenge us into the foreseeable future.

Source	2002/2003	2003/2004	2004/2005	2005/2006
Government	\$3,679,905	\$2,829,522	\$2,800,792	\$2,653,169
Industry	\$343,819	\$237,569	\$474,408	\$428,172
Univ. of Calgary	\$150,000	\$155,715	\$280,963	\$132,274
Total	\$4,173,724	\$3,222,806	\$3,556,163	\$3,213,615





Graduate Students Scholarships

Name

Award

Thamer Albourae, MSc Fabricio Anastacio, MSc Russel Apu, PhD Naimul Basher, MSc Pankaj Bhawnani, MSc Sean Boyden, MSc John Brosz, PhD

Ian Burleigh, PhD Xiaozhen (Jean) Cao, PhD Sonny Chan, MSc Erwin de Groot, PhD Angela Duta, PhD Kathryn Elliot, MSc Gustav Gutoski, PhD

Emir Halepovic, PhD

Mark Hancock, PhD Andreas Hirt, PhD Namrata Khemka, MSc Taisya Krivoruchko, MSc Anthony Lo, PhD

Alok Madhukar, MSc Aniket Mahanti, MSc Jeffrey Mahovsky, PhD

Christopher Mann, MSc

Kingdom of Saudi Arabia Ministry of Higher Education Scholarship iCORE International iCORE International iCORE International iCORE International Province of Alberta Graduate Scholarship NSERC PGS D & iCORE & Dean's Entrance Scholarship

NSERC PGS D & iCORE

TR Labs

NSERC PGS M & iCORE

iCORE International

iCORE International

Alberta Ingenuity & iCORE

NSERC PGS D & iCORE & Dean's Entrance Scholarship

NSERC CGS D & iCORE & Dean's Entrance Scholarship

NSERC PGS D & iCORE & Alberta Ingenuity

NSERC CGS D & iCORE & Alberta Ingenuity

Province of Alberta Graduate Fellowship

iCORE International

NSERC PGS D & ICORE & Dean's Entrance Scholarship

TR Labs

NSERC PGS M & iCORE

University of Calgary Silver Anniversary Graduate Fellowship

NSERC Industrial



Graduate Students Scholarships continued

CPSC 2005/2006

Name

Grigori Melnik, PhD

Fatima Mohammed Farag, PhD Petra Neumann, PhD Carman Neustaedter, PhD Michael Nunes, MSc Luke Olsen, MSc Marcin Pilat, PhD

Mohammad Rahman, PhD Shantha Ramachandran, PhD William Rosgen, PhD Adam Runions, MSc M. Omolade Saliu, PhD Reginald Sawilla, MSc Ryan Schmidt, MSc Stephanie Smale, MSc Richard Smith, PhD Julie Stromer, MSc Shui-Chun Charlotte Tang, PhD Kimberly Tee, MSc Edward Tse, PhD Ajumobi Udechukwu, PhD Ullah, M Irfan, PhD Mark Velichka, MSc Ryan Vogt, PhD

Torre Zuk, PhD

Award

Izaak Walton Killam Memorial Scholarship & iCORE Egyptian Government Scholarship Alberta Ingenuity & iCORE Alberta Ingenuity & iCORE NSERC PGS M & iCORE NSERC CGS M & iCORE NSERC CGS D & iCORE & Province of Alberta Graduate Fellowship Province of Alberta Graduate Fellowship NSERC PGS M& iCORE NSERC PGS D & iCORE NSERC PGS M & iCORE iCORE International NSERC CGS D & iCORE NSERC PGS M & iCORE NSERC PGS M & iCORE NSERC PGS D & iCORE Province of Alberta Graduate Fellowship Alberta Ingenuity & iCORE NSERC PGS M & iCORE & Alberta Ingenuity NSERC PGS D & iCORE & Alberta Ingenuity NSERC CGS D & iCORE Government of Pakistan Scholarship NSERC CGS M & iCORE NSERC CGS M & iCORE NSERC Industrial



MSc and PhD Final Oral Examinations

CPSC 2005/2006

Name	Degree	Thesis	Supervísor
Andreotti, Julie	MSc	Simulating the Spectral and Intensity Characteristics of the Aurora	Jon Rokne
Apu, Russel	MSc	Adaptive Mesh Generation for Terrain Modeling and other Applications	Marina Gavrilova
Ashraf, Fatima	MSc	Clustex: Using Clustering Techniques for Information Extraction from HTML Pages Containing Semi-Structured Data	Reda Alhajj
Bateman, Lani	MSc	A Novel Psychoacoustic Approach to Speaker Recognition	Jim Parker
Boyle, Michael John	PhD	Privacy in Video Media Spaces	Saul Greenberg
Brosz, John David Lynn	MSc	Terrain Modeling by Example Sam	1avati/Costa Sousa
Burleigh, Ian George	MSc	An Agent-Based Model of the Lac Operon	Christian Jacob
Carroll, Seamus Thomas	MSc	Cooperative Control of Multiple Airborn Agents: A GIS-Centered Approach	Denzinger/Boyd
Chau, Thomas Sheung Yan	MSc	Inter-Team Learning for Agile Software Process	es Frank Maurer
Curry, Roger John	MSc	Sequential Performance of PDES Algorithms	Brian Unger
Du, Gengshen	MSc	Design and Realization of an Explanation Component for Software Release Planning	Guenther Ruhe
Duong, Ai Quoc	MSc	Gaze Tracking: A Sclera Recognition Approach	Jim Parker
Foraie, Trevor Raymond	MSc	Course-Based Program	Frank Maurer
Foster, Kevin Graham	MSc	Gaze Tracking: A Sclera Recognition Approach	Wyvill/Costa Sousa
Fuhrer, Martin Hans	MSc	Hairs, Textures, and Shades: <i>Pr</i> Improving the Realism of Plant Models Genera	<i>usinkiewicz/Wyvill</i> ted with L-Systems
Galbraith, Callum Fergus	PhD	Modeling Natural Phenomena with Implicit Surfaces	Brian Wyvill
Gaurav, Abhishek	MSc	Coallocation of Computer and Storage Resources in Grid Environments	Rob Simmonds
Gutoski, Gustav Michael	MSc	Short Quantum Games	John Watrous
Heard, Jason Peter	MSc	Detecting Broken Social Commitments: An Implementation and Investigation	Rob Kremer
Horrian, Hossein	MSc	Course-Based Program	Guenther Ruhe
Jain, Gaurav	MSc	Security Aspects of Mobile IP	Michael Jacobson
Kendrick, Nathan James B	MSc	Human Observation and Computer Analysis of Human Running Gaits	Jeff Boyd
Khemka, Namrata	MSc	Comparing Particle Swarms and Evolution Strategies: Benchmarks and Application	Christian Jacob



MSc and PhD Final Oral Examinations continued

CPSC 2005/2006

Name	Degree	Thesis	Supervísor
Kiddle, Cameron, Charles E	PhD	Scalable Network Emulation	Brian Unger
Lo, Anthony	MSc	Virex: Powerful Visual Tool for Simple and User-friendly Querying of Relational Databto Produce XML Documents	Reda Alhajj
Luttmer, Kristopher Henry	MSc	The Complexity of Separability Testing	John Watrous
Mahovsky, Jeffrey Adam	PhD	Ray Tracing with Reduced-Precision Bounding Volume Hierarchies	Brian Wyvill
Mann, Christopher R	MSc	An Exploratory Longitudinal Case Study of Agile Methods in a Small Software Company	Frank Maurer
Mirtchovski, Andrey Andreev	MSc	Grid Computing With Plan 9 – An Alternative Solution For Grid Computing	Rob Simmonds
Osborn, Wendy Kathleen	PhD	The 2Dr-Tree: A 2-Dimensional Spatial Access Method	Ken Barker
Pakdel-Sefidgar, Hamid-Reza	MSc	Incremental Subdivision Fe	aramarz Samavati
Read, Kristopher David	MSc	Supporting Agile Teams of Teams via Test Driven Design	Frank Maurer
Scott, Stacey Dawn	PhD	Territoriality in Collaborative Shared Share	eelagh Carpendale
Smith, Colin	MSc	On Vertex-Vertex Systems and Their Use in Geometric and Biological Modelling	Prusinkiewicz
Taleb, Hala Ahmad	MSc	A TCP Toolkit for Network Simulation and Emulation	Brian Unger
Tang, Anthony Hoi Tin	MSc	Embodiments in Mixed Presence Groupware	Saul Greenberg
Taylor-Hell, Julia Faye	MSc	Biomechanics in Botanical Trees	Prusinkiewicz
Tse, Edward Hiatt	MSc	The Single Display Groupware Toolkit	Saul Greenberg
Viggers, Kevin	MSc	Improving the Modularity of Context-Sensitive Concerns Through the Use of Declarative Event	<i>Rob Walker</i> Patterns
Wang, Harry	MSc	Computational Geometry Methods in Fingerprint Identification	Marina Gavrilova
Werbicki, Paul	MSc	Developing Applications with Multiple Programming Languages – An Investigation Usi	<i>Rob Kremer</i> ing C++ and Java
Wilson, Kelly David	MSc	Automatic Generation of Network Servers	John Aycock
Wong, Yat Fung Nelson	MSc	Edgelens: An Interactive Technique for Sha Mitigating Edge Congestion in Graphs	eelagh Carpendale
Wormsbecker, Ian	MSc	Channel Selection Strategies for Multi-Channel Mac Protocols in Wireless Ad-H	<i>Carey Williamson</i> oc Networks
Yu, Bo	MSc	Inference Protection Through Query Translation	n Ken Barker

Research Personnel



Post Doctoral Fellows

Hofstra, Peter Isenberg, Tobias

Mhalla, Medhi Roehrig, Hein Rolland-Lagan, Anne-Gaelle Uzoka, Michael

Researcher

Arlitt, Martin Bauld, Eric Bowes, Jeff Cossette, Brad Curry, Roger Federl, Pavol Fox, Mark Garth, Victor Gauray, Abishek Goodlad, David Houtzager, Gwen Karwowski, Radek Kiddle, Cameron Lane, Brendan Mirtchovski, Andrey Ngo The, An Noumen, Etienne Simmonds, Robert Spiers, Greg Sun, Hongxia Wong, Nelson Wu, Qian Wu, Yujing

Theoretical Computer Science (Cockett) Applying non-photorealistic rendering to information visualization (Carpendale) Theoretical Computer Science (Watrous & Hoyer) Theoretical Computer Science (Watrous & Hoyer) Biological Modeling and Visualization (Prusinkiewicz) Large Scale Systems Management (Barker).

