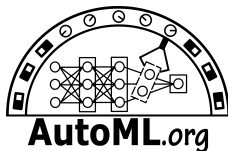


Towards White-Box Benchmarks for Algorithm Control

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DSO at IJCAI 2019





Algorithm

Image Sources <https://imgbin.com>

AC vs. PIAC vs. Algorithm Control



Algorithm

Parameter

Image Sources <https://imgbin.com>

AC vs. PIAC vs. Algorithm Control



Algorithm

Parameter

Instances

Image Sources <https://imgbin.com>

AC vs. PIAC vs. Algorithm Control



0 Gold
0 Silver
0 Bronze



Algorithm

Parameter

Instances

Objective

Image Sources <https://imgbin.com>

Algorithm Configuration

AC vs. PIAC vs. Algorithm Control



1 Gold
0 Silver
0 Bronze

Algorithm

Parameter

Instances

Objective

Image Sources <https://imgbin.com>

AC vs. PIAC vs. Algorithm Control



1 Gold
1 Silver
1 Bronze



Algorithm

Parameter

Instances

Objective

Image Sources <https://imgbin.com>

AC vs. PIAC vs. Algorithm Control



1 Gold
0 Silver
1 Bronze

Algorithm

Parameter

Instances

Objective

Image Sources <https://imgbin.com>

AC vs. PIAC vs. Algorithm Control



1 Gold
1 Silver
1 Bronze

Algorithm

Parameter

Instances

Objective

Image Sources <https://imgbin.com>

Per Instance Algorithm Configuration

AC vs. PIAC vs. Algorithm Control



Algorithm

Parameter

Instances

Objective

Image Sources <https://imgbin.com>

AC vs. PIAC vs. Algorithm Control



Algorithm

Parameter

Instances

Objective

Image Sources <https://imgbin.com>

AC vs. PIAC vs. Algorithm Control



Algorithm

Parameter

Instances

Objective

Image Sources <https://imgbin.com>

How do we solve



How do we solve

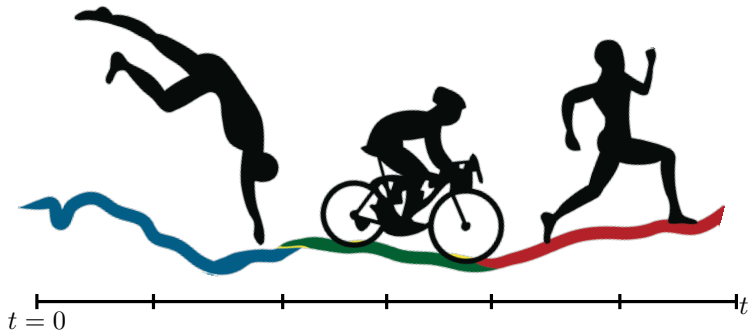


AC and PIAC will choose the best on average:



Algorithm Control

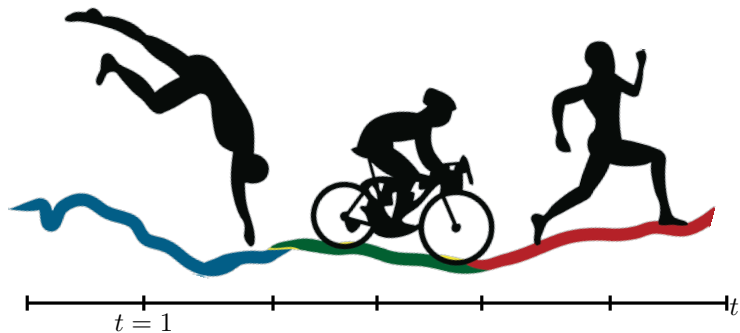
AC vs. PIAC vs. Algorithm Control



Start from some default:

