



Reinforcement Learning

Overview

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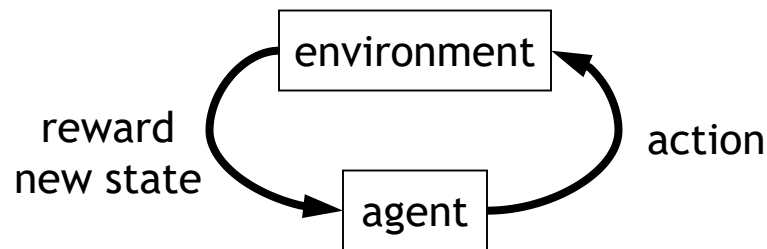
Outline

- ➔ **Motivation & Overview**
- Course Information



Reinforcement Learning

- Supervised learning
 - Classification, regression
- Unsupervised learning
 - Clustering
- Reinforcement learning
 - More general than supervised/unsupervised learning
 - Learn from interaction w/ environment to achieve a goal





Robot in a Room

			+1
START			-1

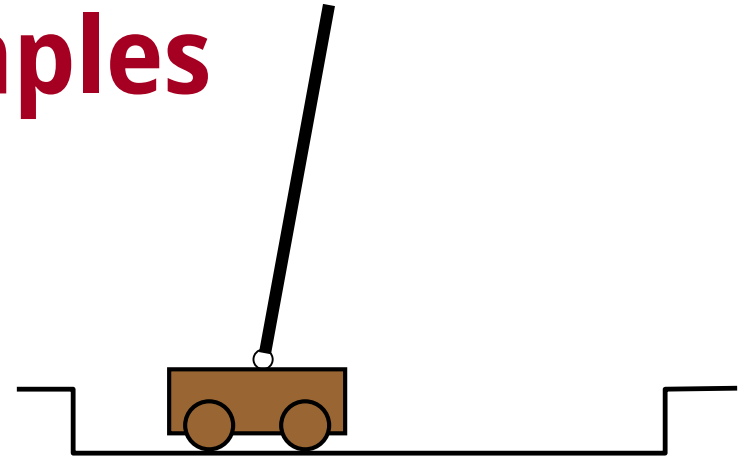
actions: UP, DOWN, LEFT, RIGHT

- Reward +1 at [4,3], -1 at [4,1]
- Reward -0.04 for each step
- What's the strategy to achieve max reward?