Area of research/Lab

Wireless Networks/Williamson/Unger *Decision support/Ruhe* Databases/Barker *Decision support/Ruhe* Grid Research Centre/Unger/Simmonds **Biological Modeling/Prusinkiewicz** Grid Research Centre/Unger/Simmonds Databases/Barker Grid Research Centre/Unger/Simmonds Decision support/Ruhe Wireless Networks/Williamson **Biological Modeling/Prusinkiewicz** Grid Research Centre/Unger/Simmonds Biological Modeling/Prusinkiewicz Grid Research Centre/Unger/Simmonds *Decision support/Ruhe* Databases/Barker Grid Research Centre/Unger *Decision support/Ruhe* Wireless Networks/Williamson Human Computer Interaction/Greenberg Wireless Networks/Williamson Wireless Networks/Williamson



Research Personnel continued

Graduate students

Adewale, Idowu Agyemang, Malik Aikema, David Albourae, Thamer Al-Emran, Ahmed Apu, Russel Bajwa, Harpreet Becerra, Gabriel Bhattacharya, Priyadarshi Bhawnani, Pankaj Boyden, Sean Boyle, Michael Brosz, John Cao, Jean Cherlin, Joseph Chu, Nelson Cieslak, Mikolaj deGraaf, Rennie DeGroot, Erwin Diaz-Marino, Rob Du, Gengshen (Kelly) Elahi, Tanvire Fanea, Elena Fuhrer, Martin Gao, Jie Gaurav, Abishek Gavinsky, Dmitry Gerhardt, Heath Gong, Mingwei Guo, Xiuzhan Gutoski, Gus Hancock, Mark

Heard, Jason Holmes, Reid Jain, Gaurav Jepp, Pauline Joevenazzo, Jill Kamaluddeen, Nuha Keijser, Jeroen Kidney, Jordan Leighton, Gregory Li, Jingzhou Li, Zhizhong Liu, Lawrence Luo, Yuan Luttmer, Kristopher Madhukar, Alok Mahmud, Shafquat Markatchev, Nayden Mason, Kaye McElroy, James McEwan, Gregor McIntyre, Mark Melnik, Grigori Mohamed, Abdallah Mohamed Farag, Fatima Morgan, Robert Neumann, Petra Olsen, Luke Omotayo, Adesola Parvez, Nadim Pattison, Eric Rahman, Rashed Ramchandran, Shantha

Rashid, Jibran Rawal, Bhavya Rizk, Philip Saliu, Omolade Sekhon, Ravdeep Severn, Aaron Shu, Xueling Siadat, Jamal Smith, Colin Taerum, Torin Tat, Annie Trinh, Quang Ullah, Irfan Viggers, Kevin Wang, Chengfeng Wang, Ye Wecker, Larkin Wong, Nelson Wormsbecker, Ian Zannier, Carmen Zhang, Hongchao Zhang, Yonghua (Michael) Zheng, Wei Wei



CPSC 2005/2006

Undergraduate students and their supervisors

Aleksic, Darko (Parker) Bauld, Eric (Ruhe) Bergman, Karel (Jacob) Chang, Joseph (Walker) Chen, Hung-Li (Costa Sousa) Cossette, Bradley (Ruhe) Dunsmore, Devlin (*Ruhe*) Echtner, Martin (Ruhe) Erman, Jeffrey (Mahanti) Fraser, Kurtis (Kremer) Friess, Nathan (Aycock) Gavinski, Alyssa (Jacob) Goodlad, David (Ruhe) Hedgeland, Ian (Walker) Jefferies, James (Maurer) Jensen, April (Gavrilova)

Kendon, Tyson (Denzinger) Lapides, Paul (Sharlin) Lees Miller, John (Jacobson) Morgan, Robert (Maurer) Nguyen, Diana (Scheidler) Novakowski, Scott (Jacob) Runions, Adam (Prusinkiewcz) Sessini, Phillipa (Mahanti) Smith, Andrew (Barbosa) Sorenson, Nathan (Samavati) Spiers, Gregory (*Ruhe*) Stagg, Andrew (Parker) Tao, Jin (Barbosa) Tsang, Kenny (Ruhe) Xin, Min (Sharlin) Zhang, John (*Rokne*)

Vísitors

In 2005/2006 we welcomed several longer term visitors to our Department. Some are visiting professors on sabbatical from their home university while others are students who have come to Calgary to work with the faculty in Computer Science.

Johnen, Collette	LRI, Universite de Paris, Sud, France
Kawash, Jalal	American University of Sharjah, UAE
Flores Mendez, Roberto	Christopher Newport University, Virginia, USA
Schlesier, Lothar	University of Magdeburg, Germany
Michel, Oliver	L'Univeriste d'Evry, France
Palme, Elia	University of Fribourg, Switzerland
Terreaux, Patrick	University of Fribourg, Switzerland
Sujir, Leila	Concordia University, Montreal
Miede, Andre	University of Magdeburg, Germany
Richter, Michael	University of Kaiserslautern, Germany
Erdogmus, Hakan	NRC Institute for Information Technology, Ottawa, Canada
Spalek, Robert	Dutch Centre for Mathematics and Computer Science, The Netherlands
Girgin, Sertan	Middle East Technical University, Ankara, Turkey
Schmidt, Gabrielle	University of Kaiserslautern, Germany
Da Silva, Altigran Soares	Universidade Federal do Amazonas Manaus, AM, Brazil.



Semínars

CPSC 2005/2006

Computer Science throughout the year encourages and supports information sharing by hosting seminars presented by individuals within the department and by invited speakers.

Dístinguísh Lectures

Dr. Reihaneh Safavi-Naini	Fingerprinting and Tracing for digital Objects
Paul C. Van Oorschot	Internet Security: Where Are We?

Invited Speakers

Ron Minnich	How to manage 1024 node and larger clusters that boot in 90 seconds_with one disk
T. Radhakrishnan	Interoperability and Usability as Two Problems in Clinical Information Systems
Sudhir Mudur	Functionality Distribution using Graphics Clusters
Yoshifumi Kitamura	Challenges of 3D Computer-Human Interactions at Osaka University Human Interface Engineering Lab
Bill Buxton	Sketching and Experience Design
Eelke Folmer	Software Architecture Analysis of Usability
Shantenu Jha	Computing Free Energies in Biomolecular Systems using First Generation Scientific HPC Grid Applications
Mark Fiala	Computer Vision for Augmented Reality - the ARTag system
Murray Woodside	The Use of Optimal Filters to Track Parameters of Performance Models
Matthew Prince	How to SPAM, make millions and never get caught.
Susan Stepney	The UK Grand Challenge in Non-Classical Computing.
Frank Tompa	Looking back at the Oxford English Dictionary project through the eyes of XML and the Web.



Graduate Semínars

Ian Burleigh	Vigo:3D A Swarm Simulation Tool	CPSC 2005/2006
Rennie deGraaf	Improved Port Knocking With Strong Authentication	
Michael Zhang	Automatic Object Tracking	
Tansel Ozyer	Iterative Clustering by Combining Multi-Objective Optimization with Weighted K-Means and Validity Analysis	
Kathryn Elliot	Time, Ownership and Awareness: The Value of Contextual Locations in the Home	
Anthony Lo	VIREX: Powerful Visual Tool for Simple and User-friendly Querying of Relational Databases to Produce XML Documer	nts
Namrata Khemka	Comparing Particle Swarms and Evolution Strategies: Benchmarks and Application	
Dany Gebara	Image Retrieval using Wavelet-Based Indexing	
Ian Wormsbecker	Channel Selection Strategies for Multi-Channel MAC Protocols in Wireless	
Joseph Cherlin	Sketch Based Modeling	
Malik Agyemang	Mining Outliers from Non-Numeric Data Repositories	
AJ Udechukwu	Reduced-Parameter Pattern Mining	
Harpreet Bajwa	Testing Process for Portal Applications	
Young Lee	Face Detection and Recognition using PCA and LDA	
Fatima Ashraf	ClusTex: Using Clustering Techniques for Information Extra	ction
Abhishek Gaurav	CoAllocation of Compute and Storage Resources in Grid Env	vironments
Chris Mann	A Case Study on the Impact of Scrum	
Lawrence Liu	An Environment for Collaborative Iteration Planning	
Jason Heard	Detecting Broken Social Commitments	
Reid Holmes	Using Structural Context to Recommend Source Code Exam	ples
Ryan Schmidt	Interactive shape modeling with the BlobTree	
Gaurav Jain	Mobile IP & Its Security Issues	
Alok Madhukar	Peer to Peer (P2P) Traffic Classification	

Art Exhibits

C. Jacob, G. Hushlak, S. Novakowski SwarmArt, Sound & i-dogs Nickle Arts Museum, University of Calgary Nov. 19, 2005 - Feb. 5, 2006

Workshops and Conferences

Rob Kremer Christian Jacob Ken Barker Carey Williamson Jim Parker Knowledge Capture (KCap 05) Intl. Conference on Artificial Immune Systems (ICARIS05) Canadian Heads Meeting 2005 ACM SIGMETRICS 2005 Imagine Network 2006

REDA ALHAJJ, Professor

Research Interests:

Selected publícatíons 2005/2006: Reda's primary research is focused on object-oriented databases, data integration and re-engineering, data mining, multiagent systems, character recognition, bio-data mining and analysis.

• A. Lo, R. Alhajj and K. Barker. "VIREX: Visual Relational to XML Conversion Tool". Journal of Visual Languages and



Computing, Vol. 17, No. 1, pp.25-45, February 2006.

- E. Korkmaz, J. Du, R. Alhajj and K. Barker. "Combining Advantages of New Chromosome Representation Scheme and Multi-Objective Genetic Algorithms for Better Clustering". Intelligent Data Analysis, Vol. 10, No. 2, 2006.
- M. Kaya and R. Alhajj. "Utilizing Genetic Algorithms to Optimize Membership Functions for Fuzzy Weighted Association Rules Mining". Applied Intelligence, Vol. 24, No. 1, 2006.
- O. Baykal, R. Alhajj and F. Polat. "Automated Product Recommendation by Employing Case-Based Reasoning Agents". International Journal of Experimental and Theoretical Artificial Intelligence, Vol. 17, No. 3, pp. 201-220, 2005.
- R. Alhajj and A. Elnagar. "Multi-Agents to Separating Handwritten Connected Digits". IEEE Transactions on Systems, Man, and Cybernetics-A, Vol. 35, No. 5, pp. 593-602, 2005.
- M. Kaya and R. Alhajj. "Efficient Mining of Fuzzy Association Rules". Fuzzy Sets and Systems, Vol. 152, No. 3, pp. 587-601, 2005.
- Malik, K. Barker and R. Alhajj. "Web Outlier Mining: Discovering outliers from web databases". Intelligent Data Analysis, Vol. 9, No. 5, pp. 416-429, 2005.

Project:

Graduate Students:

• Data mining, Biocomputing and Bioinformatics, XML and Data Re-engineering.

Michael Hanna, MSc – Natural Language Interface to Databases.

Muhaimenul Adnan, MSc – Incremental Mining.

Jeff Chang, MSc – Association-Rules Mining.

Keivan Kian Mehr, MSc – Bio data Mining.

Anthony Lo, PhD – XML Databases. Tansel Ozyer, PhD – Clustering. Jia Zeng, PhD – Bio data Analysis.

Sajib Barua, PhD – Spatial Mining.

Furat Fawzi, MSc – Fuzzy XML. Dany Gebara, MSc – Image Mining.

Ming Zhang, PhD – Online Mining. http://www.cpsc.ucalgavy.ca/~alhajj

JOHN AYCOCK, Assistant Professor

ResearchJohn has been researching computer viruses, worms and other malicious software for severalInterests:years, and is now looking at spam and spyware too. These are huge problems in our computer-
dependent society, and it is vital that future threats are identified and countered.

