1710.02298 - Rainbow: Combining Improvements in Deep Reinforcement Learning

`RL` `AAAI`

Author : Yunqiu Xu

---

0. Related resources

- http://www.sohu.com/a/197158891_610300
- https://www.jiqizhixin.com/articles/2017-10-10-2

1. Introduction

- Examines six extensions to the DQN algorithm as well as their combination
- Rainbow:
  - An agent that combines all the ingredients
  - Shows best performance on Atari 2600 benchmark, both in terms of data efficiency and final performance
  - Shows the contribution of each component to overall performance

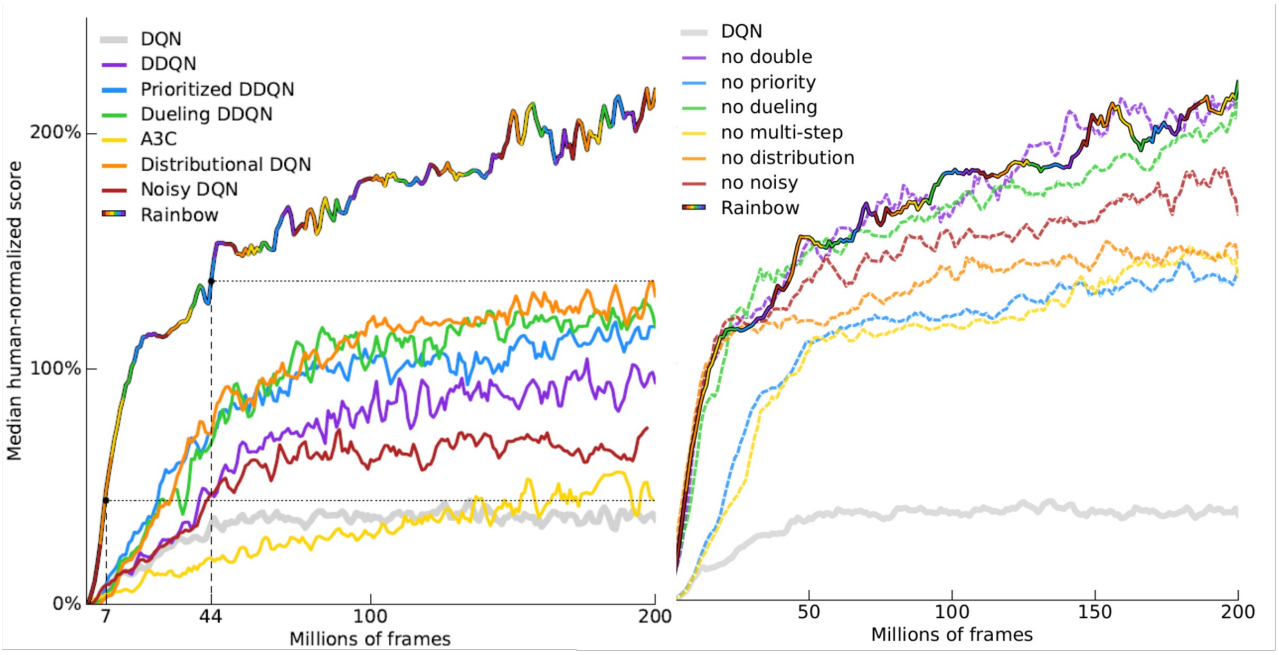
2. Different DQNs

- Original DQN
  - NIPS 2013: Playing Atari with Deep Reinforcement Learning
  - Nature 2015: Human-level control through deep reinforcement learning
- Double DQN: Deep Reinforcement Learning with Double Q-learning
- Prioritized DQN: Prioritized Experience Replay

- Dueling DQN: Dueling Network Architectures for Deep Reinforcement Learning
- A3C: Asynchronous Methods for Deep Reinforcement Learning
- Distributional DQN: A Distributional Perspective on Reinforcement Learning
- Noisy DQN: Noisy Networks for Exploration

Network	What's new
DQN	CNN; experience replay; target network
DDQN	decoupling selection + evaluation of the bootstrap action → handle overestimation
Prioritization	Improves data efficiency
Dueling DQN	Advantage function
A3C	shifts the bias-variance tradeoff ; propagate newly observed rewards faster to earlier visited states
Distributed DQN	learns a categorical distribution of discounted returns, instead of estimating the mean
Noisy DQN	uses stochastic network layers for exploration

3. Comparison results:



Left: Rainbow and different DQNs. Right: when we remove some components