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FUDAN UNIVERSITY

Applied Math Ph.D. Seminar

A Simple Adaptive Proximal Gradient Method for Nonconvex Optimization

Speaker: Zilong Ye (Nanjing University)

Time: 2026-10-15, 16:10 to 17:00

Location: Rm 1801, Guanghai East Tower

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Abstract: We consider composite nonconvex optimization problems consisting of a smooth, possibly nonconvex function and a convex, possibly nonsmooth regularizer. To address the limitations of traditional proximal gradient methods, which typically require prior knowledge of the Lipschitz constant or line search for step size selection, we propose a simple adaptive proximal gradient method, termed AdaPGNC. The proposed method adaptively adjusts its step sizes using local upper and lower curvature estimates, allowing the step sizes to both increase and decrease. It is parameter-free, line-search-free, restart-free, and features a simple single-loop structure. Under standard assumptions, including Lipschitz continuity of the gradient, we establish an $\mathcal{O}(\varepsilon^{-2})$ iteration complexity for finding an ε -stationary point in the nonconvex setting, which is optimal in terms of ε . Our convergence analysis relies on a novel Lyapunov function that combines the objective function value gap with the squared norm of consecutive iterate differences. Furthermore, in the convex setting, the method requires no function value evaluations and achieves an $\mathcal{O}(1/k)$ convergence rate in objective function values, while linear convergence is established under strong convexity. Numerical experiments on neural network training, matrix completion, nonnegative matrix factorization, and logistic regression demonstrate the effectiveness and competitive performance of the proposed method.