One reason for lapses in computer security is program error. John also looks at software tools and programming languages which make the programming task easier and less error-prone.

Selected publications 2005/2006:

Project:

Graduate

Students:

- R. deGraaf, J. Aycock and M. Jacobson Jr. "Better port knocking with strong authentication". ACSAC 2005, pp. 409-418.
 - N. Friess, R. Vogt and J. Aycock. "Timing is everything". Computers & Security 24,8 (November 2005), pp. 599-603.
 - K. Wilson and J. Aycock. "NEST: Network server tool". 11th Asia-Pacific Conference on Communications, 2005, pp. 1107-1111.
 - A. Hirt and J. Aycock. "Anonymous and malicious". 15th Annual Virus Bulletin Conference, 2005, pp. 2-8.
 - J. Aycock and K. Barker. "Viruses 101". ACM SIGCSE 2005, pp. 152-156.
- SPARK, a toolkit for implementing domain-specific languages in Python.

Randal Acton, PhD – AI and multi-agent systems in information security (co-super-visor J. Denzinger).



Rennie de Graaf, MSc – Applied Network Security (co-supervisor M. Jacobson). Margaret Nielsen, MSc – Beauty and aesthetics of computer programs. Ryan Vogt, MSc – Sandboxing for computer security (co-supervisor M. Jacobson).

http://pages.cpsc.ucalgary.ca/~aycock/

Research Interests:

Selected

publications

2005/2006:

DENILSON BARBOSA, Assistant Professor

Denilson is interested in all aspects of databases and the Web, particularly the management of semistructured data and XML. XML has become the standard format for encoding and exchanging data on the Web, and is becoming increasingly popular as underlying format for standard office applications, such as text-editors and spreadsheets. As a result, there is an increasing need for efficient XML data management techniques.

Denilson has also been working on autonomous data management, which aims at developing database systems that can improve their performance over time. In particular, he has been working on benchmarking autonomic tools and developing learning-based techniques for improving the efficacy of such tools.

- Denilson Barbosa, Laurent Mignet and Pierangelo Veltri. "Studying the XML Web: Gathering Statistics from an XML Sample". World Wide Web 8(4), pp. 413-438. Springer Business + Media, 2005.
 - Denilson Barbosa, Juliana Freire and Alberto O. Mendelzon. "Designing Information-preserving Mapping Schemes for XML". In Proceedings of the 31st International Conference on Very Large Databases, pp. 109-120. Tondheim, Norway, August 30 – September 2, 2005.



• Mariano Consens, Denilson Barbosa, Adrian Teisanu and Laurent Mignet. "Goals and Benchmarks for Autonomic Configuration Recommenders". In Proceedings of the 2005 ACM SIG-MOD International Conference on Management of Data, pp. 239-250. Baltimore, Maryland, USA, June 13-16, 2005.

Projects:
 • XML Data Management for Web Services, NSERC.
 • Autonomic Data Management.
 • ToXgene, a declarative generator of synthetic XML data.

Graduate
Gregory Leighton, PhD – XML Data Management.

http://pages.cpsc.ucalgary.ca/~denilson/

KEN BARKER, Professor and Head

Research Interests:	Ken's research interests are quite wide-ranging under the general umbrella of database systems. Much of recent work has focused on various applications of data mining but contributions have also been made to areas of health informatics, mobile data management, XML repositories, data design, data integration, data security, and bioinformatics. He is now beginning a project aimed at created a privacy-preserving database management system.
Selected publications 2005/2006:	 Camorlinga, S. and K. Barker, "A Complex Adaptive System Based on Squirrel Behaviors for Distributed Resource Allocation", Journal of Web Intelligence and Agent Systems, IOS Press Publishers, Volume 4, Number 1, March 2006, pp 1-23. Omotayo, A., M.A. Hammad, and K. Barker. Ef- ficient Data Harvesting for Tracing Phenomena in Sensor Networks. in Proceedings of the 18th International Conference on Scientific and Statisti- cal Database Management (SSDBM). 2006. Vienna, Austria. Rahman, R.M., K. Baker and R. Alhajj, Replica Placement in Data Grid: A Multi-objective Ap- proach, Proc. of International Conf. on Grid and Cooperative Computing, Springer-Verlag LNCS, Beijing, China, Nov. 2005.
Project:	• PP-DBMS, XML Data Design, Mobile Cache Management, Emergent Computing, and Data Mining.
Graduate Students:	 Malik Agyemang, PhD – Outliner Mining. Yuliang Bao, MSc – Data Mining. Steven Choy, MSc – XML Data Modeling. Nelson Chu, PhD – Tuple Space in Grids. Anguo Dong, MSc – Data Mining (co-supervisor C. Sensen). Angela Duta, PhD – XML, data security and privacy. Jeroen Keijser, MSc – Presence in virtual Reality (co-supervisor S. Carpendale). Adesola Omotayo, PhD – Data management. Rashed Rahman, PhD – Efficient algorithms in Data Grids. George Shi, PhD – Ontology based Geospatial Information Retrieval and Extraction. Julie Stromer, MSc – Interfaces for next generation bioinformatics (co-supervisor C. Sensen). Quang Trinh, PhD – Database Systems, BioInformatics, and Semantic Web. Ajumobi O. Udechukwu, PhD – Data Mining. Adepele Williams, PhD – Concept hierarchies in data mining.

http://pages.cpsc.ucalgary.ca/~barker/



Research Interests: Jeffrey's research is in the area of computer vision, focusing on the analysis of motion. Much of his work has been in the area of biometric recognition of people by their gait. He co-authored an early paper that described a method that could identify individual people by looking at temporal patterns in the descriptions of walking figures. As worldwide interest in biometrics grows, Jeffrey is refining techniques in an effort to build machine systems that emulate the way humans interpret the motion they see. Jeffrey also does work on multi-media information systems that extract descriptions of dynamic scenes from video cameras, and build models of the scene for archival, transmission, and display for remote viewers. These systems combine low-level video processing algorithms with XML documents exchanged over a network to build elaborate systems for multimedia

surveillance. Applications of the work include multimedia network broadcoast of sporting events, surveillance for traffic and security, and interactive art.

JEFFREY BOYD, Associate Professor

Selected publications 2005/2006:	 •M. Y. Zhang, L. Olsen, J. Boyd, "Subjective trajectory characterization: acquisition, matching, and retrieval", SPIE Internet Imaging VII, San Jose, CA, January, 2006. •S. Carroll, J. E. Boyd and J. Denzinger, "Data-centered control of cooperating UAVs: flying airplanes with a multimedia database", Proc. of UVS Canada 2005, Banff, Canada, November, 2005.
Projecty:	 Human motion analysis: the development of a machine vision systems that evaluate human athletic performance by emulating the way humans interpret the motion of athletes. Tracking Systems for Multimedia Sports Broadcast: Systems that extract object trajectories of humans and other moving objects from video sequences. The extracted information is used to build dynamic scene models that we can archive, transmit over a network and display. One significant application we are developing is tracking hockey players in order to analyze their motion for coaching purposes, or for broadcast to viewers.
Graduate Students:	 Seamus Carroll, MSc – Cooperative aerial surveillance (co-supervisor J. Denzinger). Jill Joevenazzo, MSc – Gait perception using passive dynamic walkers. Nathan Kendrick, MSc – Machine visdion analysis of athletic performace in runners. Quoc Nguyen, MSc – Computer Vision. Michael Zhang, MSc – Pixel tracking in video with applications to sports.

http://pages.cpsc.ucalgary.ca/~boyd/

SHEELAGH CARPENDALE, Associate Professor & Canada Research Chair in Information Visualization

Research Interests:	As a researcher in information visualization methodologies, Sheelagh explores different ways of making the invisible visible, and develops new interaction methods to support people actively exploring and manipulating information spaces. The goal is to promote comprehension by creating effective visual tools. Creating visualizations poses problems both in terms of developing appropriate information representations and presenting those representations in a manner that is meaningful to the user. While her research has concentrated on the second point, presentation issues, Sheelagh includes sufficient representational research in order to ground her work in real data, real tasks and real users.
Selected publications 2005/2006:	 Scott, S.D., Carpendale, M.S.T., Habelski, S. (2005) Storage Bins: Mobile Storage for Collaborative Tabletop Displays. IEEE Journal of Computer Graphics & Applications, Special Issue on Large Displays, 25(4), p 58-65. Fanea, E., Carpendale, S., Isenberg, T. (2005) An Interactive 3D Integration of Parallel Coordinates and Star Glyphs. Proc. IEEE Symposium on Information Visualization, InfoVis'05, p 149-156.
Projects:	 Elastic presentation. Collocated collaboration. Interactions on large displays. Visualizing human dialogues. Visualizing uncertainty in data.
Graduate Students:	 Elena Fanea, MSc – Visualizing multi-dimensional data. Mark Hancock, PhD – Collaborative tabletop interfaces. Jeroen Keijser, MSc – Presence in virtual Reality (co-supervisor K. Barker). Kaye Mason, PhD – Modelling with rendering primitives. Petra Neumann, PhD – Information visualization. Eric Pattison, MSc – Semantic zooming. Charlotte Tang, PhD – Asynchronous, Collocated Collaboration (co-supervisor S. Greenberg). Stacey Scott, PhD – Territoriality on tabletop displays (co-supervisor K. Inkpen). Annie Tat, MSc – Visualizing Human Dialog. Nelson Wong, MSc – EdgeLens: Interacting with large graphs. Torre Zuk, PhD – Visualizing uncertainty in data.

http://innovis.cpsc.ucalgary.ca

ROBIN COCKETT, Professor

Research Interests:

Selected

Projects:

publication

2005/2006:

Dr. Cockett and his students use categorical proof theory to understand program semantics and to design programming languages with special formal properties. For example; How can one design a concurrent programming language which cannot deadlock or livelock? Using the proof theory of linear logic it is actually possible to provide such a system, however, this is far from the end of the story. There remains practical issues: How complex is the required semantic checking (type checking, linearity constrains etc.); What is the operational semantics of such a language (e.g. abstract machines, interface with operating system etc.); How expressive is such a language (useability and theoretical expressive power), etc.

"A language for Multiplicative-additive Linear Logic" (with Craig Pastro) In proc. of the 10th Conference on Category Theory in Computer Science (CTCS 2004) editor Lars Birkedal. Electronic Lecture Notes in Computer Science, Elsevier, Vol 122 (pages 23-65) Appeared in 2005.

- Channel based concurrency (with C. Pastro and L. Santocanale).
- Classical restriction categories (with Ernie Manes and X. Guo).
- Computability and realizability theory for restriction categories (with P. Hofstra and X. Guo).
- Smooth and differential categories (with R. Blute and R. Seely).



- Program transformation tools for datatypes (with V. Vene).
- Flow graph optimization for compilers (with M. Burrell).

• Type checking for termination and uniqueness in the CHARITY programming language (with D. Harrington).

Graduate
Studenty:Brett Giles, MSc – A compiler and run time environment for a Quantum Programming
Language.Xiuzhan Guo, PhD – Foundations of computability and restriction categories.Dana Harrington, PhD – Theoretical foundations for a type system which permits memory
reuse optimizations in declarative languages.Keith Rogers, MSc – A circular proof system, and its underlying catergory theory.

http://pages.cpsc.ucalgary.ca/~robin

MARIO COSTA SOUSA, Assistant Professor

Research Interests: Mario's research interests are scientific and medical visualization, computer graphics and animation techniques. He performs research in non-photorealistic rendering (NPR), illustrative visualization, 3D modeling and volumetric display software.

