2019 Conference for Mathematics, Statistics and Computer Science

Dalhousie University, Halifax, NS – October 25th-27th, 2019

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Schedule

Friday, 25 October 2019		
Time	**Event**	**Location**
10:00-17:30	Registration	1st floor CS Goldberg bldg
11:30-12:00	Programming Competition Meeting	Auditorium rm127, CS Goldberg bldg
12:00-17:00	Programming Competition	Labs 134 and 143, CS Goldberg bldg
13:30-17:30	Registration (2nd desk)	Room 117 (in front), Dunn building
14:00-17:00	Mathematics Competition	Room 117, Dunn building
14:45-15:45	Joint Committee Meeting	Slonim rm430, CS Goldberg bldg
16:00-17:00	CS Committee Meeting	Slonim rm430, CS Goldberg bldg
16:00-17:00	Math Committee Meeting	Auditorium rm127, CS Goldberg bldg
17:30-19:00	Pizza Party	Atrium 1st floor, Rowe building
19:00-19:30	Sponsor Presentations or "Fun Activities"	Potter Auditorium rm1028, Rowe building
19:30-20:30	**Blundon Lecture (Math)** **Dave Kung** **University of Maryland**	Potter Auditorium rm1028, Rowe building
20:30-21:30	Reception	Atrium 1st floor, Rowe building

Saturday, 26 October 2019		
Time	**Event**	**Location**
08:30-17:00	Registration	Atrium 1st floor, Rowe building
09:00-10:30	Contributed Talks	Rooms 1007, 1011, 1014, 1016, Rowe building
10:30-11:00	Coffee Break	Atrium 1st floor, Rowe building
11:00-12:00	**Sedgwick Lecture (CS)** **Jeffrey Shallit** **University of Waterloo**	Potter Auditorium rm1028, Rowe building
12:00-13:30	Lunch Break	Atrium 1st floor, Rowe building
13:30-15:00	Contributed Talks	Rooms 1011, 1014, 1016, 1020, Rowe building
15:00-15:30	Coffee Break	Atrium 1st floor, Rowe building
15:30-16:30	**Fields Lecture (Stat)** **Michael Newton** **University of Wisconsin**	Potter Auditorium rm1028, Rowe building
16:30-16:40	Break	Atrium 1st floor, Rowe building
16:40-17:35	Contributed Talks	Rooms 1011, 1014, 1016, 1020 Rowe building
19:00-21:00	Banquet and Awards	The Westin Nova Scotian hotel, 1181 Hollis Street, Halifax
Sunday, 27 October 2019 **AARMS Session on Hopf Algebras and Tensor Categories** **Rowe building**		
Time	**Event**	**Location**
08:30-10:00	A. Introductory Overview Talks	Room 1020 Rowe building
10:00-10:30	Coffee Break	Atrium 1st floor, Rowe building
10:30-12:30	B. Research Talks	Room 1020 Rowe building

Plenary talks

Dave Kung

University of Maryland

Bio: Dave Kung fell in love with both mathematics and music at a very early age. More successful with one than the other, he completed three degrees from the University of Wisconsin - Madison, none in music, before joining the faculty at St. Mary's College of Maryland. He enjoys playing violin with students, in the local community orchestra, and with his daughter. He has authored a variety of articles on topics in harmonic analysis and mathematics education, and is the recipient of numerous awards including the 2006 Teaching Award and 2017 Service Award from the MD/VA/DC section of the MAA. His Great Courses lectures, How Music and Mathematics Relate, have quickly become a top Math & Science seller for the Teaching Company. He serves as director of MAA Project NExT, a professional development program for new faculty in the mathematical sciences.

Photo courtesy of St. Mary's College of Maryland

Title: Harmonious Equations: An Exploration of Math & Music

Abstract: Mathematics and music seem to come from different spheres (arts and sciences), yet they share an amazing array of commonalities. We will explore these connections by examining the musical experience from a mathematical perspective. The mathematical study of a single vibrating string unlocks a world of musical overtones and harmonics-and even explains why a clarinet plays so much lower than its similar-sized cousin the flute. The brain recognizes harmonics and other musical patterns, the same way it recognizes numerical patterns. However, errors in its pattern recognition lead to auditory illusions, ways to trick the brain into hearing something that isn't that. Finally, abstract algebra gives modern language to the structures beneath the surface of Bach's magnificent canons and fugues. Throughout the talk, mathematical concepts will come to life with musical examples played by the speaker, an amateur violinist.

