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# Denilson Barbosa

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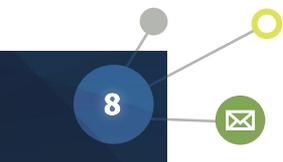
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## RESEARCH INTERESTS

Data and knowledge bases, information extraction and retrieval, text and language processing.

## RESEARCH SUMMARY

I am interested in databases and the application of database and information retrieval principles to the management of linked data, focusing on two domains: the Web and the Digital Humanities. My goal is the development of tools and techniques for the efficient storage, retrieval and analysis of data in these domains. In terms of specific areas, I work on issues related to schema mappings and data exchange, data quality, the integration of NLP and information retrieval.



# Pierre Boulanger

*Advanced Man-Machine Interfaces,  
Computer Graphics, Computer Vision  
and Multimedia Communications*



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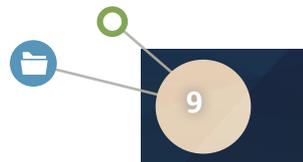
## RESEARCH INTERESTS

Virtual reality, sensor based geometric modeling, physical simulation.

## RESEARCH SUMMARY

Dr. Boulanger's main research topics are on the development of new techniques for tele-medicine, patient specific modeling using sensor fusion, and the application of tele-presence technologies to medical training, simulation, and collaborative diagnostics. His work has contributed to gain an international recognition in this field, publishing more than 310 scientific papers and collaborating with more than 20 universities, research labs, and industrial companies across the world. Dr. Boulanger is also the president of MedROAD Inc. a Canadian-based company specialized in telemedicine.

He cumulates more than 35 years of experience in 3D computer vision, rapid product development, and the applications of virtual reality systems to medicine and industrial manufacturing. Dr. Boulanger worked for 18 years at the National Research Council of Canada as a senior research officer where his primary research interest was in 3D computer vision, rapid product development, and virtualized reality systems. He now has a double appointment as a professor at the University of Alberta Department of Computing Science and at the Department of Radiology and Diagnostic Imaging. He is currently the Director of the Advanced Man Machine Interface Laboratory (AMMI) as well as the scientific Director of the SERVIER Virtual Cardiac Centre. In 2013, Dr. Boulanger was awarded the CISCO chair in healthcare solutions, a 10 years investment by CISCO systems in the development of new IT technologies for healthcare in Canada.



# Michael Bowling

*Artificial Intelligence, Computer Games,  
Reinforcement Learning, Robotics*



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## RESEARCH INTERESTS

Multiagent learning and planning, game theory, reinforcement learning, commercial computer games, robotics.

## RESEARCH SUMMARY

My research focuses on machine learning, games, and robotics, and I'm particularly fascinated by the problem of how computers can learn to play games through experience.

I am the leader of the Computer Poker Research Group, which has built some of the best poker playing programs on the planet. The programs were the first to beat top professional players in a meaningful competition and more recently have been shown to play a nearly perfect game of limit Texas hold'em poker. I also started the Arcade Learning Environment, a research testbed for investigating artificial intelligence techniques capable of general competency using Atari 2600 games. More recently I have begun exploring the application of advanced analytics to the sport of curling.

I completed my Ph.D. at Carnegie Mellon University in 2003, where my dissertation was focused on multiagent learning and I was extensively involved in the RoboCup robot soccer initiative. My research has been featured on the television programs Scientific American Frontiers, National Geographic Today, and Discovery Channel Canada, as well appearing in the New York Times, Wired, on CBC and BBC radio, and twice in exhibits at the Smithsonian Museums in Washington, DC.

# Dana Cobzas

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## RESEARCH INTERESTS

Medical images, computer vision.

## RESEARCH SUMMARY

My areas of expertise are centered around imaging and computer vision, with particular interest in mathematical models for medical image processing. Recently, I have focused on medical imaging, particularly segmentation, registration, and multidimensional data analysis, including modern techniques for Diffusion Tensor Image (DTI) processing. Among application I am involved in several projects including brain imaging with focus on neuroimaging, brain tumour segmentation and growth prediction, and body composition estimation from abdominal CT images.

