Khulna University of Engineering & Technology

CSE 4110 : Artificial Intelligence Laboratory

Report on

Animal World

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Simulation Project Report

Abstract:
The goal of this game is to maximize the generation of wildlife and the interaction between the animals. In the game three different animals have been used: Echidna, Koala, and Dingo to show the state of the animals in a closed environment. We have to give input the number of the each animals in a virtual world which will be simulated afterwards. In a closed environment, it can be seen that how each animal is interacting with other animals using a limited energy source from nature. Here the traits of Echidna, Koala, and Dingo will determine the behavioral pattern of each animal and for how many generations the game will run. It's a turn-based simulation where the state of the animals was updated and simulated. This study focused on using the actual behavioral pattern of the animals to build the formulas of their nature. The habitat, foods, movement, reproduction cycle and so on parameters were investigated to build the simulations for each animal in a constrained environment. In implementation heuristic search has been used.

Goal of the Game:
The goal of the game is to give the population of each species and maximize the generation or observe for how many generation the game has been run.

Method of Input:
The game population will have to be provided in the variables by the player.

Method of Represention the Outcome:
The outcome of the game will be shown in a video format generation by generation.

Background:
The game simulates each animal differed from one another and also tracks the status of each animal separately. The game also contains data of important events like the death of an animal and the cause and coordinates and also the birth of an animal and the information regarding it. The parameters of the behavioral patterns of the animals were set by closely observing the real-world traits. The three choices of native animals were the Echidna, the Koala, and the Dingo. As dingo is a predator animal that attacks and feeds on both echidna and koala.

As dingo is a predatory animal, the initial count of the dingo is less than the echidna and koala, as these two are herbivorous. Then the first thing needed for the project was to set movement speeds for the animals. Now, a dingo can travel up to 60 km in an hour. Where a koala has a speed up to 30km/h and an echidna is very slow, can only cap at 6-9km/h. So the echidna is the slowest one which has the same difference in speed from a koala in comparison to the speed difference between a koala and a dingo, where the dingo is the fastest one among them.

Then how many blocks the animal traveled was recorded and checked to decide if it will rest or not. It made the simulation more realistic as it gave two options to the animals to move if they are not tired and sleep if they are tired and restore their stamina for the next count of tiredness.

As, the dingo is a predator, so if it gets close to an echidna or a koala, it's most likely to devour it. Thus in every cycle, the dingo was given a chance to hunt an echidna or a koala if it's adjacent to it. Thus it introduced the concept of death to the simulation which made it more natural.

If the echidna and koala comes to the line of sight of the dingo they leave the position according to a heuristic search which will maximize their chance of life. Dingo will try to devour them if it is hungry otherwise it wii not attack them. But echinda and koala will consider the dingo as a threat irrespective fo dingo's condition.

Then reproduction information of the animals was used to build a system that will decide if a baby will be born or not. A female echidna produces only one egg per year which is more similar to the dingo, as dingo also breed once a year. But a baby echidna is more secure than a baby dingo as the dingo grows up in a hostile environment where baby echidna grows in its mother's pouch like a kangaroo and the female echidna lives more likely in a cave in that period. So a baby echidna grows up more safely than a baby dingo. Now, a koala usually breeds offspring every year but some of the koala breeds in two or three years gap which most likely depends on the habitat environment. The baby also grows up in the mother's pouch, so it has a similar reproduction rate as an echidna.

The environment contains the waterbody and green field in general. There are trees from which the echidna and koala feed on. The natural resources is used by the both animal whereas the dingo is fully depended on the echidna and koala to live on.

Methodology:
So from the information collected from the investigation at first, the movement speed was set. In every turn, the echidna was set to move between -1 to 1 block. But for a koala, the random chance of changing the position was from -2 to 2 blocks. As the difference in speed was the same, the dingo movement was between -3 to 3 blocks in one turn. Thus, the echidna could move up to 1 block per turn where a koala could move up to 2 blocks and a dingo could move up to 3 blocks per cycle.

For moving in every cycle, the movement was recorded in a factor named animal_travel. A threshold was set based on the value of the travel factor to determine if the animal needs to sleep in that cycle. If it is sleeping then the positions don't update and the status shows that that particular animal is sleeping.