Jeffrey Shallit

University of Waterloo

Bio: Jeffrey Shallit is Professor of Computer Science at the University of Waterloo, in Ontario, Canada. He received his Ph. D. in mathematics from the University of California, Berkeley in 1983, under David Goldschmidt and Manuel Blum. He taught at the University of Chicago and Dartmouth College prior to his present position. He has published over 225 papers in automata theory, combinatorics on words, formal languages, algebra, algorithms, computer graphics, history of mathematics, and number theory. He has written four books: Algorithmic Number Theory (with Eric Bach, MIT Press, 1996); Automatic Sequences (with Jean-Paul Allouche, Cambridge, 2003); A Second Course in Formal Languages and Automata Theory (Cambridge, 2009); and Neverending Fractions (with Jonathan Borwein, Alf van der Poorten, and Wadim Zudilin (Cambridge, 2014).

Title: Additive Number Theory via Automata

Abstract: Lagrange's theorem -- every non-negative integer is the sum of 4 squares of integers --- is probably the most celebrated of the classical results in additive number theory: the study of the additive properties of sets of integers. Recently there has been some interest in the additive properties of integers that are defined by their expansions in some base. For example, we could consider numbers whose base-10 expansion is a palindrome (reads the same forwards and backwards, like
12321).
Banks proved that every positive integer is the sum of at most 49 base-10 palindromes, and the "49" was improved to 3 by Cilleruelo, Luca, and Baxter. But they were unable to find results for bases 2, 3, and 4.
In this talk I will discuss how we were able to prove results about this problem in a new way, using ideas from theoretical computer science. We built automata (finite-state machines) that recognize the expansions of numbers that are the sums of palindromes, and then used a very general decision procedure to determine whether every sufficiently large number had such a representation.

Michael Newton

University of Wisconsin

Bio: Michael Newton is Professor at the University of Wisconsin Madison, in the Departments of Statistics and of Biostatistics and Medical Informatics (BMI). He recently became chair of BMI, and has worked at UW since completing his PhD in Statistics at the University of Washington in 1991. His undergraduate training was in mathematics and statistics at Dalhousie University. Dr. Newton's research concerns computational statistics, high-dimensional inference, and the development of statistics in the biological sciences, and he has been fortunate to collaborate with others in multi-disciplinary projects. With colleagues and students, Dr. Newton reported the first application of Markov chain Monte Carlo in phylogenetic analysis and the first use of mixture models for analyzing high-dimensional gene expression changes. His work has advanced statistical models in various domains, including: cancer-genomic aberrations, gene-function analysis, RNA interference, and the biology of cancer initiation. Dr. Newton has long been interested in Bayesian and empirical Bayesian computations, and recently resolved a general ranking problem in this domain. Further details may be found at http://www.stat.wisc.edu/~newton/

Title: *Bayesian inference by example in computational biology*

Abstract: Bayesian inference is a general data-analysis strategy that has proven effective in many application domains for extracting useful judgements, parameter estimates, uncertainty statements, predictions, and the like from potentially complicated data sources. It works by elaborating the observed data with some mathematical specification about how that data might have arisen. Probability models, which are central to this specification, express the structure of systematic and random sources of variation, and then inference follows by deploying the rules of probability conditional upon the data. Compared to other forms of statistics, Bayesian inference is especially compelling, although computationally challenging, when we are reasoning about a large number of unknown but related parameters, or when different kinds of data sets on the same basic objects are available, and thus with high-dimensional tasks or data integration tasks it can be very effective. I will review the basic structure of Bayesian inference using examples from computational biology.

Students Talks Schedule

	SESSION 1	SESSION 2	SESSION 3	SESSION 4
9:05-9:20am	Frédéric LeBlanc	Colin Vibert	Jennifer McNichol	Sarah Li
9:25-9:40am	William Taylor-Melanson	Joy Liu	Abby Anderson	Everett Patterson
9:45-10:00am	Nicholas Barreyre	Ben Wang	Samantha Bardwell	Adam Lucas
10:05-10:20am	Donné D'Arnall	John Marcoux	Lucas MacQuarrie	Dylan Ruth
1:35-1:50pm	Yong Yu	Brady Ryan	Ellen McCole	Charles Gerrie
1:55-2:10pm	Sarah Park	Kieran Bhaskara	Lawrence Daniel Doucett	Samuel Bauer
2:15-2:30pm	Kethireni Ajith Kumar Veera Raghavan	Jesse Preston	Graeme Zinck	Andrew Fraser
2:35-2:50pm	Maryam Tajjeddin	Emily Wright	Syed Zeeshan Ahmed	Uyen Dao
4:45-5:00pm	Samia Sifat	Caleb Jones	Mathieu Briedeau	Adam Smith
5:05-5:20pm	Deepkumar Shah	Justin Hughes	Simon Gauvin	Youssef Zaazou
5:25-5:40pm	Hardik Manek	Aaron Dwyer		Jeremy Peters

