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Assignment 5

4.1 Give the name of the algorithm that results from each of the following special cases:

a. Local beam search with k = 1.
Answer:
Local beam search with k = 1 is hill-climbing search.

b. Local beam search with one initial state and no limit on the number of states retained.
Answer:
Local beam search with one initial state and no limit on the number of states retained, resembles breadth-first search in that it adds one complete layer of nodes before adding the next layer. Starting from one state, the algorithm would be essentially identical to breadth-first search except that each layer is generated all at once.

c. Simulated annealing with T = 0 at all times (and omitting the termination test).
Answer:
Simulated annealing with T = 0 at all times: ignoring the fact that the termination step would be triggered immediately, the search would be identical to first-choice hill climbing because every downward successor would be rejected with probability 1.

d. Simulated annealing with T = ∞ at all times.
Answer:
Simulated annealing with T = ∞ at all times is a random-walk search: it always accepts a new state.

e. Genetic algorithm with population size N = 1.

Answer:

Genetic algorithm with population size N = 1: if the population size is 1, then the two selected parents will be the same individual; crossover yields an exact copy of the individual; then there is a small chance of mutation. Thus, the algorithm executes a random walk in the space of individuals.

Two Additional Homework

1. The Braitenberg vehicle in figure 3 implement its controllers with a simple neural network which has two layers of neurons; starting from the top sides, the first layer receives inputs from the sensors and sends its outputs to the second layer, while the neurons in the second layer drive the motors of the robot. The picture shows a schematic representation of a mobile robot. Assume that it is moving at a default (slow) speed.

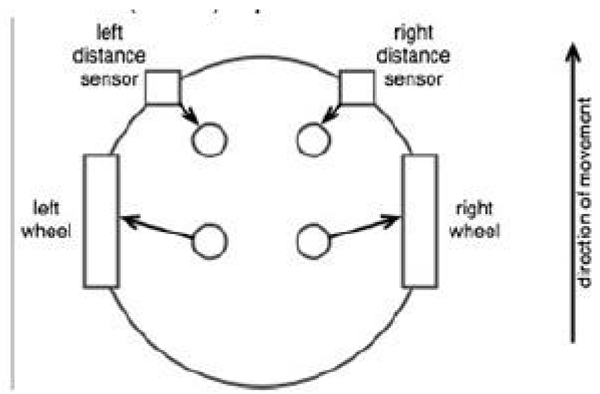

Figure 3

a) Implement a simple neural network by connecting the neurons (small circles) in order to implement the obstacle avoidance behavior (i.e., while moving in the environment, the robot avoids the obstacle that it senses by means of the IR sensors). You do not need to specify the weights of the connections; just say whether each connection is excitatory (+) or inhibitory (–). There are several ways to achieve this, just come up with ONE solution.

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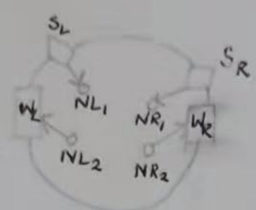
* Braitenberg vehicle for obstacle avoidance:-



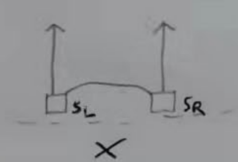
So, these are some names I have given to explain in easy and simple way.

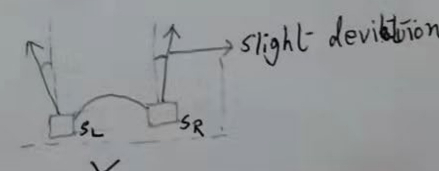
I am assuming one or two things and so I am going to write them just to avoid confusion.

I) After detecting obstacle at any one sensor, vehicle may tilt to left and/or right but may not pivot or go in reverse direction.

II) If obstacle is detected at both sensors, vehicle stops gently. (depicting behavior of "LOVE")

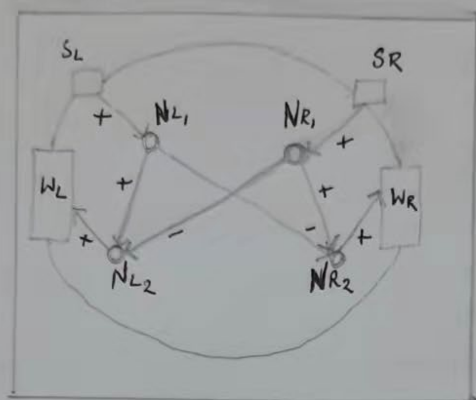
III) Sensors sense the obstacle in slightly diagonal sight and not extremely straight forward. e.g.





So, now let us move forward to connecting those neurons.

Proposed network :—



'+' – Excitatory
'–' – Inhibitory

Justification :—

- $S_L \xrightarrow{+} NL_1$, $S_R \xrightarrow{+} NR_1$: These neuron are excited directly proportional to sensor reading. So, closer the obstacle more excited are the neurons N_{L_1} & N_{R_1}.
- $N_{L_1} \xrightarrow{+} N_{L_2}$, $N_{R_1} \xrightarrow{+} N_{R_2}$: Greater the value of neurons in layer 1, greater the value of neurons in layer 2.
- $N_{L_1} \xrightarrow{-} N_{R_2}$, $N_{R_1} \xrightarrow{-} N_{L_2}$: These connections are made to decrease the value of opposite directions neurons in layer 2. These connection help to slow down the vehicle as robot approaches an obstacle covering/obscuring both sensors.

