A Short Course in Reinforcement Learning

ICTS INTERNATIONAL CENTRE for THEORETICAL SCIENCES
TATA INSTITUTE OF FUNDAMENTAL RESEARCH

Information

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- Lectures: From 1 Nov to 25 Nov 2024.
  - Fridays 2-4 pm
  - Mondays 2-4 pm (except 4 Nov pushed to 5 Nov)
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- Webpage: https://www.icts.res.in/lectures/HT-2024

Description

Reinforcement learning (RL) deals with how an agent decides on actions to take in an environment, while intending to maximise some notion of a reward. Deep neural network models now allow RL methods to solve complex problems end-to-end. This short course will cover the basic theory of RL, based on Markov decision processes and dynamical programming, as well as basic learning methods, such as temporal differences. Two Python practicals are included to apply these concepts and methods to specific applications.

Content

1. **Markov decision processes**

   Markov reward processes, Markov decision processes, value and action-value functions, Bellman equations.

2. **Dynamic programming and temporal difference methods**

   Optimal policy, dynamic programming, policy and value iterations, TD methods, Q-learning.

3. **Courseworks**

   Coursework 1: MRP, MDP, Bellman equations, Q-learning, simple applications.
   Coursework 2: Gridworld problems, gym package.

References

- R. S. Sutton and A. G. Barto, *Reinforcement Learning: An Introduction*, 2nd Ed., MIT Press, 2018.
  Available free: http://incompleteideas.net/book/the-book-2nd.html
- D. Silver, *Introduction to Reinforcement Learning*, UCL Course, 2015.
  https://www.davidsilver.uk/teaching/