FUDAN UNIVERSITY

Applied Math Ph.D. Seminar

Explicit Global Convergence Rates of BFGS without Line Search

Speaker: Jianjiang Yu (Fudan University)

Time: 2025-11-05, 16:10 to 17:00

Location: Rm 1801, Guanghua East Tower

Advisor: Weiguo Gao, Luo Luo (Fudan University)

Abstract: We present new theoretical results for the BFGS method with an adaptive step size [Gao and Goldfarb, Optimization Methods and Software, 34(1):194-217, 2019], showing explicit two-phase global convergence: a linear phase at rate $\mathcal{O}((1-1/\varkappa)^k)$ and a superlinear phase at $\mathcal{O}((\varkappa/k)^k)$, where k is the iteration counter and $\varkappa$ is the condition number. In contrast, classical analyses establish asymptotic convergence only, and recent non-asymptotic results mainly address local convergence under the unit step size or global guarantees with line search. We further propose a smoothness-aided variant that takes a larger adaptive step by leveraging the gradient Lipschitz continuity, thereby accelerating early convergence. These results provide the first explicit non-asymptotic global characterization of BFGS without line search.