

SPRING 2007

@dcs

Computer Science
UNIVERSITY OF TORONTO

**Ancient Animals,
Novel Antibiotics:
Computational biology
comes to the department**
Page 4

**BumpTop: CS alumnus
takes the PC desktop
into the 21st century**
Page 8

A Step Ahead:

Students take their studies to the
next level in Capstone Courses

Page 3

Student William Lim
shows off the motion
sensors on his shoes

Message From The Chair

It is with great pleasure that I write this introduction to our inaugural @dcs newsletter. It has taken us a while to get to this point — we are the oldest computer science department in the country, after all — but this newsletter is part of a renewed effort to stay in much closer contact with our friends, partners and alumni, and to more directly inform the world at large of the wide array of activities taking place in the department.

@dcs is just one component of a much broader outreach effort we have embarked on over the past year. Our new Communications and Liaison Officer, Sara Franca, has been at the forefront of much of this activity, including serving as editor of this newsletter and author of our new quarterly e-newsletter. Other initiatives include the launch of our new website, and our first annual Research in Action Showcase (see the story on page 5). These and other endeavours will continue to strengthen the DCS community.

In my nearly three years as Chair, the accomplishments of our faculty, students and staff have been a source of great pride; it is impossible to do justice to even a small part of this in such a short space. I am constantly amazed by the quality and impact of the research taking place in our department: by our senior faculty, almost all of whom have been leading their subfields of computer science for years; by our junior faculty, who are taking up similar leadership roles in existing fields, or in many cases helping define new fields; and, by our graduate students, whose research contributions consistently extend the state of the art in computer science.

Our teaching is as strong as ever: our average teaching evaluations continue to improve each year to among the highest levels in Arts & Science; our faculty members are recognized with significant teaching awards; our curriculum continues to challenge and excite our students. Our undergraduates have been just as successful, whether engaging in research projects or making the ACM Programming Contest 2007 World Finals in Tokyo this spring! Of course, our alumni continue their impressive work once they graduate, having an impact worldwide (see our alumni profiles on page 7).

@dcs is, in part, a celebration of the groundbreaking research, excellent teaching and successes of graduates within the department. Of course, keeping abreast of developments at DCS is a great way to keep your finger on the pulse of computer science at large. In future issues, I will delve into such developments in the life of the department in greater detail. In the meantime, I'd like to encourage all readers to provide us with feedback, not just on this newsletter, but on how best we can keep in touch. What would you like to hear about? How would you like to be contacted? We also welcome any updates you might wish to send our way. We're keenly interested in the successes of our alumni and friends, no matter what path you may have taken professionally or in life.

Until next time @dcs,

Craig Boutilier (M.Sc. 8T8, Ph.D. 9T2)
PROFESSOR & CHAIR



“Keeping abreast of developments at DCS is a great way to keep your finger on the pulse of computer science at large.”

Editor's Note

Like any field of study, Computer Science comes with its fair share of stereotypes and assumptions. Who hasn't imagined the life of a computer scientist — the individual sitting alone in a cubicle? Five minutes at Department of Computer Science (DCS) turns that perception on its head: students and faculty are on the cutting edge of the field, working together in state-of-the-art labs, developing new programs and ideas that affect the very foundation of computer science. One of my favourite experiences at the department, so far, would be observing the undergraduate capstone course (see page 3) on the day students presented their completed class projects. I could not keep the smile off my face as these undergraduates excitedly showed their work, teasing and jostling each other — and showing off very impressive work using equipment in the Dynamic Graphics Project (DGP) lab, a \$2.5 million dollar facility. Faculty, staff and students were engaged in academic collaboration; it was just a perfect example of the stimulating environment here at DCS.

Consider the range and depth of CS in our world today: it is linked to virtually every aspect of our lives, and offers the real potential to make our world a better place. @dcs offers a glimpse into the DCS community, and we hope it will give you a sense of how the department has grown over the last 43 years. With respect for our history and enthusiasm for building on that foundation, DCS continues to make an impact throughout the discipline.

We hope this newsletter reflects the character of the department: a hub of collaboration, innovation and discovery.