Selected publications 2005/2006: Foster, K., Jepp, P., Wyvill, B., Sousa, M.C., Galbraith, C. and Jorge, J. A., "Pen-and-Ink for BlobTree Implicit Models", Computer Graphics Forum (Proc. of Eurographics '05), 24(3): 267-276, 2005.

• Cherlin, J., Samavati, F., Sousa, M.C. and Jorge, J., "Sketch-based Modeling with Few

Strokes", Proc. of the ACM SIGGRAPH/ Eurographics 21st Spring Conference on Computer Graphics (SCCG '05), 132-140.

Project:

• Research and development of NPR methods for 3D model construction/analysis, natural media simulation, rendering techniques and systems for computer-generated illustrative visualization and composition in two main contexts: (1) Traditional illustration, by providing tools to help scientific and medical illustrators with the complexities of their work, preserving their style and adapting to their preferred ways of thinking and working; (2) Scientific analysis and visualization, by mainly providing novel ways on visualizing scientific data, physical phenomena, simulations, etc., and by presenting abstractions to users in ways that reconcile expressiveness and ease-of-use.



ways that reconcile expressiveness and ease-of-use.
 Graduate Students:
 Fabricio Anastacio, MSc – Sketch-based Modeling and Rendering of Plants (co-supervisor P. Prusinkiewicz).
 John Brosz, MSc – Multiresolution Terrain Modeling and Rendering (co-supervisor F. Samavati).
 Meru Brunn, MSc – Modeling and Rendering Artistic Lines by Example (co-supervisor F. Samavati).
 Joseph Cherlin, MSc – Sketch-based modeling with few strokes (co-supervisor F. Samavati).
 Kevin Foster, MSc – Precise Ink Illustrations of 3D Polygonal Models (co-supervisor B. Wyvill).
 Pauline Jepp, PhD – Interactive Sculpting Using Implicit Methods(co-supervisor F. Samavati).

http://pages.cpsc.ucalgary.ca/~mario/



Research Interests:

Faculty

JÖRG DENZINGER, Associate Professor

Jörg's research is in the areas of Artificial Intelligence and Multi-Agent Systems. One of his main interests is learning cooperative behaviour of agents. This encompasses developing appropriate agent architectures, basic learning and evaluation methods for behaviour (from the perspective of an individual, perhaps selfish, agent and of a team), specialized adaptation methods and methods to model other agents. The application areas he is interested in range from computer games to finding security problems in systems. His second major research topic is distributed, knowledge-based search. This deals with developing cooperation concepts so that several computers can work together on problems such as scheduling, theorem proving, optimizing processes or searching the Internet.



Selected publications 2005/2006:	 Denzinger, J. and Ruhe, G. "Decision Support for Software Release Planning Using e-Assistants." Journal of Decision Systems 13(4), Lavoisier, 2004, pp. 399-421. Denzinger, J. and Kidney, J. "Teaching Multi-Agent Systems using the ARES Simulator." Italics e-journal ,Volume 4 Issue 3, October 2005.
Projects:	 Cooperative Data Mining for Health Care Applications. Improving Agent Communication by Taxonomy-based Learning. Cooperative Search with Global and Agent-specific Goals. Intelligent Agents in Commercial Computer Games. Evolving Attack Teams to Test and Improve Computer Security.
Graduate Students:	 Randal Acton, PhD – AI & multi-agent systems in information security (co-supervisor J. Aycock). Seamus Carroll, MSc – Cooperative control for multiple airborne agents (co-supervisor J. Boyd). Joseph Chang, MSc – AI-methods in the re-use of software (co-supervisor R. Walker). Al Fedoruk, PhD – Development of a framework for cooperative search. Jie Gao, PhD – Cooperative data mining methods in health care data. Jordan Kidney, PhD – Cooperative behavior to test complex software systems. Shelly Park, MSc – Capturing verbal documentation in Agile planning (co-supervisor F. Maurer). Keith Randall, MSc – Learning techniques to solve difficult (NP-hard) optimization problems.

http://pages.cpsc.ucalgary.ca/~denzinge/

WAYNE EBERLY, Professor and Associate Head, Undergraduate Affairs

Research Interests: Wayne's research concerns the design and analysis of algorithms for problems in computer algebra. Randomized algorithms, and algorithms for computations over finite fields have been the focus of much of Wayne's recent work. This research generally attempts to analyze and improve algorithms for fundamental computational problems, such as the solution of systems of linear equations. Since fundamental problems are studied, potential applications of this work are diverse.

Wayne's work is also informed by experimental work and the evidence about the performance of various heuristics in realistic applications that such work can provide. In particular, Wayne's recent work attempts to explain the behaviour of heuristics that have recently been used to solve

large sparse systems of equations that are formed when the "Number Field Sieve" algorithm is used for integer factorization. His analytical work can (and has) provide explanations for poorly understood phenomena reported in the experimental literature, as well as modifications of algorithms in order to deal with infrequent failure conditions that experimental work might miss.

• B. Hovinen and W. Eberly. A Reliable Block Lonczos Algorithm over small finite fields. Proceedings of ISSAC 2005, pp. 177-184.

 Analysis of Block Lanczos and Block Wiedemann Algorithms: An analysis and improvements of heuristics that are currently used to solve large, sparse systems of equations in number-theoretic applications (including modern integer factorization algorithms), resulting in randomized algorithms that are both efficient and provably reliable in all cases.



 Decomposition of Matrix Algebras: Efficient and reliable algorithms for use by mathematicians in their experimental work to investigate properties of groups, rings, and similar structures. Several of the algorithms proposed to date have been implemented in the computer algebra systems Magma and GAP and are now in use.

Wei Wei Zheng, PhD – Design and analysis of algorithms for large sparse matrix computations. Student:

http://www.cpsc.ucalgary.ca/~eberly

Selected publication 2005/2006:

Projects:

Graduate

Research Interests:

Selected publications 2005/2006: MARINA GAVRILOVA, Associate Professor

Marina's research is on applications of geometric algorithms to biometrics, GIS, image processing and computer modeling. Related issues such as data representation, numerical stability, optimization and efficient analysis of models are of interest. Specific areas where the developed methodologies are applied include mechanical and biological systems, terrain visualization, GIS (geographical information systems) and synthesis of biometric data.

• S. Bertazzon and M. Gavrilova. (2005) Book Chapter "Multivariate Spatial Analysis in Epidemiology:



An Integrated Approach to Human Health and the Environment", in the Book "GIS for Sustainable Development", Chapter 22, 35 pages, CRC Press, Editor (Dr. Michele Campagna, Università degli Studi di Cagliari, Italy.

- M. Gavrilova, Guest Editor, International Journal of Computational Geometry and Applications 2005, IJCGA Journal, Vol 15 Number 2, Guest Editor Special Issue: Selected Papers from the 3rd International Workshop on Computational Geometry and Applications CGA'03, 156 pages, April 2005, World Scientific.
- O. Gevrasi, M. Gavrilova, V. Kumar, Y. Mun and K. Tan. Lecture Notes in Computer Science Book of Proceedings, Springer-Verlag, in four volumes, LNCS 3480, 3481, 3482, 3483, refereed submissions to International Conference on Computational Science and Its Applications 2005, Singapore, May 2005.
- R. Apu and M. Gavrilova. "Modeling Realistic Inflation and Deflation Effects on Closed 3D Geometric Mesh for Computer Animation", Computer Graphics and CAD/CAM (CGACC), ISBN 1817-3489, International Scientific Publishers, 2006. (invited)

Projects:

- GIS data models and techniques.
- Computational Science.
- Biometric Technologies.

Graduate
Students:Russel Apu, PhD – Adaptive memory subdivision for strategic motion planning and navigation.
Priyadarshi Bhattacharyja, MSc – Risk Analysis of Ship Routes using Topological Information.
Yuan Luo, MSc – Non-photorealistic Rendering Approach for Modeling the Process of Aging.
Chengfeng Wang, MSc – Topology-based Approach to Fingerprint Recognition and Synthesis.
Lakin Wecker, MSc – Multi-resolution approach to iris synthesis (co-supervisor F. Samavati).

www.cpsc.ucalgary.ca/~marina

SAUL GREENBERG, Professor & Associate Head, Graduate Affairs

Research Interests:

Saul is an active researcher in Human Computer Interaction, a sub-area of Computer Science concerned with methods and principles on how to design computer interfaces so that people can interact effectively with them. He specializes in computer supported cooperative work, where he investigates how people work together, how the computer and related technologies (groupware) affect group behaviour, and how software can be designed to support and



augment group work. He also investigates context-aware computing, where computers can be crafted to fit within their environment in a way that encourages natural interaction.

Selected publications 2005/2006:	•Boyle, M. and Greenberg, S. (2005) The Language of Privacy: Learning from Video Media Space Analysis and Design. ACM Transactions on Computer-Human Interaction (TOCHI). 12(2), June, 328-370, ACM Press.
	•Elliot, K., Neustaedter, C. and Greenberg, S. (2005) Time, Ownership and Awareness: The Value of Contextual Locations in the Home. In Beigl, M., Intille, S., Rekimoto, J. and Tokuda, H. (Eds) UBICOMP 2005: Ubiquitous Computing (Proceedings of the 7 th International Conference on Ubiquitous Computing, Sept 11-14, Tokyo, Japan), LNCS 3660, pp. 251-268, Springer.
Project:	•NSERC Research Network – Network for Effective Collaboration Technologies through Advanced Research.
Graduate Students:	Roberto Diaz-Marino , MSc – Toolkit using the DiamondTouch multi-user multi-touch tabletop surface.
	Kathryn Elliot , MSc – Displaying communication information in the home using ambient displays.
	Gregor McEwan, MSc – The Community Bar: A system promoting casual interaction.
	Carman Neustaedter, PhD – Interpersonal awareness within domestic settings.
	Michael Nunes, MSc – Computer Supported Cooperative Work.
	Stephanie Smale, MSc – Groupware.
	Kimberley Tee, MSc – Informal Awareness and casual interaction.
	Edward Tse, PhD – SDGToolkit.

http://www.cpsc.ucalgary.ca/~saul

Research Interests:

Selected

Projects:

publication

2005/2006:

Moustafa's current research interests lie in the area of Database Systems. Specifically, his work focuses on proposing, building, and evaluating database technologies for non-traditional data types. The following are some of the research avenues that he is currently exploring. (1) Stream Data Systems: Specifically, query processing and storage management of applications that receive endless amounts of data (data streams). Such applications include sensor-based environments, earth sciences, real time business processing, object's tracking, and network monitoring. (2)

Multimedia Databases: Specifically, video modeling, access control, buffer management, and video query processing. (3) Spatio-temporal Databases: Specifically, designing efficient index structures and querying moving objects. (4) Architecture-aware database design: Specifically, the efficient utilization of the underlying hardware in the database design such as memory systems (e.g., caches) and the multi-threaded CPU pipelines, while designing database components.