I also have good knowledge of most computer vision such as dynamic vision (tracking), 3D modeling from uncalibrated images and video (reconstruction of geometry and appearance from images).

# Ehab Elmallah

*Algorithmics, Communication Networks*

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## RESEARCH INTERESTS

Communication networks, combinatorial algorithms.

## RESEARCH SUMMARY

My research interests lie in designing computational tools, protocols, mathematical models, and combinatorial algorithms with guaranteed performance measures for the design and analysis of computer networks.

## RECENT PROJECTS

- Path exposure and intrusion detection reliability problems in wireless sensor networks
- Location uncertainty problems in underwater sensor networks
- Mobility aspects in RFID systems
- Policy analysis in the design of firewalls and software defined networks
- Quality-of-service provisioning in wireless cellular networks
- Resource management in multi-hop wireless mesh networks



# Zachary Friggstad

*Algorithmics*

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## RESEARCH INTERESTS

Discrete optimization, approximation algorithms, mathematical programming.

## RESEARCH SUMMARY

I design algorithms for discrete optimization problems. Common examples include vehicle routing, facility placement, resource allocation, and job scheduling problems.

Many of these problems are NP-hard. This means we do not expect any algorithm is able to efficiently find optimum solutions to these problems. I cope with this difficulty by designing approximation algorithms: algorithms that find near-optimum solutions. These are not just heuristics that tend to perform well in experiments. Such algorithms come with a proven guarantee on how far their computed solutions can deviate from the optimum solution.

Often, but not exclusively, I consider tractable convex relaxations of these problems such as linear or semidefinite programming relaxations. The goal is then to find such a relaxation that represents the original problem with high fidelity.

# Russ Greiner

*Artificial Intelligence, Bioinformatics,  
Machine Learning*



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## RESEARCH INTERESTS

Artificial intelligence, bioinformatics, machine learning.

## RESEARCH SUMMARY

I am interested in building algorithms that learn from experience, to be able to perform their tasks better. Most of my current work has a strong application pull – i.e., is motivated by some specific tasks: for example, to better understand brain tumors (from MRI scans), various cancers based on microarray data, Single Nucleotide Polymorphisms, and/or metabolic profiles. Some other projects are more technology push – where the goal is more exploring some foundation or mathematical framework, rather than solving some application: such as learning Bayesian belief nets, active learning and addressing high-dimensional data (“large  $p$ , small  $n$ ”).

# Janelle Harms

*Communication Networks*



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## RESEARCH INTERESTS

Networks, resource management, wireless networks, sensor networks, mobile ad hoc networks, network design, performance evaluation.

## RESEARCH SUMMARY

The challenge of networks today is to accommodate a wide variety of applications with different service requirements on the same network. Research areas of interest include mobile computing, ad hoc networks, wireless sensor networks, Internet protocols, and network design. The research projects that I am interested in all have common threads of resource allocation and performance evaluation. The tools I use in my research include simulation, queueing analysis, combinatorial methods, operations research and measurement.

# Ryan Hayward

*Algorithmics, Computer Games*



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## RESEARCH INTERESTS

Algorithmics and games.

## RESEARCH SUMMARY

I am interested in algorithms, especially algorithmic graph theory. Much of my work relates to classes of graphs for which certain NP-hard optimization problems (e.g. min colour, max clique, max independent set) can be solved in polynomial time. Some such graph classes (e.g. weakly chordal graphs) are sufficiently general to include many well known classes of graphs, and/or many classes of graphs which arise from various applications.

I am also interested in algorithms for 2-player board games, especially Hex.

## RECENT PROJECTS

- Algorithms for Hex players and solvers (with P. Henderson and B. Arneson)
- Integer programming feasibility heuristics (with S. Ghosh)
- Weakly chordal graph optimization and recognition (with J. Spinrad and R. Sritharan)

# Abram Hindle

*Software Engineering*

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## RESEARCH INTERESTS

Software engineering, empirical software engineering, mining software repositories, power consumption analysis.

