New statistical phenomena for entropic optimal transport

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Optimal transport (OT) suffers from a well-known and severse statistical curse of dimensionality, obstructing its direct use in even moderate dimension. In practice, however, the OT problem is typically regularized with an entropic penalty term to afford the use of simpler and more scalable algorithms, forming entropic optimal transport (entropic OT). The ubiquity of entropic OT in practice, as well as the curse of dimensionality for unregularized OT, motivates the statistical study of entropic OT. In this talk, we identify two novel statistical phenomena for entropic OT in the form of non-asymptotic bounds for various entropic OT quantities such as values, maps, and densities. Our first set of bounds are for high-dimensional settings, and give totally dimension-free rates of convergence, albeit with exponential dependence on the regularization parameter. And our second set of bounds identify a refined form of intrinsic dimension-dependence, which we call Minimum Intrinsic Dimension scaling (MID scaling), where the effective dimension is the minimum of the single-scale dimensions of the distributions. Our proof techniques are inspired by convex optimization, and notably avoid empirical process theory almost entirely.

Based on joint work with Philippe Rigollet.