STATISTICS
COLORADO STATE UNIVERSITY

Spring 2026 Departmental Seminar

Saifuddin Syed

Assistant Professor
Statistics
University of British Columbia

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Wagar Building Rm 232

A simple recipe for CREPE (Controlling REPlica-Exchange)

Abstract

Markov Chain Monte Carlo (MCMC) is a powerful algorithmic framework for sampling from complex probability distributions. Standard MCMC methods struggle with high-dimensional distributions containing well-separated modes, becoming trapped in local regions. Parallel tempering (PT) addresses this by using intermediate annealing distributions to bridge a tractable reference (e.g., Gaussian) and an intractable target distribution. However, classical PT is inflexible, fragile, hard to tune, and prone to performance collapse on challenging inference tasks.

This talk introduces non-reversible parallel tempering (NRPT), which provably dominates classical PT algorithms. We show that NRPT undergoes a sharp algorithmic phase transition with increased parallelism, becoming robust, easy to tune, and scaling efficiently to GPUs. I will then demonstrate how to further accelerate PT using neural transports such as normalising flows and diffusions. We demonstrate this framework across a variety of examples in Bayesian inference and inference-time control for diffusion models.