Sara Franca
EDITOR-IN-CHIEF

@dcs

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EDITOR-IN-CHIEF: Sara Franca

EDITORIAL BOARD: Marsha Chechik, Sven Dickinson, Graeme Hirst, Karen Reid

CONTRIBUTORS: Anand Agarawala, Craig Boutilier, Sara Burns, Leanne Dawkins, Marina Haloulos, Alina Rahman, Frank Rudzicz, Christopher Sparks, Julie Weedmark

DESIGN: JoAnn McHardy

COVER: Cindy Yvonne Blažević

LETTERS, COMMENTS AND ADDRESS UPDATES SHOULD BE SENT TO:

Editor, @DCS

Department of Computer Science
University of Toronto

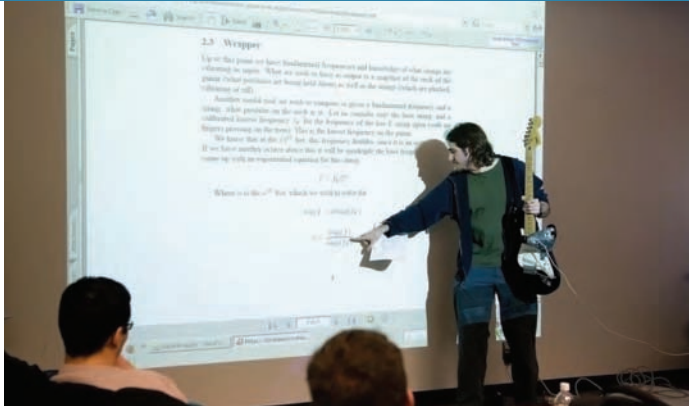
10 King's College Road, Room 3302
Toronto, ON M5S 3G4

Tel: 416-978-3619 Fax: 416-978-1931

E-mail: dcs-newsletter@cs.toronto.edu

Website: www.cs.toronto.edu

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(Above) Ben Cecchetto explains the computer-guitar interface he developed to his class.



(Left) At the Mentorship Reception on January 25, alumna Allison Straker (B.Sc. OT), left, advises students Cristina Balanescu and Fei Shi on life after DCS.

Undergraduate Alumni-Student Career Mentorship Program

The mentorship program, hosted jointly by DCS and the Faculty of Arts & Science Alumni Office, gives students the chance to meet with professionals who have a firsthand perspective on making the transition from DCS to the working world. This year's program matched up 18 mentors with 23 eager students, and offered undergraduates the opportunity to network and gain advice and encouragement from industry professionals. We invite alumni who are interested in participating in this program to contact the Arts & Science Alumni Office: alumni@artsci.utoronto.ca.



First-Year Learning Communities Introduce New Students to DCS in Style

The First-Year Learning Communities (FLC) program in the Faculty of Arts & Science provides first-year students with the opportunity to develop friendships with other students and be introduced to the resources, opportunities, culture and treasures of the campus and its surrounding community. This year, 37 CS students took part in the program, attending information sessions and participating in social activities such as tours, sports and games, ice skating and pumpkin carving.

A Step Ahead: Capstone Courses Bring Research into the Classroom

COVER STORY

DCS offers a course in which students work on a project that brings together ideas from across their undergraduate education. Each year, the CSC490 "capstone" experience includes a different theme; the most recent course was based on the concept "User Interfaces for Video Games." This small and interactive class gives students the chance to develop their own projects and produce a working implementation of their creation.



(Right) William Lim plays with classmate Liezhao Xie's video game interface, which uses the Vicon Motion Capture System to use body movements as the interface to a martial arts game.

National Awards Recognize DCS Graduate Students

Asked why he chose to come to UofT, Ph.D. candidate Frank Rudzicz declares simply, "DCS has the best graduate-level program in Computer Science in Canada." He was attracted, more specifically, to the Computational Linguistics program housed within the department's Artificial Intelligence group.

It is no secret that the department's research strength is due to the participation of high-quality graduate students such as Rudzicz, who has been recognized with the top student award in the country: the Canada Graduate Scholarship (CGS) in the D3 category. The CGSD3 (2006-2007), offered by the Natural Sciences and Engineering Research Council of Canada (NSERC), provides the winner with a 3-year grant of \$35,000 per year. When asked about how it felt to receive such a prestigious award, Rudzicz modestly comments, "The award was helpful in getting me accepted to DCS, and for that I am very grateful."

