The Landscape of the Proximal Point Method for Nonconvex-Nonconcave Minimax Optimization

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Abstract: Minimax optimization has become a central tool for modern machine learning with applications in generative adversarial networks, robust training, reinforcement learning, etc. These applications are often nonconvex-nonconcave, but the existing theory is unable to deal with the fundamental difficulties this poses. In this talk, we will overcome these limitations, describing the convergence landscape of the classic proximal point method on nonconvex-nonconcave minimax problems. We find that a classic generalization of the Moreau Envelope not only smoothes the original objective but can convexify and concavify it based on the interaction between the minimizing and maximizing variables. When interaction is sufficiently strong, we derive global linear convergence guarantees. When interaction is weak, we derive local linear convergence guarantees under proper initialization. Between these two settings, we show undesirable behaviors like divergence and cycling can occur.

Bio: Benjamin Grimmer is a graduating fifth-year PhD student in the ORIE department at Cornell University advised by Jim Renegar and Damek Davis. He will be joining the faculty of the Johns Hopkins Department of Applied Math and Statistics this coming Fall. Ben's research focuses on mathematical programming and continuous optimization methods that work at scale, supported by an NSF Graduate Research Fellowship. An overarching theme in Ben's research is bridging the gap between our understanding of classical continuous optimization approaches and the potentially stochastic, nonconvex, nonsmooth, adversarial models employed in data science and machine learning.

This talk is part of the School of Mathematical and Statistical Sciences Seminar Series, and will take place from 11:15AM to 12:05PM through Zoom: an invitation will be forwarded to everyone soon.