  Note: Only possible when inhibitory connections are dominant than excitatory connections. $(W^- \gg W^+)$
- $N_{L_2} \xrightarrow{+} W_L$, $N_{R_2} \xrightarrow{+} W_R$: Whatever the value of neurons in layer 2, directly proportional is the speed of motor.

b) Are there any inspiration for you to design an intelligent robot?

- Inspirations to design an intelligent robot:

Human like behaving robots are not the only extent of robots that could learn from natural elements other than humans can be very useful.

e.g. A) Ants: Ants are classic example of how small units when combined together could easily solve complex tasks. So, they could be an inspiration.

B) Cockroach: Natural instinct of this insect is to hide and be not seen in light. This behavior could be helpful to build a robot capable of hiding effectively.

c) Mouse: If we observe mice carefully, they always run guided in a direction with respect to a wall. They depict an obstacle following behavior.

And there could be many more examples.

2. In his book “Vehicles: Experiments in Synthetic Psychology”, Braitenberg describes, among other things the following vehicles: a) The “love” vehicle likes to stay as close to a light source as possible. b) The “aggression” vehicle tries to destroy the light sources by colliding with them. c) The “fear” vehicle flees away from any light source. d) The “explorer” vehicle slows down at each light source and then goes to the **next one. As shown in the following figure 3, each robot possesses two light sensors as well as either** positive or negative connections to the motors. All connections have the same absolute weight values. The signs of the weights are given in the head of the corresponding arrows. The signal amplitude of the light sensors is here proportional to the intensity of detected light.

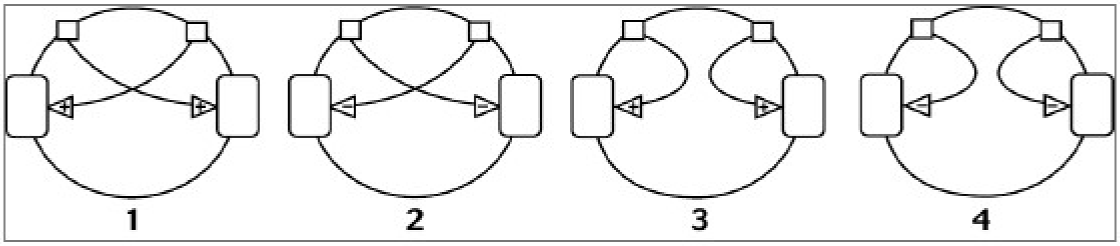


Figure 3

(1)

Answer:

The 1 can be considered as an aggression vehicle which will destroy the light source by colliding with them.

The 2 can be considered as an explorer vehicle which slows down at each light source and then goes to next one.

The 3 can be considered as a fear vehicle which can flees away from the light source.

The 4 can be considered as a love vehicle which likes to stay close to a light source as possible.

(2)

What happens if you keep the same connections but you move the position of the right sensor to the left side of the robot (just next to the left sensor) in Figure 3?

Answer:

If you change the position of the right sensor to the left side of robot then there will be some changes occur that robot cannot perform the light source coming towards it. When 4(Love) is change the position 3(fear) then it is near the light source so the destination of their completion cannot fulfilled and they cannot perform their task correctly.

(3)

What conclusions can you derive from the experiment assumed in above (2)?
Answer:
The conclusion is that if we can change the position of the robots then they can mismatch all the light source and cannot complete it properly.

3. “SWISS ROBOTS” are a set of simple robots, each robot as shown in Figure 1 was equipped with two motors, one on the left and one on the right, and two infrared sensors, one front left and one front right.

(a) initial state (b) final state (c) *Didabot robot*

Figure 4 Swiss Robots

a) What intelligent behaviors do you think emerged from the “Swiss Robots” after you watched the video illustration as in figure 1?

Answer:

Swiss Robots were the simple robots and were very small devices with high intelligence that was developed to maintain high usability for the mankind in several utilities.

So, the answer for the above questions can be discussed as follows:-

According to the figure given above it was clear that Swiss Robots will exhibit high intelligent behaviors and those can be distinguished as:-

1. The main concept of intelligence can be discussed from the IR sensors which is the acronym for infrared sensors which has much intelligence in detecting the temperature using the infrared radiation and it can detect the motion of any particular object.

2. The motors which were fixed on left and right side of the robots can help to move faster with help of the intelligent device IR sensor.

3. The main concept of intelligence comes by discussing about the neural networks because the neural networks is the framework which helps the Swiss Robots to perform the functions without being programming by default.

b) What are the robots really doing when we think in agent's perspective –situated perspective?

Answer:

When we think in agents perspective the actual work of robots in our perspective can be discussed as follow:-

1) Considering this situation of Swiss Robots it was equipped with neural networks thereby exhibiting some of the intelligence in our perspective and could move faster and sense faster.

2) These Swiss Robots fulfill almost all of the agents perspective and so these became highly friendly.

c) Are there any inspirations for you to design an intelligent robot?

Answer:

Obviously, the answer for this question is always a YES.

Coming to my point i have an inspiration to design an intelligent robot and thereby it will be helpful to the mankind and I have feeling, even by the design of intelligent robots some of the jobs were lost there will be creation of employment for sure. There will high development if an intelligent robot was designed and it was used in an effective manner.