Pacific Institute *for the* Mathematical Sciences

Year in Review 2018

Table of Contents

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From the Director

2018 was an excellent year for PIMS! Three Collaborative Research Groups and the Postdoctoral Training Centre in Stochastics were active. A new initiative called Callysto was launched to enrich the wide array of education outreach programs operated by PIMS. We hosted an intertwined collection of summer events aimed at addressing diversity challenges in mathematics. Our strategic partnership with CNRS was enhanced with the PIMS-Europe Fellowship and Student Mobility Programs and a pilot project with Germany was initiated. We continued to develop connections with industrial and non-profit partners.

A new CRG focused on high dimensional data analysis launched in Summer 2018 with a kickoff retreat, a summer school and a workshop. An ongoing CRG, linking researchers from Australia, British Columbia, China, and Washington, participated in a special year focused on Geometric Analysis and Nonlinear Partial Differential Equations at Australia National University. The CRG on Geometric and Cohomological Methods in Algebra hosted a summer school with partners at the University of Chicago. The Postdoctoral Training Centre in Stochastics (PTCS), with joint support from NSERC and NSF, maintained a high level of activity connecting postdocs and researchers in probability at multiple sites across the PIMS network.

Together with our partner Cybera, PIMS was awarded $1.5M from the Government of Canada's CanCODE program to launch Callysto in 2018. The Callysto initiative developed open education resources for students in grades 5-12 leveraging a cloud-hosted interactive computing platform called Jupyter. More than fifty undergraduate students were employed by PIMS during Summer 2018 to help develop content and run events for Callysto. PIMS' work on Callysto and other initiatives in interactive computing were showcased in a special session at JupyterCon in New York City.

The Diversity in Mathematics initiative is a multi-year strategy aimed at establishing a stable support network to enhance minority representation in STEM fields. The summer program included a math day camp for high school students from underrepresented groups and a summer school for female-identifying undergraduate students studying mathematical sciences. The public lecture given by Ami Radunskaya, President of the Association of Women Mathematicians, was a highlight of the summer program.

PIMS established new programs to strengthen the Institute's ongoing collaboration with the CNRS of France. Since 2008, PIMS has hosted an International Research Laboratory (IRL) of the CNRS. Through the IRL, CNRS provides funding that allows researchers from France to engage in long-term visits to PIMS member universities. PIMS established reciprocal programs to support visits, by faculty at our member universities, to France for research collaborations. PIMS collaborated with Mitacs to establish a mobility program to support students from Canada to engage in research visits to France and vice versa. PIMS launched a pilot program to explore similar integrations with researchers in Germany this year as well.

PIMS has a long history of catalyzing mathematical science research with industry partners. In 2018, PIMS launched bcdata to integrate the Institute's experience with Industrial Problem Solving Workshops with cloud-hosted interactive computing resources to support collaboration. The curated computational tools allowed the teams participating in the 2018 bcdata workshop to generate solution prototypes and iterate rapidly with their industry partners.

The success PIMS achieved in 2018 is a testament to the many collaborations and connections from within the PIMS network, and the strength of our community. We thank our collaborators and colleagues for their support, helping us to further advance our mission and continue to support high-level research in the mathematical sciences.

James Colliander
Director

About PIMS

The Pacific Institute for the Mathematical Sciences was founded in 1996; it is a consortium of universities in the Pacific Northwest and Western Canada.

Member universities: Simon Fraser University, University of Alberta, University of British Columbia, University of Calgary, University of Lethbridge, University of Manitoba, University of Regina, University of Saskatchewan, University of Victoria and University of Washington.

Affiliates: Portland State University, and the University of Northern British Columbia

The Pacific Institute for the Mathematical Sciences (PIMS) is a collaborative network dedicated to the promotion of discovery, understanding and awareness in the mathematical sciences. PIMS brings together leading researchers from major Universities across western Canada, as well as the University of Washington, and is a Unité Mixte Internationale of the National Center for Scientific Research (Le Centre national de la recherche scientifique, CNRS).

PIMS sponsors and organizes educational and community outreach, aboriginal math camps, and summer schools for both teachers and students, as well as initiatives to promote diversity in mathematics, partnerships that bring mathematical research to industry, cutting edge mathematical and scientific research, and events across the PIMS network that promote advancement in computer science, pure and applied mathematics, and statistics.

The central office is at the University of British Columbia, with a PIMS site office and a Site Director local to each of the ten member universities. The Site Director facilitates local opportunities and synergies, while the PIMS site offices provide administrative assistance for organizing local events. This distributed structure renders it quite unique, involving strong local site offices and activities, and allowing a broad impact across Western Canada and beyond.

