ROBUST SHAPE INFERENCE FROM A SPARSE APPROXIMATION OF THE GAUSSIAN TRIMMED LOGLIKELIHOOD

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Abstract:

Given a noisy sample of points lying around some shape M, with possibly outliers or clutter noise, we focus on the question of recovering M. Often, such inference is based on the sublevel sets of distance-like functions such as the function distance to M, the distance-to-measure (DTM) or the k-witnessed distance.

A sparse approximation of the DTM, the m-power-distance-to-measure (m-PDTM) is introduced and studied. Its sublevel sets are unions of m balls, with m possibly much smaller than the sample size. By miming the construction of the m-PDTM from the DTM, we propose an approximation of the trimmed log-likelihood associated to the family of Gaussian distributions on $\mathbb{R}^d$. Its sublevel sets are unions of m ellipsoids.

We provide Lloyd-type algorithms to compute the centers of the balls and ellipsoids. Trimmed versions of these algorithms allow to wipe out clutter noise and to recover the homology of M, from noisy data ; this requiring the storage of only m points and covariance matrices.