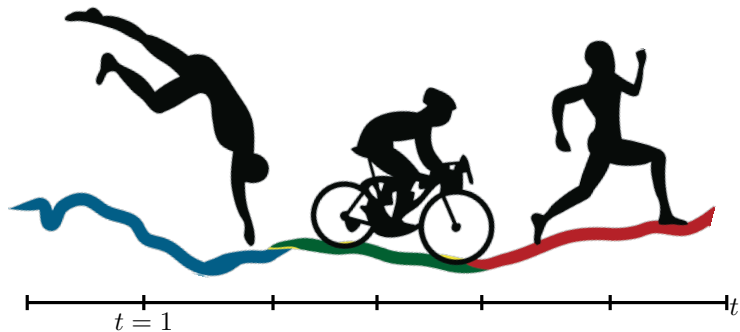


AC vs. PIAC vs. Algorithm Control



Observe state: Water

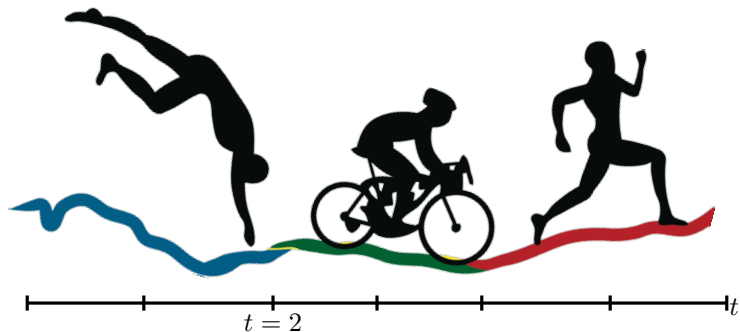
AC vs. PIAC vs. Algorithm Control



Adjust parameter:

