# Table of Contents

Message from the Head 4  
Computer Science at the University of Calgary 5  
Research Support 6  
Graduate Students Scholarships 7 & 8  
MSc and PhD Final Oral Examination 9 & 10  
Research Personnel and Visitors 11 - 13  
Seminars, Art Exhibits, Workshops and Conferences 14 & 15  

## Research Faculty

<table>
<thead>
<tr>
<th>Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alhajj, Reda</td>
<td>16</td>
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<tr>
<td>Aycock, John</td>
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Message from the Head

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 undergraduate 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

About CPSC

The Department of Computer Science continues to grow and flourish at the University of Calgary. Our full-time 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 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 breadth 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.
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.

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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

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<td>Fabricio Anastacio, MSc</td>
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## MSc and PhD Final Oral Examinations continued

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<td>Channel Selection Strategies for Multi-Channel Mac Protocols in Wireless Ad-Hoc Networks</td>
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<td>Yu, Bo</td>
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<td>Inference Protection Through Query Translation</td>
<td>Ken Barker</td>
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# Research Personnel

## Post Doctoral Fellows

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<td>Hofstra, Peter</td>
<td>Theoretical Computer Science (Cockett)</td>
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<td>Isenberg, Tobias</td>
<td>Applying non-photorealistic rendering to information visualization (Carpendale)</td>
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<td>Large Scale Systems Management (Barker).</td>
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## Researcher

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Graduate students

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Apu, Russell
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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
Jooenazzo, 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
Salisu, 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
Undergraduate students and their supervisors

Aleskic, Darko (Parker)  Kendon, Tyson (Denzinger)
Bauld, Eric (Ruhe)  Lapides, Paul (Sharlin)
Bergman, Karel (Jacob)  Lees Miller, John (Jacobson)
Chang, Joseph (Walker)  Morgan, Robert (Maurer)
Chen, Hung-Li (Costa Sousa)  Nguyen, Diana (Scheidler)
Cossette, Bradley (Ruhe)  Novakowski, Scott (Jacob)
Dunsmore, Devlin (Ruhe)  Runions, Adam (Prusinkiewcz)
Echtner, Martin (Ruhe)  Sessini, Phillipa (Mahanti)
Erman, Jeffrey (Mahanti)  Smith, Andrew (Barbosa)
Fraser, Kurtis (Kremer)  Sorenson, Nathan (Samavati)
Friess, Nathan (Aycock)  Spiers, Gregory (Ruhe)
Gavinski, Alyssa (Jacob)  Stagg, Andrew (Parker)
Goodlad, David (Ruhe)  Tao, Jin (Barbosa)
Hedgeland, Ian (Walker)  Tsang, Kenny (Ruhe)
Jefferies, James (Maurer)  Xin, Min (Sharlin)
Jensen, April (Gavrilo)  Zhang, John (Rokne)

Visitors

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

**Distinguished 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 Seminars

Ian Burleigh  Vigo:3D A Swarm Simulation Tool
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 Documents
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 Agyegam  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 Extraction
Abhishek Gaurav  CoAllocation of Compute and Storage Resources in Grid Environments
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 Examples
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  Nickle Arts Museum, University of Calgary
SwarmArt, Sound & i-dogs  Nov. 19, 2005 - Feb. 5, 2006

Workshops and Conferences

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

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.

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

Graduate Students:

Muhammad Adnan, MSc – Incremental Mining.
Sajib Barua, PhD – Spatial Mining.
Jeff Chang, MSc – Association-Rules Mining.
Furat Fawzi, MSc – Fuzzy XML.
Dany Gebara, MSc – Image Mining.
Michael Hanna, MSc – Natural Language Interface to Databases.
Keivan Kian Mehr, MSc – Bio data Mining.
Anthony Lo, PhD – XML Databases.
Tansel Ozyer, PhD – Clustering.
Jia Zeng, PhD – Bio data Analysis.
Ming Zhang, PhD – Online Mining.

http://www.cpsc.ucalgary.ca/~alhajj
JOHN AYCOCK, Assistant Professor

John has been researching computer viruses, worms and other malicious software for several 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:

• SPARK, a toolkit for implementing domain-specific languages in Python.

