hw5_rl_q9_feature_based_representation_update

Question 9: Feature-Based Representation: Update

18/18 points (graded)

Consider the following feature based representation of the Q-function:

$$Q(s,a) = w_1 f_1(s,a) + w_2 f_2(s,a)$$

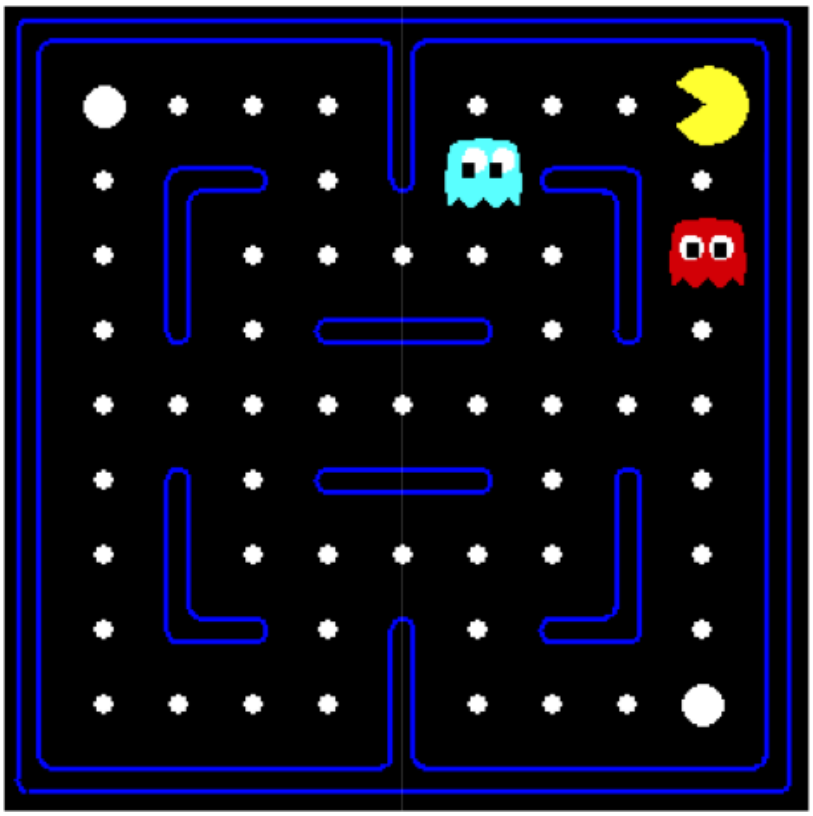
with

$$f_1(s,a) = 1/(\text{Manhattan distance to nearest dot after having executed action } a \text{ in state } s)$$

$$f_2(s,a) = (\text{Manhattan distance to nearest ghost after having executed action } a \text{ in state } s)$$

Part 1

Assume $w_1 = 1, w_2 = 10$. For the state s shown below, find the following quantities. Assume that the red and blue ghosts are both sitting on top of a dot.



$Q(s, West) =$

31 ✔

$Q(s, South) =$

11 ✔

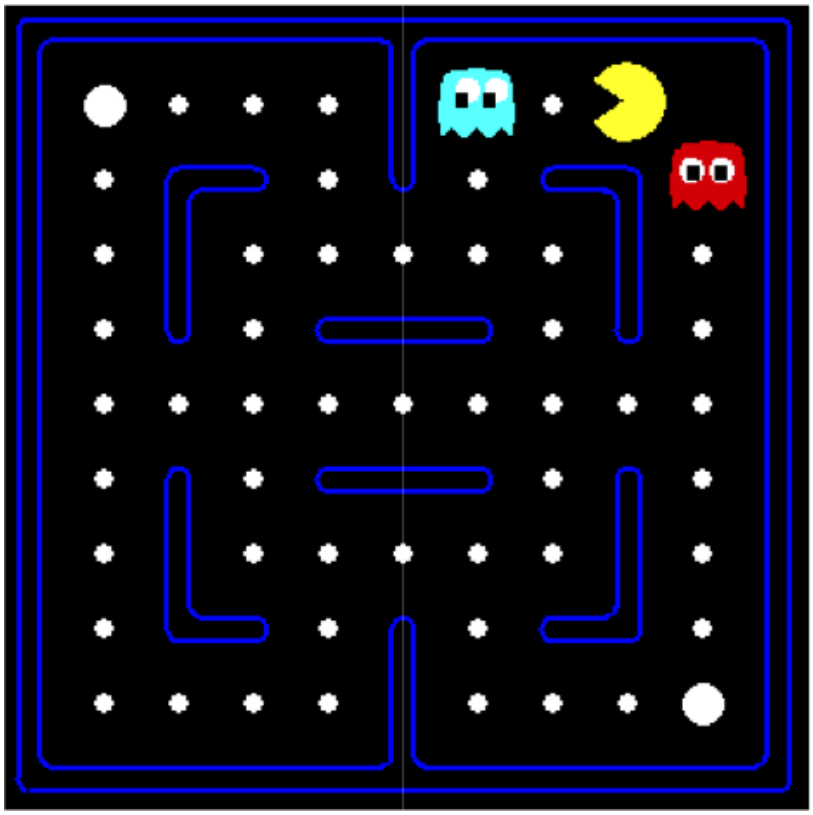
Based on this approximate Q-function, which action would be chosen:

- (•) West
- ( ) South

✔

Part 2

Assume Pac-Man moves West. This results in the state s' shown below.



The reward for this transition is $r = +10 - 1 = 9$ (+10: for food pellet eating, -1 for time passed).
Fill in the following quantities. Assume that the red and blue ghosts are both sitting on top of a dot.

$Q(s', West) =$

11 ✔

$Q\left(s', East\right) =$

11 ✔

What is the sample value (assuming $\gamma = 1$)?

$\text{sample } = [r + \gamma \max_{a'} Q\left(s', a'\right)] =$

20 ✔

Part 3

Now let's compute the update to the weights. Let $\alpha = 0.5$.

$\text{difference } = [r + \gamma \max_{a'} Q\left(s', a'\right)] - Q\left(s, a\right) =$

-11 ✔

$w_1 \leftarrow w_1 + \alpha\left(\text{difference}\right) f_1\left(s, a\right) =$

-4.5 ✔

$w_2 \leftarrow w_2 + \alpha\left(\text{difference}\right) f_2\left(s, a\right) =$

-6.5 ✔

For this problem, you may press "Check" as many times as you want without resetting the problem, so that you don't have to reset the problem for trivial math mistakes.

Submit

✔ Correct (18/18 points)