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THE COMMITTEE ON
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COLLOQUIUM

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Gradient-Guided Density Peak Clustering

THURSDAY, October 29th at 4:00 PM

Jones 303, 5747 S. Ellis Ave. Chicago, IL 60637

ABSTRACT

Density peak clustering (DPC) connects each observation to its nearest neighbor of higher density and identifies cluster centers as high-density observations with unusually large nearest neighbor uphill shifts. The resulting uphill paths from observations to cluster centers, however, can be irregular and unstable in low-density regions, making the clustering assignments sensitive to local perturbations and obscuring the population geometry of the DPC graph.

In this talk, we introduce gradient-guided density peak clustering (GGDPC), which performs a gradient ascent step before each nearest neighbor uphill search. We develop a stability theory that relates the GGDPC graph to the gradient ascent flow of the population density. In particular, we establish consistency of GGDPC under five complementary criteria: recovery of local modes, convergence of the clustering assignments under the adjusted Rand index, Gromov-Hausdorff convergence of the induced dendrogram (cluster tree), stability of GGDPC path lengths, and convergence of a novel density waterfall representation. Together, these results provide new statistical, geometric, and topological interpretations of DPC-type clustering algorithms.

Organizers:

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