ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

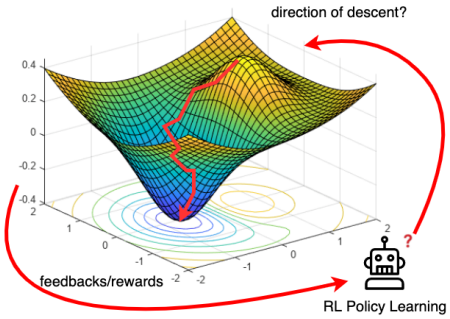
Distributed Computing

Prof. R. Wattenhofer

Reinforcement Learning to Optimize (RL2O)

Learning to optimize (L2O) is an emerging approach that leverages machine learning to develop algorithms for solving classical optimization problems. Instead of relying on conventional solutions built by optimization experts with theories and experience, L2O automates the design of optimization methods based on their performance on a set of training problems. This data-driven approach can efficiently solve intractable problems that traditional optimization methods cannot handle. Despite its promising applications, there are many open problems in the research of L2O. For example, an optimizer trained using supervised machine learning will tend to overfit the geometry of the training objective functions, limiting the practicability of L2O in the real world.

Reinforcement learning (RL), on the other hand, has been successfully applied to many sequential decision-making problems in real-world applications such as gaming, robotics, and healthcare. RL algorithms are designed to learn and adapt to changing environments, which means they can continue to improve their performance over time, even with unseen states in the training data. This makes RL promising in solving the aforementioned overfitting issue of L2O.



This project expects the student first to survey the literature on L2O and explore different L2O algorithms and libraries. The student will also investigate how to formulate optimization problems as RL problems and develop RL2O algorithms to effectively find solutions to optimization problems.

Requirements: Knowledge in reinforcement learning or a solid background in machine learning. Knowledge in optimization is a strong bonus. Experience with PyTorch (or TensorFlow) and OpenAI Gym is an advantage. We will have weekly meetings to address questions, discuss progress and think about future ideas. Motivation to conduct independent research is a strong plus, as this project is expected to lead to a conference publication.

Interested? Please contact us for more details!

Contact

- Flint Xiaofeng Fan: xiafan@ethz.ch, ETZ G93
- Joël Mathys: jmathys@ethz.ch, ETZ G63