Rudzicz is currently starting an impressive new project in collaboration with the Department of Speech-Language Pathology in the Faculty of Medicine. He explains: "The project will combine various elements of computational linguistics with physiologically-inspired models for speech recognition." While working with a strong research team and being published are important to Rudzicz, he also knows the importance of being involved in various other ways at DCS. The department is fortunate to have graduate students like Rudzicz, who are not only the brightest student minds, but are deeply committed to their academic environment as a whole.

During the 2006-2007 year, Toronto emerged with 13 CGSD3 awards – 26.5% of the total given in Ontario, and almost twice as many as the next closest university. Of that total of 13 awards, 5 DCS students held CGSD3s, representing over 38% of the total amount given to the university. It is an honour for our students to be recognized by distinguished organizations like NSERC. *For more information on these awards, please visit the NSERC website, at www.nserc.gc.ca.*



Graduate

Computational Biology: The New Research Group at DCS

Examines the Various Molecular Faces of Life on Earth

“We’re not even a year old,” Professor Michael Brudno says, gesturing to the newly appointed lab space. “Even the carpet is new.”

In the last year, the Computational Biology research group has moved forward quickly, establishing a presence at the university. Collaborations within the department, the university and beyond have been forged, new research projects continue to be developed, courses are attracting an audience and more undergraduate and graduate students are joining the team all the time.

The perfect university, the perfect city

The location of the department makes this an ideal place to create such a research group. Brudno, who is actually a Canada Research Chair holder joint-appointed to DCS and UofT’s Donnelly Centre for Cellular & Biomolecular Research (CCBR) notes, “Here at the University of Toronto, we can combine a top-level CS department with a top-level medical program – all on the same campus. There are maybe only one or two other places you can do that in North America.” The Computational Biology group has the ability to work with celebrated minds in both computer science and biology, and, an added bonus, has access to the top computer science and biology students.

What’s more, the city of Toronto has what Brudno calls a “scientific atmosphere.” Professor Ryan Lilien, also jointly appointed to DCS and the Donnelly CCBR (and who also holds an M.D. in addition to a Ph. D. in Computer Science), con-

curs: “four of the top Toronto hospitals are right across the street, and they are affiliated with UofT... we have direct access to not only the best minds in the field, but also to the equipment and resources that can play an important role in research.”

While the research group has immersed itself in this academically rich location, they have also built and maintained strong ties with leading universities and institutes throughout the rest of North America. Collaborations with faculty and students from places such as Berkeley, Michigan, Carnegie Mellon and Duke allow the Computational Biology group to explore research from an even broader perspective.

Research: where we have come from, where we are going

Under the umbrella of computational biology, the research group addresses essential questions, ranging from evolutionary science to medical health.

Brudno, in collaboration with faculty member Quaid Morris (at the Banting and Best Department of Medical Research and cross-appointed to DCS), has begun working on a project that predicts the genetic makeup of ancient animals, helping us understand how we as a species evolved. The group is exploring what the ancestors of humans and fish might have looked like, down to the regulatory systems.

Students in Computational Biology are encouraged to get involved in research work as soon as possible, so they can take ownership of their work.

“We really value their participation,” Brudno comments. He also emphasizes the importance of getting the students involved in the collaborations across campus and beyond: “we don’t want them sitting in the small vacuum of the lab.”

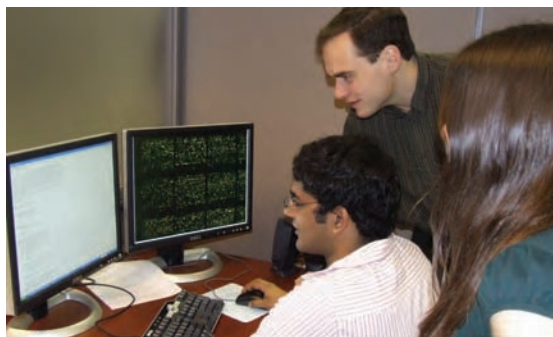
Lilien is currently working on a project that carries a more distinctly medical focus. This project, an external collaboration with a group at Duke University, is working on algorithms for protein design. “We are developing computational tools to predict ways of tweaking the structure of proteins involved in antibiotic synthesis, so that they may produce variants on their natural antibiotic product... these variants may avoid existing problems with antibiotic resistance while maintaining their antimicrobial properties. Essentially, by changing the structure of the proteins, we will have the power to synthetically alter antibiotics.” In some related work, Lilien is collaborating with the Structural Genomics Consortium at UofT to reduce the time required to experimentally determine a protein’s 3D structure.

