



復旦大學

数据科学与深度学习
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Finite-Particle Convergence of (Regularized) Stein Variational Gradient Descent



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Abstract: Stein Variational Gradient Descent (SVGD) is a widely used particle-based algorithm for approximate Bayesian inference. To address the intrinsic bias of SVGD, a regularized variant (R-SVGD) has been proposed that applies a resolvent-type preconditioner to the kernelized Wasserstein gradient. In this talk, I present recent results establishing explicit non-asymptotic finite-particle convergence guarantees for both SVGD and R-SVGD. The analysis is based on an entropy method for interacting particle systems, showing that the time derivative of the relative entropy between the joint law of the particles and the product target measure decomposes into a dominant negative term proportional to the number of particles times the expected squared Kernelized Stein Discrepancy (KSD^2), together with a smaller positive correction. This structure yields finite-particle convergence rates of order $(N^{-1/2})$ in KSD and Fisher information for SVGD and R-SVGD respectively. Under mild assumptions on the kernel and the target potential, the resulting bounds grow only polynomially with the dimension. The analysis further yields Wasserstein convergence rates for both algorithms, as well as marginal convergence and long-time propagation of chaos for the interacting particle system.

个人简介: Krishna Balasubramanian is an Associate Professor in the Department of Statistics at the University of California, Davis, where he is also affiliated with the Graduate Group in Applied Mathematics and the Graduate Program in ECE. He is also now an Amazon Scholar. His research spans deep learning, generative foundation models, stochastic optimization, sampling algorithms and statistics. He currently serves as AE for Annals of Statistics, JMLR, IEEE TIT and AC for ICML, NeurIPS, COLT and AISTATS.