MOUSTAFA HAMMAD, Assistant Professor

 Moustafa A. Hammad, Walid G. Aref and Ahmed K. Elmagarmid. "Optimizing In-Order Execution of Continuous Queries over Streamed Sensor Data". In Proceedings of the 17th International Conference on Scientific and Statistical Database Management (SSDBM), Santa Barbara, California, USA, June 2005.

- A Scalable Data Management Framework for Streaming Data Sources.
 - SeMag: A Sensor Data Management System.
 - Development of Lidar-aided Mono-plotting & true Ortho-Photo Generation.

Graduate **Fatima M. Farag**, PhD – Database Management Systems. Student:





LISA HIGHAM, Associate Professor

Research Interests: Lisa's research concerns the design and analysis of distributed algorithms. One specific research interest is fault tolerance. Current systems consist of many processors and other components and hence are increasing likely to fail in some way as their size and interconnection complexity grows. So robust algorithms that can withstand or recover from various faults are required. For example, a self-stabilizing distributed system can recover from an arbitrary transient fault without external intervention or re-initialization, and eventually resume correct behaviour.

Another research interest is memory consistency. Multiprocessors employ a variety of buffering, caching, and communication techniques that enhance speed but can result in unexpected computations. We developed a framework for precisely defining the memory behaviour of multiprocessor systems, and now use this framework to compare multi-processor machines, design efficient programs for them, and to port programs between them.



Selected publications 2005/2006:	 L. Higham and J. Kawash. Tight Bounds for Critical Sections in Processor Consistent Platforms. IEEE Transactions on Parallel and Distributed Systems Volume 17(10) pages 1072- 1083. October 2006. L.Higham, L. Jackson and J. Kawash. Specifying Memory Consistency of Write Buffer Multiprocessors. In press: ACM Transactions on Computer Systems. 42 pages. L. Higham and L. Jackson. Translating Between Itanium and Sparc Memory Consistency Models. 18th ACM Symposium on Parallelism in Algorithms and Architectures, pages 170- 179. ACM Press. July 2006.
Projects:	Itanium Memory Consistency.Models for Self-stabilization.
Graduate Students:	 LillAnne Jackson, PhD – Porting between machines with different memory consistency guarantees. Nuha Kamaluddeen, MSc – The design of obstruction-free distributed algorithms.

www.cpsc.ucalgary.ca/~higham

Research Interests: PETER HÖYER, Assistant Professor

Peter Höyer is interested in theoretical aspects of computer science and in the relationship between physics and computer science. His research is mainly on algorithms, data structures, and complexity theory, with a focus on algorithms for quantum computers. A quantum computer is a computational device that is based on quantum physics as opposed to being based on bits as a traditional computer. His research goal is characterizing problems that can be solved efficiently with the being of eventum me

the help of quantum mechanics. Problems that on the surface seem very complex, yet contain an internal well-behaved structure, are particularly well-suited for being solved on quantum computers. His research methodologies are theoretical and aims at a fundamental understanding. His research is part of an effort to say what it means to compute something on a very basic level.

•H. Buhrman, Ch. Dürr,

M. Heiligman, P. Höyer,

F. Magniez, M. Santha and R. de Wolf. "Quan-



tum algorithms for element distinctness". SIAM Journal on Computing, 34(6), pp. 1324-1330, 2005.
P. Höyer and R. Spalek. "Quantum circuits with unbounded fan-out". Theory of Computing, 1, pp. 81-103, 2005.

Project:

Selected

publications

2005/2006:

• Develop new quantum algorithms, understand their relationship with classical algorithms, and prove lower bounds.

GraduateJop Briet, MSc – Physics and Astronony (co-supervisor D. Feder).Students:Michael Garrett, MSc – Physics and Astronomy (co-supervisor D. Feder).Hongchao Zhang, MSc – Quantum lower bounds.

www.cpsc.ucalgary.ca/~hoyer

CHRISTIAN JACOB, Associate Professor (Joint appointment with the Department of Biochemistry & Molecular Biology, Faculty of Medicine)

Research Interests:

Christian's Evolutionary & Swarm Design Group (www.swarm-design.org) is building agent-based simulations of mostly biological systems for different levels of granularity, from vehicular and pedestrian traffic simulations to the modelling of army ant raids. In collaboration with our colleagues in the Faculty of Medicine, we focus



on 3-dimensional agent-based models of biomolecular systems, such as gene regulatory networks, bacterial chemotaxis, immune system reactions, and blood clotting. These mathematical and computer models open new opportunities for biological and life sciences, bioinformatics and computational biology research in order to understand systems with massively parallel interactions and their emergent properties.

Christian also collaborates with Prof. Jerry Hushlak from the Department of Art to investigate the use of evolutionary swarm intelligence systems to build virtual "swarm sculptures" (www.swarmart.com) and interactive computer installations that illustrate principles of emergence in Art & Science.

Selected	• Jacob, C., Pilat, M., Bentley, P., and Timmis, J., ICARIS 2005 - 4th International Conference on
publications	Artificial Immune Systems, Springer Verlag, 2005.
2005/2006:	• Jacob, C., and Burleigh, I., Genetic Programming inside a Cell, in: T. Yu, R. Riolo, and
	B. Worzel (eds), Genetic Programming Theory and Practice III, Springer Verlag, 2006.
	• Khemka, N., Jacob, C., and Cole, G. (2005), Making Soccer Kicks Better: A Study in Particle
	Swarm Optimization and Evolution Strategies, IEEE Congress on Evo-lutionary Computation
	(CEC 2005), Edinburgh, U.K., IEEE Press.
	• von Mammen, S., Jacob, C., and Kokai, G. (2005), Evolving Swarms that Build 3D Structures,
	EEE Congress on Evolutionary Computation (CEC 2005), Edinburgh, U.K., IEEE Press.
Graduate	Ian Burleigh, PhD – Agent-based computing in musical theory.
Students:	Namrata Khemka, PhD – Evolutionary Optimization for Biosimulations.
	Navneet Bhalla, PhD – Self-assembly and Emergent Design.
	Marcin Pilat, PhD – Evolution and coevolution of morphologies.
	Lance Hanlen, MSc – Evolutionary Games.
	Paul Nuytten, MSc – Agent-based Neural Network Modeling.
	Sebastian von Mammen, PhD – Swarm-based Development and Evolution.

http://www.cpsc.ucalgary.ca/~jacob

Research Interests: MICHAEL JACOBSON, JR., Assistant Professor

Mike's main areas of research are cryptography (data security) and computational number theory. In particular, he is involved in investigating the suitability of certain number-theoretic structures and problems as bases for public-key cryotosystems, enabling applications such as secure key-exchange and digital signatures. The efficiency of such cryptosystems is tested by implementing the best-known algorithms and devising improvements. The security is tested by developing sequential and distributed algorithms for solving the underlying number-theoretic problem.



Selected publications 2005/2006:	 A. Hirt, M.J. Jacobson, Jr. and C. Williamson. A practical buses protocol for anonymous internet communication, Proceedings of the Third Annual Conference on Privacy, Security, and Trust (PST 2005), St. Andrews, New Brunswick, 2005, pp. 233-236. R. deGraaf, J. Aycock and M.J. Jacobson, Jr. Port knocking with strong authentication, Proceedings of the 21st Annual Computer Security Applications Conference (ACSAC 2005), Tucson, Arizona, IEEE Computer Society, 2005, pp. 409-418.
Projects:	 Improving the efficiency of public-key cryptographic protocols based on elliptic curves and low-genus hyperelliptic curves. Investigating the security of cryptosystems based on arithmetic in number fields and function fields. Improving index-calculus algorithms for computing class groups and discrete logarithms in class groups of quadratic number and function fields. Developing new, improved algorithms for unconditional class group and regulator computation in quadratic fields, and for various computations related to algebraic number theory.
Graduate Students:	 Wai Fong Chan, MSc – Efficient point multiplication on Koblitz curves. Rennie de Graaf, MSc – Applied network security (co-supervisor J. Aycock). Andreas Hirt, PhD – Anonymous network communication (co-supervisor C. Williamson). William Lorimer, PhD – Authentication protocols and zero-knowledge. Shantha Ramachandran, MSc – Unconditional class group computation in quadratic fields. Pieter Rozenhart, PhD – Mathematics (co-supervisor R. Scheidler). Nick Sullivan, MSc – Mathematics (co-supervisor R. Scheidler). Mark Velichka, MSc – Class group computation in quadratic fields. Ryan Vogt, MSc – Sandboxing for computer security (co-supervisor J. Aycock).

www.cpsc.ucalgary.ca/~jacobscisac.math.ucalgary.ca

ROBERT KREMER, Associate Professor

Research Interests:

Selected

publication

2005/2006:

Rob's research interests focus on agent based systems, concept mapping, and formal methods. He is currently developing a flexible and easy-to-use infrastructure for agent development as a research tool. This will lead to the ability to test the effectiveness of various conversational strategies, for

example, Is the "traditional" conversation protocol approach better or worse than the social commitment approach to complex agent-based conversations? This work dovetails with previous work on concept mapping systems, in that the agent infrastructure supports a multi-user interface and data store for the concept mapping system. Conversely, the concept mapping system will form a sophisticated view (and controller) of the agent environment. A formal model of the agent infrastructure is also under development.

•Kremer, R. and Flores, R. (2005) "Using a Performative Subsumption Latttice to Support Commitment-based Conversations". Full paper in the Proceedings of the 4th International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS'2005), Utrecht, The Netherlands, July 25-29, 2005. ACM Press.



Project: Development of the CASA agent based infrastructure. Implementation of a formally-specified social commitment protocol under CASA.

Graduate
Students:David Baker, MSc – Course based.Filip Balas, MSc – Agent based systems.
Gabriel Becerra Ayala, MSc – Constraints satisfactin approach to agent based negotiation.
Guy Davis, MSc – Course based.
Jason Heard, MSc – Detecting broken social commitments in open multi-agent systems.
Ibrahim Jadalowen, MSc – Course based.
Chad La Fournie, MSc – Course based.
HuiMing Luo, MSc – Course based.
Jerrall Prakash, MSc – Implementation of a multi-agent system network security.
Paul Werbicki, MSc – Programming language interoperability.

http://sern.ucalgary.ca/%7Ekremer/

Research Interests:

Christiane is studying quasi-Monte Carlo methods, which can be seen as a deterministic version of the Monte Carlo method. These methods are mostly used for multi-dimensional numerical integration, and they try to improve upon the Monte Carlo method by using more uniformly distributed samples to build their approximation. Christiane's current research is mostly focused on using quasi-Monte Carlo methods in complex applications, and finding better parameters for different quasi-Monte Carlo constructions.

CHRISTIANE LEMIEUX, Associate Professor (Joint appointment with the Department

of Mathematics)

Selected • C. Lemieux. "Quasi-random publications number techniques", book 2005/2006: chapter to appear in "Handbook in Operations Research and Management Science: Simulation", Elsevier, 2005. • F. J. Hickernell, C. Lemieux and A. B. Owen. "Control Variates for Quasi-Monte Carlo", to appear in Statistical Science, 2005. Projects: •Using simulation and diffusion approximations to model plant development. •Quality measures and parameter searches for quasi-Monte Carlo constructions. • Pricing American options using quasi-Monte Carlo methods and other variance reduction techniques. • Using highly-uniform sampling in Metropolis-type algorithms. Graduate Students:



Mikolaj Cieslak, MSc – Solving chemical processes usually represented as a set of coupled. ordinary differential equations using Gillespie's stochastic method (co-supervisor P. Prusinkiewicz).