Then in every cycle, the position of the animals update which is then used to determine the birth and death. For the death, it is first checked if an echidna or a koala is in the range of one block of a dingo. If that happens, a death message is shown, where it describes that an echidna or a koala is dead and gives the coordinate along with which dingo killed it.

The second type of interaction between the animals is when koala and echidna sees a dingo. If they sees a dingo they try to move away from the dingo using a heuristic function which maximize their chances of living. When a dingo are in a line of sight the other two animal will move try to move opposite of the current location and try to save them from the predator.

Then the final type of interaction between the animals is reproduction. So if two same types of animals get close to each other, in this project in one block radius then there is a random chance that they will give birth to a baby animal. The message shows where a baby animal was born and the type of animal. Investigating the real-world behaviors, the echidnas were given a 15% and the koalas a 13%, and the dingoes a 10% chance to breed in an interaction.

Then every event is shown and the position of each differently colored animal is shown in the 2D world simulation with every cycle until the end of the cycle.

RMAX and CMAX are the world boundary, the maximum coordinates. POP_echidna, POP_koala, and POP_dingo respectively show the number of animals from which the simulation will start. And STEPS is the number of cycles the simulation will be on.

The Menu-Driven Interface :

In the simulation of the game waterbody, trees and the three animals are determined with separate colors.

- The water body is represented with lime color.
- The trees are stated with turquoise
- The nature of green field around the environment is represented with forestgreen
- The echidna is colored with yellow
- The koala is marked with violet
- The dingo is symbolized with the color red

