ODE-based Learning to Optimize

Speaker: Zhonglin Xie (Peking University)

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Location: Rm 1801, Guanghua East Tower

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Abstract: Recent years have seen a growing interest in understanding acceleration methods through the lens of ordinary differential equations (ODEs). Despite the theoretical advancements, translating the rapid convergence observed in continuous-time models to discrete-time iterative methods poses significant challenges. In this talk, we present a comprehensive framework integrating the inertial systems with Hessian-driven damping (ISHD) and learning-based approaches for developing optimization methods. We first establish the convergence condition for ensuring the convergence of the solution trajectory of ISHD. Then, we show that provided the stability condition, the sequence generated through the explicit Euler discretization of ISHD converges, which gives a large family of practical optimization methods. In order to select the best optimization method in this family, we introduce the stopping time, the time required for an optimization method derived from ISHD to achieve a predefined level of suboptimality. Then, we formulate a novel learning to optimize (L2O) problem aimed at minimizing the stopping time subject to the convergence and stability condition. Empirical validation of our framework is conducted through extensive numerical experiments. These experiments showcase the superior performance of the learned optimization methods.