GE-103
Natural Selection Modelling

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***Abstract*— In this project, an attempt was made to model natural selection using computing. This model simulated a species in a closed system and observed the different traits of evolution. The answers to the following questions were observed: how the species compete in a closed environment, how different traits get selected over the course of evolution and finally how a species adapts to a dynamic environment.**

***Keywords*— Natural Selection, Mutation, Evolution Simulation, Adaptation, Selection, Computing and Evolution.**

I. INTRODUCTION

This project depicts how nature selects the most suited species in a given environment. The natural selection model will be replicated in this project. We live in a closed ecosystem, where organisms must survive and reproduce in order to exist. Organisms will be able to mutate, and we will study how species adapt to environmental changes over generations. We will also look at how nature chooses organisms that have desirable traits. This experiment will also demonstrate which traits are most stable for an organism to live under given conditions. Apart from that, we will try to demonstrate how organisms change in order to acquire traits that will help them survive in the future generation. We began with 10 organisms in an environment where they could freely move and breed. In the second model, we allowed mutation to happen in each generation and then observed how their traits changed.

II. LITERATURE REVIEW

Although it is very difficult to trace back the history of computing natural selection. But there is strong evidence that digital computers were used in the mid-1950 to simulate the natural process of evolution. In 1959, Friedberg published an article that suggests the use of an evolutionary process for computer problems. Attempting to model evolution and natural selection leads to the invention of algorithms that can solve many other problems.

III. OBJECTIVE

The purpose of the project is to model a species' selection of specific traits in a closed environment under specific conditions. The following three points will be the primary emphasis of this project:

A. Growth of population

We made a simulation to see observe how a species grows or shrinks in a confined environment over time, as well as the influence of changing food resources on population growth.

B. Selection of traits

A little percentage of mutation was permitted in some organisms' attributes in species chosen at random. We looked at how different traits are selected by nature and how different factors influence trait selection.

C. Adaptation of species

We studied with shifting environmental conditions to see how a species adapts over generations to a changing habitat.

IV. CONCLUSIONS

When we simulate a species in an environment, we observed that the population first grows over time as there was an abundance of resources in the environment but as the population increases, so does the competition. Hence, organisms begin to compete with each other and so the population begins to reach a constant value.

Increasing and decreasing the number of species, in turn, increase and decrease the population at the saturated point. But this trend continues if we decrease the number of resources below a minimum amount. The population beings to collapse and are reduced down to zero even though there is enough food. One possible explanation is that organisms run out of energy before they can find any food.

After we allowed mutation in species for velocity trait, it is observed that the average velocity begins to increase for the population. In this close environment, moving faster could give an organism advantage in this competition as they can consume food faster than others.

Then in the next simulation, we allowed both velocity and sensing distance traits to evolve and observe them over 3000 generations. It was observed that first, these traits increase but later being to reach a constant value. Initially moving faster and having greater sensing distance give species an advantage as they can sense food quicker and can move directly toward the food. But as energy consumption increase with kinetic energy and sensing distance, after a point, increasing these traits no longer gives any advantage as moving advantage as organism run out of energy before reaching food resources.

In our last simulation, we change the number of resources over the course of a generation. As we observe in our first simulation, the population begins to collapse below – food resources. Now population also collapse if we reduce the amount of resource at sudden because the organism doesn't get sufficient time to adapt but if we reduce the resources slowly. Then it was observed that organisms were able to serve to survive well below. This is because species are adapting to the environment slowly. But still, population collapse after – suggesting species cannot survive below a threshold time no matter how much time is given to adapt.

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REFERENCES

[7] https://www.youtube.com/c/PrimerLearning
[7] https://labs.minutelabs.io/evolution-simulator/
[7] https://en.wikipedia.org/wiki/Evolutionary_programming