Computational Math Seminar

Game Theory, AI, and Optimal Transportation

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Abstract: The modern world constitutes a network of complex socioeconomic interactions leading to increasingly challenging decision-making problems for participating agents such as households, governments, firms, and autonomous systems. We consequently need refined mathematical models and solution techniques for addressing these difficulties. ¡br¿¡br¿In this talk, I will demonstrate how to apply mathematical game theory, optimal control, and statistical physics to model large systems of interacting agents and discuss novel dimension reduction and machine learning techniques for their solution. ¡br¿¡br¿An intriguing aspect of this research is that the mathematics of interacting agent systems provides a foundation for fast and robust core machine learning algorithms and their analysis. For example, I will demonstrate how to solve the regularity problem in normalizing flows based on their "crowd-motion" or optimal transportation interpretation. ¡br¿¡br¿Yet another essential utility of optimal transportation in data science is that it provides a metric in the space of probability measures. I will briefly discuss the application of this metric for robust solution methods in inverse problems appearing in physical applications. ¡br¿¡br¿I will conclude by discussing future research towards socioeconomic applications, data science, and intelligent autonomous systems.

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