



Optimization and Machine Learning Seminar

How does generalization behave under suitable model capacities in modern machine learning? From deterministic equivalence to function spaces

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Abstract

In this talk, I will discuss some fundamental questions in modern machine learning:

- What is a suitable model capacity of a modern machine learning model?
- How to precisely characterize the test risk under such a model capacity?
- What is the corresponding function space induced by such a model capacity?
- What are the fundamental limits of statistical/computational learning efficiency within space?

My talk will partly answer the above questions, through the lens of norm-based capacity control. By deterministic equivalence, we provide a precise characterization of how the estimator's norm concentrates and how it governs the associated test risk. Our results show the predicted learning curve admits a phase transition from under- to over-parameterization, but no double descent behavior, and reshapes scaling laws as well. I will talk about the path-norm based capacities and the induced Barron spaces to understand the fundamental limits of statistical efficiency, particularly in terms of sample complexity and dimension dependence — highlighting key statistical-computational gaps.

Date: July 11, 2025 (Friday)

Time: 11:00 am – 12:00 pm

Venue: Room 210, Run Run Shaw
Building HKU