Statistical theory for transport-based generative modelling

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Measure transport provides a powerful toolbox for estimation and generative modelling of complicated probability distributions. The common principle is to learn a transport map between a simple reference distribution and a complicated target distribution. In this talk, we discuss recent advances in statistical guarantees for such methods. We discuss multiple relevant classes of maps: (1) triangular maps, which are the building blocks for 'autoregressive normalizing flows', (2) optimal transport maps and (3) ODE-based maps, where the coupling between reference and target is given by an ODE flow. This encompasses NeuralODEs, a popular method for generative modeling.

We derive non-asymptotic convergence rates for the distance between the transport-based estimator and the unknown 'ground truth' probability distribution, which converges to 0 algebraically in the statistical sample size. Our results imply that in certain cases, transport methods achieve minimax-optimal convergence rates for non-parametric density estimation, which was previously unknown.

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