

Snake Game Playing A.I. Using Q Learning

1.0 About

This project is to create a A.I. Agent that can play Snake Game which uses Approximate Q Learning algorithm in a neural network.

2.0 Implementation

Here I have used a neural network with six input neurons and one output neuron. The inputs are the x and y distances to food and three squares around the head of the snake and the square behind the tail of the snake to see if they are occupied by its own tail (x, y and 1, 2, 3 and 4 in Figure 2.0).

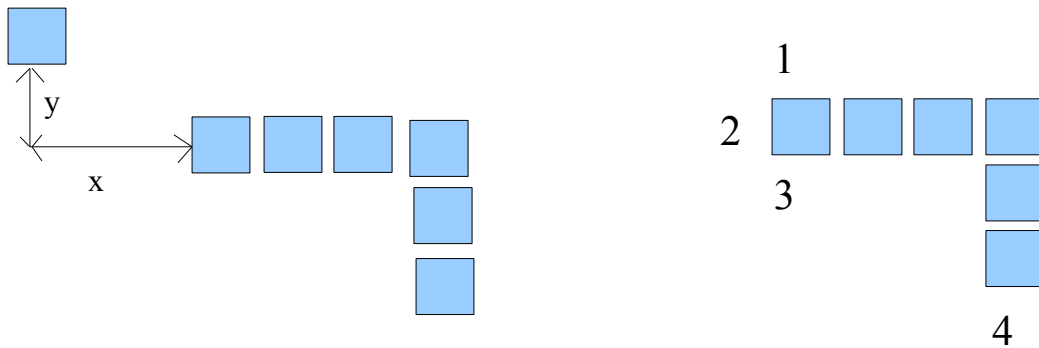


Figure 2.0 – inputs of the neural network

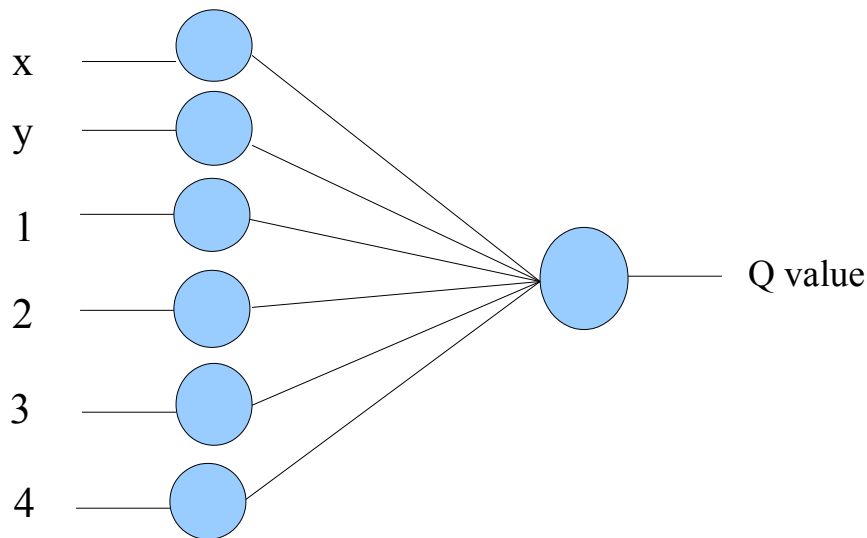


Figure 2.1 – neural network

And the neural network outputs a approximate Q value of each step (position) which use to calculate the next best move. And it uses the below equation to update the weights to get better approximation of Q values.

$Q(s, a)$ – Q value for current position and action

$Q(s', a')$ - maximum Q value of calculated for next four moves and actions

R – reward for the max move

α – learning rate

w^i – i^{th} weight of the input layer of the neural network

$f^i(s, a)$ – i^{th} input of the neural network

γ - discount

$$\begin{aligned} \text{difference} &= [R + \gamma * Q(s', a')] - Q(s, a) \\ w^i &\rightarrow w^i + \alpha * [\text{difference}] * f^i(s, a) \end{aligned}$$

To give the A.I. a chance to explore new steps this uses exploration rate of 40 % in the beginning of the game. When the snake is started to score the rate is decreased using this formula,

$$\text{exploration_rate} = \text{exploration_rate} / 3$$

3.0 Compilation and Running

You need 'openGL' and glut to compile . Install them by running,

```
sudo apt-get install freeglut3-dev  
sudo apt-get install libgl1-mesa-dev
```

on terminal. Then use make command to compile. Use,

```
./[executable]
```

command to execute. The simulator has following keyboard commands.

- esc – exit
- p – toggle pause
- q – reset the position of the food
- s – skip 500 iterations

5.0 More Info

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6.0 License

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