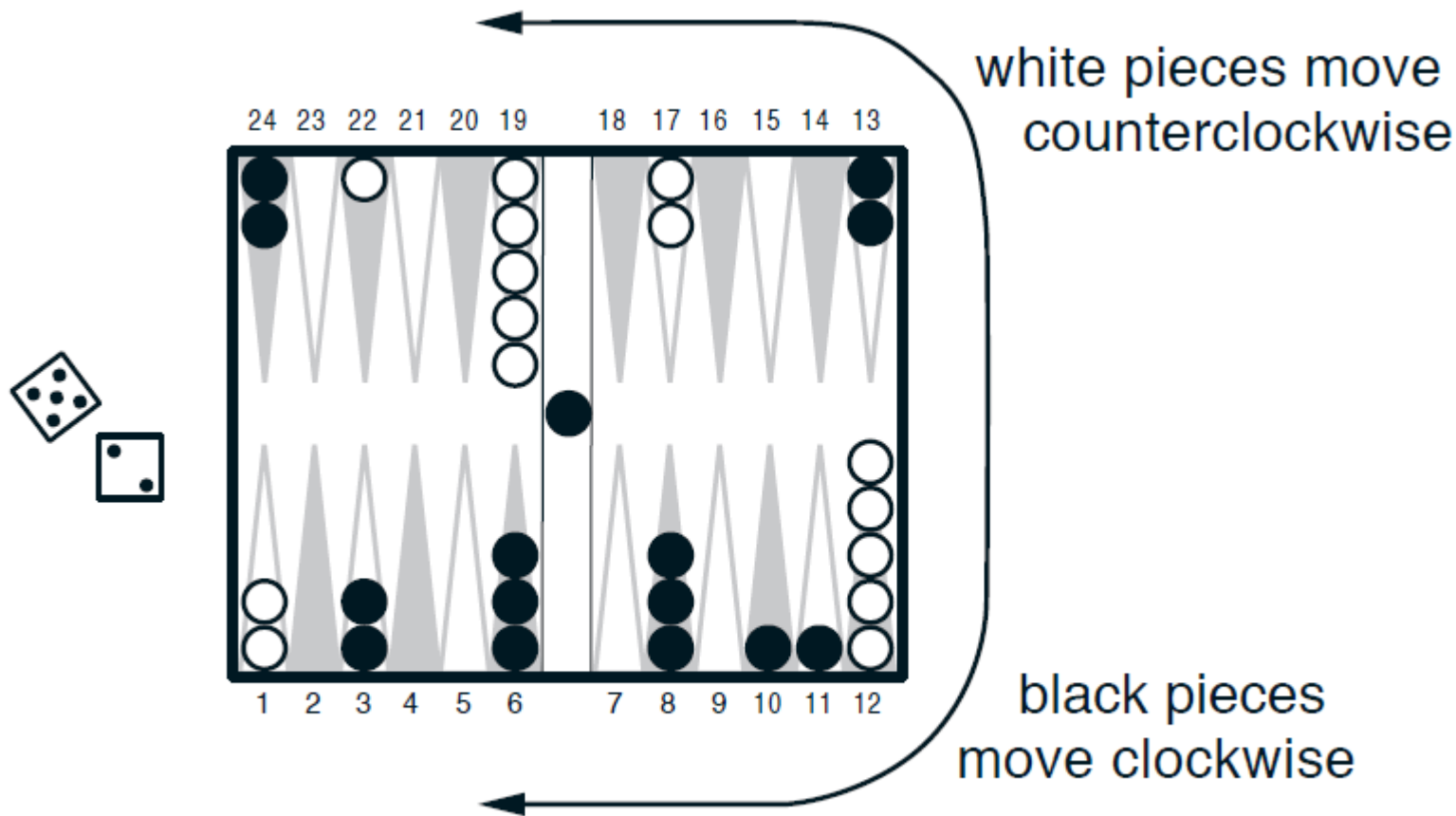
Other Examples

- Pole-balancing
- TD-Gammon
- Helicopter
- No teacher who would say “good” or “bad”
 - Is reward “20” good or bad?
 - Delayed rewards
- Explore the environment and learn from experience





