Student Research Session
Séance de recherche étudiante

KATRINA DE VERA, Acadia University
Clique Cut Sets of Signed Graphs and Zero-Free Chromatic Equivalence

Introduced by Thomas Zaslavsky, the *Zero-Free Chromatic Polynomial* is a function of a signed graph and an even positive integer, λ, which evaluates to the number of proper colourings of the signed graph with a symmetric set of λ nonzero integers. If two signed graphs have the same zero-free chromatic polynomial then they are *zero-free chromatically equivalent*. In this presentation we will consider signed graphs containing a clique cut set, and introduce a method to simplify the computation of their zero-free chromatic polynomials. We will also give a method for determining zero-free chromatic equivalence of such signed graphs.

HIN LON LAO, York University
Acyclic Presentation of Transversal Matroid

A matroid M on a finite set S is said to be *transversal* if the collection of independent sets of M are partial transversals of a set system $\mathcal{A} = (A_1, ..., A_n)$ of S. A set system $\mathcal{A}$ can be represented by a bipartite graph $G_{\mathcal{A}} = (S \cup V, E)$, where $\mathcal{A}$ or $G_{\mathcal{A}}$ is called a *presentation* of M. If a transversal matroid M admits an acyclic presentation $G_{\mathcal{A}}$, the circuits of M can be spotted easily from $G_{\mathcal{A}}$. Moreover, we are going to look at some conditions under which we may find another presentation $G_{\mathcal{A}'}$ of M such that part of $G_{\mathcal{A}'}$ is acyclic.

JOY MORRIS, University of Lethbridge
Making your academic job application stand out

I will provide an overview of the typical components of an academic job application in Canada (very similar to the USA but quite different from some other countries). I will briefly discuss what should be included in each component, and how to make your application stand out from other applications. There will be lots of time for questions, answers, and interactive discussion.

AIDEN TAYLOR, University of Calgary
Learnable Wavelet Filter Banks in Convolutional Neural Networks

Deep learning methods such as a Convolutional Neural Network (CNN) typically learn filters directly from data, which reduces the need for engineers to design filters for specific problems. This is great for general use, but learned filters in deep learning methods are usually unintelligible due to their lack of mathematical structure, and multiresolution/multiscale behaviour is learned implicitly. An easy solution to both of these problems is to incorporate wavelet transforms into ones deep learning model because wavelet transforms provide a framework for multiresolution analysis, where wavelet filter banks naturally arise from, as well as provable approximation properties in terms of the vanishing moments of a wavelet. However, in practice, said wavelet filter bank are often fixed and do not learn from the data given to them. This motivates the question of whether or not we can formulate learnable wavelet filter banks. In our research, we explore using the vanishing moments of wavelets as a viable avenue for learnability as wavelet filters can be factorized in a way to fix the number of vanishing moments along with certain degrees of freedom. To investigate the relationship between the number of vanishing moments (denoted L) and the degrees of freedom (denoted N), we compute the classification accuracy of a labeled dataset of images with different combinations of L and N. In the end, we find that the vanishing moments of wavelets are indeed a viable avenue for learnable wavelet filter banks as well as a heuristic proportional relationship between L and N.

KATERYNA TRETIAKOVA, University of Ottawa

Beyond the Lecture: Testing Pedagogical Formats in Undergraduate Mathematics Tutorials

The university mathematics tutorial is an understudied pedagogical space that, in practice, often defaults to a slower version of the lecture. Yet it holds genuine potential for active engagement and consolidation that many graduate student instructors never fully explore, in part because access to pedagogical training varies considerably across institutions.

Drawing on personal reflection and informal student feedback across introductory calculus, service-level, and proof-based courses, this talk compares several tutorial formats: traditional lecturing in various forms, the Thinking Classroom framework in whole-group and small-group settings, and more. Each is evaluated for cognitive demand, participation breadth, and characteristic failure modes. I argue that the choice of tutorial structure is itself a deliberate pedagogical decision, and conclude with practical recommendations for instructors who may be navigating that choice without formal training.