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## Report for Assignment 2

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### Introduction

To achieve the goal of the assignment I implemented 3 versions:

- **MATLAB 2D:** Using just lists and the non-optimized version of the algorithm. Complexity:  $O(n^2)$
- **Python 2D:** In the beginning I used lists of objects and then I switched to dictionaries for better performances. Complexity:  $O(n)$  using cell lists.
- **Python 3D:** Same as the previous version but in a 3D environment. Complexity:  $O(n)$

Unfortunately, I found the best parameters that can lead to similar results for Lotka-Volterra equations. I am going to list those parameters later.

### Initial Conditions

The rabbits and the wolves are distributed randomly within the environment as shown below (example). I decided to not set fixed seed for random functions to have every time a different initial condition.

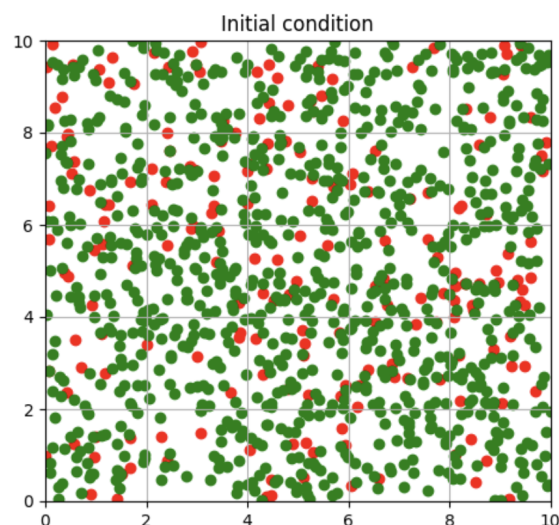


Figure 1: Initial conditions

## Point A

In both MATLAB and Python implementations after very few hundred iterations and with the given parameters the wolves die. In contrast what I expected, the wolves death rate maybe is high probably because the rabbit birth rate is not high enough.

By running main.py I draw the following plots:

- **Simulation**
- **Number of rabbits and wolves over iterations**
- **Rabbits and wolves density**

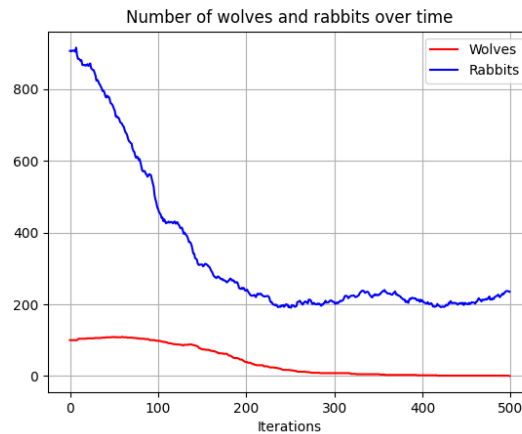


Figure 2: PointA;2D; Number of rabbits and wolves over iterations

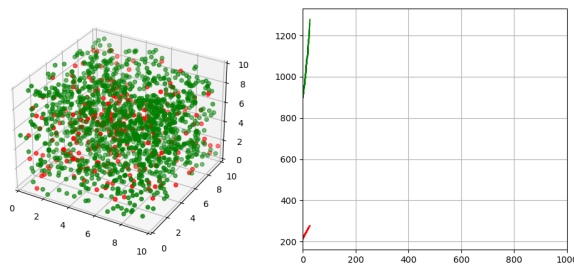


Figure 3: RT visualization

In the 3D plot the number of rabbits grows exponentially as well with more than 8000 rabbits only in the very first iterations.

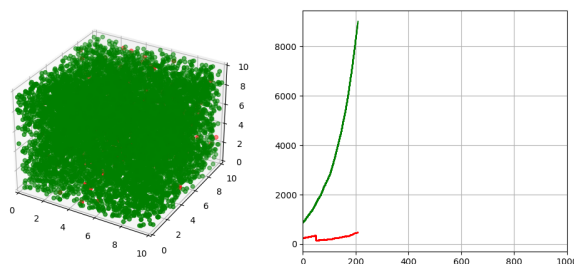


Figure 4: Environment visualization after just 200 iters