## RESEARCH SUMMARY

The focus of my research is the evidence-based study of software development. My field of research depends upon statistics, data mining, social network analysis, machine learning, NLP, signal processing, visualization, and software engineering. With respect to software engineering my research focuses on empirical software engineering, mining software repositories, software development processes, software maintenance, and software metrics. Other interests include computer music, music information retrieval, computer vision, programming languages, and computer security.

# Martin Jagersand

*Computer Vision and Multimedia  
Communications, Robotics, Computer  
Graphics*



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## RESEARCH SUMMARY

My group researches and develops real-time 2D and 3D video tracking, 3D modeling of geometry and appearance from camera vision, on-line camera-scene-robot kinematic model estimation, and vision guided motion control for robot arms and hands. Our aim is to make these methods robust so they work in unstructured natural environments such as outdoors or in human homes.

Applications that we work on include first-response robotics in dangerous or remote areas, to assess damage, and turn off damaged infrastructure (shut fluid valves, turn off electricity breakers etc.); tele-robotic systems for on-orbit Satellite repair; assistance robotics for the elderly and disabled; better human-robot collaboration, so humans can work with robots, not separately from robot work cells. We have developed 3D modeling from video and images for both objects and scenes, and we have expertise in how to extract precise geometric measurements from images and video.

## INDUSTRY COLLABORATIONS AND COMMERCIALIZATION

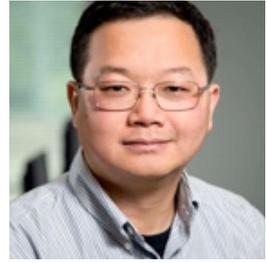
- **Canadian Space Agency and German Aerospace Centre:** Real-time capture of 3D geometry and appearance for robot predictive display. Tele-robotic systems for high-DOF robot arms and hands.
- **Robotics manufacturers in Canada and USA:** Vision-based motion guidance systems for robot arms and hands. Human-Robot Interfaces (HRI).
- **Aerospace companies:** 2D and 3D video tracking algorithms and software.
- **Traffic authorities:** Analysis of road intersection camera images.

# Paul Lu

*Software Systems*

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## RESEARCH INTERESTS

Parallel and distributed systems, operating systems, cloud computing, high-performance wide-area networks, bioinformatics.

## RESEARCH SUMMARY

I am interested in all aspects of high-performance computing, but especially parallel and distributed systems, and cloud computing. My research program centers on systems software (OS, VMs, parallel programming) and, most recently, high-performance data transfers and IaaS cloud computing.

# Martin Mueller

*Artificial Intelligence, Computer Games,  
Machine Learning, Reinforcement  
Learning*



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## RESEARCH INTERESTS

Algorithms, artificial intelligence, heuristic search, computer games, automated planning, knowledge engineering, machine learning, combinatorial game theory, computer Go.

## RESEARCH SUMMARY

Powerful modern heuristic search programs rely on 3+1 foundations: 1. a search algorithm, 2. the domain knowledge used for building evaluation functions and search control, and 3. simulation techniques that are used to explore many possible trajectories of possible action sequences. The fourth foundation is machine learning, which is used on a large-scale to acquire domain knowledge.

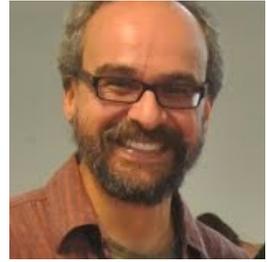
The high-level goal of our research is to develop new theoretical and practical approaches which advance the performance of heuristic search techniques.

I have worked for thirty years on these research topics, focusing on game tree search, domain-independent planning, and algorithms for combinatorial games. One notable success of my research group is the development of the open source games software framework Fuego. In our work in the field of AI planning we have developed a series of internationally successful planning systems based on macro learning and on Monte Carlo random walks. My group has numerous publications in top quality venues and major conferences in the fields of computer games, planning and general AI.

# Mario Nascimento

*Database Systems*

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## RESEARCH INTERESTS

Databases.

## RESEARCH SUMMARY

Within the wide area of databases, my students and I are mainly interested in spatio-temporal data management and data management within sensor networks.