The Board of Directors oversees the administration of PIMS, with membership consisting of the VP of Research from each of the member universities, as well as distinguished scientists and representatives from industry. An independent Scientific Review Panel composed of internationally renowned mathematical scientists assesses proposals for scientific events and programs.

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2018 Around the Sites

The individual universities that make up the **PIMS** community organize a wide range of seminars, conferences and workshops that pack the annual calendar. Here is a small selection of some activity highlights from 2018.

Simon Fraser University

The notoriety around the use and applications of Jupyter Notebooks has increased dramatically across Canada, and nowhere are they getting more traction than at SFU. The team met with renowned basket weavers from the Tla'amin nation to develop a series of notebooks on the mathematical modelling of the geometric patterns observed on the baskets. The notebooks are an impressive way to teach math with First Nations content as well as a useful tool to collate and preserve Indigenous knowledge. This work has already been used in indigenous summer camps and presented at the CMS Winter Meeting 2018.

University of Regina

The ongoing Graph Searching in Canada (GRASCan) workshop was organized at the University and saw plenary speakers including Shannon Fitzpatrick (UPEI) and Bill Kinnersley (URhode Island). The invitation-only workshop brings together graph searchers working in any and all aspects of vertex pursuit games on graphs and their variants, such as Cops and Robbers, edge searching, firefighting, burning, and graph cleaning.

University of Calgary

The 2018 Calgary Datathon created an opportunity for Calgarians to analyze and evaluate the open data provided by the city's Open Data Portal, and propose solutions to enhance the infrastructure and build a healthy, green and safe city. Final projects included strategies for mapping pedestrian routes, analysis of water demand, and discovering barriers to recreational activities for local residents.

University of Manitoba

The University of Manitoba is leading the way when it comes to promoting diversity and equity in mathematics. This commitment is demonstrated by the all-female lineup for their distinguished speaker series throughout 2018 and 2019, and starting the Path2Math Camp to prepare Indigenous students for university mathematics and English requirements.

University of Alberta

A number of big events were hosted by UofA. The Joint Canada-Asia Pacific Conference on General Relativity and Relativistic Astrophysics has been an important conference for over 30 years and brought together relativists, cosmologists and mathematical physicists, from Canada, the Asia-Pacific countries, and from around the world.

University of Lethbridge

Renowned mathematician, Professor Jean-Marc Deshouillers from the University of Bordeaux, visited in April. During his time on campus, he discussed research problems with the Lethbridge number theory group, gave a short course of four lectures on automatic sequences and a further seminar talk.

The tenth annual meeting of Alberta number theorists, originally started in Lethbridge in 2008, was held at BIRS as a weekend conference in May 2018 and continues to be a great success.

University of Victoria

PIMS-UVic continues to have a very active Math Mania program, in which graduate students, undergraduates, faculty and others visit local elementary schools to run fun math events. PIMS recently supported a retirement conference for Ahmed Sourour, who had been at the University of Victoria for 39 years. Ahmed introduced the Putnam Competition and the conference included a math competition segment in his honour. The University of Victoria recently hired Stephen Scully, a PIMS Postdoc (2016-2018) at the University of Alberta, as an Assistant Professor.

University of British Columbia

As part of Diversity in Mathematics, a multi-year, multi-level program geared towards promoting diversity and inclusivity in STEM, PIMS hosted the Undergraduate Summer School for female-identified undergraduate students studying mathematics. This event introduced the undergraduate participants to a wide variety of professions and careers in academia and in industry, where advanced mathematics is used every day with spectacular success.

University of Saskatchewan

The PIMS-University of Saskatchewan Applied Math Seminar Series has been running since 2010 and saw some significant speakers in 2018, which included Bob Moody, who is one of the most accomplished mathematicians in Canada, a Fellow of the Royal Society of Canada and an Officer of the Order of Canada, and Anne Broadbent, the University Chair in Quantum Information Processing at the University of Ottawa.