Jennie La, MSc – (Department of Mathematics and Statistics).

ZONGPENG LI, Assistant Professor

Research Interests:

Selected

publications

2005/2006:

Zongpeng's research interests are in computer networks and distributed algorithms. Recently, he has been working on distributed network optimization for multicast applications such as media streaming and file distribution. Zongpeng is also interested in information theory, coding theory, and wireless communications.

• Z. Li and B. Li. On Increasing End-to-end Throughout in Wireless Ad Hoc Networks, in the Proceedings of QShine 2005,

Orlando, Florida, August 22-24, 2005.

- Z. Li and B. Li. Probabilistic Power Management for Wireless Ad Hoc Networks. In ACM/Kluwer Mobile Networks and Applications (MONET), 10(5), pp. 771-782, 2005.
- M. Wang, Z. Li and B. Li. A High-Throughout Overlay Multicast Infrastructure with Network Coding, in the Proceedings of IEEE IWQoS 2005, Passau, Germany, June 20-23, 2005.

Projects:

- Optimization Algorithms in Data Networks.
- Scalable P2P On-demand Media Streaming Based on Network Coding.



www.cpsc.ucalgary.ca/~zongpeng

Research Interests:

KENNETH LOOSE, Associate Professor

Kenneth's research focuses on two distinct areas - Computer Science Education and the role of users in software evaluation. He has spent some time looking at the role of discrete mathematics in the undergraduate program, specifically with respect to student mathematical maturity and its effect on the ability of students to effectively learn discrete math. Looking to expand this to also include linear mathematics and calculus to attempt to determine if there is an optimal sequence for the mathematics that is currently required for Computer Science majors. In the area of software evaluation, Kenneth's is focusing on the use of investigative techniques more common to the Social Sciences but that are applicable to finding relationships among users and the software that they use. This is in many ways an analysis of users and particular software to identify relationships affecting the interaction of the user with the software. In both areas, he is especially interested in games programming and software.

Kenneth is currently involved with an interdisciplinary group that is working toward creating a network of researchers involved in educational games. This is partially funded by a grant from SSHRC. He is also working on data from the last eight years that includes performance in the three areas of mathematics that are required for Computer Science students. This should add significantly to findings already obtained in looking at discrete mathematics performance. A final major project is one in which he wishs to create a profile of skills that are critical components in computer games, especially educational computer games - an area that is receiving increased recent attention.



Jessica Mason, MSc – Profiling educational games user to identify critical game components.

http://www.cpsc.ucalgary.ca/Dept/contact.php?profile=loose

Graduate Student:

ANIRBAN MAHANTI, Assistant Professor

Research Interests:

Selected

publications

2005/2006:

Anirban's research interests are in the areas of performance evaluation of distributed computer

systems and computer networks. His specific research interests include multimedia streaming systems, Web performance, network measurement and modelling, network protocols and architectures, and distributed systems.

• Sean Boyden, Anirban Mahanti and Carey Williamson. "Characterizing the Behavior of Real Video Streams". In Proceedings of the SCS Symposium on Performance Evaluation of Computer and Telecommunication Systems (SPECTS), Philadelphia, PA, July 2005, pp. 783-791.

• Aniket Mahanti, Anirban Mahanti and Carey Williamson. "Locality Charac<image>

teristics of Web Streams Revisited". In Proceedings of the SCS SPECTS, Philadelphia, PA, July 2005, pp. 795-803.

• Anirban Mahanti, Derek Eager and Mary Vernon. "Improving Multi-rate Congestion Control Using a TCP Vegas Throughput Model". Computer Networks Journal, Vol. 48, No. 2, June 2005, pp. 113-136.

Projects: • Multimedia Streaming Protocols and Performances.

• Internet Traffic Classification.

Graduate
Students:Naimul Basher, MSc – On-demand Media Streaming in a Peer-to-Peer Setting.Students:Sean Boyden, MSc – Media Streaming using TCP Vegas (co-supervisor C. Williamson).Jeffrey Erman, MSc – Internet Traffic Classification using Machine Learning Techniques.
Nadim Parvez, PhD – TCP for Wired/Wireless Networks (co-supervisor C. Williamson).

Research Interests:

Selected

Projects:

publications

2005/2006:

Frank's research interests include agile software methodologies (such as Extreme Programming, Scrum DSDM, etc.), software engineering approaches for e-Business software development, web engineering, globally distributed software development, and experience and knowledge management. Frank is the head of the e-Business engineering group at the University of Calgary and serves as the Associate Head Planning and Research.

FRANK MAURER, Professor and Associate Head, Research & Planning

- P. McInerney and F. Maurer. UCD in Agile Projects: Dream Team or Odd Couple? ACM Interactions, Nov-Dec 2005.
 - L. Liu, H. Erdogmous and F. Maurer. An Environment for Collaborative Iteration Planning, in Proceedings of Agile 2005, Denver, IEEE Press, 2005.
 - C. Mann and F. Maurer. A Case Study on the Impact of Scrum on Overtime and Customer Satisfaction, in Proceedings of Agile 2005, Denver, IEEE Press, 2005.
- MASE Tool Support for Agile Project Management.



- Single Display Groupware for Agile Software Teams.
 Alan A robotic colleague for agile teams (with J. Denzinger & E. Sharlin).
 - FitClipse Tool support for early acceptance testing and interaction design.
 - AcceptJ2EE Acceptance testing of distributed J2EE applications.

GraduateRuth Ablett, MSc – A robotic companion for agile software teams (co-supervisor E. Sharlin).Studenty:Harprett Bajwa, MSc – Testing processes for portlet applications.Kobe Davis, MSc – Software Engineering.Chengyao Deng, MSc – Acceptance Testing for Distributed J2EE Applications.Brian Fox, MSc – Agile usability tools.Harprit Grewal, MSc – Course based study.Grigori Melnik, PhD – Early acceptance testing.Robert Morgan, MSc – Group collaboration support for agile planning.Shelly Park, MSc – Capturing verbal documentation in Agile planning (co-supervisorJ. Denzinger).Xueling Shu, MSc – Agile methods for bioinformatics.Wenliang Xiong, MSc – Tool support for portlet applications.

Carmen Zannier, PhD – An Empirical Evaluation of Decision Making in Software Design.

http://ebe.cpsc.ucalgary.ca/Frank.Maurer

JAMES PARKER, Professor

Research Interests:	Jim is currently working on computer game technology, especially the synthesis and coding of digital audio. This includes creating sound effects and music, and manipulating, classifying and recognizing. He has been involved in pattern recognition and computer vision research for over 20 years, and applies this knowledge to practical projects. He and his students have designed and built a number of computer games. His students are currently working on pattern recognition in biometrics (signature, face, and voice recognition), virtual reality, games and entertainment technology (audio analysis and synthesis), and natural computer interfaces (gesture and gaze recognition, similarity search for pictures and sounds). He is the founder of the Digital Media Lab, which works with local and distance game developers and animation groups, and has research ties with the Banff New Media Institute, Education, Kinesiology, Fine Arts, and Engineering.
Selected publications	• J. R. Parker, Using Games to Advance Language Training and Education, Serious Games summit, Washington, D.C., Oct 31-Nov 1, 2005.
2005/2006:	• J. R. Parker & Brad Behm, Composite Algorithms in Image Content Searches, 11 th Intl. Conf. on Distributed Multimedia Systems (DMS2005) Sep 5-7, 2005, Calgary, AB, Canada.
Projects:	• Caching of audio files in computer games: Implementing a sound file scheduling algorithm that will be integrated into a game.
	 Query by example for sound: Given a sound file, find others in a set of files that sound like it. Determining Body Pose In Images: An image that includes a human body is given - What is the angle of the arms/legs? There is a very practical use for this, if it can be accomplished in a fast enough time.
Graduate	Lani Bateman, MSc – Speaker recognition using signal processing and learning.
Students:	Sonny Chan, MSc – Medical Image Analysis.
	Ai Duong, MSc – Gaze Determination.
	Shannon Jaeger, MSc – Virtual reality and games for teaching.
	Young Lee, MSc – Face detection/recognition using linear classifiers.
	Christopher Marriott, PhD – Joint with Philosophy: epistemological basis of A.I.
	John Heerema, MSc (Int. Stud.) – A computer hearing system to coach music students.
	Hugh Tyreman , MSc (Kines) – Goaltender Coaching with Virtual Reality: 2D/3D/Immersive.
	Lori Shyba, PhD (Int. Stud.) – Virtual and Interactive Theatre.

http://pages.cpsc.ucalgary.ca/~parker

Research Interests:

Selected

publications

2005/2006:

PRZEMYSLAW PRUSINKIEWICZ, Professor

Dr. Prusinkiewicz and his students look at facilitating the modeling of plants using the conceptual framework of Lindenmayer Systems (L-Systems). They investigate the dynamics of reciprocal interaction between plants and their environment and explore the relationships between various theoretical models used to describe plant architecture. This makes it possible to understand the data required, the limitations and capabilities necessary to model plants that result in images

which are photorealistic and highly complex. They have developed software environments for conducting simulated experiments, called the Virtual Laboratory and L-Studio.

- A. Runions, M. Fuhrer, B. Lane, P. Federl, A.G. Rolland-Lagan & P. Prusinkiewicz.
 "Modeling and visualization of leaf venation patterns". ACM Trans. on Graphics 24(3). Proc. of SIGGRAPH 2005, pp. 702-711.
 - A.G. Rolland-Lagan & P. Prusinkiewicz. "Reviewing models of auxin canalization in the context of leaf vein pattern formation in Arabidopsis". The Plant Journal 44, pp. 854-865.
 - R. Smith, S. Guyomarc'h, T. Mandel, D. Reinhardt, C. Kuhlemeier & P. Prusinkiewicz. "A plausible model of phyllotaxis. Proc. of the National Academy of Sciences 103, pp. 1301-1306.



Projects:
 Modeling plants from genes to phenotypes.
 New programming paradigms and languages for modeling, simulation and visualization of biological systems.
 Graduate Students:
 Fabricio Anastacio, Msc – Sketch-based modeling & rendering of plants (co-supervisor M. Costa Sousa).
 Mikolaj Cieslak, MSc – Stochastic simulation methods in biology (co-supervisor C. Lemieux).
 Adam Runions, MSc – Modeling and visualization of venation patterns.
 Colin Smith, PhD – Vertex-vertex systems and their use in geometric and biological modeling.
 Richard Smith, PhD – Computational models of spiral phyllotaxis.

http://pages.cpsc.ucalgary.ca/~pwp www.algorithmicbotany.org

JON ROKNE, Professor

Research Interests:

Jon's research interests span the areas of interval analysis, global optimization, computer graphics and solid modeling. Within these areas he aims to develop algorithms for solving a variety of problems such as robust computations of intersection tests, finding good inclusion for functions over intervals computing zeros of function, etc. He has also worked on global illumination as applied to the modeling of plants and on physically based computer graphics.



