

# CSE 6730, Group 37 Proposal

## Project 2: Complex Simulation

### 1 Project Title

Simulation of Predator-Prey Population Dynamics

### 2 Team Members

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### 3 Problem Description and Purpose

Predator and prey complex system is important ecological system.

- it is also have some extension, such as military response

Complex systems has contributed to the understanding of the ecology

### 4 Data Source

-pending

### 5 Methodology

Our simulation will first simulate predators and preys entering and exiting a predefined area. Both prey and predators are affecting each other. In simplest interaction, predators depend on the prey as the food source. However, any abuse of the food source may result in decrease in population of the prey, and subsequently decrease the number of the predators due to lack of food. Because of such interaction, the population of the predators and the prey may oscillate, and inversely proportional to each others.

Traditionally, there is non linear Lotka Volterra Model of the predator-prey dynamic system [2, 3]. LVM approach is a simplified model and suitable for detailed stability analysis. However, it is also very limited model and lack of flexibility for complex interaction. Hence, we also hope to incorporate Agent Based Model [1] in this project to increase the completeness of our analysis.

In our project, some of the simulation situation that we wish to investigate including:

1. Long term population among preys and predators.
2. Introduction of the uncertainties: eg disease.
3. Introduction of the third parties interaction: eg human activity, natural disasters etc.

## 6 Development Platform

The programming language is Python 3. We shall provide a Jupyter notebook for user interaction. In the Jupyter notebook, we shall allow the user to change some of the probability and the simulation parameters to see different result of the simulation.

## 7 Division of Labor

As we move forward on our project, we plan to work concurrently. The timeline is as below:

Task	Duration
Data collection	2 weeks
Modeling design and implementaion	4 weeks
Modeling revised	4 weeks

## References

- [1] Migdat Hodzic, Suvad Selma, and Mirsad Hadzikadic. Complex ecological system modeling. *Periodical of Engineering and Natural Sciences*, 4(1), 2016.
- [2] Migdat Hodzic, Suvad Selma, Mirsad Hadzikadic, and Ted Carmichael. Dual approach to complex ecological dynamic system modeling and control. 03 2015.
- [3] V. Lakshmikantham. Large-scale dynamic systems: Stability and structure [book reviews]. *IEEE Transactions on Automatic Control*, 26(4):976–977, August 1981.