Education Overview
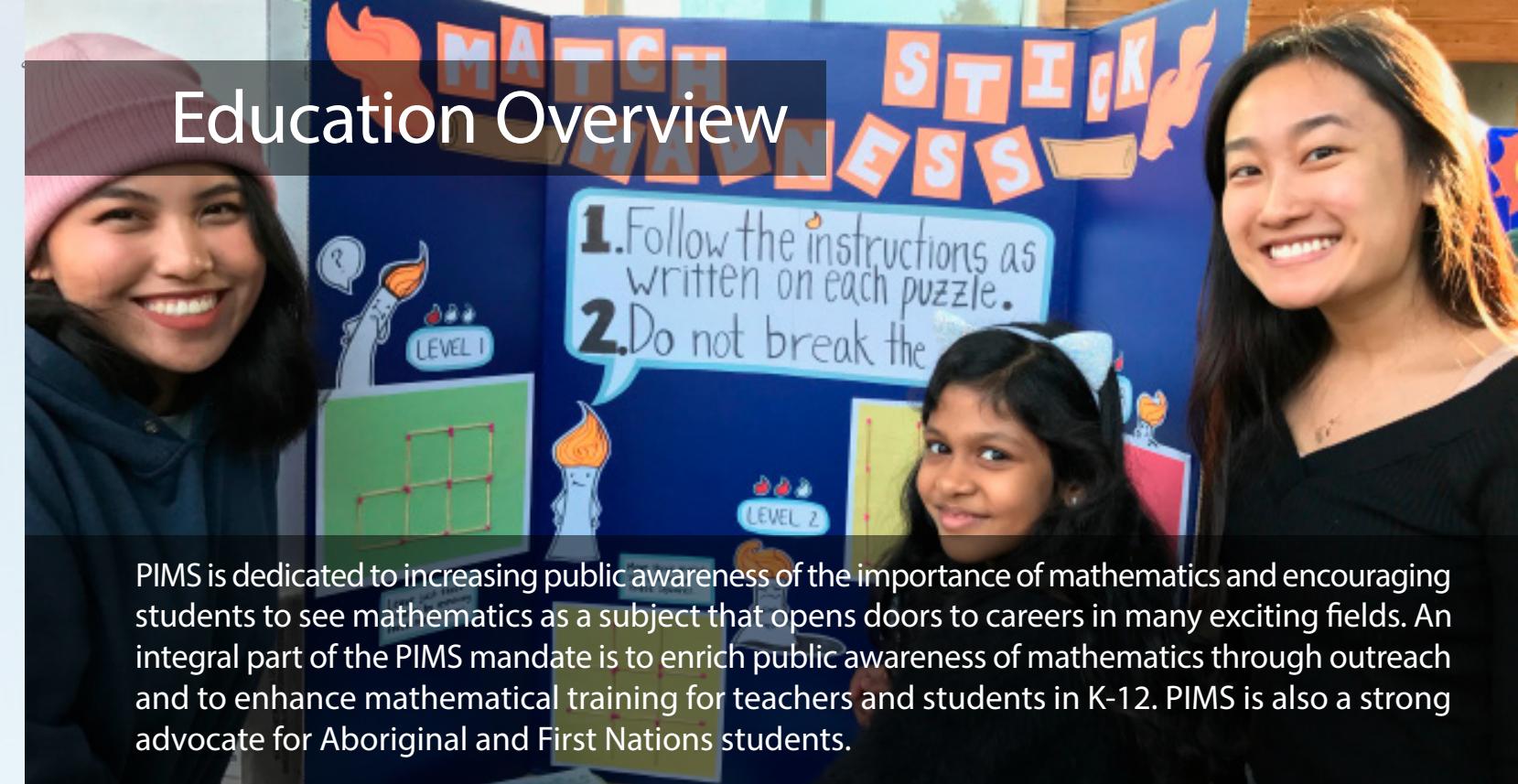
PIMS is dedicated to increasing public awareness of the importance of mathematics and encouraging students to see mathematics as a subject that opens doors to careers in many exciting fields. An integral part of the PIMS mandate is to enrich public awareness of mathematics through outreach and to enhance mathematical training for teachers and students in K-12. PIMS is also a strong advocate for Aboriginal and First Nations students.

Math education and outreach are fundamentally important component of PIMS' activities and, with a continuous calendar of events, keeps the team extremely busy. This year, in addition to the usual activities, which includes Math Circles, ELMACON, Math Mania, the Aboriginal Math Symposium, and the Math Summer School for Elementary School Teachers, there were some new initiatives introduced.

PIMS Mathematical Education Circle Events in BC

The main goal of this initiative is to create a forum in which math instructors across BC can discuss the educational topics of common interest and share their experiences and resources. Around 40 mathematicians, math educators and high school teachers attend this event regularly.

Path2Math Camp in Manitoba

Working with Indigenous students to prepare them for university mathematics and English requirements. The students in the camp all made great measurable gains in their math skills and were better positioned for the start of their post-secondary education.

Alberta Summer Mathematics Institute (ASMI)

The institute offers a fun, educational summer mathematics program to high school students (Grades 10 through 12). Its mission is to inspire exploration and research in mathematical studies. The ASMI is a day-style summer camp that runs over a four-week period, and takes place on the campus of the University of Alberta.

