

# Zense Project Report

## **Idea:**

The idea was to simulate the population of a predator species and a prey species in a specific environment over time according to certain constraints and whose population values are given by two differential equations known as the Lotka-Volterra equations.

There are two types of graphs that can be drawn from this data:

1. Population vs Time Graph for both the predator species and prey species
2. Phase Space Diagram - the graph of the predator species' population vs that of the prey species

## **Technology used and implementation details:**

The simulation was written entirely in Python.

The window used to select the factors that influence the simulation was implemented using the tkinter module.

To solve differential equations, I used the odeint function in the module integrate from the module scipy.

To plot the graphs of the populations, I used matplotlib.pyplot .

## **Future Scope of your project:**

If I had worked more on this project I would add animated graphs which go over a range of initial conditions and also be able to study in greater detail the various miscellaneous factors which affect the constants in the differential equations.

I would also want to explore whether specific species themselves influence the values for population over time and how they factor in to the constants in the differential equations.

## **How was your overall experience while doing the project:**

I overall enjoyed the prospect of learning various new modules and searching for specific ways to implement certain factors I wanted to design my simulation around.

I will admit that my time management was not impeccable and as a result I was not able to add animated graphs but I was able to achieve everything else I wanted to do and I was satisfied with how what ideas I had for influencing the simulation tied into the code I had written, and so I hope that this project can show the great potential in this idea.

## Screen for selection of various factors

Activities Factors in the simulation Sun Jan 13, 23:33:54

factors In The Simulation

The Lotka-Volterra model for the population of a predator and prey species in a given environment is a set of two differential equations that calculates their populations given certain factors

There are certain assumptions this model makes:

- 1.The prey species finds sufficient amount of food at all times
- 2.The food supply of the predator species depends solely on the prey population
- 3.The rate of change of population is proportional to its size
- 4.During the process,the enviroment doesn't change in favour of any species, and genetic adaptation doesn't affect anything
- 5.Predator have limitless appetite

Please select the initial populations and the various constants you would like in your graph, then close this Window to be able to select the graph

Alpha represents the rate of growth of the population of the prey species in the absence of predators, affected by eg. the relative prevalence of food or water supply for the prey species

Beta represents the rate for the Prey of encountering the Predator(and thus dying), affected by eg. the landmass which would increase the chance of the predator and prey species meeting

Delta represents the rate for the Predator of encountering the Prey(the Predator's food), affected by eg. the landmass which would increase the chance of the predator and prey species meeting

Gamma represents the rate of population decrease for the predator in the absence of any prey species, affected by eg. the water supply, natural death rate or emigration rate for the predator species

Initial Population of the Prey  
0

Initial Population of the Predator  
0

Alpha \* 100  
0

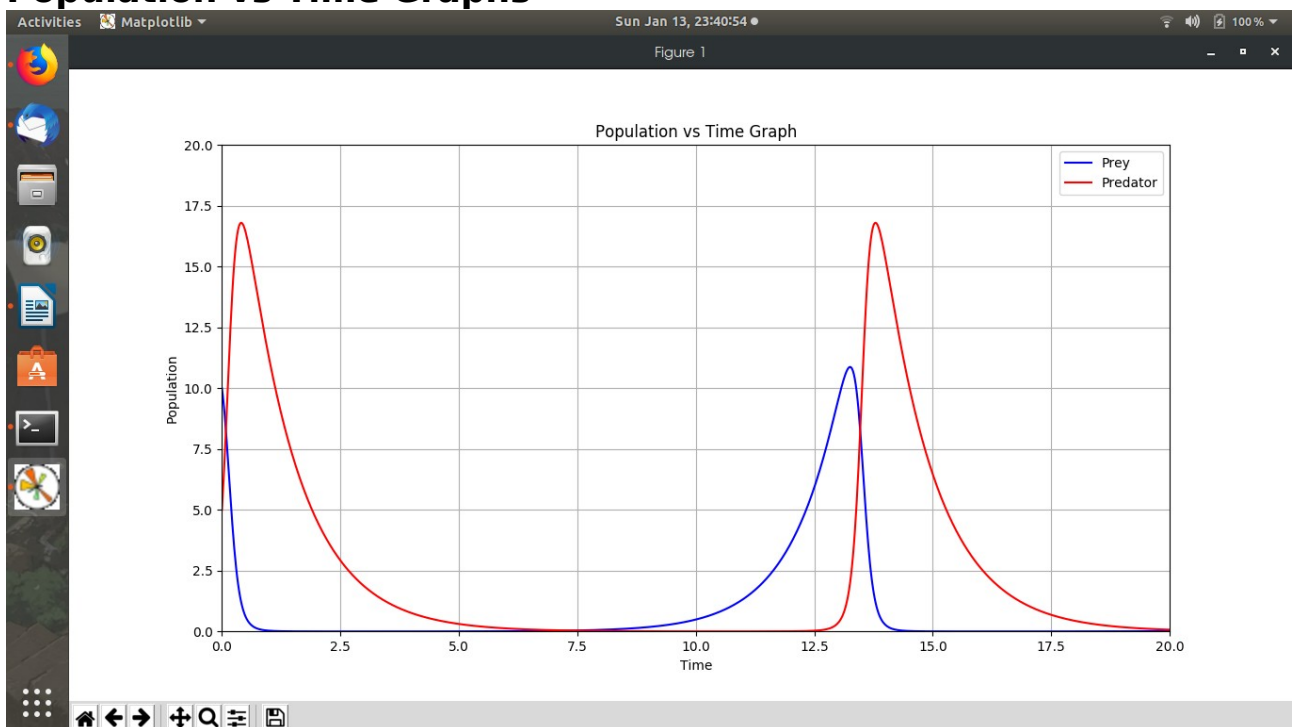
Beta \* 100  
0

Delta \* 100  
0

Gamma \* 100  
0

Use These Factors

## Population vs Time Graphs



# Phase Space Diagram

