**Application Of Neural Networks To Robot Animals**

**Final Project CS547**

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# Abstract

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# 1. Introduction

This paper rigorously establishes that neural network design models can be used to manipulate learning on simulated biological system. All the research was done using professor Thomas Caudell’s animal robot environmental model. ADDIN EN.CITE <EndNote><Cite><Author>Thomas Caudell</Author><DisplayText> (Caudell)</DisplayText><record><ref-type name="Generic">13</ref-type><contributors><authors><author>Thomas Caudell</author></authors></contributors><titles/><title>Flatworld</title><periodical/><dates><year></year><pub-dates/></dates></record></Cite></EndNote> (Caudell) The starting point of the research involved 3 architectures, used to establish the parameters of life with respect to the simulated organism and its environment. These provide a basis for analyzing the implemented neural network algorithms, the goal of which is to create a “neuron” based brain for the organism to live as long as possible in its environment, and determine what neuronal design structures degrade or enhance this attribute.

# 2. Approach

2.1 Architecture 0: No movement, measure lifetime

For the first architecture, we will test the basic metabolic consumption for the neuron. So we just set the neuron speed as 0 and do nothing until it dies. Then we record down how many cycles the neuron could survive for.

2.2 Architecture 1: Movement, measure lifetime as a function of speed

This test will try to explore the effect of neuron speed on neuron’s lifespan. So that we could find a speed where the speed change will not affect the final result. Here we will let neuron start at the same position, but in different direction. To try test different direction, we will turn the neuron head to 5 degree counter-clockwise each time. When the neuron is moving, it will always head to the brightest object in the space, no matter if the food is poisonous or not. Each time after the neuron finish moving, it will eat nothing in the space, so that the only variable in this test is the neuron speed.

2.3 Architecture 2: Movement, eat food and measure lifetime based on speed

This test will try to explore the effect of neuron speed on neurons’s lifetime. However, it is different from Architecture 2 in that neuron will eat food it means each time. What is more, we will not let neuron to classify object this time. Just let it eat whatever it contacts. Therefore, we could know more about speed effect based on eating. When the neuron is moving, it will always head to the brightest object in the space, no matter if the food is poisonous. To get the speed effect randomly, we will change the initial neuron head angle each time, but keep the initial position the same as origin point.

# 3. Results

### 3.1 Architecture 0: No movement, measure lifetime

Table 1: Over 200 runs, every run of a stationary robot had a lifespan of 5001 cycles

|  |  |  |
| --- | --- | --- |
| Number of Runs | Lifespan of Robot | Standard Deviation |
| 200 | 5001 cycles | 0 |

### 3.2 Architecture 1: Movement, measure lifetime as a function of speed



Figure 1: Shows the max speed of the robot to be 0.1

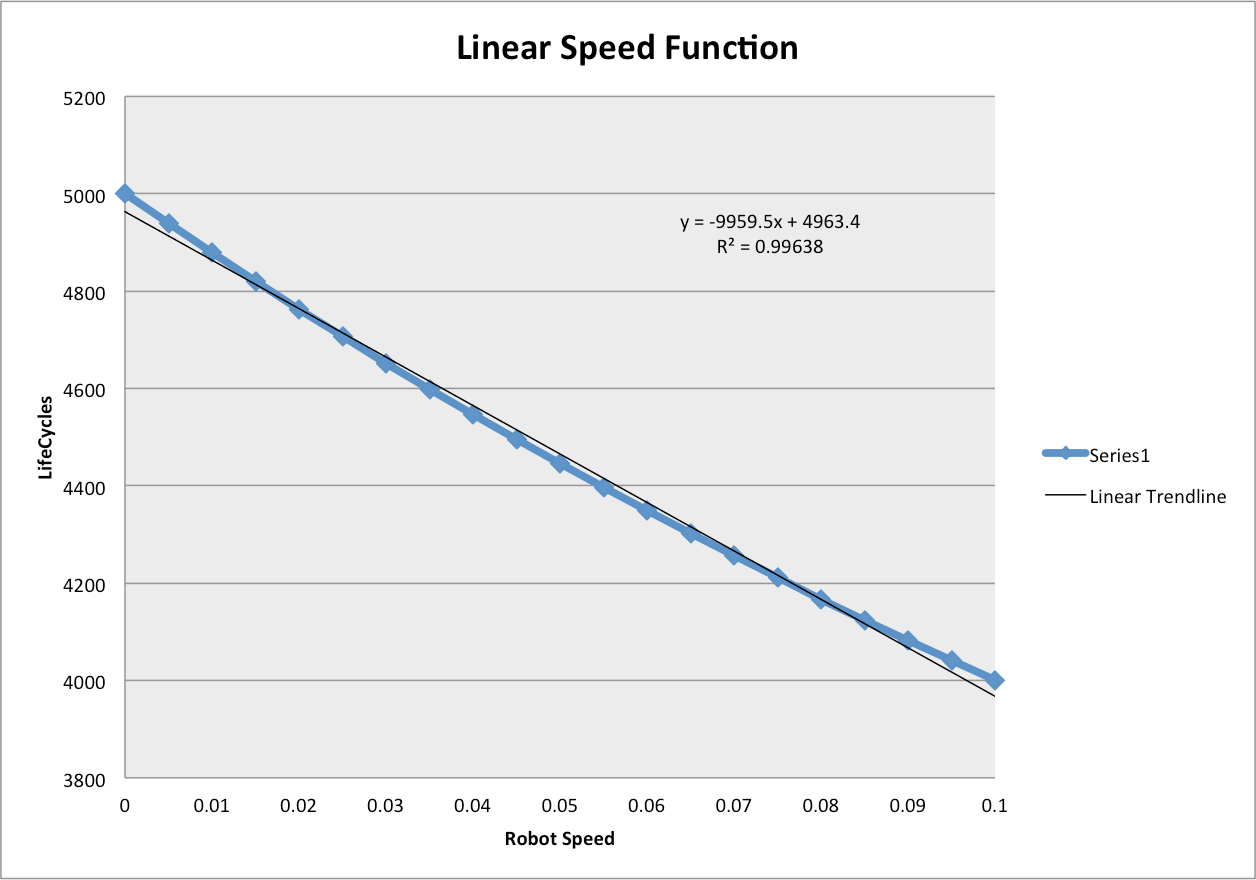


Figure 2: Linear function of the lifecycles with respect to the Robots speed. The standard deviation was 0.

# 4. Discussion

# 5. Summary and Conclusion

# 6. Acknowledgements

# 7. References

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Caudell, Thomas. "Flatworld."

# 8. Appendix A