The Computational Biology group is also developing tools that are computationally state-of-the-art while remaining useful to biologists. One project Brudno is working on with the DCS Computer Systems and Networks research group focuses on virtual clusters (or clusters of virtual machines), and would enable computational biologists to work more easily, without compromising security. This development would be beneficial to all study areas: “it will make it easier to get computation done, especially for those who don’t have the hardware resources.”

A heterogeneous lab, a dynamic hub for collaboration and academic discourse

While Computational Biology is a new kid on the UofT block, with its various collaborative partners, eager students and burgeoning research projects, there’s no doubt it will continue to make major strides. Lilien sees the exciting opportunity to create a “heterogenous lab” at the university, made up of faculty and students from different backgrounds: “we can then approach research from multiple (academic) perspectives.”

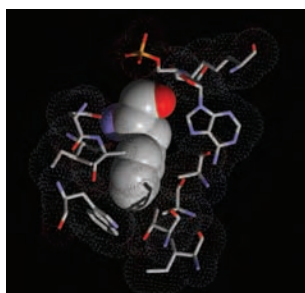
This group has filled a real need here at the UofT, receiving an enthusiastic response from both faculty and students. One could take the example of the graduate student who flies into Toronto just one day a week for Lilien’s new Computational Structural Biology course. “He lives in Boston,” Lilien comments. “He missed a class this winter because flights out of Logan Airport were delayed due to a snowstorm.” Sure beats the “I overslept” excuse.



(Left) Professor Michael Brudno works in the lab with graduate student Elango Cheran, while another student, Nilgun Donmez, looks on.

(Below left) This image shows the active site of a protein; by computationally predicting changes to its structure, researchers can reduce the number of experiments required to alter its function.

(Below) A team is exploring the genetic roots of ancient animals, using “living fossils” such as the Coelacanth.



Wikipedia: Ballista

Research in Action: Showcasing Work at DCS

“ The showcase provided us with a great opportunity to cross the divide between different professions and institutions ... creating new potential pathways for future research and collaborations. ”

Jennifer Boger
Manager, IASTSL

In early February, the department welcomed over 80 industry representatives to its inaugural Research in Action (RIA) showcase. The afternoon event, held in DCS's Great Hall of Computing, highlighted 12 research projects – just a fraction of the work taking place in the department. The purpose of the showcase was to share a sampling of work and inspire more collaborative research, bringing together faculty and students with potential industry partners.

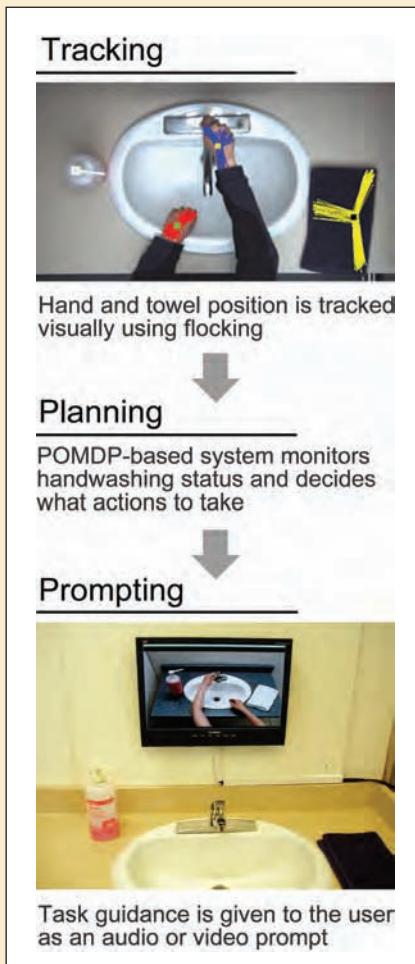
A real strength of the department is the truly collaborative, interdisciplinary nature of DCS research. The projects that were showcased at RIA came from a broad spectrum of fields, including economics, medicine and life sciences. Jennifer Boger, Manager of the Intelligent Assistive Technology and Systems Lab, which presented COACH (see at right), commented, “the showcase provided us with a great opportunity to cross the divide between different professions and institutions... attendees came from a refreshing variety of backgrounds, such as industry, academia, government and media. A forum like this allows us to share our ideas, and exposes us to people who focus on different fields and applications, creating new potential pathways for future research and collaborations that we may not have thought of otherwise.”

