Spark – Crawling Robot Simulation

1.0 About

The project is to implement a virtual robot which learn to walk itself .

2.0 Implementation

The robot has a box like body and one arm with a joint to walk. The robot can move the tip of the arm in 1 unit towards eight directions in 5 x 8 area.
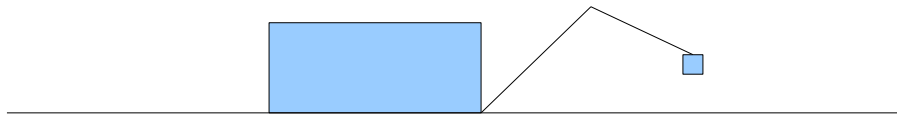

Figure 2.0 : view of the robot

The state of the robot is defined as the position of the tip of the arm. Each state can have eight actions. The reward is defined as the distance of the which the robot moves its body with a -1 living reward.

The program uses "Temporal Difference Learning" algorithm to learn. The "values of each state" (V value) are stored for each state is stored in a 2D array. And the are updated in each state change using the below equation. The learning rate for the algorithm is 0.01. In every action / sample the V(s) values will be update. (R(s, a, a') – reward for the next action + state, γ - discount, α – learning rate)

$$sample = R(s, a, a') + \gamma\, V(s')$$

$$V(s) = V(s) + \alpha\, (sample - V(s))$$

The next best action for a state is chosen using The maximum Q values (state action pair) for each action from the state. But because the robot has to try new things the 10 % exploration rate is used with a random action.

$$Q(s, a) = \Sigma R(s, a, a') + \gamma V(s')$$

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 commend to compile. Use,

./[executable]

command to execute. The simulator has following keyboard commands.

- esc – exit
- p – pause
- r – resume
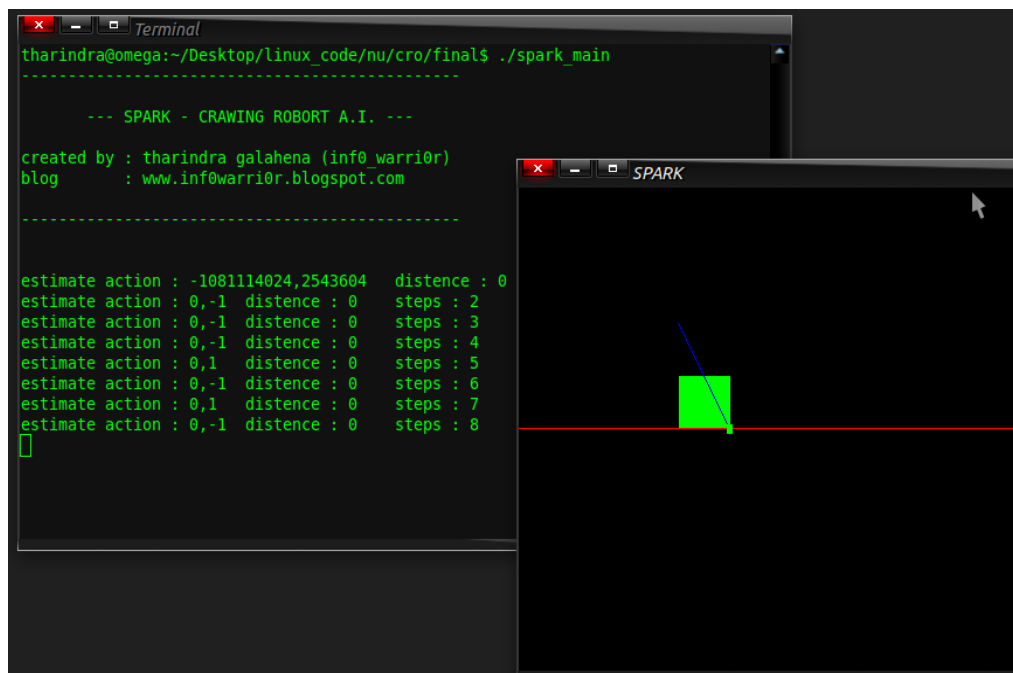- s – skip 1000 iterations
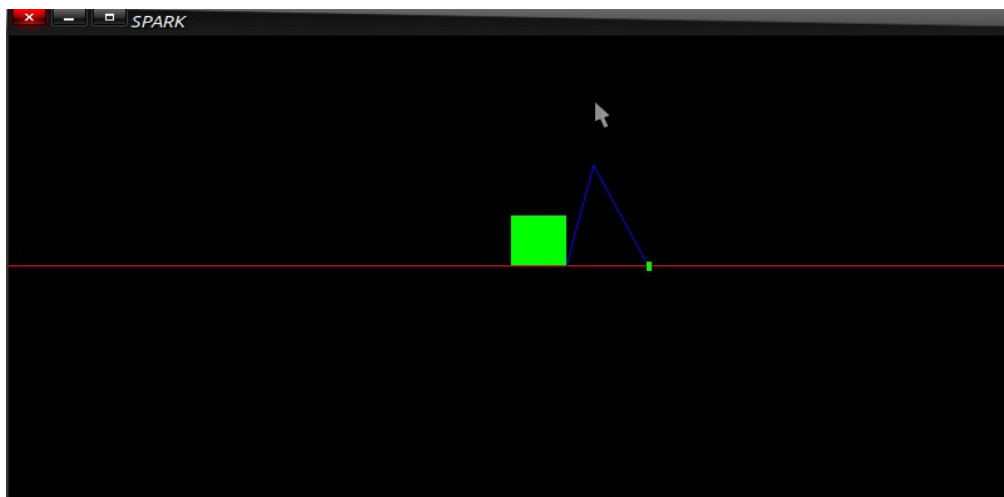
4.0 Screen Shots

Figure 4.0

Figure 4.1

5.0 More Inf0

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