K-12 Classroom Sessions in Saskatchewan

During the 2018-19 academic year there are three weekly classrooms delivering curriculum-tied, hands-on math activities in classrooms that have a high Indigenous student to teacher population. Over 60 students in these classes receive instruction that incorporates the Cree language in the teaching material.

Callysto Project in Calgary

Cybera and the Pacific Institute for Mathematical Sciences (PIMS) are participating in the new national CanCode program. This two-year program supports initiatives that aid coding and digital skills development among Canadian youth, from grade 5-12. The project has involved teachers in a number of workshops during the year in Calgary.

Postdoctoral Fellows

Every year PIMS sponsors numerous postdoctoral fellows (PDFs), attracting outstanding young scientists who contribute to PIMS research programs, many of whom later become faculty members at Canadian universities. PDFs are distributed throughout PIMS sites on a competitive basis. In addition, each one of PIMS' Collaborative Research Groups is allocated a number of PDFs, the selection of which is determined by an assessment panel.

2018 postdocs:

Yifan Sun (UBC)	Jun Wang (UBC)	Hung Le (UVictoria)
Rostislav Devyakov (UAlberta)	Sergio DaSilva (UManitoba)	Arthur Ghigo (UBC)
Daniel Drimbe (URegina)	Sam Cole (UManitoba)	Shirou Wang (UAlberta)
Seth Wolbert (UManitoba)	Jongchon Kim (UBC)	Erwan Tanne (UBC)
Qing Zhang (UCalgary)	Nick Dexter (SFU)	Halyun Jeong (UBC)
Lee Troupe (ULethbridge)	Boyi Li (UVictoria)	Tyrone Ghaswala (UManitoba)
Alessandro Malusà (USaskatchewan)	Jishnu Ray (UBC)	Gerarda Vargas (UAlberta)

Featured Postdoctoral Fellow: Moumanti Podder

Moumanti is an Acting Assistant Professor at the University of Washington and a graduate of the Courant Institute of Mathematical Sciences at New York University. This is an extract from a recent PIMS interview.

How have the instructors you've had in your life helped inspire you to become a mathematician?
Both of my parents studied physics as their major, and this gave them a keen interest in mathematics. They would relentlessly inspire me to delve deeper into mathematical problems from a very tender age. They somehow found the perfect balance between allowing me to take a sneak peek at lots of very interesting and fascinating problems of mathematics all the way up to the start of my undergraduate program, and advising me to always follow my heart.
However, the truly amazing and brilliant professors during my time at the Indian Statistical Institute, Kolkata, were instrumental in furthering my interests in mathematics.

Why did you decide to write your PhD on Galton-Watson Trees?
Once I started working in this area, I soon realized that the Galton-Watson trees were absolutely beautiful objects to study. They presented with a very natural way of ordering edges in a graph, and so many logical relations, such as the parent-child relation, or ancestry, are naturally defined on these trees. I enjoyed working on this topic a lot and still continue to pursue this topic in my ongoing collaborations with Prof. Spencer and several other people.

What is your favourite aspect of teaching?
It gives me a very welcome sense of accomplishment. If you have taught a class nicely, and perhaps helped students understand the intricacies of the homework problems in your office hours, and industriously prepared your lecture notes for the next class, it gives you a very refreshing and much needed sense of having fruitfully completed something, of having some semblance of control on one of the things you do and are good at.

How does your art hobby compliment your work as a mathematician?
Part of becoming or growing into a mathematician is to discipline your mind, to train it to start thinking and analyzing problems that it encounters along certain avenues. Of course, innovation and novel thinking are very much needed and appreciated, but not before you have first explored and exhausted known routes and tools and, even then, there is a certain regime of discipline and rules that my mind has to follow. Painting, on the other hand, lets my mind, in some sense, break all rules and create something that need not even belong to this world. It need follow no rules, and it can have a whim of its own.

2018 PIMS fourth Postdoctoral Training Centre in Stochastics (PTCS)

This was the fourth annual meeting of the PIMS Postdoctoral Training Centre in Stochastics (PTCS). The retreat offers an opportunity for young researchers in pure or applied probability from Western Canada and Washington state to interact, communicate their recent results and ongoing research programs, and initiate new collaborations. Eight of the nine postdoctoral fellows affiliated with PTCS spoke at the meeting. The 25 participants included postdoctoral fellows from UWashington, UAlberta and UBC; Ph.D. students from USaskatchewan, UCalgary, UAlberta and UBC; and faculty from UCalgary, UAlberta, UVictoria, URegina, and UBC.

Moumanti Podder (UW) spoke about her joint work with Ander Holroyd, Avi levy and Joel Spencer on second order logic and random trees.

