Research

Nanotechnology to merge art and engineering

From butterfly wings come great things. Engineering Science professor Bozena Kaminska developed ground-breaking nanotechnology that can replace holograms on items needing authentication, such as bank notes and concert tickets. Similar to shimmering morpho butterfly wings, Kaminska’s nanotechnology product captures, reflects and refracts light to release an array of colours without using pigments or dyes.

Today this nanotechnology innovation is finding its way to commercial markets driven by Nanotech Security Corp., a company in which Kaminska serves as Director and Chief Scientific Officer. Clients in North America, Asia and Europe are currently piloting it in their bank notes and other security products.

Her research team used microscopic gratings composed of nanostructures – or tiny holes – to interact with light. A one square centimetre surface could contain 1.6 billion holes. These nanostructures can be implanted on many different materials and are difficult, if not impossible, to be replicated by a counterfeiter.
Never one to sit still, Kaminska, who was appointed a member of Natural Sciences and Engineering Research Council of Canada (NSERC) last year and who is Canada Research Chair in Wireless Sensor Networks, is preparing to launch a second-generation of this nanotechnology. This will incorporate nanotechnology into visual art pieces.

Her inspiration came after meeting with Passport Canada’s research and development team in 2013. When they said they wanted a cost-effective way to embed passport photos into nanostructures, Kaminska and her post-doctoral fellow Hao Jiang started working on a solution. Using a grant through the Graphics, Animation and New Media Network Centre of Excellence, her SFU research group started collaborating with media artist Christine Davis and post-doctoral fellow Aleksandra Kaminska (Bozena’s daughter) to explore integrating these nanostructures in a wide range of products and materials suitable for mass production.

The team of SFU engineers and media artists developed a product called Nano-Media, and are preparing for a launch later this year.

Nano-Media manipulates nanostructures so they act as pixels, allowing the display of multi-channel images. Owing to the small scale of nanostructures, they can be used to embed color images at ultra-high resolutions, potentially 100,000 DPI.

In addition to displaying ultra-high resolution images, Nano-Media can store covert information. This information, which can be encoded in analogue or digital form, can be retrieved using a reader device, such as a smartphone or camera.

Kaminska’s team, along with Davis, is now mass-producing Nano-Media for the cover design of visual art Journal PUBLIC Art Culture Ideas. The 50th anniversary issue comes out November 2014 at Toronto’s Art Gallery of Ontario.

Next up, the team will be expanding the display, storage and interactive possibilities of Nano-Media in applications such as publishing, archiving and security. They will also continue to collaborate with Davis and A. Kaminska to produce an art installation and exhibition in which they will integrate Nano-Media into threads and sensors to produce smart textiles and wearable materials.

Partnerships
Scholarships celebrate women in computing science

Two alumni-supported initiatives hope to crack the code in drawing women to computing science.

Amyn Rajan, Simba Technologies’ president and CEO, established the Simba Technologies Scholarship in Computing Science endowment fund, which disburses more than $4,000 a year, providing two scholarships of $2,000 each.

A passionate proponent of gender diversity, Rajan hopes the scholarship will help close the gender gap in computing science by fostering innovation and spurring B.C.’s brightest minds.

For Jasleen Grewal, who recently completed a summer internship at Harvard’s prestigious Stem Cell Institute, the award was a golden opportunity.

“Winning the scholarship is a real honour and a great help financially, especially as an international student,” says Grewal.

“Simba Technologies is a big player in database management and big data, so being recognized for my achievements by a giant in computing science is very motivational. The money and the recognition go a long way in helping me feel that I’m really doing something beneficial.”

Rajan has no doubt that Grewal’s contributions to science will make a positive impact. “I strongly believe that in some small, indirect way, this scholarship will help a young scientist achieve the next great breakthrough, and I can’t wait to see her do it,” he says.

Brittany Zenger and Kate Tsoukalas have built highly successful careers in computing science while simultaneously championing women in technology. Together, they established an endowment fund for the new Women in Computing Science Alumni Award.

“If you don’t encourage women to study computing science, you will be missing out on some of the brightest students,” says Tsoukalas.

“Women are a critical part of every future breakthrough. There is a strong need for women’s representation in the field. We are very excited about our partnership with SFU and our ability to fund female students,” says Zenger.

“Women’s contributions to computing science are indispensable to the field. This award will provide formal recognition of outstanding volunteer efforts. Together, Zenger, Tsoukalas and the SFU community are excited about the Women in Computing Science Alumni Award.”
Better together: connecting students and industry

How do you catch the attention of a tech-savvy development team? With robots, of course! SFU’s Science Alive team and their newly minted robotic creations recently paid a visit to Appnovation, who helped fund the science camp’s Lego Mindstorm upgrade.

