hw5_rl_q9_feature_based_representation_update

Question 9: Feature-Based Representation: Update

18/18 points (ungraded)

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

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

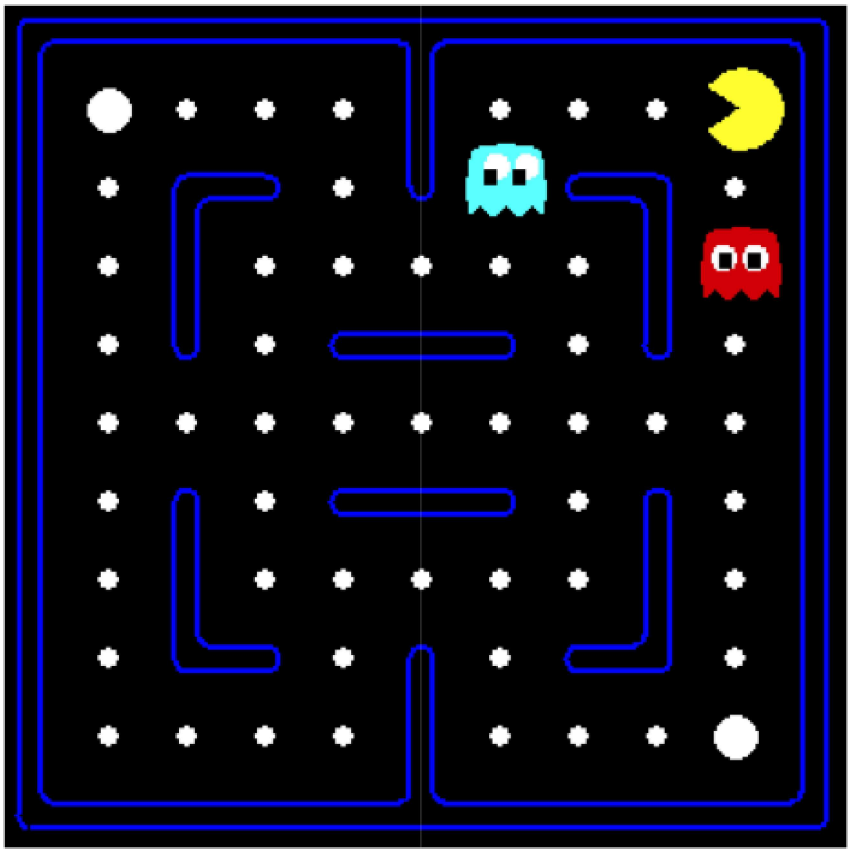
with

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

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

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 ✔

$Q(s, South) =$

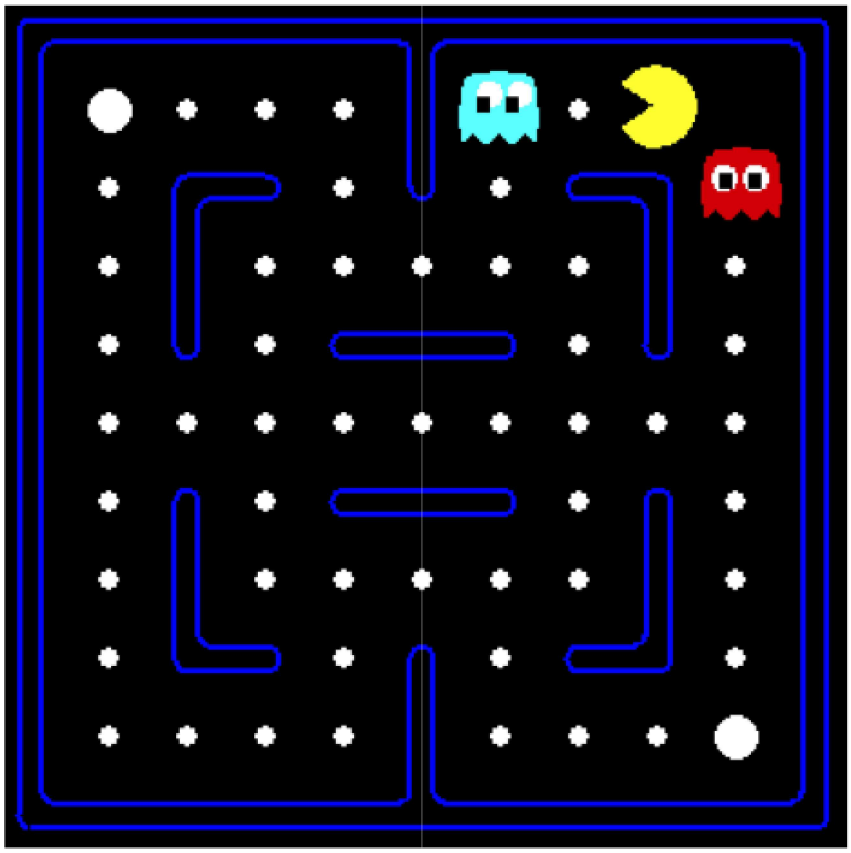
11 ✔

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.
$Q\left(s', West\right) =$

11 ✔

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

11 ✔

What is the sample value (assuming $\gamma = 1$)?
$\textbf{sample} = \left[r + \gamma \max_{a'} Q\left(s', a'\right)\right] =$

20 ✔

Part 3
Now let's compute the update to the weights. Let $\alpha = 0.5$.

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

-11 ✔

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

-4.5 ✔

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

-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.

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✔ Correct (18/18 points)