Welcome to the RL Lecture

Brief Motivation and Orga

Marius Lindauer

AutoML.org
Automated
Machine Learning
Hannover

Question

Why are you interested to learn more about reinforcement learning (RL)?

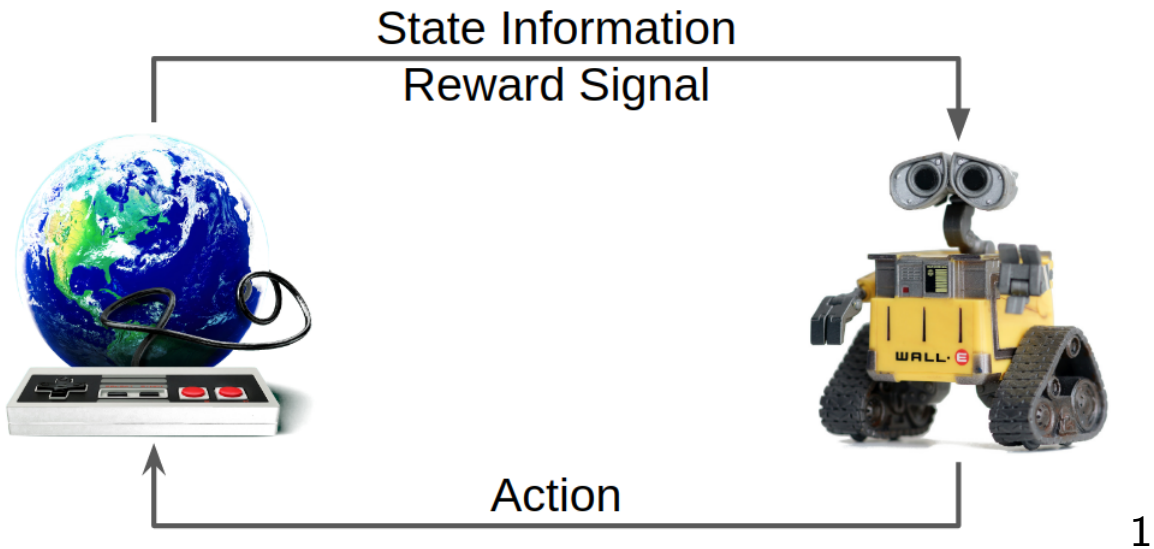
$\rightarrow$ use the chat to answer!

Machine Learning

"Machine learning is the science of getting computers to act without being explicitly programmed."

by Andrew Ng

Reinforcement Learning



[1]

- Data: Self-acquired observations + rewards
- Task: Learn how to behave s.t. reward is maximized

$\rightsquigarrow$ Not a single decision, but a sequence of good decisions

[1] Image source: Morning Brew and Marius Haakestad on Unsplash

Goals of the Lecture

You will be able to ...

1. understand the basic algorithms in RL
2. discuss the assumptions and limitations of RL and its algorithms
3. decide which RL algorithm to use on a given environments
4. do research on RL yourself
   - perfect opportunity to do a master project or thesis with us afterwards

Course Overview (tentative)

1. Big Picture (Introduction)
2. MDP, Policy, Value Iteration
3. Policy Evaluation
4. Model Free Control
5. Linear Function Approximation
6. Deep RL
7. Policy Gradient
8. Exploration
9. Meta-RL
10. Reproducibility in RL
11. Project

Course Format

- Concepts over details
  - we provide references and links to papers
    s.t. you can read up details!
- Interactive lecture and exercise sessions
  - short inputs ($\sim$10min) followed by Q&A
  - interactive quizzes in exercise sessions to reinforce your knowledge

  $\rightsquigarrow$ The success of it depends on whether you are willing to talk to us!
- (Mostly) Practical exercises
  - implement it, use it and play with it!

Team

Prof. Dr.
Marius Lindauer

Theresa Eimer

Frederik Schubert

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- Meeting via Zoom – as you already figured out ;-)

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- Interactive Kahoot quiz
- Feedback to exercise sheet
  - You don't need to achieve any point threshold
  - But you need to submit something every week

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- Every week, a new exercise sheet
  - exercise focus is one week behind the lecture topics
  - Most exercises will be practical, i.e., you have to implement something
  - Team work highly recommended, team size at most 3!

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- If you need help or have questions, use the chat!

You need help?

Priority list:

1. Ask your friends and peers
2. Use our chat system via Mattermost (see Stud.IP for invitation link) and post to the "town square" channel
   - You can also answer the questions of your peers!
   - We will only reply if we have the feeling that it is necessary.
3. If there are organizational questions, contact Theresa or Frederik directly (via Mattermost)
4. Only as the very last option, contact me ;-)

Requirements for Attending

- Basics of AI (mandatory)
  - Search, planning, optimization . . . , expectations, . . .
- Basics of Machine Learning (mandatory)
  - Classification, regression, clustering, decision tree, training-test split, cross validation, pre-processing . . .
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- Experience in Python and git (strongly recommended)
  - nearly all exercises will require that you implement something in Python and submit the solution to a git repo

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Final Grading

- Implement a larger project (worth $1-2$ weeks full time)
  - You can propose your own project idea!
    - ★ Hand-in a short summary of the idea (half a page) and we will provide feedback regarding feasibility
  - Teamwork (at most 3) again possible
    - ★ Larger team $\rightarrow$ larger scope of the project
- "Exam"
  - First 15 minutes: Present your project idea and results in the
    - ★ Of course, everyone will present the project on their own
  - Second 15min: We will ask further questions about your project and how it relates to stuff you learned in the lecture.
- You will have the choice between a virtual and on-site exam.

Bonus Points?

- You can earn bonus points for the exam by finding bugs in our slides and exercises:
  - You can get at most 10% as a bonus of the overall points in the exam
  - 0.1% for each typo in the slides or exercise sheet
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- How get to it?
  1. Submit a PR with the fix to our GitHub repo: `https://github.com/automl-edu/RL_lecture`
  2. Send us a message with link to your PR in the corresponding Mattermost channel

Additional Resources

- To get a deep understanding of RL,
  you should also read some papers
- RL book by Sutton and Barto: `https://www.andrew.cmu.edu/course/10-703/textbook/BartoSutton.pdf`
- Video lectures – click on it!
  - [Emma Brunskill (2019-20)]
  - [Sergey Levine (2020)]
  - [David Silver (2015)]

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Challenges:

- The research on RL is very active and there is so much progress $\rightsquigarrow$ impossible to catch up with state of the art with one course
- The origins of RL go back to robotics, control, theory on bandits and computer science $\rightsquigarrow$ different notations
- You will find some typos and issues in the slides $\rightsquigarrow$ please tell us if you find something

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$\rightarrow$ Give us some feedback and we will improve the course!

Questions?