

## INF-16580: Evolutionary Robotics

### Introduction

In this problem we had to create a simulation of Braitenbergs vehicle 2 - fear and aggression. We have to create a torus world with some light source. Then we need an agent that has 2 light sensors in front of it which have the ability to detect the light intensity at their position (Task 1.1). Then we should direct the heading of the agent based on the linear difference of the readings of the sensors (Task 1.2). From this simple programming we should expect to see an agent that "intelligently" chases/avoids the light source, based only on its light sensors. Maybe in rare cases we can expect an agent to have its sensors perfectly symmetric to each side of the light source, where the light reading difference would be 0 therefore driving towards/against it without reacting.

### Solution Method

We completed tasks 1.1 and 1.2. Our implementation can be seen on Github. First we created the torus environment by checking whenever the agent is out of bounds, and updating its position to the other side. We limited the maximum velocity and angle change of the agent by limiting the values on the step/turn methods of the agent. Since only one of each is called each step, this effectively limits its movement. For the light source on the environment, we created a 3 dimensional array that stores the values of each pixels light intensity (x, y, rgb) which then the light sensor can fetch. The same array is used when drawing the light in the background. The light intensity is calculated by the distance of a pixel to the center of the world which is then weighted so that the maximum possible distance gets a 0 (black) and the center gets a maximum intensity (255).

We then create two light sensors, which have a relative position to the agent and follow its heading. The sensor method reads the light intensity from the environment based on its position and reports it to the controller.

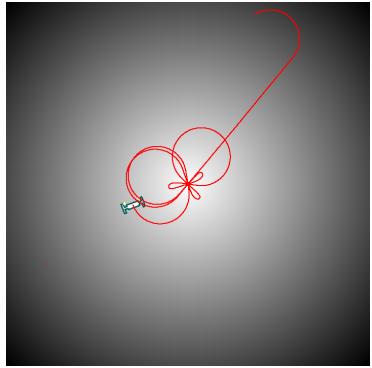
In the controller, for each frame we change the heading of the agent based on the linear difference of the sensors times a linear constant and move the agent forward one step **c**.

### Results [1.75 pages]

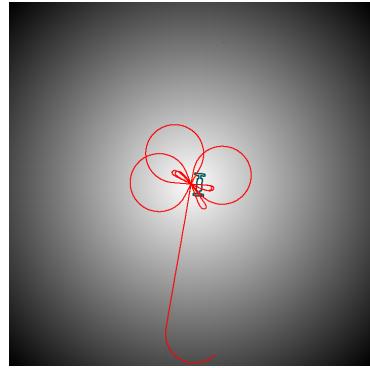
We find that for a positive constant **c** we get an aggression behavior, picture 1 and 2, where we see the agent path approaching the light source (Pictures below).

For a negative constant we get a fear behavior , picture 3 and 4, we observe a fear behavior, where the agent is trying to stay on the edges of the world where its darkest.

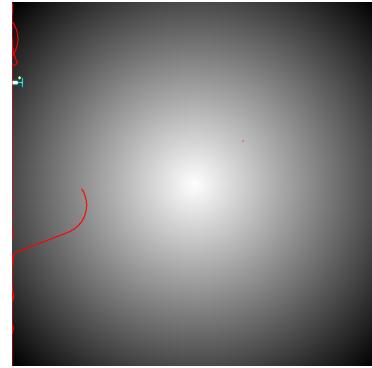
We were also able to reproduce the perfectly symmetric behavior, where the agent keeps going on a straight line (picture 5) without reacting to the light source. This case happened with varying probability based on the maximum angle that we allowed the agent to turn on each step, where higher turn angle resulted more often into the agent driving in a straight line. This was probably because it had an easier time to adjust itself perfectly to the light source before it passed through it. We see an example of a higher turn angle on picture 6 which didn't result in a straight line drive.



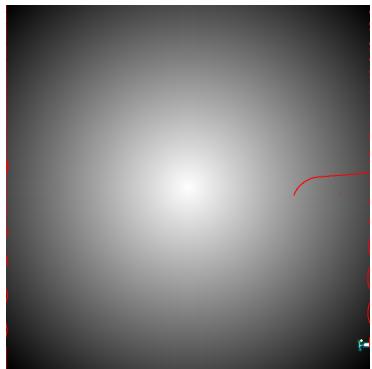
Picture 1



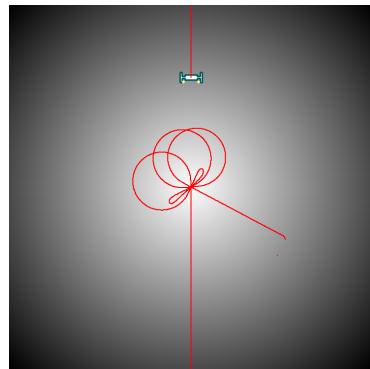
Picture 2



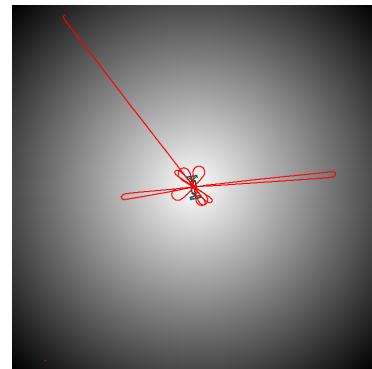
Picture 3



Picture 4



Picture 5



Picture 6

## Conclusion

We were able to effectively emulate the behavior of Braitenbergs vehicle for both aggression and fear. With relatively simple programming and logic we have recreated an agent that seems to be behaving "intelligently" and chase or flee from a light source by having only 2 simple sensors.

## References