Backgammon



A backgammon position

Sutton and Barto,
Reinforcement
Learning, 2018



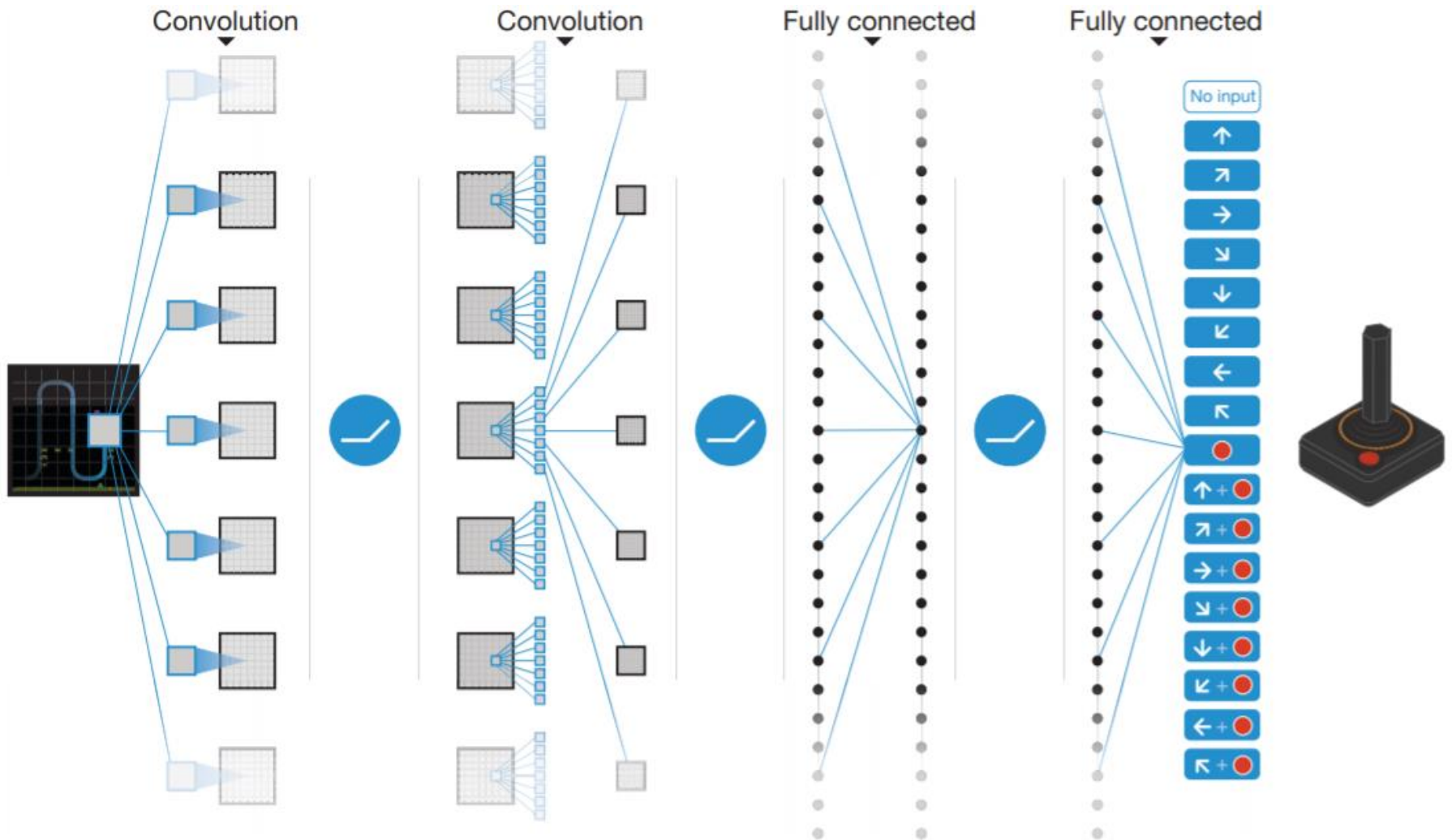
Atari 2600 Games



<https://arxiv.org/pdf/1312.5602.pdf>



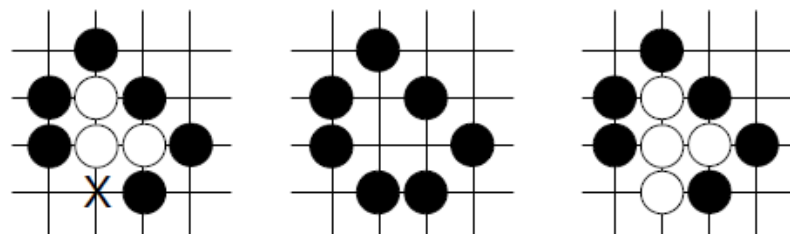
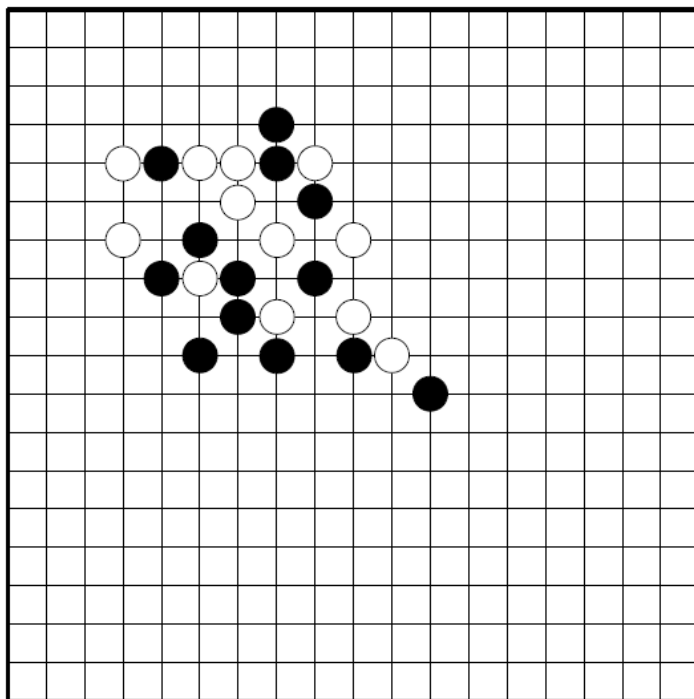
Human-level Video Game Play





Mastering the Game of Go

- Go game



Sutton and Barto,
Reinforcement
Learning, 2018



Topics in This Course

- Multi-armed Bandits
- Finite Markov Decision Process
- Dynamic Programming
- Monte Carlo Methods
- Temporal Difference Learning
- n-step Bootstrapping
- Planning and Learning with Tabular Methods
- On-policy Prediction with Approximation
- On-policy Control with Approximation
- Eligibility Traces
- Policy Gradient Methods
- Applications and Case Studies



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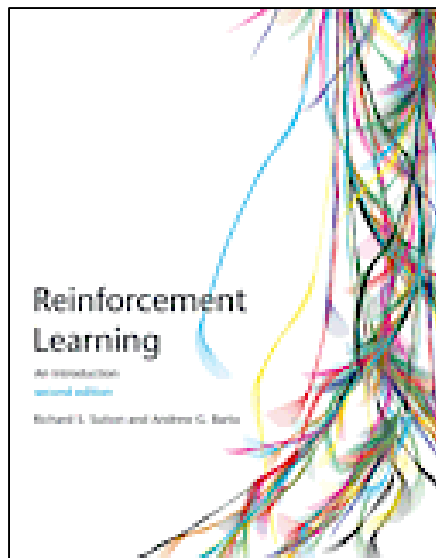
Motivation & Overview

 **Course Information**



Textbook

- Reinforcement Learning (Richard S. Sutton and Andrew G. Barto)



- Available at <http://www.incompleteideas.net/book/the-book-2nd.html>



Prerequisites

- **Basic probability**
 - Average, std. deviation, typical distributions, MLE, ...
- **Machine Learning or Artificial Intelligence**
 - Basic understandings of machine learning



Advice

- Read each chapter before class
 - It is ok to encounter something you don't understand. Just mark it, and later you will understand it when you come back.

- “Understand” intuitions of main ideas
 - Do not memorize without understanding
 - Improve your problem solving skills

- Enjoy this course, and study hard!

Good Luck!



Questions?