**Spatio-temporal Data Management:** Spatio-temporal data has always existed, but is more common nowadays, due, for instance, for advances in mobile devices in general. Hence, there is a pressing demand for more effective and efficient management techniques for this type of data. At a very high level, the task at hand is managing who was, is or will be where and when. Several research issues arise, for instance, when indexing this type of data when one has to deal with very large number of updates while still offering acceptable real-time query performance.

**Data Management in Sensor Networks:** A close and relatively new research topic related to spatio-temporal data management is that of data management on sensor networks. For instance, using this paradigm, (very small) sensors can be spread over a large area (e.g., a forest) in order to gather and store data which can be used for (a posteriori) query processing. A chief concern in this environment is to minimize the energy consumption, in particular during query processing time.

# Ioanis Nikolaidis

*Communication Networks*

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## RESEARCH INTERESTS

Networked and distributed systems and protocols, performance evaluation, wireless sensor networks, applications of sensor networks.

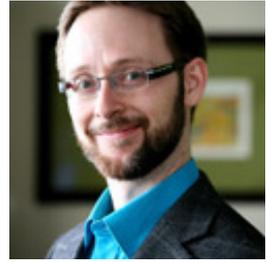
## RESEARCH SUMMARY

My research interests include the design and performance analysis of network protocols, and networked distributed systems in general with an emphasis on wireless sensor-based systems. In particular, I am conducting research related to (a) specialized medium access, scheduling and routing protocols, (b) efficient information extraction and aggregation of sensor data, (c) characterization and mitigation of interference in wireless communication environments, (d) applications of wireless sensors in localization and tracking, and (e) design approaches for energy harvesting to support self-sustaining operation of wireless sensor networks.

As a side issue, I develop models and specialized simulation environments for the study of such systems. I use as the proof-of-concept environments the various deployments of the SmartCondo (of which I was a founding member) infrastructure, as well as deployments in building and building construction environments.

# Patrick Pilarski

*Artificial Intelligence, Machine Learning, Reinforcement Learning, Robotics*



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## RESEARCH INTERESTS

Reinforcement learning for real-world environments (e.g. autonomous robotics, rehabilitation, and prosthetics), adaptive rehabilitation technology, real-time machine learning, human-machine interfaces, biomedical pattern analysis, robotics.

## RESEARCH SUMMARY

Patrick leads the AICML Adaptive Prosthetics Project—an interdisciplinary initiative focused on creating intelligent artificial limbs to restore and extend abilities for people with amputations. As part of this research, Patrick explores new real-time machine learning techniques for sensorimotor control and prediction, including methods for human-device interaction and communication, long-term control adaptation, and patient-specific device optimization. Patrick has also pioneered techniques for rapid cancer and pathogen screening through work on biomedical pattern recognition, robotic micro-manipulation of medical samples, and hand-held microfluidic diagnostic devices.

# Davood Rafiei

*Database Systems*



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## RESEARCH INTERESTS

Big data, querying and indexing, text management and integration, web and social media search and analysis.

## RESEARCH SUMMARY

My current research is in the intersection of database systems and Web information retrieval, where I study scalable methods for search and exploration of big document collections and online resources, querying and analyzing large networks and storage and indexing of non-traditional data.

## CURRENT PROJECTS

<http://webdocs.cs.ualberta.ca/~drafie/research.html>

- Querying web tables
- Text information retrieval and management
- Historical data querying and indexing
- Stream query processing



# Mohammad Salavatipour

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## RESEARCH INTERESTS

Approximation algorithms, hardness of approximation, algorithmic graph theory, probabilistic and randomized algorithms.

## RESEARCH SUMMARY

I am interested in design and analysis of algorithms; in particular approximation algorithms and hardness of approximation. Most of these problems are optimization problems that are known to be hard. Our goal is to design efficient algorithms with provable guarantee on the quality of the solution with respect to the optimum one. These problems arise in various applications such as clustering problems, vehicle routing, scheduling, and network design.

# Jonathan Schaeffer

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## RESEARCH INTERESTS

Artificial intelligence, computer games.

## RESEARCH SUMMARY

I am interested in anything to do with heuristic search (such as single-agent (A\*) and two-player (alpha-beta) search). Single-agent search has important industrial applications including planning problems and optimization problems.