Projects shown included the iTrustPage (software that exposes spam), work with a video-based people-tracking system, the BlogScope tool that pulls interesting information from millions of blogs on the Web and some work on modelling financial instruments, to name a few. Another project that attracted great interest was the NAViGaTOR demo — which illustrated the uses of software that visualizes and analyzes protein-protein interaction networks.

Due to widespread industry, media and university interest in the 2007 event, the department plans to present RIA on an annual basis. For a description of all of the projects shown at this year's event, please visit the DCS website at www.cs.toronto.edu.



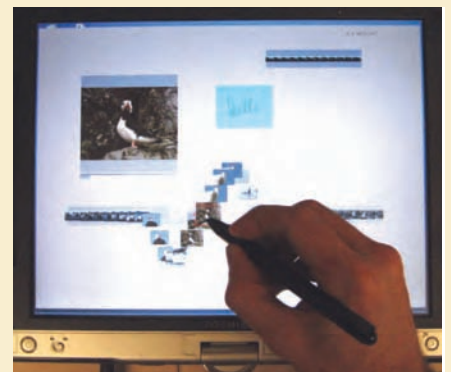
Nilesch Bansal (graduate student, far right), demonstrates BlogScope to a number of showcase attendees.



COACH (Cognitive Orthosis for Assisting Activities in the Home) is a prototype of a supportive environment being developed to help people with dementia complete activities of daily living without the aid of a caregiver.



Graduate student Jennifer Horkoff leads a discussion on the i* Modelling Language, which was designed to help organizations understand the rationale for introducing new computer systems.



The "Pressure-Sensitive Pen Interaction" demonstration showed how the manipulation of raw digital video footage is simplified by a set of novel interaction techniques.

Faculty Awards



Steve Cook

This past summer, **Steve Cook** was honoured with the John L. Synge Award of the Royal Society of Canada. This prestigious award acknowledges outstanding research in any of the branches of the mathematical sciences. The citation noted, “[Professor Cook’s] work is characterized by its creativity and pervasive influence throughout his distinguished 40 year career; he continues to produce seminal contributions on feasible logics and complexity theory.”

Hector Levesque (B.Sc. 7T5, M.Sc. 7T7, Ph.D. 8T2) has been elected to the Academy of Science of the Royal Society of Canada. This is the highest honour that can be attained by scholars, artists and scientists in the country. Levesque is one of only three computer scientists elected to the RSC in 2006, and his tremendous body of work on knowledge representation and reasoning has been recognized for its originality and impact.



Hector Levesque

This February, **François Pitt** (M.Sc. 9T4, Ph.D. 0T0) was named a recipient of the Faculty of Arts and Science Outstanding Teaching Award for 2005-06. This significant prize is awarded on the basis of excellence in teaching and contributions to undergraduate education during the past academic year. Nominations are made by both peers and students, and recognize the ability to stimulate critical thinking and enthusiasm in students.



François Pitt

Ravin Balakrishnan (M.Sc. 9T7, Ph.D. 0T1) was awarded a 2007 Alfred P. Sloan Research Fellowships. These distinguished awards are given to young faculty across North America, recognizing excellence in specified fields of science. Balakrishnan is one of only 16 faculty members honoured within computer science. This is the third year in a row that DCS has had a faculty member win a Sloan Fellowship, and is the only CS department in Canada with that distinction.

