A Quick Look at the “Reinforcement Learning” course

A. LAZARIC (SequeL Team @INRIA-Lille)
Ecole Centrale - Option DAD
Why
Why: Important Problems
Why: Important Problems

- Autonomous robotics
Why: Important Problems

- Autonomous robotics
- Elder care
Why: Important Problems

- Autonomous robotics
  - Elder care
  - Exploration of unknown/dangerous environments
Why: Important Problems

- Autonomous robotics
  - Elder care
  - Exploration of unknown/dangerous environments
  - Robotics for entertainment
Why: Important Problems

- Autonomous robotics
- Financial applications
Why: Important Problems

- Autonomous robotics
- Financial applications
- Trading execution algorithms
Why: Important Problems

- Autonomous robotics
- Financial applications
- Trading execution algorithms
- Portfolio management
Why: Important Problems

- Autonomous robotics
- Financial applications

- Trading execution algorithms
- Portfolio management
- Option pricing
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management

- Energy grid integration
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management

- Energy grid integration
- Maintenance scheduling
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management

- Energy grid integration
- Maintenance scheduling
- Energy market regulation
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management

- Energy grid integration
- Maintenance scheduling
- Energy market regulation
- Energy production management
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management
- Recommender systems
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management
- Recommender systems

- Web advertising
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management
- Recommender systems

- Web advertising
- Product recommendation
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management
- Recommender systems

- Web advertising
- Product recommendation
- Date matching
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management
- Recommender systems
- Social applications
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management
- Recommender systems
- Social applications
- Bike sharing optimization
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management
- Recommender systems
- Social applications

- Bike sharing optimization
- Election campaign
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management
- Recommender systems
- Social applications

- *Bike sharing optimization*
- *Election campaign*
- *ER service optimization*
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management
- Recommender systems
- Social applications

- Bike sharing optimization
- Election campaign
- ER service optimization
- Resource distribution optimization
Why: Important Problems

- Autonomous robotics
- Financial applications
- Energy management
- Recommender systems
- Social applications
- And many more...
What
What: Decision-Making under Uncertainty

Environment

Agent

action / actuation

state / perception
Reinforcement learning is learning what to do – how to map situations to actions – so as to maximize a numerical reward signal. The learner is not told which actions to take, as in most forms of machine learning, but instead must discover which actions yield the most reward by trying them (trial–and–error). In the most interesting and challenging cases, actions may affect not only the immediate reward but also the next situation and, through that, all subsequent rewards (delayed reward).

How: the Course
How: the Course
How: the Course
How: the Course

A. LAZARIC – Introduction to Reinforcement Learning
How: the Course

Formal and rigorous approach to the RL's way to decision-making under uncertainty

A. LAZARIC – Introduction to Reinforcement Learning
How: the Course
How: the Course

Agent

Environment

state / perception

action / actuation

A. LAZARIC – Introduction to Reinforcement Learning
Formal and rigorous approach to the RL’s way to decision-making under uncertainty
What: the Highlights of the Course

How do we formalize the agent-environment interaction?
What: the Highlights of the Course

How do we formalize the agent-environment interaction?

How do we solve an MDP?
What: the Highlights of the Course

How do we formalize the agent-environment interaction?
How do we solve an MDP?
How do we solve an MDP “online”?
What: the Highlights of the Course

How do we formalize the agent-environment interaction?
How do we solve an MDP?
How do we solve an MDP “online”?
How do we effectively trade-off exploration and exploitation?
What: the Highlights of the Course

How do we formalize the agent-environment interaction?
How do we solve an MDP?
How do we solve an MDP “online”?
How do we effectively trade-off exploration and exploitation?
How do we solve a “huge” MDP?
Who

Lectures and Practical Sessions

Alessandro LAZARIC
SequeL Team
INRIA-Lille Nord Europe

alessandro.lazaric@inria.fr
researchers.lille.inria.fr/~lazaric/
When/What/Where

See planning on the website.
Evaluation

- Three homework (dynamic programming, multi-armed bandit, approximate dynamic programming): 2.5 points each.
- Review of literature with oral presentation: 12.5 points.
Reinforcement Learning

Alessandro Lazaric
alessandro.lazaric@inria.fr
sequel.lille.inria.fr