Artificial Intelligence Initiative (Aii)

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Invited Speaker

Dr. Wu Lin, Vector Institute for Artificial Intelligence

"Utilizing Mathematical Structures for Efficient Machine Learning"

Monday, April 14, 2025 • 11:00AM • TC2 222 • Zoom

Abstract:
Mathematical structures play an essential role in classical machine learning. Yet, many such structures remain hidden or underexplored in modern large-scale machine learning systems. Identifying and leveraging these structures not only deepens our understanding of machine learning but also enables the design of faster and more efficient algorithms. Surprisingly, many optimization and inference problems can be formulated from a probabilistic perspective to exploit the underlying structure of a probability family.

In this talk, I advocate for utilizing mathematical structures---such as convex duality and geometric invariance---to unlock new algorithmic opportunities in modern machine learning. I will illustrate the benefits through several examples: (i) viewing Newton's method as a Gaussian approximation from a probabilistic perspective, (ii) using this view to design practical Newton-like methods for training large deep neural networks, and (iii) generalizing the approach to enable efficient Bayesian estimation in complex probabilistic models.

By leveraging mathematical structures, we can open new directions for fundamental research and drive advancements in practical machine learning applications.

Bio:
Dr. Lin is a Distinguished Postdoctoral Fellow at the Vector Institute for Artificial Intelligence. His research lies at the intersection of differential geometry and machine learning, with a particular emphasis on optimization and inference. His work has appeared in top-tier machine learning venues, including the International Conference on Machine Learning (ICML). Currently, his projects investigate geometric approaches with broad implications for large-scale optimization and emerging paradigms in machine learning.