Interplays between Machine Learning and Optimization

Abstract:
Over the past two decades, machine learning has rapidly evolved and emerged as a highly influential discipline of computer science and engineering. One of the pillars of machine learning is mathematical optimization, and the connection between the two fields has been a primary focus of research. In this talk, I will present two recent works that contribute to this study, focusing on online learning---a central model in machine learning for sequential decision making and learning under uncertainty. In the first part of the talk, I will describe a foundational result concerned with the power of optimization in online learning, and give answer to the question: does there exist a generic and efficient reduction from online learning to black-box optimization? In the second part, I will discuss a recent work that employs online learning techniques to design a new efficient and adaptive preconditioned algorithm for large-scale optimization. Despite employing preconditioning, the algorithm is practical even in modern optimization scenarios such as those arising in training state-of-the-art deep neural networks. I will present the new algorithm along with its theoretical guarantees and demonstrate its performance empirically.