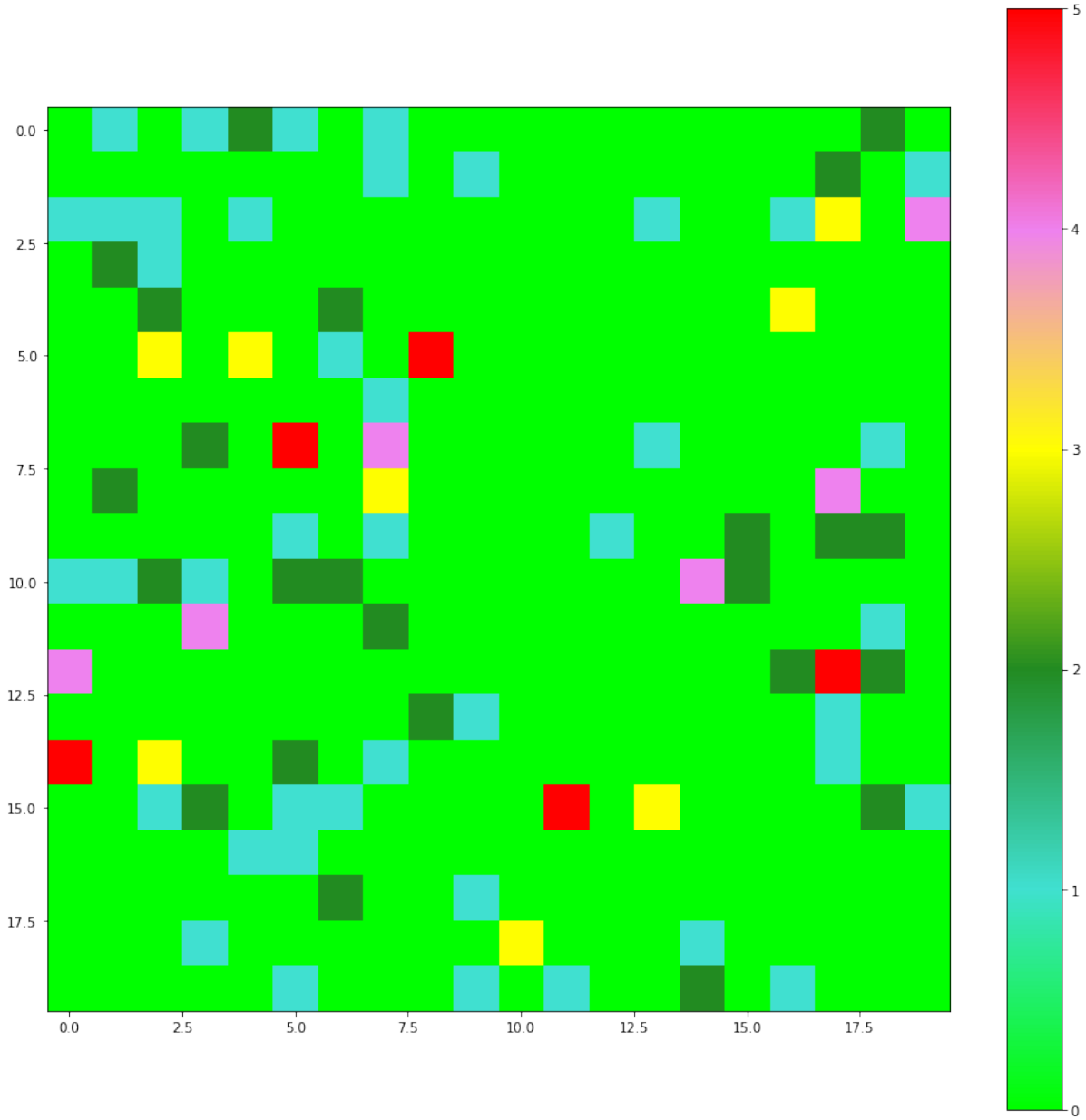

Fig1: Snapshot of the environment of animal world game.

Results:

RMAX = 50, CMAX = 50
POP_echidna = 8, POP_koala = 5, POP_dingo = 6
The OUTPUT:
2D Growth Simulation

Echidna Life at : [8 6]
Echidna Life at : [19 9]
Echidna Life at : [1 17]
Echidna Life at : [5 5]
Echidna Life at : [5 17]
Echidna Life at : [15 13]
Echidna Life at : [15 3]
Echidna Life at : [4 2]
Koala Life at : [12 12]
Koala Life at : [9 3]
Koala Life at : [6 19]
Koala Life at : [7 9]
Koala Life at : [10 0]
Koala Life at : [4 19]
Dingo Life at : [5 8]
Dingo Life at : [15 14]
Dingo Life at : [9 14]
Dingo Life at : [7 8]
Dingo Life at : [14 1]