Graduate Students:

Randal Acton, PhD – AI and multi-agent systems in information security (co-supervisor 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/
Denilson is interested in all aspects of databases and the Web, particularly the management of semi-structured 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.

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

**Projects:**

**Graduate Student:**

**Selected publications 2005/2006:**

**Projects:**

**Graduate Student:**

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 creating a privacy-preserving database management system.


Malik Agyemang, PhD – Outlier 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).
Ajumobi O. Udechukwu, PhD – Data Mining.
Adepele Williams, PhD – Concept hierarchies in data mining.

http://pages.cpsc.ucalgary.ca/~barker/
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 broadcast of sporting events, surveillance for traffic and security, and interactive art.

Selected publications 2005/2006:

Projects:
- 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 Joenavezno, MSc – Gait perception using passive dynamic walkers.
- Nathan Kendrick, MSc – Machine vision analysis of athletic performance 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:


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
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 constraints, 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 (usability and theoretical expressive power), etc.

Selected publication 2005/2006:


Projects:

- 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 Students:

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 category theory.

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


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.

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).
Torin Taerum, MSc – Computer-generated Medical Illustrations(co-supervisor F. Samavati).

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

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’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.

Selected publication 2005/2006:


Projects:

• 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.

Graduate Student:

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

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

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.

Selected publications 2005/2006:


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 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:


Project:


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
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.

Selected publication 2005/2006:


Projects:

- 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 Student:

Fatima M. Farag, PhD – Database Management Systems.
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. Multi-processors 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:


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
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 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.

**Selected publications 2005/2006:**


**Project:**

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

**Graduate Students:**

- Jop Briet, MSc – Physics and Astronomy (co-supervisor D. Feder).
- Michael Garrett, MSc – Physics and Astronomy (co-supervisor D. Feder).
- Hongchao Zhang, MSc – Quantum lower bounds.
Christian’s Evolutionary
& Swarm Design Group
(www.swarm-design.org) is
building agent-based simu-
lations of mostly biological
systems for different levels of
granularity, from vehicular
and pedestrian traffic simu-
lations to the modelling of
army ant raids. In collabora-
tion 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 interac-
tions and their emergent properties.

Christian also collaborates with Prof. Jerry Hushlak from the Department of Art to investi-
gate the use of evolutionary swarm intelligence systems to build virtual “swarm sculptures”
(www.swarmart.com) and interactive computer installations that illustrate principles of emer-
gence in Art & Science.

Selected
publications
2005/2006:

• Jacob, C., Pilat, M., Bentley, P., and Timmis, J., ICARIS 2005 - 4th International Conference on
• Jacob, C., and Burleigh, I., Genetic Programming inside a Cell, in: T. Yu, R. Riolo, and
• 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
• von Mammen, S., Jacob, C., and Kokai, G. (2005), Evolving Swarms that Build 3D Structures,

Graduate
Students:

Ian Burleigh, PhD – Agent-based computing in musical theory.
Namrata Khemka, PhD – Evolutionary Optimization for Biosimulations.
Navneet Bhatta, 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.
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 cryptosystems, 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:


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
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.

**Selected publication 2005/2006:**


**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 satisfaction 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.
- **Paul Werbicki,** MSc – Programming language interoperability.

[Robert Kremer, Associate Professor](http://sern.ucalgary.ca/%7Ekremer/)
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.


Using simulation and diffusion approximations to model plant development.

Projects:

- 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.

Selected publications 2005/2006:

- 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’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.

Selected publications 2005/2006:


Projects:

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

www.cpsc.ucalgary.ca/~zongpeng
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 wishes 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
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.

Selected publications 2005/2006:


Projects:

- Multimedia Streaming Protocols and Performances.
- Internet Traffic Classification.

