

Model Free Control

Introduction

Marius Lindauer



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Overview

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 - ▶ Aim: We wanted to know how well a given policy would perform
 - ▶ MDP model (e.g., transition function and reward function) not given

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 - ▶ Aim: We wanted to know how well a given policy would perform
 - ▶ MDP model (e.g., transition function and reward function) not given
- ▶ This time: Control (making decisions) without a model of how the world works
 - ▶ We have to search for a well-performing policy
 - ▶ We still don't know the MDP model
 - ▶ We assume that we can model everything by table look-ups

Recall: Reinforcement Learning involves

- ▶ Optimization
- ▶ Delayed consequences
- ▶ Exploration
- ▶ Generalization

Learning to Control Involves

- ▶ Optimization: Goal is to identify a policy with high expected rewards (similar to before on computing an optimal policy **given** an MDP)
- ▶ Delayed consequences: May take many time steps to evaluate whether an earlier decision was good or not
- ▶ Exploration: Necessary to try different actions to learn what actions can lead to high rewards
- ▶ (Generalization – deferred to later)

Model-free Control Examples

- ▶ Many applications can be modeled as an MDP: Backgammon, Go, Robot locomotion, Helicopter flight, Robocup soccer, Autonomous driving, Customer ad selection, Invasive species management, Patient treatment
- ▶ For many of these and other problems either:
 - ▶ MDP model is unknown but can be sampled
 - ▶ MDP model is known but it is computationally infeasible to use directly, except through sampling

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On and Off-Policy Learning

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 - ▶ Direct experience
 - ▶ Learn to estimate and evaluate a policy from experience obtained from following **that** policy
- ▶ Off-policy learning
 - ▶ Learn to estimate and evaluate a policy using experience gathered from following a **different** policy