

Mathematics Colloquium

Markov Chain Monte Carlo Sampling of Tropically Convex Sets

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Friday, April 21, 2023
11:10 am – 12 pm, Building 180, Room 102
4:10 – 5 pm, Building 180, Room 112

Abstract

Tropically convex sets arise in tropical geometry which is the piecewise-linear analogue to classical mathematics where addition and multiplication are replaced by the maximum function and addition, respectively. Tropically convex sets are present in problems throughout operations research in the areas of optimization, extreme value statistics and causal inference, game theory, and phylogenetics. However, conducting the statistical analysis over tropically convex sets can be challenging because the associated probability distributions are of high-dimension, complex, and often analytically intractable. To better understand data defined over tropically convex sets we employ a Markov Chain Monte Carlo (MCMC) method called a tropical Hit-and-Run (HAR) sampler which simulates a desired target distribution by constructing an ergodic Markov chain where the stationary and target distributions are the same. While the application of HAR samplers to sets in Euclidean space is well studied, little research has been conducted focusing on applying HAR samplers to tropically convex sets. We consider the application of the HAR sampler to sample uniformly from a tropical polytope representing a tropically convex set as well as obtaining volume estimates of the same tropical polytope by constructing and sampling from a minimum enclosing tropical ball.

About the speaker: Dave has been a naval officer for 18 years, earning his commission from the United States Naval Academy (USNA) in 2005, where he graduated with a BS in History with a Russian language minor. After 13 years of flying helicopters for the US Navy, he began his studies at the Naval Postgraduate School in 2019 earning an MS in Operations Research and where he is currently a PhD candidate. Upon graduation in March 2024 he will move to Annapolis, MD where we will become a Permanent Military Professor in the USNA Mathematics Department.