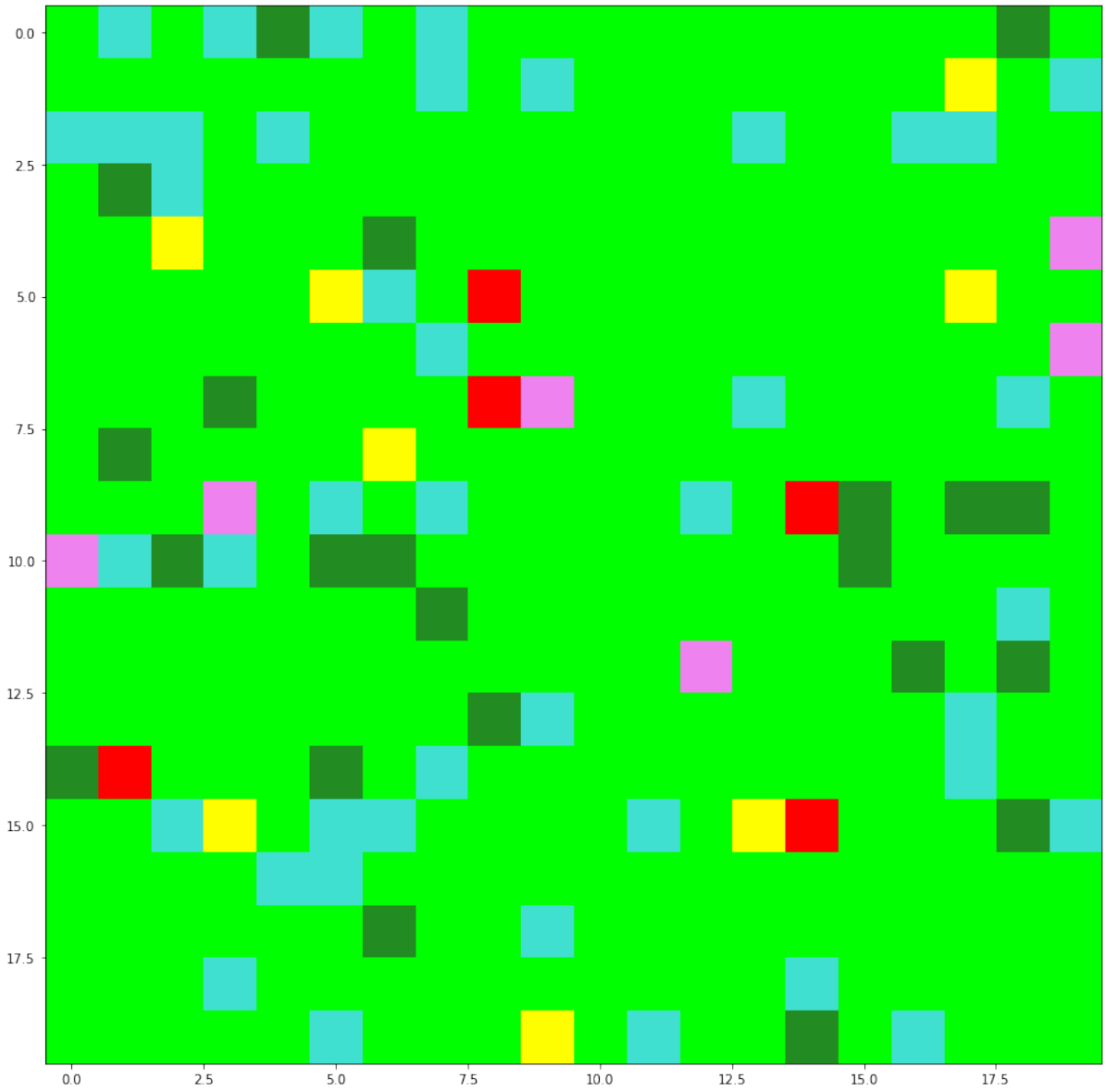

Fig2: Initial population of the simulated world

TIMESTEP 1
echidna moved to : [8 7] tiredness : 1
echidna moved to : [18 10] tiredness : 2
echidna moved to : [2 17] tiredness : 1
echidna moved to : [5 4] tiredness : 1
echidna moved to : [4 16] tiredness : 2
echidna moved to : [15 13] tiredness : 0
echidna moved to : [14 2] tiredness : 2
echidna moved to : [5 2] tiredness : 1
koala moved to : [10 14] tiredness : 4
koala moved to : [11 3] tiredness : 2

koala moved to : [8 17] tiredness : 4
koala moved to : [7 7] tiredness : 2
koala moved to : [12 0] tiredness : 2
koala moved to : [2 19] tiredness : 2
dingo moved to : [5 8] tiredness : 0
dingo moved to : [15 11] tiredness : 3
dingo moved to : [12 17] tiredness : 6
dingo moved to : [7 5] tiredness : 3
dingo moved to : [14 0] tiredness : 1