“Our staff had a ball with the robots,” says Appnovation marketing manager Isabel da Costa. “The volunteers showed us a thank-you video of the camps, with the kids doing fun experiments and building robots. It was really neat to see how our donation helped.”

Appnovation and Science Alive connected through the company’s senior business consultant Simon Mok, an SFU computing science alumnus and member of the Faculty’s External Advisory Council. “It immediately seemed like a great fit,” says Isabel. “It’s important for us to give back to community and we were really on board with Science Alive’s mandate to inspire kids through technology.”

This wasn’t the first time SFU students paid a visit Appnovation’s downtown Vancouver office. Keen to build a future talent pool and promote the local tech industry, the company hosted a focus group of TechConnect students and their parents. The group, mostly first and second year students, had the opportunity to ask questions to Appnovation’s developers, designers and project managers.

“We wanted to help students see what roles are out there and get an idea of which areas to focus on,” says Isabel. “There’s always a shortage of available talent in this industry, so it’s beneficial for students to stay ahead of the curve.”

In the fast-moving tech industry, Appnovation’s support can help students get a measure of the job climate and prepare for existing jobs. In turn, Appnovation has the opportunity to hear students’ perceptions of the industry.

SFU Alumni Appreciation Project

Do you know an SFU grad who deserves to be appreciated? Submit a note of appreciation for them to the SFU Alumni Appreciation Project (sfu.ca/appreciation) – it’s a simple act that can provide a ripple effect of inspiration!

For the remainder of 2014, every person who submits a note of appreciation will be automatically entered into the monthly draw to win a MasterCard gift card! The winner will be contacted via email the first week of the following month.

Bonus: Submit your appreciation note about a Faculty of Applied Sciences grad to the website before October 31, 2014, and you’ll receive a Faculty of Applied Sciences notebook and pen! It’s our way of saying “thank you” for taking the time to showcase our amazing alumni.
Alumni Snapshot: Tim Chu

What I do:
I am accountable for operational efficiency and improving customers’ experiences of our products through sponsoring projects and making business decisions. My scope is wide, and varies from order automation, improving Internet speed and reliability, or eliminating pixilation customers see on TV.

What I do makes a difference because:
Reliability is number one across all industries. In my product, an outage as short as one second could mean you miss the game’s winning shot in the Olympics, or a critical conversation on an IP phone. Our customers can see, hear, and experience in real-time how our products perform, and I’d like to ensure they get value for subscribing to our products.

Three things that keep me motivated:
1. The teams I work with, knowing I am contributing value and I can also rely on them for things I do not know.
2. The never-ending changes in the Canadian telecommunications landscape.
3. Project related challenges, whether they are timeline or cost.

How I keep up with changes in my industry:
There are much smarter team members in the company. I often chat with them just to find out what is exciting in their areas. For example, newer routers or frequencies that would increase bandwidth for Internet services – we have come a long way, from 1200bps to 100Mbps today and growing! It can also be a different software development life cycle we trial out internally, or problem-solving toolkits we can apply. Technology is definitely one factor in my industry, and how we solve issues is also changing constantly.

How my degree from SFU prepared me for my job:
The projects and assignments I worked through shaped how I approach problems in general. Having the opportunity to collaborate with others at SFU helped when managing and implementing projects in my current role. The width and depth of my experience during those years at SFU definitely helped not only specifically to my job, but continues to guide my career.
Computer engineering student Carmen Tang is a mentor for TechConnect, a cohort program that helps new students in computing and engineering science transition from high school to university. In this Q & A, she shares what motivates her to get involved in the community and what she’s learned along the way.

Why did you decide to get involved with TechConnect? What do you enjoy about it most?

As a TechConnect mentor for the third time, the biggest thing that drives my involvement is my first year experience at SFU. It was an uphill climb until my third year: learning how to schedule courses and find good project partners and senior students who could help me answer common questions like, ‘What specialization of engineering should I choose?’ and ‘Should I study engineering or computing science?’ and ‘Should I go into industry or do research and a master’s?’

The TechConnect program does an amazing job of giving first year students a time and place to come together and get to know each other, make study groups, and have any of their questions answered by two senior students and an advisor, Daniela. There are some tips and experiences only students can provide, and there are lots of complex technicalities about university courses and registration that advisors know well.

Last year there were even presentations by various professors to give the students a better idea of what specialization they wish to pursue, and I gave a tutorial session for CMPT 128. I love the idea of helping to reduce the stressfulness of the transition to university, and really enjoy being able to help these students with my own experiences and knowledge while working with Daniela.

How has your involvement with TechConnect been beneficial?

Being a mentor has improved my ability to present and give guidance to others. It has allowed me to get to know another senior engineering student as well as a wonderful advisor as friends. I was also able to connect with many other engineering students and some continued to ask for mentorship even after the program ended. Getting to know more people in the program makes my life as a studying student much more enjoyable.