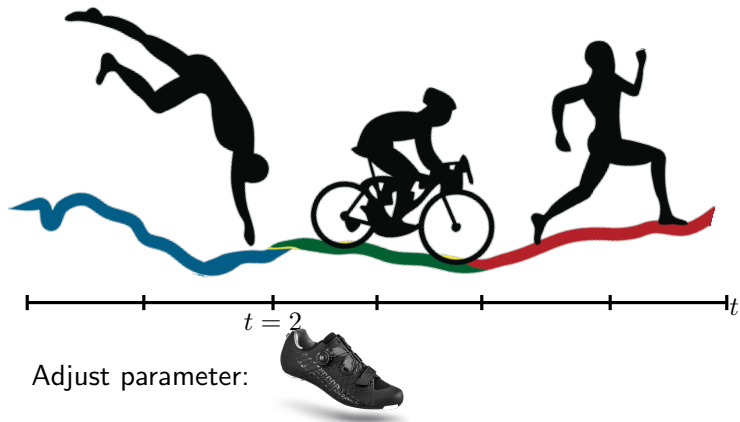


AC vs. PIAC vs. Algorithm Control

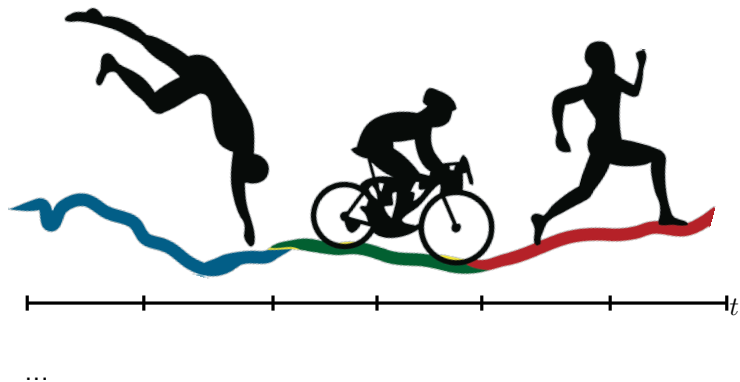


Observe state: Bike

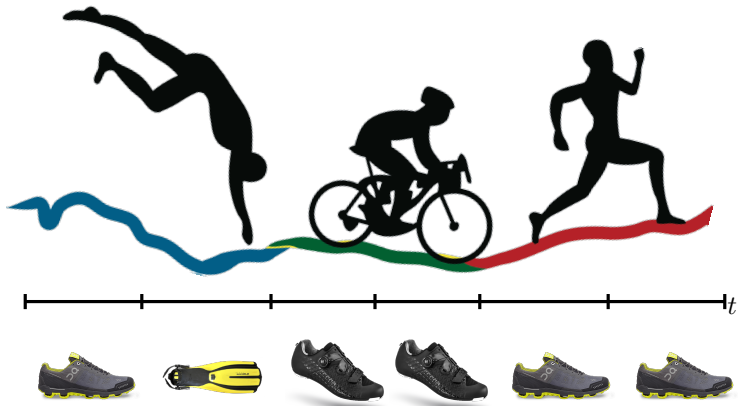
AC vs. PIAC vs. Algorithm Control



AC vs. PIAC vs. Algorithm Control



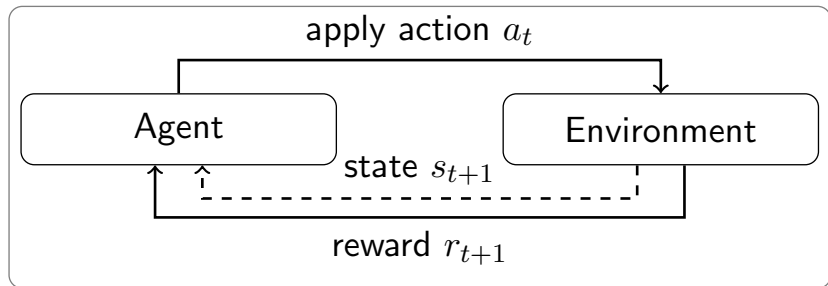
AC vs. PIAC vs. Algorithm Control



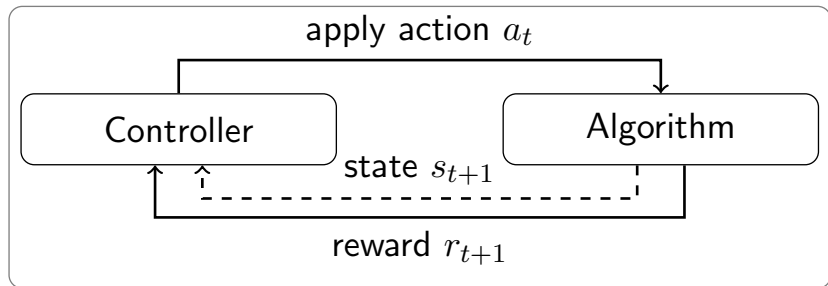
Algorithm Control as RL Problem

- Learn to control parameters online
 - Learn control policies directly from data
 - Learn across a set/distribution of instances
- Subsumes AC and PIAC and AS

