Feature Engineering Exploration of Super Mario Agent

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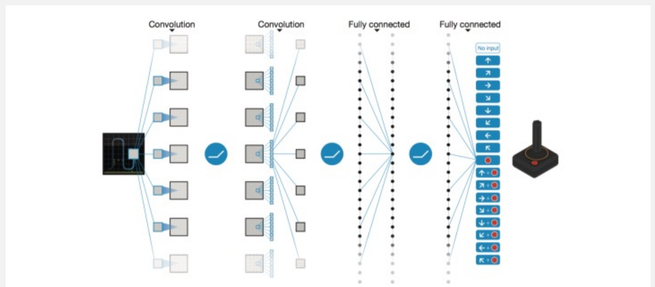
Introduction of Our Work

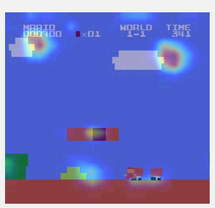
What:
Train a Mario agent with DQN. Conduct Feature Engineering Exploration. Implement additional functions e.g. fast pass , coins collect, level up.

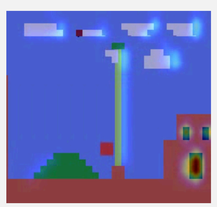
How:
Set 18 sets of parameters to conduct 3 spaces(feature space, observation space, action space) e.g. write status reward to conduct action space.

In this work, we used DQN as the training model and use tensorboard, Class Activation Mapping(CAM) and average reward curve to show our result.



Analysis:
1. The influence brought by different baseline parameters.
2. The reason that causes different passing time, and the reward w/o coins.



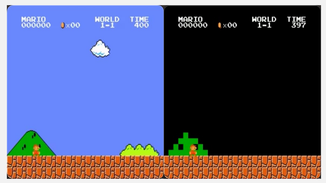


Different Downsample

Codes and experiment results are at
https://github.com/lintaojlu/MarioAgent

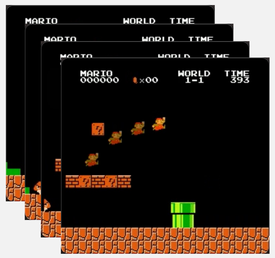
Highlights

1. The shortest time of passing 1-1: **55s**



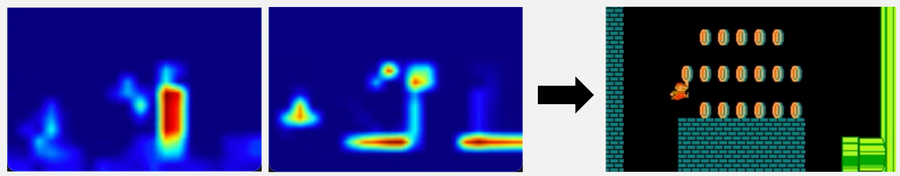
v_1 to downsample

a_12 to learn deceleration



o_4 to overlap frames

2. Mario **learned** to go down the hidden space to eat **coins** through pipe. (20 coins, 43s to finish)



3. Mario **learned** to level up by obtaining the **mushroom**.

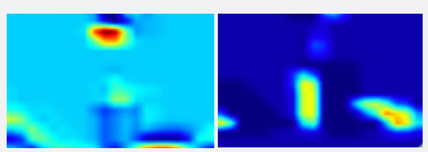
$$r = v + c + d - v + 200 * m$$

Representative Parameter Setting

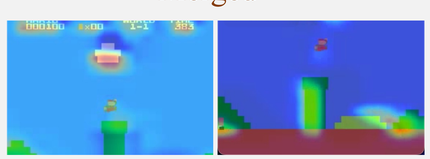
5 sets (version, action, observation)

v	a	o
0	7	1
1	2	4
1	**12**	**4**
2	**12**	**4**
3	12	4

CAM



Merged*



* Items in Red indicates the best parameters, items in blue can't convergence and the right images tell why

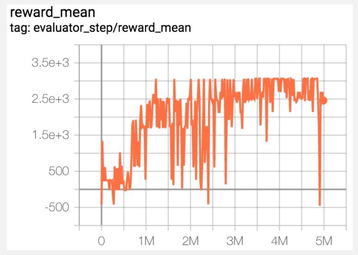
Experiments and Results

1. **15 Baseline parameter combinations** with 4 versions, 3 actions and 2 overlap selections utilized.

2. Three given ways and one customized way of modifying the Reward Space.

3. Exploration of four different stages.

Sparse Wrapper



Best baseline

1-1 completion-v3

1-2 completion

1-3 completion

1-4 completion