Echidna count : 8 Koala count : 6 Dingo count : 5

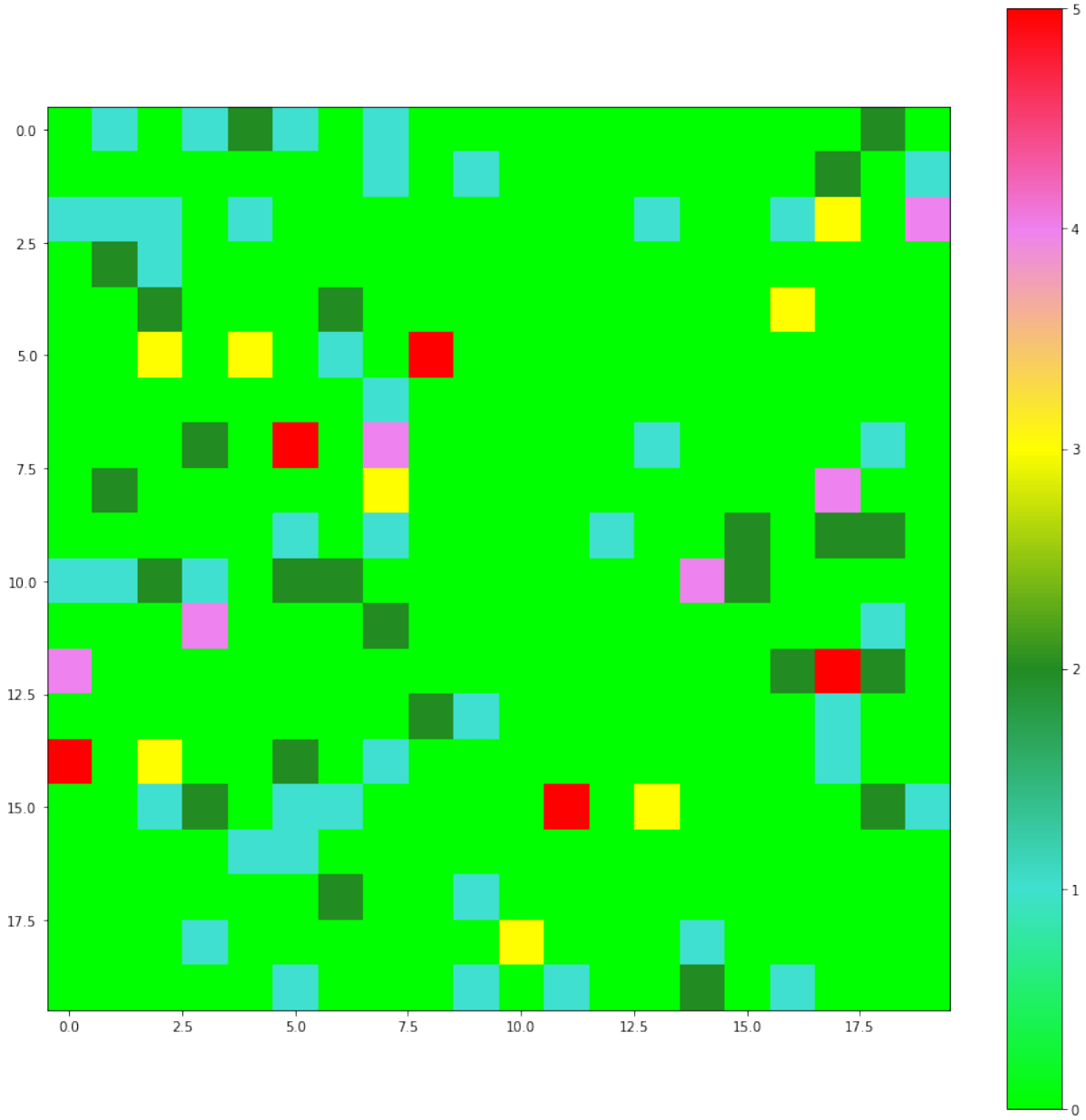

Fig3: Population state after first generation.

TIMESTEP 2
echidna moved to : [8 7] tiredness : 1
echidna moved to : [18 10] tiredness : 2
echidna moved to : [2 17] tiredness : 1
echidna moved to : [5 4] tiredness : 1
echidna moved to : [4 16] tiredness : 2
echidna moved to : [15 13] tiredness : 0
echidna moved to : [14 2] tiredness : 2
echidna moved to : [5 2] tiredness : 1
koala moved to : [10 14] tiredness : 4
koala moved to : [11 3] tiredness : 2
koala moved to : [8 17] tiredness : 4
koala moved to : [7 7] tiredness : 2
koala moved to : [12 0] tiredness : 2
koala moved to : [2 19] tiredness : 2
dingo moved to : [5 8] tiredness : 0
dingo moved to : [15 11] tiredness : 3
dingo moved to : [12 17] tiredness : 6
dingo moved to : [7 5] tiredness : 3
dingo moved to : [14 0] tiredness : 1