Can you tell us about your favourite memory from the TechConnect program?

When I was asked to put on a final review session for CMPT 128, a first year introductory computing course for all engineering students, I was excited about the opportunity. It was great to see so many of the students coming to my session and many were even prepared with questions. It was a new experience for me, and very fun.

What is the biggest challenge you’ve faced as a TechConnect mentor?

The biggest challenge I face as a mentor is figuring out how to help a student who doesn’t know what to ask. It took some time for me to learn to identify when a student has questions that they want to ask, but don’t know what or how to ask. With just a little bit of explaining or a discussion of the topic, eventually I found that students will be able to ask specific questions. Not being afraid to show you don’t know a topic, and knowing how to ask the right questions are important to being successful in studies and at work.

In what ways have you been involved with the wider community?

In my early years at SFU I was involved with WEG, WICS, OpFair, Big Fair, HSAAP and Try/CATCH, an amazing outreach program for young high school females to discover computing science at SFU with hands-on activities and industry/faculty speakers. The last two years I have been a Microsoft Intern Ambassador at SFU, helping to promote the technical community at SFU as well as Microsoft internships. We’ve held Intern Panel Sessions, Xbox socials and Tech Talks by full-time employees. Earlier this year we held the first large 24-hour hackathon at SFU, which we hope to have again this coming school year. We keep a Facebook page with information about the ambassadors, our events, recent news and application/interview tips at [www.facebook.com/sfuiamssft](http://www.facebook.com/sfuiamssft).

Why do you think it’s important to get involved with the community?

I find getting involved and giving back to the community really rewarding. I have been able to meet so many amazing people along the way, each with their own individual stories and fields of expertise. This has made my life as a student so much more colourful and enjoyable.

Who inspires you?

My family. They are the most hardworking and loving people I know.

What is the best advice you have ever received?

Ask, ask, ask. The road to becoming a professional involves many stumbles, failures, and a lot of time and effort spent learning and mastering.
Kudos

School of Computing Science

Academic Ranking of World Universities

The School of Computing Science ranked in the top 50 computing schools in the world according to the Academic Ranking of World Universities (ARWU), released in August. The ARWU is considered one of the top three international university rankings. The school ranks third in Canada, behind the University of Toronto and UBC. SFU Dean of Applied Sciences Nimal Rajapakse says it is an outstanding achievement for SFU to be recognised for its strength in computing science, adding that that current and past faculty, students and staff deserve credit for “this significant international achievement.”

Majid Bahrami
Canada Research Chair in Alternative Energy Conversion Systems

Majid Bahrami, Mechatronic Systems Engineering, is now a Canada Research Chair, Tier 2, in Alternative Energy Conversion Systems. He oversees research at SFU involving green cooling systems and thermal management technology. He has made great strides in using this technology to improve the performance of batteries, power electronics and fuel cells, hybrid automobiles and refrigeration systems.

Martin Ester
NSERC Research Tools and Instruments Grant (RTI)

Computing Science will use a $110,000 RTI Grant to support the School’s advanced research in data mining, computational biology and cloud computing. School Director Martin Ester is leading a research group that will use the grant to purchase new computers, multi-processors and disk arrays to store large amounts of data.

Rodney Vaughan
NSERC Research Tools and Instruments Grant (RTI)

Rodney Vaughan in Engineering Science, SFU’s Sierra Wireless Professor in Mobile Communications, researches smart antennas that use spatial signal processing. He will use a $147,000 RTI Grant to upgrade a planar synthetic aperture holographic measurement system to include a cylindrical synthetic aperture capability. This combination of planar and cylindrical systems complements the existing spherical system, allowing the advanced estimation of the radiation, receiving and scattering patterns – the most difficult properties of an antenna to measure.

Faisal Beg
NSERC Discovery Accelerator Supplement (DAS)

Faisal Beg in Engineering Science will use NSERC DAS funds to advance his research into early detection of Alzheimer’s disease. He will hire a researcher to focus on developing novel computational algorithms to measure magnetic resonance images of the brain and optical coherence tomography images of the retina. His group will research novel classifiers trained on normative and diseased brain/retina images so they can detect whether changes in the retina can be linked to changes in the brain and possibly detect the onset of Alzheimer’s disease or other dementias in their early stages.
Kudos

Behraad Bahreyni
NSERC Discovery Accelerator Supplement (DAS)
Behraad Bahreyni’s research group in Mechatronic Systems Engineering uses semiconductor microelectronic devices to do mechanical work at small scales. His research will study the design methodologies of a new actuation mechanism that can be applied in micro- and nano-devices. The proposed technology simplifies the fabrication process and paves the way for wide-scale, chip-level integration of micro- and nano-mechanical systems with microelectronics.