Selected publications 2005/2006:	• J.F. Taylor-Hell, G.V.G. Baranoski and J.G. Rokne. State of art in the realistic
	modeling of plant venation systems. International Journal of Image and graphics, Volume 5, Issue 3, 2005, pp. 663-678, Refereed.
	• G.V.G. Baranoski, J. Wan, J.G. Rokne and I. Bell. Simulating the dynamics of auroral phenomena. ACM Transactions on Graphics, Volume 24, 2005, pp. 37-59, Refereed.
	• H. Ratschek and J. Rokne. SCCI-hybrid method for 2D curve tracing. International Journal of Image and Graphics. Volume 5, Issue 3, 2005, pp. 447-479. Refereed.
	• R.R. Lemos, J. Rokne, G.V.G. Baranoski, Y. Kawakami and T. Kurihara. Modeling and simulat- ing the deformation of human skeletal muscle based on anatomy and physiology. Computer Animation and Virual Worlds, Volume 16, 2005, pp. 319-330, Refereed.
Projects:	• Computer-aided desing algorithms.
	 Interval analysis algorithm. Physical based computer graphic simulations. Geometric computations.
Graduate Students:	Kelly Lin Poon , MSc – Physically-based techniques to model flowers. Ravdeep Sekhon , MSc – Realistic implementation of veins in leaves. Ye Wang , MSc – NPR implementation of Chinese calligraphy and painting.

http://pages.cpsc.ucalgary.ca/~rokne/

GÜNTHER RUHE, iCORE Professor in Software Engineering. (Joint appointment with the Department of Electrical & Computer Engineering) Research Geunther Ruhe is an iCORE Professor. This is a joint appointment in the Departments of Computer Interests: Science and Electrical and Computer Engineering. His research is in the area of intelligent support, in particular for design and analysis of releases in incremental software development, analysis of software requirements, project management, and selection of components-of-the shelf (COTS) products. A new generation of intelligent decision support tool has been designed, implemented and initially evaluated. ReleasePlanner[™] is a tool suite that provides flexible and web-based tool support for assigning requirements of features to releases so that the most important risk, resource, and budget constraints are fulfilled. Selected • A. Ngo-The, G. Ruhe (eds.), publications **Proceedings Workshop Requirements** 2005/2006: **Engineering Decision Support** (REDECS'2005), September 2005, Paris, 54 pages. • S. Maurice, G. Ruhe, A. Ngo-The, O. Saliu: Decision Support for Valuebased Software Release Planning. Value-based Software Engineering(S. Biffl et al., eds.), Springer 2005, pp 247-262. Projects: Intelligent support for release and design decision of evolvable software systems. • Intelligent design decisions. • Simulation-based decision support for software quality assurance (SimQuali). Graduate Jingzhou Li, PhD – Effort Prediction for Release Planning Using Collaborative Filtering. Students: Abdallah Mohamed, PhD - COTS Software Product Selection. James McElroy, PhD – Use Case Analysis for Planning of Releases. **Omolade Saliu**, PhD – Decision Support for Software Release Planning in Evolving Systems. Gensheng Du, PhD – Intelligent Explanation for Software Release Planning. Irfan Ullah, MSc - Planning Releases for Software Product Lines. Pankaj Bhawnani, MSc – Decision Support for Release Decisions based on Reliability Analysis. Zhizhong Li, MSc - Management of Tabular-based Requirements Using Rough Sets. Yuhang Wang, MSc – Machine Learning for Improving Performance of Software Inspections. Thamer Al Boura'e, MSc – Impact Analysis for Parametric Release Planning. Ahmed Raihan Al-Emran, MSc - Process Simulation for Software Release Planning.

http://sem.cpsc.ucalgary.ca/~ruhe

FARAMARZ SAMAVATI, Assistant Professor

Research Interests:	Faramarz Samavati works on various aspects of Computer Graphics. His research areas are Geometric Modeling, Sketch-Based Modeling, Visualizations and Non-photo Realistic Ren- dering. More specifically, the research topics in his area are Surface Modeling, Volumetric Modeling, Subdivision Surfaces, Splines, Least Squares, NURBS, Multiresolution and Wavelets. As one of his important research results, he was able to obtain Multiresolution representation for smooth objects by reversing subdivision and without direct use of wavelets. Faramarz and his group also explore various applications of these modeling techniques in Biometric, Medi- cal, terrain and Seismic simulation and visualization.
Selected publications 2005/2006:	 Pakdel, H.R. and Samavati, F.F. "Incremental Subdivision for Triangle Meshes", International Journal of Computational Science and Engineering, 14 pages, accepted, in press, March 2006. Bartels, R., Golub, G. and Samavati, F.F. "Some Observations on Local Least Squares", to appear in BIT Numerical Mathematics, 19 pages, 2006. Foster, K., Sousa, M.C., Samavati, F.F. and Wyvill, B. "Polygonal Silhouette Error Correction: A Reverse Subdivision Approach", International Journal of Computational Science and Engineering, 20 pages, accepted, in press, March 2006. Taerum, T., Sousa, M.C., Samavati, F.F., Chan, S. and Mitchell, R. "Real-Time Super Resolution Contextual Close-up of Clinical Volumetric Data", To Appear, the Eurographics/IEEE-VGTC Symposium on Visualization (EuroVIS 2006), May 2006, Lisbon, Portugal.
Project:	• Multi-resolution in Computer Graphics.
Graduate Students:	 John Brosz, PhD – Modeling & visualization of seismic data. Meru Brunn, MSc – Curve Synthesis by example. Hung-Li Jason Chen, MSc – Interactive volume deformation & manipulation. Joseph Cherlin, MSc – Sketch-based modeling with few strokes (co-supervisor M. Costa Sousa). Mahsa Eshraghyi Boroojeni, MSc – Modeling in Graphics. Vishal Kochhar, MSc – Modeling in Graphics. Luke Olsen, MSc – Local Multi-resolution Filters in NPR. Aaron Severn, MSc – Sketch-based Assembly of Subdivision Surfaces. Mitra Shirmohammadi, MSc – Geometric modeling with L-systems. Torin Taerum, MSc – Medical Illustrations (co-supervisor M. Costa Sousa). Lakin Wecker, MSc – Multi-resolution approach to iris synthesis (co-supervisor M. Gavrilova).

http://pages.cpsc.ucalgary.ca/~samavati/

Research Interests:

Renate's principal areas of interest include computational number theory and cryptography. Specifically, her research explores algorithms for finding invariants of algebraic number fields and function fields, as well as the design and analysis of cryptographic systems whose security is based on the problem of computing such invariants. Currently, the best known methods for finding invariants are sub-exponential and frequently exponential, so the cryptosystems in question are very secure. She is interested in faster cryptographic and number theoretic algorithms. as well as. efficient implementations.



Selected publication 2005/2006:	• M. J. Jacobson Jr., R. Scheidler and H. C. Williams. An improved real quadratic field based key exchange procedure. University of Calgary Yellow Series 845; to appear in Journal of Cryptology 2006 (published online May 27, 2005).
Projects:	 Algorithms and Cryptography in Algebraic Function Fields. Novel Implementation of Cryptographic Algorithms on Custom Hardware Platforms. Efficient Arithmetic in Global Quadratic Fields. Privacy and Number Theoretic Cryptography. Construction of Hyperelliptic Function Fields of High Three-Rank (with M. Bauer, M. J. Jacobson, and Y. Lee). Cubic Function Fields from Quadratic Infrastructure (with M. J. Jacobson, Y. Lee, and H. C. Williams). Quartic Function Fields (with Q. Wu).
Graduate Students:	 Karel Bergmann, MSc – Genetic Algorithms in Cryptanalysis. Eric Landquist, PhD – Mathematics. Taisya Krivoruchko, MSc – Mathematics. Manisha Parmar, MSc – Hyperelliptic Curve Cryptography. Pieter Rozenhart, PhD – Mathematics. Adrian Tang, PhD – Mathematics. Qingquan Qu, PhD – Quartic Function Fields.

RENATE SCHEIDLER, Associate Professor (Joint appointment with the Department

of Mathematics)

www.math.ucalgary.ca/~rscheidl www.cisac.math.ucalgary.ca

EHUD SHARLIN, Assistant Professor

Research Interests:

Ehud is interested in physical interfaces between humans and computers, tangible user interfaces, human-robot interaction, and virtual and mixed reality interfaces. Physical interfaces rely directly on the physical world using its extremely rich collection of objects, tools, interaction rules and concepts, all well learned and well practiced by humans from their everyday experiences. Good physical interfaces embody function and content and can be very intuitive and simple to use.

- J. Young and E. Sharlin, "Sharing Spaces with Robots—an Integrated Environment for Human-Robot Interaction" International Symposium on Intelligent Environments (ISIE) '06, Cambridge, UK.
- M. Xin and E. Sharlin, "Sheep and Wolves - Test Bed for Human-Robot Interaction", ACM CHI WIP 2006, Montréal, Canada.

 P. Lapides, E. Sharlin, M. C. Sousa, and L. Streit, "The 3D Tractus: A Three-Dimensional Drawing Board", TableTop '06, Adelaide, Australia.

• T. Asano, E. Sharlin, Y. Kitamura, K. Takashima, and F. Kishino, "Predictive Interaction using the Delphian Desktop", ACM Symposium on User Interface Software and Technology (UIST) '05, Seattle, WA. <image>

Projects:
 Mixed reality-based human robot interfaces.
 Sheep and Wolves - game-based testbed for human robot interaction.
 The 3D Tractus: a 3D tangible drawing board (with M. Costa Sousa).
 Alan: a robotic companion for agile software engineering teams (with F. Maurer and J. Denzinger).
 Graduate Students:
 James Young, MSc – Mixed reality-based human robot interfaces.
 Ruth Ablett, MSc – A robotic companion for agile software teams (co-supervisor F. Maurer).
 Min Xin, MSc – The 3D Tractus: a 3D tangible drawing board (co-supervisor M. Costa Sousa).

http://pages.cpsc.ucalgary.ca/~ehud/

Selected publications 2005/2006:

ROBERT SIMMONDS, Adjunct Assistant Professor

Research Interests: Rob performs research into grid computing, parallel discrete event simulation and parallel network emulation. The main grid computing research activities includes a project that aims to understand many issues relating to monitoring grid environments. The goal is to produce models of computer, network and monitoring components and models of different monitoring activities. This should enable monitoring requirements to be mapped programmatically to a grid environment. Another grid related project is considering how data replication and caching decisions should be made by grid data management systems in environments with access to dynamically controlled optical light path networks.

Selected publícatíons 2005/2006: P. Rizk, C. Kiddle and R. Simmonds. "Improving Grid FTP Performance with Split TCP Connections". In Proceedings of the 1st IEEE International Conference on e-Science and Grid Computing, pp. 263-270, Melbourne, Australia, December 5-8, 2005.

C. Kiddle, R. Simmonds and B. Unger.
"Advances in Network Emulation". IEC Annual Review of Communications, Vol. 58, 2005.

· Proactive Data Management.

• High performance overlay networks.



• R. Simmonds and B. Unger. "Towards Scalable Network Emulation". Journal of Computer Communications, Vol 26 (3), pp. 264-277, 2003.