Session 1

9:05- 9:20am	Fredéric LeBlanc **Bounding the Complexity of Classes of Decision Trees**
9:25- 9:40am	William Taylor-Melanson **A Wearable System for Gait Phase Prediction and Interactive Movement Feedback**
9:45- 10:00am	Nicholas Barreyre **Bitwise Conditional Controls Over Language Models for Music and Text**
10:05- 10:20am	Donné D'Arnall **Crop and Weed Stem Classification Using Recurrent Neural Networks**
1:35- 1:50pm	Yong Yu **Alignment Historical Aerial Images using Machine Learning**
1:55- 2:10pm	Sarah Park **Classification of Engraved Illustrations using a Statistical Machine Learning Approach**
2:15- 2:30pm	Kethireni Ajith Kumar Veera Raghavan **Predict the Donor Journey Using Deep Learning Models**
2:35- 2:50pm	Maryam Tajjeddin **Predicting Risk of Aggressive Responsive Behaviours among People Suffering from Dementia using Natural Language Processing (NLP) and Machine Learning (ML)**
4:45- 5:00pm	Samia Sifat **Facial Expression Recognition and Morphing with Machine Learning**
5:05- 5:20pm	Deepkumar Shah **Using Machine Learning in Cannabis Industry**
5:25- 5:40pm	Hardik Manek **Credit Card Fraud Detection**

Session 2

9:05- 9:20am	Colin Vibert **One-sided simultaneous confidence intervals for one-way layouts with unequal variances**
9:25- 9:40am	Joy Liu **Animal Risk Assessment and Disease Control**
9:45- 10:00am	Ben Wang **Financial Data Exploration and Analysis for Stock Screening**
10:05- 10:20am	John Marcoux **Total Variation Denoising of Diffusion MRI Images Using a Modified Monge-Kantorovich Norm**
1:35- 1:50pm	Brady Ryan **Evaluation of Designs and Statistical Methods Under Response-Dependent Two-Phase Sampling for Genetic Association Studies**
1:55- 2:10pm	Kieran Bhaskara **Fractions with a twist: Continued fractions and polynomial Pell equations**
2:15- 2:30pm	Jesse Preston **Source-Sink Diffusion**
2:35- 2:50pm	Emily Wright **Diffusion with Multiple Sources and Sinks**
4:45- 5:00pm	Caleb Jones **An Algorithm Approach to the Game of Surrounding Cops and Robbers on Graphs**
5:05- 5:20pm	Justin Hughes **Delayed Cops and Robbers on Graphs**
5:25- 5:40pm	Aaron Dwyer **Domineering in Misère Play**

Session 3

9:05- 9:20am	Jennifer McNichol **The Estimation of Calibration Coefficients in Quantitative Fatty Acid Signature Analysis**
9:25- 9:40am	Abby Anderson **Modeling of spruce budworm population on a windy island**
9:45- 10:00am	Samantha Bardwell **A Dynamic Individual-Based Model of a Population of People Who Inject Drugs**
10:05- 10:20am	Lucas MacQuarrie **An Introduction to Mathematical Biology and Modelling of Tumour Development**
1:35- 1:50pm	Ellen McCole **Benchmarking MDLR for OGI in the field in a way that doesn't directly involve CH4 release**
1:55- 2:10pm	Lawrence Daniel Doucett **SphereSkeltons: Sphere-mesh Fitting for Extracting Topologically Accurate Medial Skeletons from Point Clouds**
2:15- 2:30pm	Graeme Zinck **Opacity in Modular Systems**
2:35- 2:50pm	Syed Zeeshan Ahmed **Preserving consumer DNA privacy for finding relatives in a malicious two-party computation**
4:45- 5:00pm	Mathieu Briedeau **Improving heterogeneous distributed databases resiliency using fuzzy logic**
5:05- 5:20pm	Simon Gauvin **Vizwik: Lessons Learned from the Design and Realization of a Visual Dataflow Language for the Web**

Session 4

9:05- 9:20am	Sarah Li **Towards a Finite Presentation of Unitary Dyadic Operators**
9:25- 9:40am	Everett Patterson **Using Linear Algebra in Quantum Enganglement Theory**
9:45- 10:00am	Adam Lucas **A Look at Distributed Computing and Modal Logic**
10:05- 10:20am	Dylan Ruth **Quantifier Elimination in Divisible Abelian Groups and Their Expansions**
1:35- 1:50pm	Charles Gerrie **Multi-block analysis of Unixcrypt**
1:55- 2:10pm	Samuel Bauer **Recovering Matrix Algebras**
2:15- 2:30pm	Andrew Fraser **How Good is Your Approximation? – The Essential Role of Error Estimation and Control in Numerical Computation**
2:35- 2:50pm	Uyen Dao **On Scheffe's criteria**
4:45- 5:00pm	Adam Smith **Applications and Numerical Solutions of Integral Equations**
5:05- 5:20pm	Youssef Zaazou **Horizons as Boundary Conditions in Spherical Symmetry**
5:25- 5:40pm	Jeremy Peters **Geometric Algebra for Relativity**