MANAGEMENT SCIENCES SEMINAR SERIES

Scalable Bayes via Barycenter in Wasserstein Space

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Abstract

Divide-and-conquer based methods for Bayesian inference provide a general approach for tractable posterior inference when the sample size is large. These methods divide the data into smaller subsets, sample from the posterior distribution of parameters in parallel across all subsets, and combine posterior samples from all the subsets to approximate the full-data posterior distribution. Sampling in the second step is more efficient than sampling from the full-data posterior due to a smaller sample size. Since the combination in the third step takes negligible time relative to sampling, posterior computations can be scaled to massive data by choosing a sufficiently large number of data subsets. One such approach, called WASP, relies on the geometry of posterior distributions estimated across different subsets. WASP combines subset posterior distributions through their mean in the Wasserstein space of probability measures. Theoretical results show that that WASP provides an accurate approximation of the full-data posterior. Empirical results demonstrate that the WASP and full-data posterior distribution have similar uncertainty quantification across diverse simulations, including mixture models, nonparametric density estimation, and mixed effects models. WASP also reproduces known results when applied to a movie rating database where full-data posterior computations are intractable.

Dr. Sanvesh Srivastava's Bio

Sanvesh Srivastava is an Assistant Professor the Department of Statistics and Actuarial Science and a member of Iowa Informatics Initiative. His research aims to develop flexible Bayesian methods and efficient computational algorithms for big data sets, tailored for both their complexity and size. Motivating examples include big data in genomics, medical imaging, and recommender systems. Before coming to the University of Iowa, Sanvesh received his Ph.D. in Statistics in August, 2013 from Purdue University, where he also won I.W. Burr Award for "promise of contribution to the profession as evidenced by academic excellence in courses and exams, by the quality of research, and by excellence in teaching and consulting." After Ph.D., he spent two years at Duke University and Statistical and Applied Mathematical Sciences Institute (SAMSI) as a postdoctoral researcher.