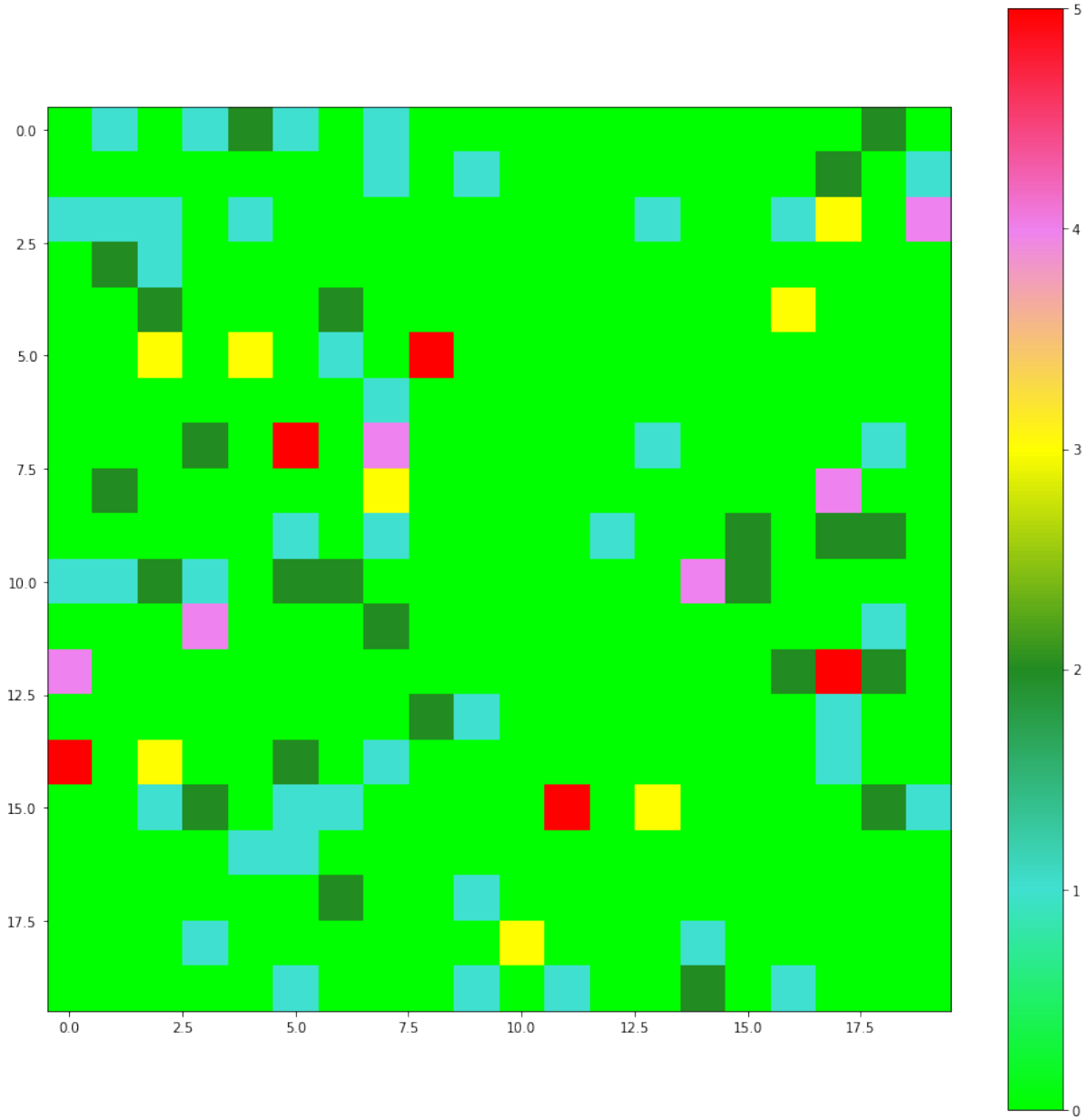

Fig4: Population state after second generation.

