From Policy Gradient to Actor-Critic methods

Introduction: the 4 routes to deep RL

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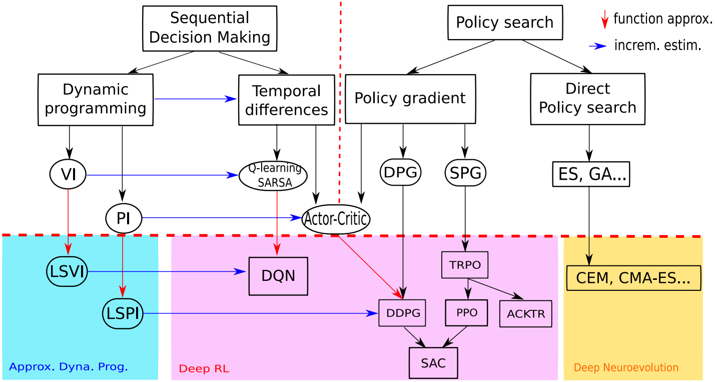
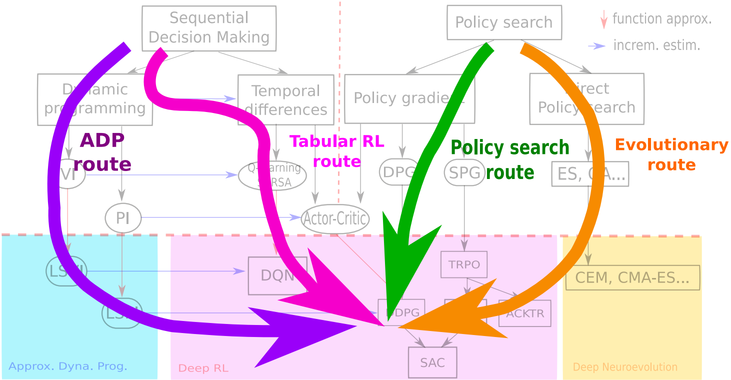
The Big Picture



- A very partial view of the whole Deep RL literature

Sutton, R. S. & Barto, A. G. (1998) *Reinforcement Learning: An Introduction*. MIT Press.

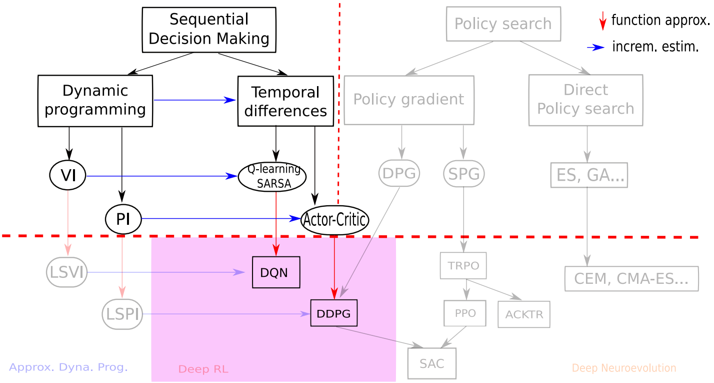
The four routes



- Four different ways to come to Deep RL

Sutton, R. S. & Barto, A. G. (1998) *Reinforcement Learning: An Introduction*. MIT Press.

The Tabular RL route



- The favorite route of beginners
- Start from Sutton&Barto, present Q-learning, SARSA and Actor-Critic
- Add function approximation, go to DQN, then DDPG

