Building models of machine learning with mathematical physics

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Neural networks continue to surprise us in their remarkable capabilities for high-dimensional function approximation. Applications of machine learning now pervade essentially every scientific discipline, but predictive models to describe the optimization dynamics, inference properties, and flexibility of modern neural networks remain limited. In this series of lectures, I will introduce several approaches to both analyzing and building machine learning models based on ideas from statistical and nonequilibrium physics. This will include leveraging analytical tools from the study of interacting particle systems, physics-informed neural network strategies for computing solutions to high-dimensional PDEs, and generative modeling strategies based on optimal mass transport.