Sarai Hernandez (UBC) spoke about her ongoing joint work with Omer Angel, David Croyden and Daisuke Shiraishi on scaling limits of Uniform Spanning Trees (UST) in 3 dimensions.

Liping Xu (UW) presented some very recent work with Zhenqing Chen on pathwise uniqueness for finite-dimensional stochastic differential equations (SDE's) with multiplicative noise and non-Lipschitz drifts driven by a Levy process.

Yinon Spinka (UBC) presented applications to various well-known models from statistical physics such as the Potts model, proper colorings and the random cluster model.

2018 Results: The level of talks at this retreat was extremely high in terms of content and presentation. Five of the ten lectures were given by outstanding young female probabilists from UAlberta, UCalgary, UBC and UWashington. The Open Problems Session was also particularly successful. For example, the day after his presentation Tony Ware announced that as a result of the discussion he had made significant progress on the Hawaiian options problem.

During the meeting it was agreed that these annual meetings featuring young researchers in Probability from PIMS sites should continue. It was felt that a 3-day meeting might offer more time for informal discussion.

2018 attending postdocs:

Liping Xu (UWashington)	
Gerado Barrera Vargas (UAlberta)	Wenning Wei
Noah Forman (UWashington)	Zhongwei Shen (UAlberta)
Eric Foxall (UAlberta)	Yinon Spinka (UBC)
Moumanti Podder (UWashington)	Shirou Wang (UAlberta)

2018 Prizes & Awards

CRM - Fields - PIMS Prize

Jeremy Quastel (University of Toronto)

Jeremy is widely recognized as one of the top probabilists in the world, having made major advances in the fields of hydrodynamic theory, stochastic partial differential equations, and integrable probability. He is particularly recognized for a series of ground-breaking works during the last ten years related to the Kardar-Parisi-Zhang (KPZ) equation and the wider class of random growth models conjectured to share the same long-time, large-scale limit (the so-called KPZ universality class).

For the profound impact of his work, Quastel has been recognized as a Fellow of the Royal Society of Canada (2016), and was the recipient of a Killam Research Fellowship (2013). He delivered an invited address at the 2010 International Congress of Mathematicians in Hyderabad India.

CAIMS/PIMS Early Career Award in Applied Mathematics

Alexander Bihlo (Memorial University)

Alexander is a meteorologist and numerical analyst who currently holds a Tier II CRC position in the Department of Mathematics and Statistics at Memorial University. In the seven years since receiving his Ph.D., Dr. Bihlo has made over 30 peer-reviewed contributions to the literature.

His most significant work impacts climate modelling and refining computational approaches for real-world problems. In this way, Dr. Bihlo's work highlights our greatest hopes for applied math by showing how it can support environmental stewardship, promote economic prosperity, and ultimately improve the lives of all Canadians.

PIMS Education Prize

Julia Pevtsova (University of Washington)

Julia has an astonishing record of local K-12 outreach. She has set up a program for fourth and fifth graders at Montlake Elementary School, not far from UW, called Math Challenge as well as running a Math Circle for 7th, 8th, and 9th graders one evening a week, on campus, with co-director, Steve Klee, a professor at Seattle University. Dr. Pevstova supplements Math Circle with Math Hour and Math Hour Olympiad. More than these accomplishments, Dr. Pevstova is a passionate, undeniable ambassador for Mathematics.

"*Julia Pevtsova is an enormously talented mathematician whose already large impact on mathematics education—within our university and beyond—continues to expand. What is most striking is the range of her activities, involving every level of mathematical learner from elementary school to Ph.D.*" said Dr. Tatiana Toro, Craig McKibben & Sarah Merner, University of Washington.

Collaborative Research Groups

PIMS Collaborative Research Groups (CRGs) develop research and training networks, establishing lasting interdisciplinary links between geographically dispersed groups of researchers at member universities. CRGs organize thematic activities, such as workshops, summer schools and seminars, make joint postdoctoral fellowship (PDF) appointments, and/or develop joint graduate training programs. PIMS has developed 30 CRGs since its inception in areas ranging across all the mathematical sciences. These have served as catalysts for producing mathematical research of the highest quality in Western Canada and attracting outstanding faculty to PIMS universities.

PIMS had six CRGs operating in 2018: Applied Combinatorics (2014-2018); Applied, Algebraic and Geometric Topology (2014-2018); Explicit Methods for Abelian Varieties (2015-2018); Geometric and Cohomological Methods in Algebra (2016-2019); Geometric Analysis (2016-2019); High Dimensional Data Analysis (2018-2021)

High Dimensional Data Analysis CRG (2018 – 2021)

There are fundamental open questions that limit the industrial uptake of ideas from the mathematics of high-dimensional data and their application in practice. These include bridging the gap between the sampling required by theory and what is efficient in practice; translating the theory from analogue to digital; developing algorithms that scale gracefully to big data applications; and implementation of open-source software, which serves as an effective means of technology transfer.