Graduate Students:

Naimul Bashir, MSc – On-demand Media Streaming in a Peer-to-Peer Setting.
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).

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

Selected publications 2005/2006:


Projects:

- 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.

Graduate Students:

- Ruth Ablett, MSc – A robotic companion for agile software teams (co-supervisor E. Sharlin).
- 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-supervisor J. Denzinger).
- Xueling Shu, MSc – Agile methods for bioinformatics.
- Wenliang Xiong, MSc – Tool support for portlet applications.

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 2005/2006:


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 Students:

- Lani Bateman, MSc – Speaker recognition using signal processing and learning.
- 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
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.

Selected publications 2005/2006:


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’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:


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/
**Faculty**

**Günter Ruhe, iCORE Professor in Software Engineering. (Joint appointment with the Department of Electrical & Computer Engineering)**

**Research Interests:**

Geunther Ruhe is an iCORE Professor. This is a joint appointment in the Departments of Computer 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 publications 2005/2006:**


**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 Students:**

- Abdallah Mohamed, PhD – COTS Software Product Selection.
- James McElroy, PhD – Use Case Analysis for Planning of Releases.
- Irfan Ullah, MSc – Planning Releases for Software Product Lines.
- Pankaj Bhawanni, 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.

**http://sem.cpsc.ucalgary.ca/~ruhe**
Faramarz Samavati works on various aspects of Computer Graphics. His research areas are Geometric Modeling, Sketch-Based Modeling, Visualizations and Non-photo Realistic Rendering. More specifically, the research topics in his area are Surface Modeling, Volumetric Modeling, Subdivision Surfaces, Splines, Least Squares, NURBS, Multi-resolution and Wavelets.

As one of his important research results, he was able to obtain Multi-resolution 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, Medical, terrain and Seismic simulation and visualization.

Selected publications 2005/2006:


Project:

- Multi-resolution in Computer Graphics.

Graduate Students:

- John Brosz, PhD – Modeling & visualization of seismic data.
- Meru Brun, 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/
Faculty

RENATE SCHEIDLER, Associate Professor (Joint appointment with the Department of Mathematics)

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:


Projects:

- Algorithms and Cryptography in Algebraic Function Fields.
- Efficient Arithmetic in Global Quadratic Fields.
- Privacy and Number Theoretic Cryptography.
- 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.

www.math.ucalgary.ca/~rscheidl
www.cisac.math.ucalgary.ca
EHUD SHARLIN, Assistant Professor

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.


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/
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 publications 2005/2006:


Projects:

- Model based grid monitoring (Joint project with HP Labs, Palo Alto).
- Proactive Data Management.
- Internet Protocol Traffic and Network Emulator (IP-TNE).

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).
**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:**


**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/
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:


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.

http://pages.cpsc.ucalgary.ca/~rwalker/
JOHN WATROUS, Associate Professor and Canada Research Chair in Quantum Computing

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-theoretic problems, and properties of quantum entanglement.

Selected publications 2005/2006:


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

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 industrially-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.

Selected publications 2005/2006:

Projects:
• Wireless Internet Traffic Modeling.
• Multi-channel MAC Protocols for Wireless Networks.
• Stochastic Capacity Networks.

Graduate Students:
Sean Boyden, MSc – Media streaming applications on the internet (co-supervisor A. Mahanti).
Jean Cao, PhD – QoS support for mobile applications in wireless networks.
Mingwei Gong, PhD – Scheduling issues in wireless 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 Worsmsbecker, MSc – Multi-Channel (MAC) protocols.

http://pages.cpsc.ucalgary.ca/~carey/
Brian Wyvill, Professor

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 animation 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 methods for controlled blending, animation, precise contact modelling and volume control.

Selected publications 2005/2006:

- 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.

Projects:

- Better Blending between Multiple Nodes of the Blobtree.
- BlobTree Modeling System.

Graduate Students:

- 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.
- 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. Pfeeger
Shari L. Pfeeger
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