Weak limits for entropic optimal transport

Abstract: We study the statistical behavior of empirical estimators of entropy-regularized optimal transport couplings between compact probability measures. These couplings were first proposed in a thought experiment of Schrödinger as a model for diffusing particles observed at different times, and have become popular in the last 10 years as computationally efficient proxies for optimal transport couplings. We review progress in characterizing rates of estimation for these estimators as well as their asymptotic limits. In particular, we describe a recent proof of a functional CLT conjectured by Harchaoui, Liu, and Pal (2020). Our proof is based on a stronger CLT for the dual solutions to the entropy-regularized problem in a suitable Hölder space. These CLTs also allow us to propose asymptotically valid goodness-of-fit tests based on the Sinkhorn divergence, a popular measure in machine learning.

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