TIMESTEP 3
echidna moved to : [9 6] tiredness : 3
echidna moved to : [19 10] tiredness : 3
echidna moved to : [1 17] tiredness : 2
echidna moved to : [6 4] tiredness : 2
echidna moved to : [3 15] tiredness : 4
echidna moved to : [14 13] tiredness : 1
echidna moved to : [15 3] tiredness : 4
echidna moved to : [5 1] tiredness : 2
koala moved to : [12 16] tiredness : 8
koala moved to : [9 3] tiredness : 4

koala moved to : [10 17] tiredness : 6
koala moved to : [5 5] tiredness : 6
koala moved to : [10 0] tiredness : 4
koala moved to : [0 17] tiredness : 6
dingo moved to : [2 8] tiredness : 3
dingo moved to : [18 8] tiredness : 9
dingo moved to : [15 14] tiredness : 12
dingo moved to : [10 8] tiredness : 9
dingo moved to : [11 0] tiredness : 4
echidna in position : 14 13 is dead by dingo from position : 15 14
koala in position : 10 0 is dead by dingo from position : 11 0

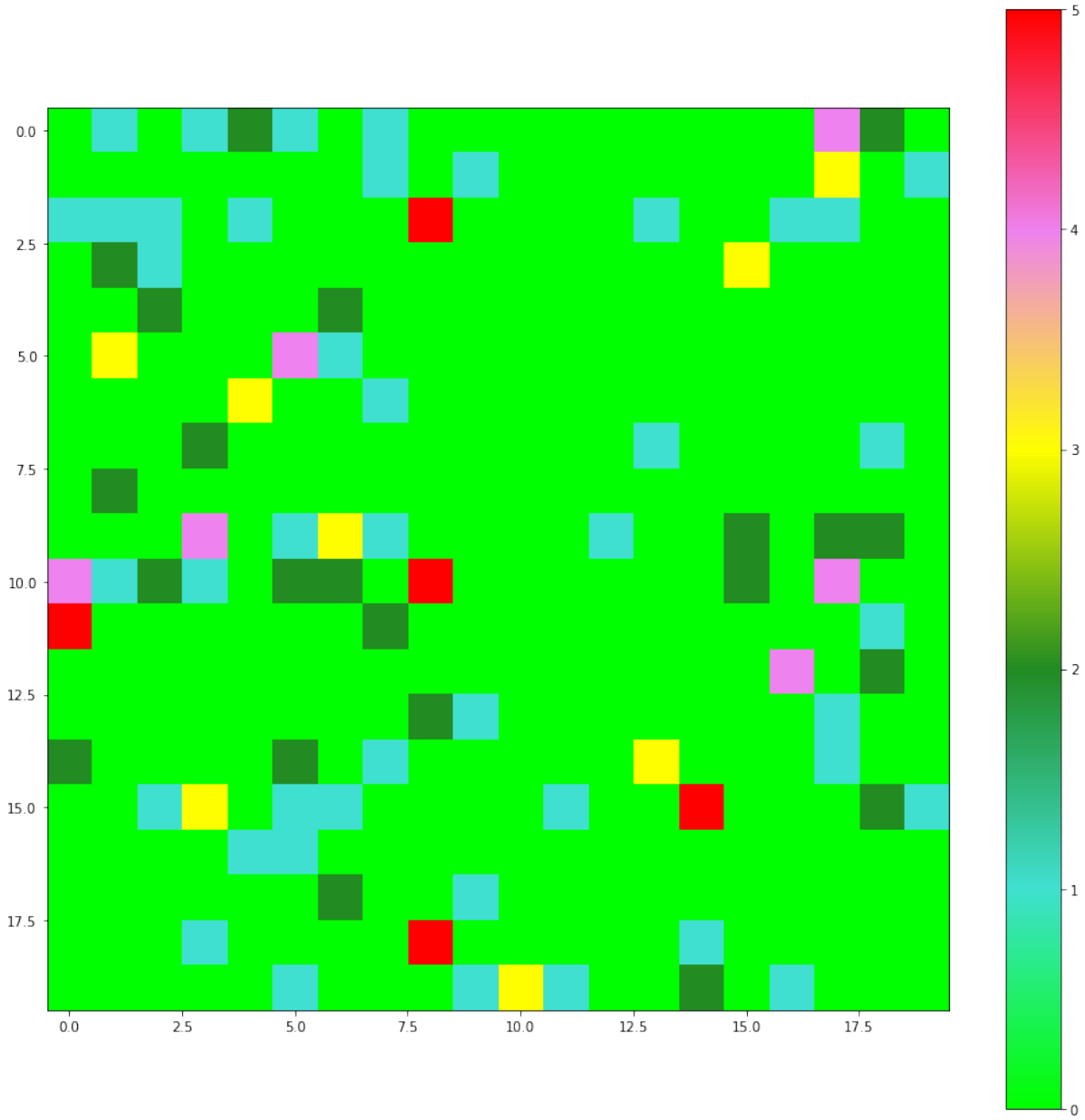

Fig5: Population state after Third generation.