I am co-founder of Onlea (Onlea.org), the world's first MOOC (Massive Open Online Course) production company. Our mission is to create "Mindful online learning crafted with scholarship, creativity and quality." We strive to achieve the highest possible engagement, completion and retention rates in all of our products.

## INDUSTRY COLLABORATIONS AND COMMERCIALIZATION

We work on commercial games with our partners Electronic Arts and BioWare. Some of the problems we are looking at are AI scripting, path-finding, earning, and testing. We have applied our work to role-playing games, sports games and real-time strategy games.

# Eleni Stroulia

*Artificial Intelligence, Software Engineering*



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## RESEARCH INTERESTS

Web-based systems, service-oriented architectures, legacy systems re-engineering, interface migration, design reuse and evolution, services science, virtual worlds, mobile apps, model-driven engineering.

## RESEARCH SUMMARY

Eleni Stroulia is a Professor and NSERC/AITF Industrial Research Chair on Service Systems Management (with support from IBM) with the Department of Computing Science at the University of Alberta. Her research addresses problems motivated by industrial and community needs with software systems designed to support the activities of the people involved and improve their efficiency and the quality of their output.

## PROJECTS AND RESEARCH COLLABORATIONS

- **Smart Condo / AGE-WELL:** Technology to support people with chronic conditions so they are able to live independently longer, as well as to educate health-science students in using technology to provide better care. Co-led by Dr. Lili Liu (Occupational Therapy). Clinically evaluated with the Glenrose Rehabilitation Hospital.
- **GRAND/HLTHSIM:** Serious-game virtual-world simulations for training health professionals, including students in medicine nursing and EMS programs, integrating mobile devices and virtual worlds.
- **SAVI (Smart Applications on Virtual Infrastructures):** Methods for extending and migrating web-based systems with mobile and cloud-based components to enable analytics services.
- **Data-Driven Knowledge Mobilization, Translation & Innovation:** Tools (“the Forum”) for managing, observing and mobilizing the research activities of distributed teams.



# Csaba Szepesvari

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## RESEARCH INTERESTS

Machine learning, reinforcement learning, learning theory.

## RESEARCH SUMMARY

Traditional programming fails miserably when computers need to interact with the “real-world.” Examples include a robot whose mission is to explore Mars or to clean up a room, an algorithm that needs to decide if a person should be given credit, or a chat-bot that should talk to humans in English. Artificial intelligence is the science whose aim is to create computer programs that are able to cope with problems like these.

A core tool of artificial intelligence is machine learning. Machine learning allows computers to learn from data. This way computers can discover solutions to difficult problems on their own.

My research focuses on creating smart, efficient learning algorithms. I am working on developing better learning algorithms and understanding what makes efficient learning possible. I am particularly interested in problems when a machine continuously interacts with its environment while trying to discover autonomously a good way of interacting with it.

# Ken Wong

*Software Engineering*

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## RESEARCH INTERESTS

Software engineering, reverse engineering, program understanding, software visualization, mining software repositories, problem determination, root cause analysis.

## RESEARCH SUMMARY

Software must evolve over time or it becomes useless. Unfortunately, over time, software systems become more complex and increasingly difficult to understand and change to meet new business requirements. An understanding gap has grown between what is known, useful, and available information about the system and what needs to be known to make changes.

## INDUSTRY COLLABORATIONS

Software engineering research does not happen in a vacuum. I am involved in the Consortium for Software Engineering Research (CSER). I am currently working with CA Technologies Labs. In the past, we have worked with IBM Canada in Toronto, klocwork Solutions in Ottawa, and Intuit Canada in Edmonton.

# Jia You

*Artificial Intelligence*

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## RESEARCH INTERESTS

Knowledge representation and reasoning.

## RESEARCH SUMMARY

A computational problem can be solved by designing and implementing an algorithm for it, or by expressing it by a computer program in an intuitive modelling language that comes with software for processing programs written in the language. The latter is an example of what is called declarative problem solving and knowledge representation. I am interested in all aspects of declarative problem solving and paradigms, such as answer set programming, constraint programming, SMT solving, data access with ontology and rules, etc. My research typically focuses on semantic issues, computational properties, implementation strategies, and applications.