For more information on these honours and for more faculty award-winners, visit the DCS website www.cs.toronto.edu.

Sheila McIlraith (Ph.D. 9T7)

After research stints at Stanford University and Xerox PARC, graduate Sheila McIlraith returned to DCS, joining the Artificial Intelligence group as a faculty member in 2004. While at Stanford, McIlraith applied her research to developing next-generation NASA space systems. She is also credited with doing pioneering work in the area of the Semantic Web, a vision for a next-generation Web that can be understood by computer programs. McIlraith finds DCS a great fit, due to “the high cal-

ibre of the faculty and the value this department places on fundamental research.”

McIlraith and her students study problems in the area of knowledge representation and automated reasoning. She gives the example, “If you’ve ever planned vacation or business travel online, you know how long it takes to find a plan that optimizes all your personal constraints.” Some of the research they are developing will facilitate interoperability among pro-

New Faculty

Yashar Ganjali comes to the department after completing his Ph.D. work at Stanford.

His research is focused on the architecture, design and algorithms involved in developing high speed routers and switches. Ganjali notes, “It’s great having a position with the Computer Systems and Networking group – young, smart and energetic people who are really passionate about what they do. This group has huge potential to grow, and I’m excited to be part of it.”

Ganjali spends his free time hiking, camping, swimming, reading and spending time with family and friends.



Ryan Lilien joins DCS after having completed his Ph.D. and M.D. at Dartmouth. With a joint appointment between Computer Science and Medicine, Lilien is part of the Computational Biology research group (see page 4), and is involved in projects such as working on algorithms for protein design. When asked

about what he does in his spare time, Lilien’s answer is concise: “Ice hockey. Playing, watching, reading, talking – it’s ice hockey.” Sounds like a good fit for a Canadian university.



grams and devices on the Web. Their work has the potential for high impact for businesses, as well as saving the rest of us time for more pleasurable pursuits.

Time is at a premium for Sheila these days, with an active research group and a young family. An outdoor enthusiast, McIlraith looks forward to more time in the backwoods and on the slopes when her family is a little older.

Staff Q&A



Donna George

Undergraduate Program Administrator

What is your favourite part about your job?

Working with our great Associate Chair, Jim Clarke, and our student counsellors, Leanne Dawkins and Wendy Pais. This position has a lot of diversity and allows us to develop ways to improve the student experience and the teaching faculty experience.

What do you enjoy doing in your spare time?

I am an avid outdoor person and I am involved with a small Northern Ontario town. I also love cooking, entertaining, reading, laughing and enjoying life.



Lloyd Smith

Administrative Computing Support

What is your favourite part about your job?

I like not knowing what is going to happen on any given day. No two days are the same; it keeps everything new and interesting.

What do you enjoy doing in your spare time?

I enjoy reading and surfing the web, especially about science and technology issues. My family and I go to see a movie every week, and I love to travel.



Calculator provided courtesy of Professor C.C. Gottlieb

The Monroe Calculator

(circa 1950) uses octal, rather than decimal, arithmetic. Since each octal digit is represented by three bits, it effectively does binary arithmetic, too. It was used to check the arithmetic unit of FERUT, the electronic digital computer acquired by the University of Toronto in 1952. (This was the second electronic digital computer sold anywhere in the world.) When FERUT was first installed, it was sometimes unreliable, and a product displayed in binary on the CRT monitor could be compared with that calculated on the Monroe.

SPECIAL EVENT

Craig Boutilier
 Professor and Chair, Department of Computer Science
Cordially invites you and a guest to attend the fifth annual
**Spring Reunion Alumni Reception
 and Inaugural Guest Lecture**

Thursday, May 31, 2007
Lecture - 5:30 p.m., Room 1210
Reception - 6:15 p.m., Room 3200
Bahen Centre for Information Technology
 40 St. George Street
 R.S.V.P.
 Acceptance Only by May 25, 2007
 Contact Meera Rai (416) 978-1194
 alumni@artsci.utoronto.ca

Featuring our Guest Lecturer
 Professor and Alumna
Sheila McIlraith
 (Ph.D. 9T7)
who will be presenting
 “The Semantic Web Allows
 Computers to Automate Finding,
 Sharing and Combining Information
 – Will it Flourish or Fail?”

