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THE HONG KONG UNIVERSITY OF SCIENCE TECHNOLOGY
Department of Mathematics

MATHEMATICS COLLOQUIUM

Intrinsic low-dimensional geometry in high-dimensional data: from adaptive Gaussian processes to manifold diffusion operators

By

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Abstract

Many modern datasets, though high-dimensional in ambient space, exhibit latent low-dimensional structure. This talk develops statistical theory for learning in such settings, showing that ambient kernels, without explicitly inferring the latent geometry, can yield statistical rates determined by intrinsic rather than ambient dimension. The first part focuses on Gaussian process regression on manifolds, where RKHS approximation on the manifold yields minimax-optimal posterior contraction rates that adapt to both unknown smoothness and unknown intrinsic dimensionality. The second part addresses learning the manifold's diffusion geometry, where the iterated graph diffusion operator approximates the manifold heat semigroup at finite diffusion times, under minimal regularity assumptions on the test function. In both cases, ambient kernels are used directly, without relying on spectral or Laplacian methods.

Bio: Xiuyuan Cheng is a Professor of Mathematics at Duke University. She received her Ph.D. in Mathematics from Princeton University in 2013. Before joining Duke, she was a postdoctoral researcher at École Normale Supérieure in Paris from 2013 to 2015 and a Gibbs Assistant Professor at Yale University from 2015 to 2017. Her research develops theoretical and computational methods for high-dimensional data analysis, signal processing, and machine learning. Her work has been recognized with a Sloan Research Fellowship and an NSF CAREER Award.

Date : 12 June 2026 (Friday)
Time : 3:00pm - 4:00pm
Venue : Lecture Theatre F (Lift 25/26)
All Are Welcome!