TIMESTEP 4
echidna moved to : [8 5] tiredness : 5
echidna moved to : [19 9] tiredness : 4
echidna moved to : [0 16] tiredness : 4
echidna moved to : [5 4] tiredness : 3
echidna moved to : [3 14] tiredness : 5
echidna moved to : [15 3] tiredness : 4
echidna moved to : [6 0] tiredness : 4
koala moved to : [12 16] tiredness : 8
koala moved to : [11 1] tiredness : 8
koala moved to : [8 19] tiredness : 10
koala moved to : [7 7] tiredness : 10
koala moved to : [0 15] tiredness : 8
dingo moved to : [0 8] tiredness : 5
dingo sleeping at : [18 8]
dingo sleeping at : [15 14]
dingo sleeping at : [10 8]
dingo moved to : [14 0] tiredness : 7
echidna in position : 19 9 is dead by dingo from position : 18 8

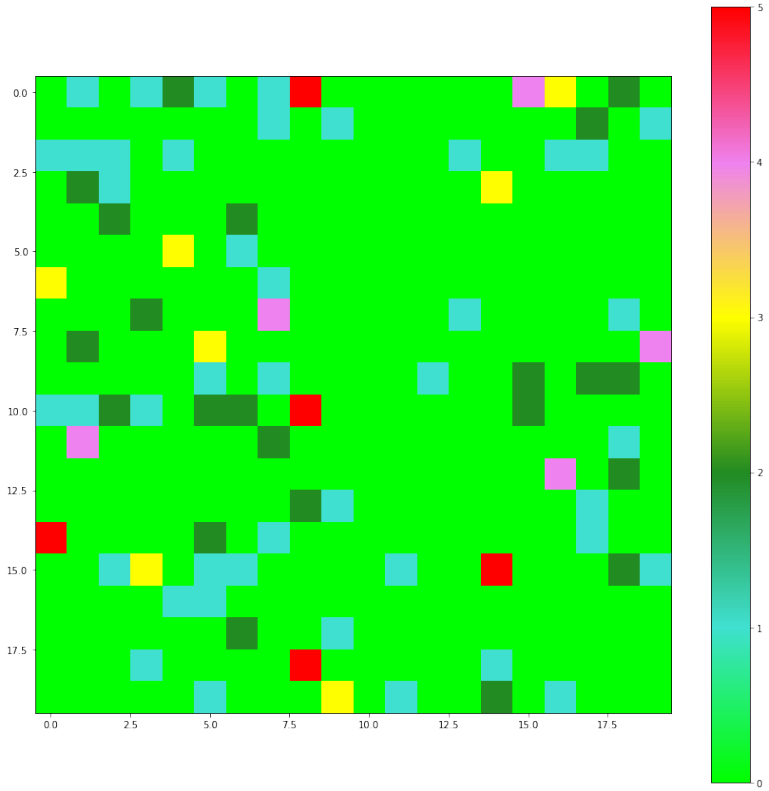

Fig6: Population state after fourth generation.

Stopping Criteria:

The game will stop when there will be no way of reproduction of animals. Thus means if only single of any species denotes that there will be no reproduction. Also the for the convenience the reproduction is rate is selected with a random probability. So chance of overpopulation is not a concern.

Conclusion and Future Work:

This game focused on the traits, movements, and interactions more between most animals. So in the future, it would be great to focus on the environment of the simulation of different landscapes. And different advantages and disadvantages of that region. And also as the simulation focused on each animal, all the animals can have a random nature like, gentle and calm, fast, aggressive, and so on, which will create a slight change on the predetermined parameters and make the simulation more interesting.