*See Prof. McIlraith's Profile on Page 6.

COLLABORATION INNOVATION DISCOVERY

Alumni Profiles

Anand Agarawala (M.Sc. 0T6)

When Anand Agarawala re-imagined the PC desktop in a dynamic, 3-D environment known as BumpTop, he created serious buzz. A demo of the project is currently the most-watched video of software in YouTube's history. Agarawala comments, "We're now up to over 2.5 million views, if you count all of the different uploads." Media coverage of BumpTop has also been extensive; the project has been reported by the New York Times, BBC World News, MTV, CBC, CTV and dozens of magazines around the world.

As a graduate student at DCS, Agarawala was encouraged by research advisor Ravin Balakrishnan to develop his ideas in the world-renowned Dynamic Graphics Project (DGP) lab. Agarawala even got involved in an undergraduate project course, where he was exposed to interaction design work, like CrossY, which imagined what would happen if you removed pointing-and-clicking on icons from traditional interfaces and replaced it with crossing a line, "which is more natural on a pen – a really visionary piece of work." Agarawala acknowledges, "These sorts of projects really opened up my ways of thinking."

They eventually inspired him to create BumpTop, software that treats desktop documents as objects that can be piled, grouped, resized, crumpled and appear to be affected by gravity: "Traditional interfaces can feel lifeless and not very engaging, so there are lots of opportunities to improve them with new user interface ideas." When asked about the public response to the project, Agarawala



observes, "I think maybe there's something really visceral about BumpTop that resonates with people. Often, a person will stay organized in a way that would look messy to others, but which is actually a very meaningful way of organizing for that person. Computers don't really support this type of more casual organization; they're very binary, reflecting more how a computer thinks."

Agarawala started up his own company, Bump Technologies, Inc. (www.bumptop.com), after graduation, and has remained in touch with the department. It helps to have that support; the last couple of years have been a heady ride. Agarawala notes with a wry smile, "this past February, somebody created a Wikipedia page about me... and my life was officially fulfilled."

“There's something really visceral about BumpTop that resonates with people.”

Alina Rahman (Hons. B.Sc. 0T4)

Alina Rahman enrolled at UofT, seeking a computer science department with "a great reputation, convenient urban location and a recruitment list that included highly regarded companies." She soon discovered a rich, multi-faceted experience that helped pave the way to a satisfying career in Technology Consulting.

"One particularly memorable highlight was my first-year, introductory Computer Science course with Professor Francois Pitt," Rahman shares. "Professor Pitt's enthusiasm for the subject and engaging approach to teaching constantly elevated course lectures and assignments to the top of my priority list!"

As an undergraduate student, Rahman was able to do some interdisciplinary research: "I landed a Research Assistant position in the department of Economics; I was responsible for the extensive statistical analysis of millions of Census records. I designed programs that calculated and logically sorted data, and it introduced me to the practical applications of CS... seeing my code transformed into a working program made it a really rewarding experience."

As she approached graduation, Rahman became intrigued by the consulting profession: "it appealed to me as a balance of technical skills development and extensive client and colleague interaction, and offered

a continuous learning environment." It was not long before she secured a position with Accenture as a consulting analyst, specializing in the Canadian telecommunications sector. Rahman has enjoyed the demands of this exciting position, working with industry-leading companies in the areas of networking, post-merger integration and customer billing solutions.

Rahman is not only an accomplished graduate, but also a donor to the program. When asked about why she has chosen to support DCS, she explains, "I am grateful to the UofT and the department for arming me with the skills and competencies that enabled me to define a career and find a job with a global consulting firm. I wanted to give back to DCS so that others, like me, are given the same opportunities I enjoyed."

Reflecting on her own experience, Rahman notes, "To succeed in the world of business, one requires a balance of interpersonal, technical and analytical skills. Being engaged in social networks, such as the DCS Student Union, taking courses with a large element of group work and learning to think beyond the immediate problem are all keys to fully leveraging your university experience in the post-graduation realm." We can agree that this is something Rahman has managed to do with great success.



“I wanted to give back to DCS so that others, like me, are given the same opportunities I enjoyed.”