The aim of this CRG to address these questions. Three particular focal areas are:

- Bridging the gap between theory and practice in applications of sparse recovery
- Methods for large-scale optimization
- Deep learning and sampling.

As part of the CRG, two events were held in 2018:

- *Optimization for Data Science:* a two-day summer school focusing on bringing together academics and industry experts to communicate challenges and successes in data science
- *Foundations of Data Science Workshop:* the goal is to expose students to recent advances and promote interaction between the next generation of researchers.

CRG Leaders
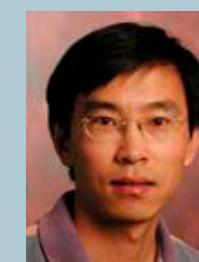
|						
Jingyi Chen (UBC)	Chris Soteros (USaskatchewan)	Kristine Bauer (UCalgary)	Ben Adcock (SFU)	Michael Ward (UBC)	Michael Jacobson (UCalgary)	Zinovy Reichstein (UBC)

Diversity in Math, UBC

Promoting digital literacy to help Canada's youth become future drivers of innovation

Diverstity in Mathematics

As part of Diversity in Mathematics, a multi-year, multi-level program geared towards promoting diversity and inclusivity in STEM, between August 7-17, 2018, the Pacific Institute for Mathematical Sciences (PIMS) hosted the Undergraduate Summer School for female-identified undergraduate students studying mathematics.

The purpose of the program was to introduce the undergraduate participants to a wide variety of professions and careers, in academia and in industry, where advanced mathematics is used every day with spectacular success.

The highlights of the annual two-week program include:

(a) An interactive math day camp for high school students from groups that are consistently under-represented in the STEM fields. The aim is to increase their representation and retention at post-secondary institutions in STEM fields.

(b) A national summer school that inspires talented undergraduate women to specialize in a mathematics-related field at the graduate and post-graduate level and consider career options focused on science and mathematics.

(c) A creative forum for mentorship and leadership at all levels, where the undergraduate participants learn to serve as mentors for their younger counterparts.

Only a stable support network can enhance minority representation in STEM fields. The program does not just teach exciting math, but also showcases role models and creates a self-sustaining support system by training future leaders.

In addition to a panel discussion about careers in STEM, the school participants visited two companies that employ mathematicians, 1Qbit and Huawei Research.

A new component of the summer school was engagement and interaction with high school students who participate in the High School Math Camp, which is the other part of the Diversity in Mathematics program. Due to the success of this component of the program, greater interaction between the two groups will be facilitated in the future.

The Callysto program was launched in November 2017 by Cybera and the Pacific Institute for Mathematical Sciences (PIMS), with funding support from CanCode, a national program that supports initiatives that aid coding and digital skill development among Canadian youth.

Callysto is a free multimodal learning platform for grades 5-12 students across Canada. The interactive, online tool utilizes a multitude of creative technologies, such as coding, digital graphics and a variety of multimedia applications.

The program was created to advance Canada's education landscape and address the growing needs of the modern world at large. The goal of Callysto program is to help young learners complete high school with the fundamental skills – computational and design thinking – required to be able to tackle any challenge they might face. These newly learned computational and design thinking skills can be applied to nearly any job and any sector. The ability to solve problems, critically analyze information, communicate and think creatively and beyond the current method of doing things, are invaluable competencies in our constantly evolving, technology-driven world.

During 2018, the impact of Callysto went beyond its original mandate and demonstrated the huge potential of the platform. A team of mathematicians at Simon Fraser University created a notebook that teaches basic geometric math concepts based on the intricate weaving of Indigenous basketry patterns.

Using baskets provided by the Tla'amin Nation on the Sunshine Coast, their team of undergraduate students developed a program that incorporates the weaved patterns and enables them to be flipped or reflected and to visualize them as 3D shapes. The tool uses basic math operations of symmetry, reflection and translations which also allows users to create and preview complex patterns, as well as generate completely new designs.