Projects:

Graduate Students:

Idowu Adewale, MSc – User oriented monitoring for grid environments.David Aikema, MSc – Virtual organization management.Tanvire Elahi, PhD – Model based job scheduling.Nayden Markatchev, MSc – Data management in grid environments.Philip Rizk, MSc – Overlay networks in grid environments (co-supervisor B. Unger).

• Internet Protocol Traffic and Network Emulator (IP-TNE).

• Model based grid monitoring (Joint project with HP Labs, Palo Alto).

http://grid.ucalgary.ca

BRIAN UNGER, Professor

Research Interests:

Brian's research interests focus on the parallel and distributed simulation of computer communication networks. Key research problems include the design and development of efficient optimistic and conservative synchronization methods, modeling large, complex, non-homogeneous networks such as the Internet, and Alberta's Supernet, and integrated network simulation and emulation methods. Brian's work in these areas is pursued in collaboration with Rob Simmonds, an Adjunct Professor of Computer Science.

Recent areas include performance monitoring and data management in high end computational grids.

Selected publications 2005/2006: • Kiddle, C., Simmonds, R. and Unger, B.W. (2005) "Advances in Network Emulation", IEC Annual Review of Communications, Vol. 58.

• Kiddle, C., Simmonds, R. and Unger, B.W. (2005) "Channel Based Sequential Simulation", Proceedings of the Winter Simulation Conference, Orlando, December, pp. 637-647.



• Curry, R., Kiddle, C., Simmonds, R. and Unger, B.W. (2005) "Sequential Performance of Asynchronous Conservative PDES Algorithms", Proceedings of the 19th Workshop on Principles of Advanced and Distributed Simulation (PADS), Monterey, California, June, pp. 217-226.

• Kiddle, C., Simmonds, R. and Unger, B.W. (2005) "Improving Scalability of Network Emulation through Parallelism and Abstraction", Proceedings of the 38th Annual Simulation Symposium, San Diego, California, April, pp. 119-129.

Projects:Canadian DataGrid - Proactive Data Management.Model Driven Open Data Collection.

Graduate Student: Philip Rizk, MSc – Overlay networks in grid environments (co-supervisor R. Simmonds).

http://pages.cpsc.ucalgary.ca/~unger/



Research Interests:

ROBERT J. WALKER, Assistant Professor

Rob's primary research concerns easing problems of software evolution and reuse. This centers around the observation that software is developed assuming that one sees essentially the entire "world" — you know what classes exist, what libraries are in use, their exact interfaces and properties, etc. The reality is that libraries, standards, and languages all change over time. By isolating a module from the world around it, but still allowing it to interact with the world, we could make our modules less likely to need to change. Rob has created a mechanism called implicit context for permitting such apparent isolationism. Rob is also heavily involved in the



recently-introduced programming paradigm called aspect-oriented software development.

Selected publications 2005/2006:	 J. Siadat, R.J. Walker and C. Kiddle. Optimization aspects in network simulation. In Proc of the Intl. Conf. Aspect-Oriented Software Development, 2006. R. Holmes, G.C. Murphy and R.J. Walker. The Strathcona example recommendation tool. Proc. of ACM SIGSOFT Intl. Symposium. Foundations Software Engineering, 2005. J.J.C. Chang and R.J. Walker. Incomplete resolution of references in Eclipse. Proc. of Eclipse Technology Exchange, 2005.
Projects:	 Context insensitivity for software evolution. Aspect-oriented software development and its assessment. Large-scale unanticipated software reuse. Technical risk estimation.
Graduate Students:	 Joseph Chang, MSc – Using AI-methods in the re-use of software (co-supervisor J. Denzinger). Brad Cossette, MSc – Language-independent probabilistic change impact analysis. Rylan Cottrell, MSc – Context-sensitive call chain suggestions. Mark Dochstader, MSc – Evolvable software design. Reid Holmes, PhD – Large-scale unanticipated software reuse. Shafquat Mahmud, MSc – Are aspects better treated early or late in the lifecycle? Mark McIntyre, MSc – Dataflow-based suggestions of near clones. Bhavya Rawal, MSc – Incorporation of transformations into change history mining. Jamal Siadat, MSc – Aspect-oriented programming in the context of network simulation.

JOHN WATROUS, Associate Professor and Canada Research Chair in Quantum Computing

Research Interests:

John's research focuses on quantum computation and information. This area of research is concerned with models of computation based on quantum mechanics, and on the information-theoretic properties of quantum mechanical systems. In particular, he is interested in quantum computational variants of interactive proof systems, quantum algorithms for group-theorectic problems, and properties of quantum entanglement.

Selected publications 2005/2006:

- J. Watrous. Zero-knowledge against quantum attacks. Proceedings of the 38th Annual ACM Symposium on Theory of Computing, 2006.
- J. Watrous. Bipartite subspaces having no bases distinguishable by local operations and classical communication. Physical Review Letters 95(8): Article 080505, 2005.
- B. Rosgen and J. Watrous. On the hardness of distinguishing mixed-state quantum computations. Proceedings of the 20th Annual Conference on Computational Complexity, pp. 344-354, 2005.



- C. Marriott and J. Watrous. Quantum Arthur-Merlin games. Computational Complexity, 14(2): pp. 122-152, 2005.
- G. Gutoski and J. Watrous. Quantum interactive proofs with competing provers. In Proceedings of the 22nd Annual Symposium on Theoretical Aspects of Computer Science, Volume 3404 of Lecture Notes in Computer Science, pp. 605-616, Springer-Verlag, 2005.

Graduate
Students:Dmitry Gavinsky, PhD – Quantum communication complexity.Heath Gerhardt, PhD – Quantum and iterated quantum processes.
Gus Gutoski, PhD – Quantum interactive proof systems with competing provers.
Jibran Rashid, MSc – Norms and distance measures of quantum super-operators.
William Rosgen, PhD – Bell inequalities and quantum nonlocality.

http://pages.cpsc.ucalgary.ca/~jwatrous

Research Interests:

Carey's general research interests are in computer networks and computer systems performance evaluation. Specific interests include Internet protocols, wireless networks, network traffic measurement, workload characterization, network simulation, and Web server performance. A self-described "Internet mechanic", Carey focuses a lot of his research on the interactions between Internet protocols, and the resulting impacts on user-perceived performance. Much of this work is experimental, with an applied focus on industri-

Chair



ally-relevant network performance problems. He is currently an iCORE Professor in "Broadband Wireless Networks, Protocols, Applications, and Performance" and holds an NSERC/iCORE/TELUS Mobility Industrial Research Chair in Wireless Internet Traffic Modelling.

CAREY WILLIAMSON, iCORE Professor and NSERC/iCORE/Telus Mobility Industrial

Selected publicatíons 2005/2006:	 M. Arlitt and C. Williamson. "An Analysis of TCP Reset Behaviour on the Internet", ACM Computer Communication Review, Vol. 35, No. 1, pp. 37-44, January 2005. Y. Wu and C. Williamson. "Impacts of Data Call Characteristics on Multi-Service CDMA System Capacity", Performance Evaluation, Vol. 62, pp. 83-99, September 2005.
Projects:	• Wireless Internet Traffic Modeling.
	 Multi-channel MAC Protocols for Wireless Networks.
	• Stochastic Capacity Networks.
Graduate	Sean Boyden, MSc – Media streaming applications on the internet (co-supervisor A. Mahanti).
Students:	Jean Cao, PhD – QoS support for mobile applications in wireless networks.
	Mingwei Gong, PhD – Scheduling issues in wirless networks.
	Emir Halepovic, PhD – Evaluation of large-scale peer-to-peer computing applications.
	Andreas Hirt, PhD – Anonymous network communication (co-supervisor M. Jacobson).
	Alok Madhukar, MSc – P2P traffic classification.
	Aniket Mahanti, MSc – Network traffic measurements from a campus-level wireless network.
	Nadim Parvez, PhD – TCP Protocols for wired/wireless networks.
	Ian Wormsbecker, MSc – Multi-Channel (MAC) protocols.

http://pages.cpsc.ucalgary.ca/~carey/

BRIAN WYVILL, Professor

Research Interests:	Brian's research interests centers around the theme of computer animation. In 3D modelling he (and his brother Geoff Wyvill) have designed methods for interacting and rendering implicit surfaces. These models, called SOFT objects, are very useful in ani- mation for representing deformable surfaces. More recently, he has been working on the BlobTree, which includes blends, CSG boolean operations, Barr warps, and texturing of implicit surfaces. He is currently working on new mehtods for controlled blending, animation, precise contact modelling and volume control.
Selected publications 2005/2006:	 Kevin Foster, Pauline Jepp, Brian Wyvill, Mario Costa Sousa, Callum Galbraith, Joaquim A. Jorge, Pen-and-Ink for BlobTree Implicit Models, Com- puter Graphics Forum (Proc. of Eurographics 2005), 24(3) (2005), 267-276. Ryan Schmidt, Brian Wyvill, Mario Costa Sousa, Joaquim A. Jorge, ShapeShop: Sketch-Based Solid Modeling with the BlobTree, 2nd Eurographics Workshop on Sketch-based Interfaces and Modeling, Dublin, Ireland, August 2005. Brian Wyvill, Kevin Foster, Pauline Jepp, Ryan Schmidt, Mario Costa Sousa, Joaquim A. Jorge, Stylistic Rendering of Implicit Models, 1st EG Workshop on Computational Aesthetics in Graphics, Visualization and Imaging, Girona, Spain, May 2005. Ryan Schmidt, Brian Wyvill, Mario Costa Sousa, Sketch Based Modeling with the Blob Tree, ACM Siggraph 2005 Sketch presentation, August 2005.
Projecty:	Better Blending between Multiple Nodes of the Blobtree.BlobTree Modeling System.
Graduate Student <u>s</u> :	 Erwin deGroot, PhD – Development of a new method to speed up raytracing Blobtrees. Kevin Foster, MSc – Precise Ink Illustrations (co-supervisor M. Costa Sousa). Martin Fuhrer, MSc – Photorealistic rendering of plants (co-supervisor P. Prusinkiewicz). Callum Galbraith, PhD – Use of implicit surface for surface description. Pauline Jepp, PhD – Interactive Sculpting Using Implicit Methods(co-supervisor M. Costa Sousa). Jeffrey Mahovsky, PhD – Speeding up ray tracing with reduced-precision arithmetic. Ryan Schmidt, MSc – Computer graphics. Alton Yu, MSc – Computer graphics and modelling.

http://pages.cpsc.ucalgary.ca/~blob/

Faculty:

Anton Colijn - Faculty Association

Instructors

Katrin Becker Frank Deur Donna Fremont Ivo Jirasek Rose Joshua Leonard Manzara Craig Schock James Tam Nathaly Verwaal Chris Walpole

Adjunct Professors:

Don Ariel Hakan Erdogmus Abram Gamer Joaquim Jorge Jalal Kawash Tom Keenan Maria L. Lantin J. Ross Mitchell Charles P. Pfleeger Shari L. Pfleeger Michael M. Richter Christoph Sensen **Robert Simmonds** Peter D. Vize Thomas W. Williams Ian Witten

Emeritus Faculty:

Graham Birtwistle James Bradley Mike Brebner Brian R. Gaines David Hill John Kendall Mildred L. G. Shaw Brian W. Unger Michael R. Williams



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