Wasserstein Gradients for the Temporal Evolution of Probability Distributions

Yaqing Chen

University of California, Davis
E-mail: yaqchen@ucdavis.edu

Abstract: Many studies have been conducted on flows of probability measures, often in terms of gradient flows. We utilize a generalized notion of derivatives with respect to time to model the instantaneous evolution of empirically observed one-dimensional distributions that vary over time and develop consistent estimates for these derivatives. Employing local Fréchet regression and working in local tangent spaces with regard to the Wasserstein metric, we derive the rate of convergence of the proposed estimators. The resulting time dynamics are illustrated with time-varying distribution data that include yearly income distributions and the evolution of mortality over calendar years.