The potential of the Callysto platform and the importance of this work should not be understated - it demonstrates that modern technology can be used to enable First Nations communities to preserve, maintain and share their traditions and knowledge, as well as have them at the forefront of computational and math education in schools across Canada, promoting inclusiveness and encouraging reconciliation, and this is just the start.
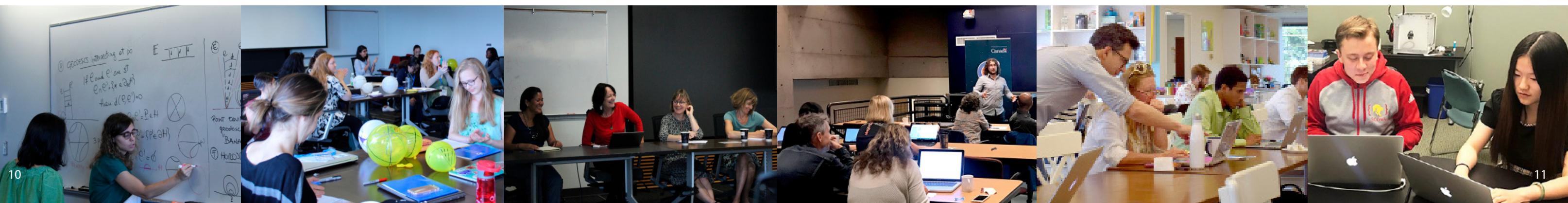
Targeted at graduate students from PIMS institutions with an interest in data science and strong mathematical backgrounds, the 2018 BC Data Science Workshop had two main goals: to bring together top researchers, industry professionals and BC Math students to tackle interesting research and industry problems; and to develop data science literacy in students with strong mathematical skills who may have little or no previous experience in the realm of "data science".

This workshop gave students experience with data science tools — such as working with large data sets, statistical inference, and machine learning — that will be helpful in their research, as well as in their career options after graduation.

This one-week workshop included both theoretical and practical components. Data sets and problems from prominent industry collaborators such as SSR Mining and SNC-Lavaliun, and government institutions were introduced by guest speakers.

Computational work was done with Jupyter notebooks using bcdata.syzygy.ca. Participants had the opportunity to work with big data, and learn subsequent analysis motifs using machine learning, data clustering, parameter fitting, and other techniques.

One particular project worked with data from St. Paul's Hospital in Vancouver and made progress identifying potential drug targets for new therapy to treat sepsis, the leading cause of death in intensive care units worldwide.

As part of the workshop participants gathered at KPMG headquarters for a career panel and social event. The panel discussed non-academic career options for the math-inclined; how to be prepared for industry jobs and job interviews; and what differences to expect in industry. More broadly, the panelists discussed career success, personal values, and strategies for achieving career-oriented goals.

WORKSHOP PROJECTS

Industry Partner: SSR MINING
- Predicting Heavy Equipment Failure

Industry Partner: ST. PAUL'S HOSPITAL
- Connecting Genetic Mutations to Cytokine Levels

Industry Partner: SNC-LAVALIN
- A risk-based platform for accident prevention

Industry Partner: COMM100
- Determining Intent and Automating Knowledge Base Creation From Live Chat Transcripts

Industry Partner: CLOUDPBX
- Analyzing User Opinion of Call Quality and Network Performance of a VOIP PBX
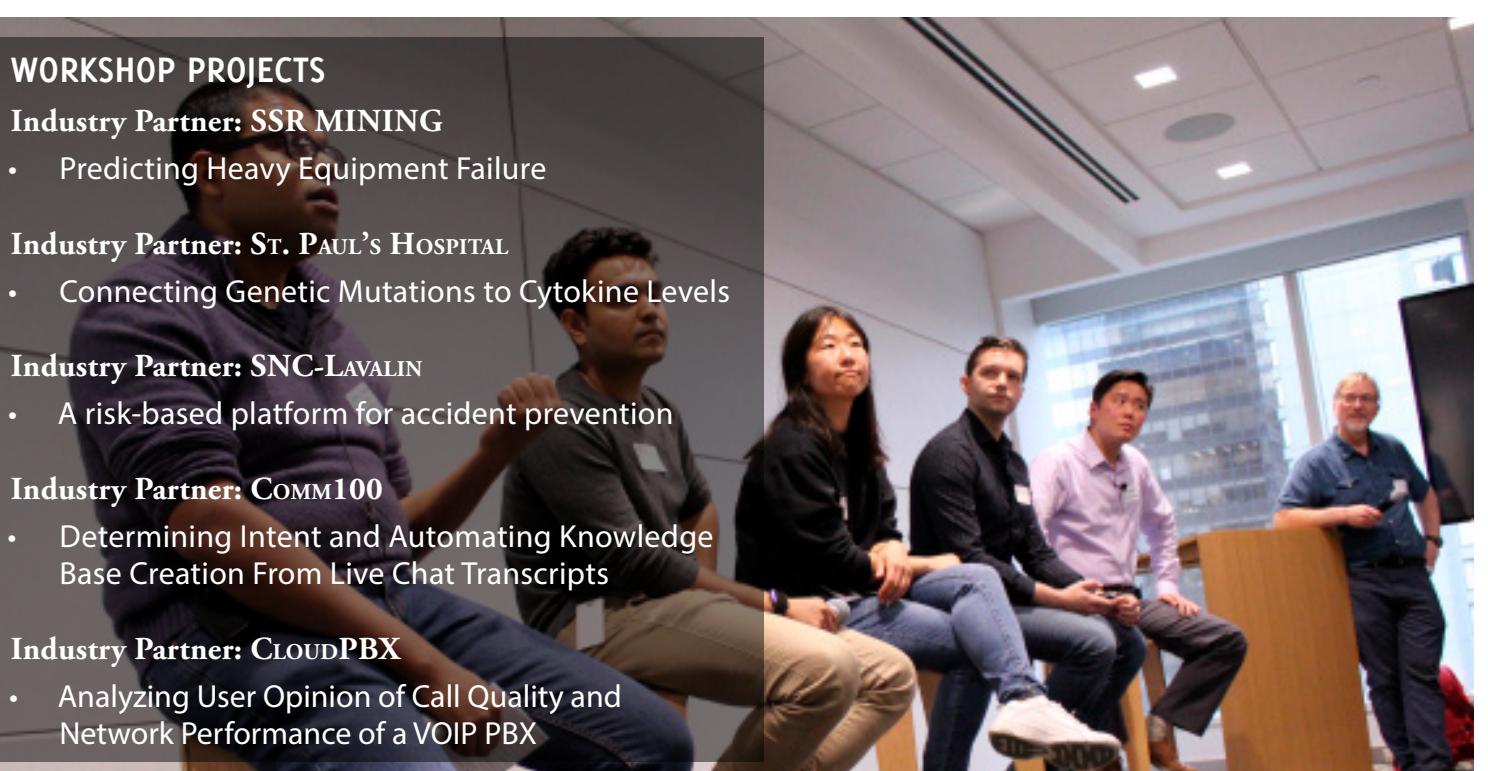
2019 Event Highlights