Richard Zhang
NSERC Discovery Accelerator Supplement (DAS)
Computing Science’s Richard Zhang has been awarded an NSERC DAS. He leads the computer graphics group that will use the grant to hire researchers specializing in shape analysis and geometric modelling. His group will study the interplay between geometric forms and functionality of 3D shapes, targeting applications in 3D content creation, product design and 3D fabrication.

Mehdi Seyfi
Dean of Graduate Studies Convocation Medals
Mehdi Seyfi, former PhD student in Engineering Science, received a Dean of Graduate Studies Convocation Medal. He placed in the top five per cent of his class based on his cumulative grade-point average. Seyfi was supervised by Jie Liang and his thesis was on Advanced relay selection techniques for cooperative communications.

Ping Tan
NSERC Discovery Accelerator Supplement (DAS)
Ping Tan in Computing Science will use NSERC DAS funds to advance his research in 3D computational vision. He will hire two PhD students to develop novel algorithms for real-time 3D skeleton motion tracking from multiple moving cameras. His group will research 3D vision algorithms and explore their applications in computer graphics and robotics, such as 3D model creation and autonomous robot navigation.

Faraz Hach
Governor General’s Gold Medal
Faraz Hach received the Governor General’s Gold Medal upon completing his PhD in Computing Science. This prestigious award recognizes the two SFU graduate students who achieve the highest academic standing upon graduation from a master’s or doctoral degree program. Hach studied computational biology under supervisor Cenk Sahinalp, and now has a post-doctoral appointment between SFU and the Vancouver Prostate Centre where he is working on prostate cancer research.

John Boxall and Igor Faletski
BC Business Top 30 Under 30
Computing Science alumni John Boxall and Igor Faletski were named two of BC Business’ Top 30 Under 30. Both were 29 years old last year, and they were recognized for excelling in the high-tech industry by founding Mobify and growing it from a three-person company to 80+ employees. Mobify optimizes websites for mobile communications and counts many brand-name companies as clients, including Lululemon and Starbucks.
Welcome New Faculty

Ping Tan

Ping Tan is a new assistant professor in Computing Science whose area of specialty is computer graphics. Tan comes to SFU from the National University of Singapore where he was an associate professor. He has been an editorial member of the International Journal of Computer Vision (IJCV), an associate editor of the Machine Vision and Applications (MVA) and has served on the program committees of SIGGRAPH, SIGGRAPH Asia.
Message from the Dean of Applied Sciences

The Faculty of Applied Sciences and SFU recently welcomed a new intake of students and are preparing for some exciting upcoming events. Here’s a list of a few notable faculty updates and initiatives that we will embark on in the next year:

1. **Professional Master’s Program in Big Data.** A brand new program in Computing Science (CS), we were pleased to see the inaugural class filled to capacity at 25 students. This shows the industry need for professionals in big data science. The program is designed for those who have some programming and work experience, and will offer a well-rounded education from our world-renowned CS faculty.

2. **Accreditation of Mechatronic Systems Engineering.** The undergraduate program in Mechatronics, based at SFU Surrey campus, successfully received its second accreditation from the Canadian Engineering Accreditation Board.

3. **Indian Oil PhD exchange.** SFU has signed a one-of-a-kind PhD exchange program with Indian Oil Corp. (IOC). Selected IOC Fellows will have the opportunity to enroll in an SFU PhD program related to clean energy and travel to Canada to study for a portion of their term. Once here they gain hands-on experience in our hydrogen and fuel cell labs. SFU faculty and students can also travel to IOC’s world-class R&D facility in Faridabad, India. This is a major milestone in encouraging a sharing of expertise in hydrogen and fuel cell research between countries.

4. **SFU to celebrate 50 years!** The Faculty of Applied Sciences (FAS) is participating in university celebrations marking its 50th anniversary in 2015. Activities will include community events, alumni networking sessions, and expanding our collection of FAS Alumni Appreciation stories (visit www.sfu.ca/appreciation/).

5. **SFU Surrey campus expansion.** As I wrote about last summer, FAS supports all efforts to grow the SFU Surrey campus. We hope that support from government is forthcoming, allowing us to provide greater access for South Fraser Region students who are interested in computing and engineering science. By 2016, one-third of graduating B.C. Grade 12 students will be from a South Fraser secondary school.

6. **Enrollment growth in fall 2014.** Fall is typically our largest student intake. This September, our faculty enrolled 573 students compared to 557 last September. The Burnaby campus Computing Science and Engineering Science programs saw the largest gains in students.

Dr. Nimal Rajapakse, P.Eng.
Dean and Professor,
Faculty of Applied Sciences
fascomms@sfu.ca