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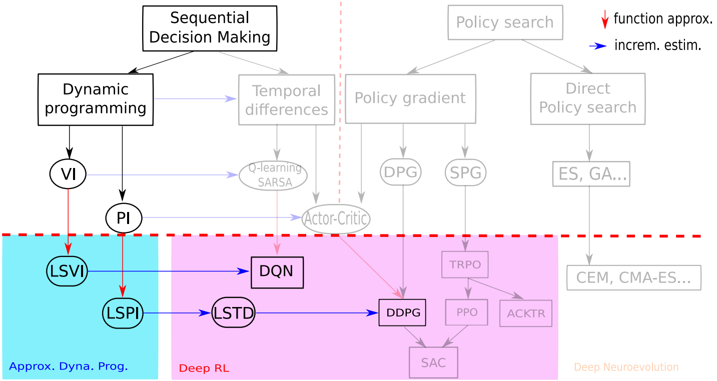
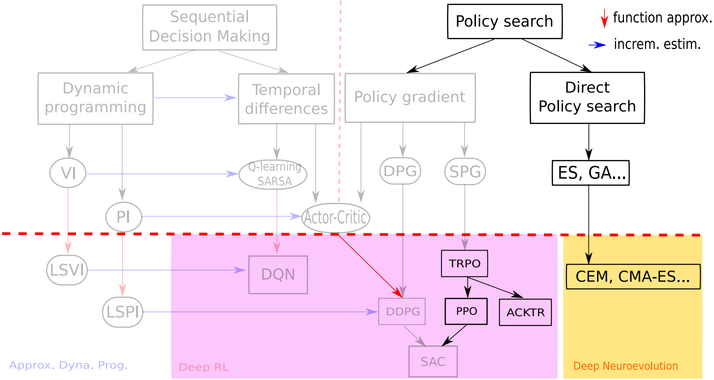
The Approximate Dynamic Programming route



- The favorite route of mathematicians
- I never travelled this route

Warren B. Powell. *Approximate Dynamic Programming: Solving the curses of dimensionality*, volume 703. John Wiley & Sons, 2007

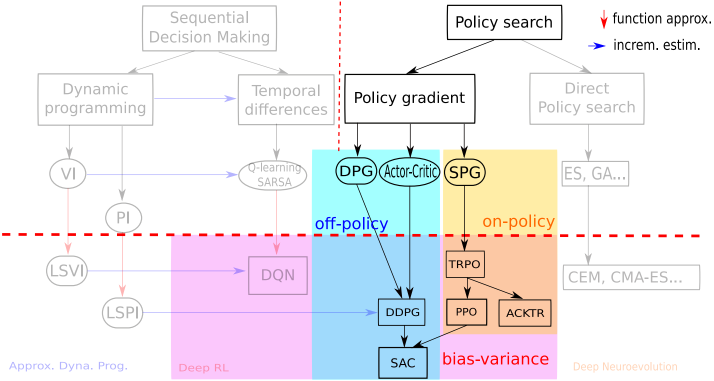
The Evolutionary route



- The favorite route of non-RL people
- Much more efficient than RL people think

Tim Salimans, Jonathan Ho, Xi Chen, and Ilya Sutskever. Evolution strategies as a scalable alternative to reinforcement learning. *arXiv preprint arXiv:1703.03864*, 2017

The Policy Search route



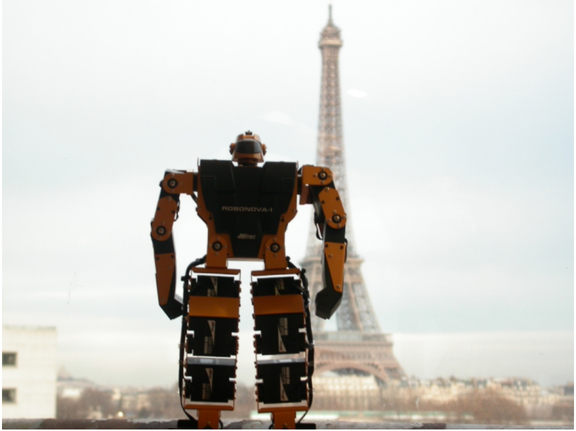
- The favorite route of roboticists
- The one I'm travelling in these lessons

Marc P. Deisenroth, Gerhard Neumann, Jan Peters, et al. A survey on policy search for robotics. *Foundations and Trends® in Robotics*, 2(1–2):1–142, 2013

Outline of lessons content

1. The policy search problem
2. Policy Gradient derivation
3. Understanding the Policy Gradient
4. From policy gradient with baseline to actor-critic
5. Bias-variance trade-off
6. On-policy vs off-policy
7. TRPO, ACKTR and PPO
8. DDPG and TD3
9. SAC
10. Wrap-up

Any question?



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