Machine Learning
Introduction

- Artificial intelligence
- Machine learning
- Reinforcement learning
Reinforcement learning

- Theory: How an agent should perform actions in an environment to maximize some specific reward.
- Solution: Find a policy that will lead you to the goal.
Reinforcement learning

History

• Inspired by behavioral psychology
Reinforcement learning
History

- Mechanism of learning how to act
Reinforcement learning

Theory

• *agent* performs *actions* in an *environment*.
• *agent* recieves a *reward* for every *action*.
• *agent* must learn to act so it obtains the maximum possible reward
• *policy* is being created based on analysis of incoming *rewards*
Reinforcement learning
In general

- \textbf{S} – a set of states \textit{s}
- \textbf{A} – a set of possible actions \textit{a}
- A transition function \textbf{T}(s,a,s')
- A reward function \textbf{R}(s,a,s')

- Compute \textit{values} for every \textit{states} and then search for the optimal \textit{policy}
Reinforcement learning
Techniques

- Model-based learning
- Model-free learning
  - Active reinforcement learning

- Difference
  - States
  - Rewards
  - Transitions
Q-learning
Active reinforcement learning
(in general ... )

\[ Q(s, a) = \sum T(s, a, s') [R(s, a, s') + \gamma V(s')] \]

Q – Q-value, T – transition, R – reward, \( \gamma \) – discount
Q-learning
Active reinforcement learning

EXAMPLES
Reinforcement learning

REAL-LIFE EXAMPLES

http://youtu.be/2VjNTQ5cGzM

http://youtu.be/W_gxLKSsSIE

http://youtu.be/xyJAvghtqIM

http://youtu.be/p3aEFxamRGU

http://youtu.be/Policy after 25 Trials