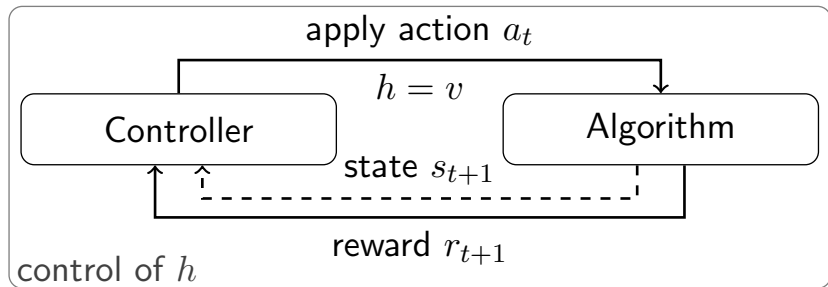
Algorithm Control as RL Problem



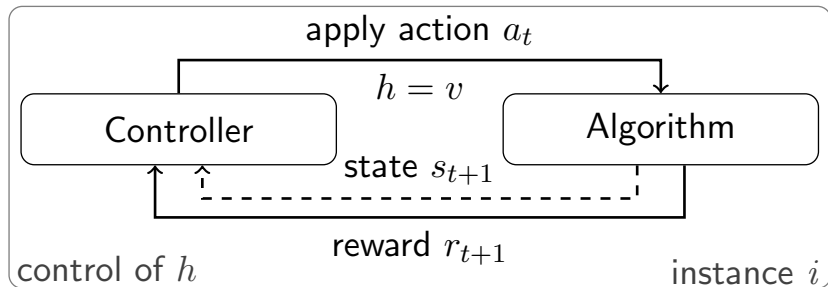
Algorithm Control as RL Problem



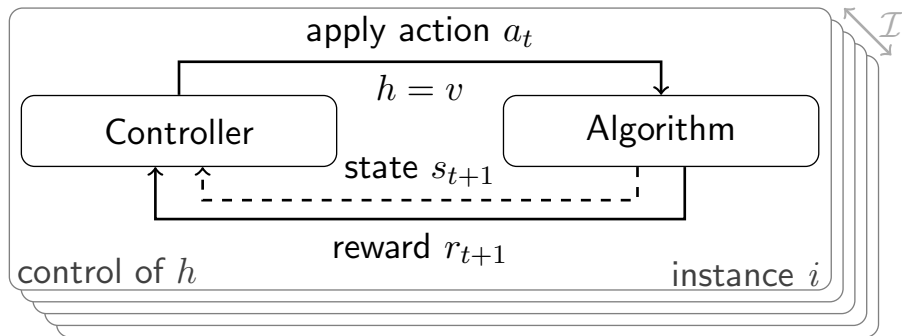
Algorithm Control as RL Problem



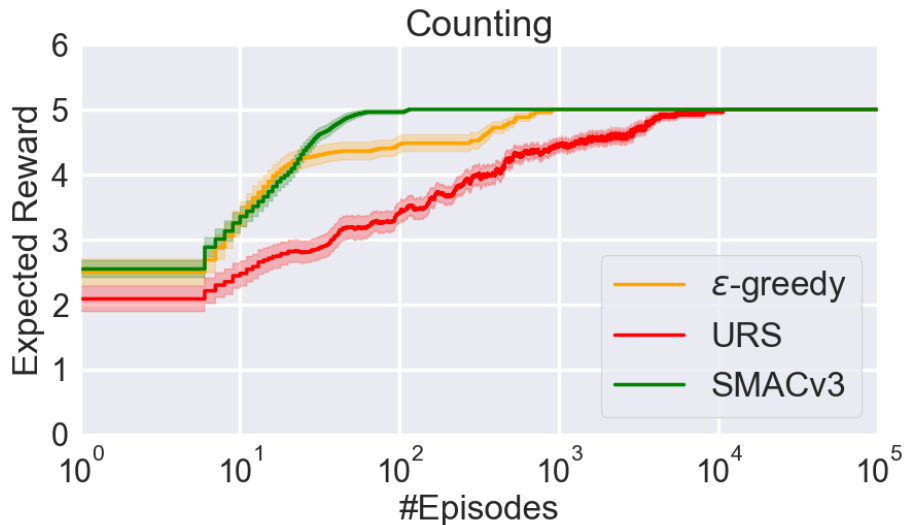
Algorithm Control as RL Problem



Algorithm Control as RL Problem

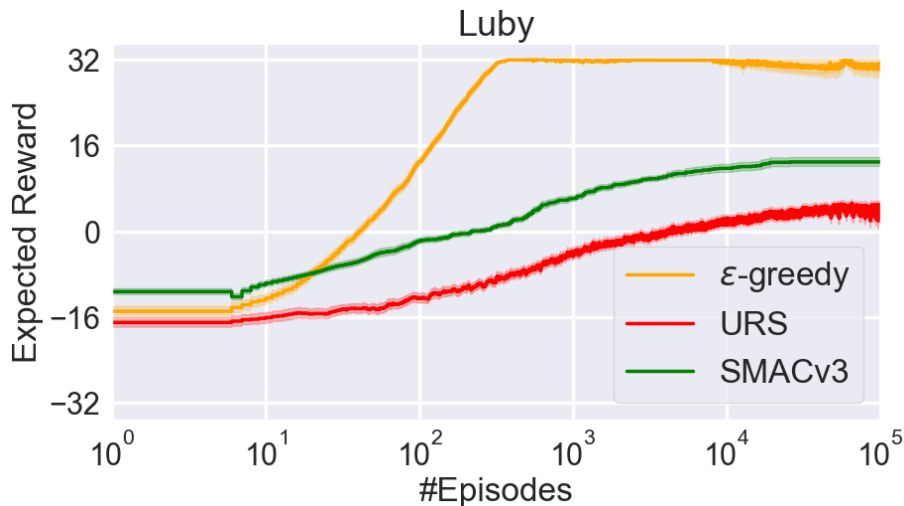


- Black-box Optimizer SMAC
- Context-oblivious Optimizer URS
- RL-agent ϵ -greedy Q-learning



