A test of isomorphism between metric-measure spaces using the distance-to-a-measure signature

Claire Brécheteau

We introduce the notion of DTM-signature, a measure on $\mathbb{R}_+$ that can be associated to any metric-measure space. This signature is based on the distance to a measure (DTM) introduced by Chazal, Cohen-Steiner and Mérigot (2011). It leads to a pseudo-metric between metric-measure spaces, upper-bounded by the Gromov-Wasserstein distance. Under some geometric assumptions, we derive lower bounds for this pseudo-metric. Given two N-samples, we also build an asymptotic statistical test based on the DTM-signature, to reject the hypothesis of equality of the two underlying metric-measure spaces, up to a measure-preserving isometry. We give strong theoretical justifications for this test involving Wasserstein metrics.