THE UNIVERSITY OF CHICAGO

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STATISTICS COLLOQUIUM

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Combining Multiple Parameterizations to Accelerate Perfect Sampling

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ABSTRACT

Fitting Bayesian multilevel models can pose significant computational challenges. Recent research demonstrates that strategically combining multiple parameterizations of such models can substantially accelerate algorithms for drawing samples from posterior distributions. In this talk, I will use multiple parameterizations to accelerate perfect sampling using Markov chains, illustrating with the example of the conjugate Dirichlet-multinomial hierarchical model. Drawing samples from the posterior distribution of the hyperparameters is made easier by a convenient data augmentation strategy, and the fact that the augmentation is discrete with a finite state space facilitates exact sampling under a default prior distribution. I develop two exact samplers using bounding chains that take advantage of monotonicity and anti-monotonicity in the target posterior distribution, and show that a composite algorithm that strategically alternates between the two samplers' updates can be faster than either individually. In simulations, the composite algorithm reduces the time until coalescence by several orders of magnitude. The speed gains come because the composite algorithm takes a divide-and-conquer approach in which one update quickly shrinks the bounding set for the augmented data, and the other update immediately coalesces on the parameter, once the augmented data bounding set is a singleton. The expected time until coalescence for the composite algorithm can be bounded, and in simulations the theoretical bounds are often close to actual performance.