SEMINARS, CONFERENCES AND WORKSHOPS

January - 30 April	Scientific Computing, Applied and Industrial Mathematics (SCAIM) Seminar Series University of British Columbia	11 - 19 June	Banach Algebras and Applications 2019 University of Manitoba
Jan - 31 Dec	Seminar Series on Variable Selection and Dimension Reduction University of Calgary	5 - 8 August	Algorithms and Data Structures Symposium (WADS) 2019 University of Alberta
8 - 9 February	Calculus of Variations and Partial Differential Equations Around the Work of Alessio Figalli University of British Columbia	8-10 August	31st Canadian Conference on Computational Geometry University of Manitoba
Spring	New trends in Hamiltonian Systems and Celestial Mechanics University of Victoria	1 Sept - Aug 2020	Number Theory and Combinatorics Seminars University of Lethbridge
Spring	Alberta Number Theory Days XI Banff International Research Station	1 Oct- Sept 2020	CORE Seminars University of Washington
1 Apr - Mar 2020	Computational Applied Mathematics Seminar Series Simon Fraser University		
1 Apr - Mar 2020	Peripatetic Seminars University of Calgary		**SUMMER SCHOOLS**
1 Apr - Apr 2020	Math Across Campus University of Washington	1 - 13 June	Séminaire de Mathématiques Supérieures: Current trends in Symplectic Topology University of Montreal
5 - 7 April	Flows on the Saskatchewan: a Workshop on Integrability and Inverse Problems University of Saskatchewan	10 - 21 June	PIMS Data Science Bootcamp University of Saskatchewan
27 April	ELMACON University of British Columbia	24 - 28 June	Algebraic Geometry in High-Energy Physics University of Saskatchewan
21 - 24 May	Mathematics and Clean Energy Applications University of British Columbia	22 Jul - 2 Aug	Diversity in Mathematics 2019 UBC and SFU
28 May - 2 Jun	Foundational Methods in Computer Science Barrier Lake Station - Kananaskis, AB		**COLLABORATIVE RESEARCH GROUPS**
30 - 31 May	Time Series, Spatial Processes and Asymptotic Methods University of British Columbia - Okanagan	2016 - 2019	Geometric & Cohomological Methods in Algebra
3 - 7 June	The 14th Finite Fields and their Applications (Fq14) Conference Simon Fraser University	2016 - 2019	Geometric Analysis
3 - 7 June	The 47th Canadian Operator Algebra Symposium University of Regina	2018 - 2021	High-Dimensional Data Analysis
9 - 11 June	Scientific Grand Challenges and new Perspectives in Applied Mathematics University of Victoria		
10 - 14 June	Arithmetic Topology University of British Columbia		

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