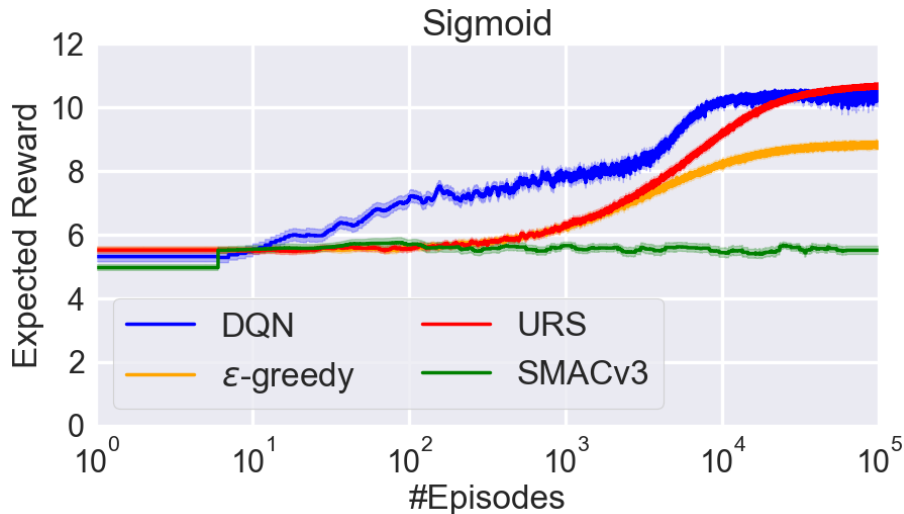
Learn to count from 0 to 4

White-Box Benchmarks



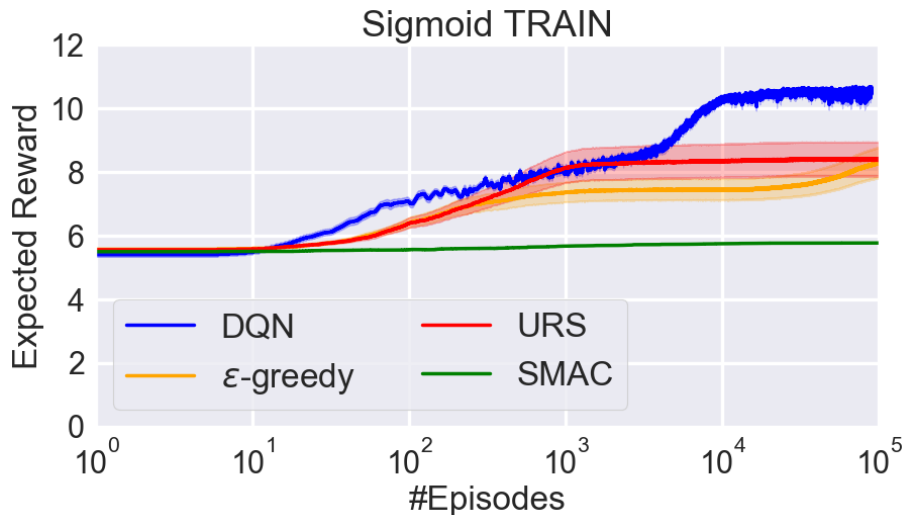
Learn to follow the Luby sequence (1, 1, 2, 1, 1, 2, 4, 1, 1, 2, 1, 1, 2, 4, 8, ...)

White-Box Benchmarks



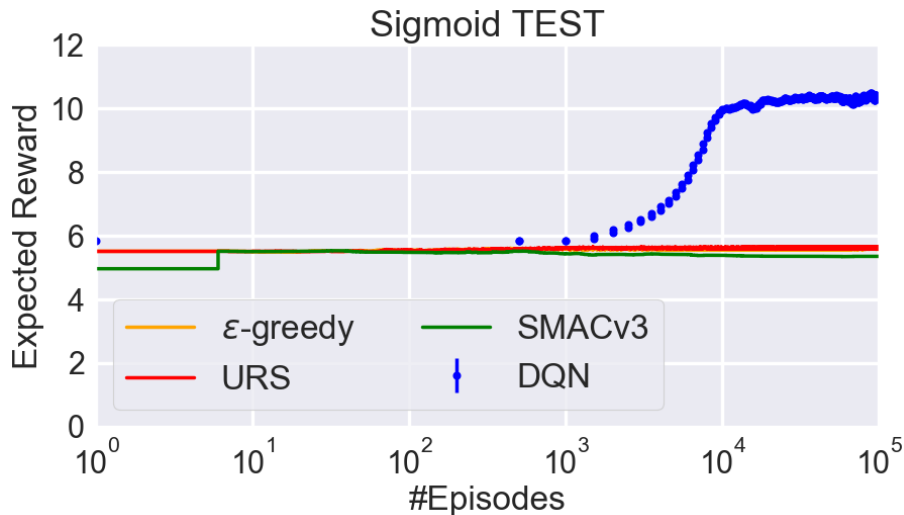
Learn to approximate a distribution of sigmoids
given a discrete action space

White-Box Benchmarks



Learn to approximate a set of sigmoids
given a discrete action space

White-Box Benchmarks



Learn to generalize to a set of unseen sigmoids
given a discrete action space

- ① Control as contextual MDP allows for the notion of instances;
- ② Configuration is a well-performing option for learning short policies;
- ③ Configuration becomes infeasible with increasing policy length;
- ④ Demonstrated learning of dynamic policies across a set of instances via RL