

Cartesian vs. Polar in a Predator-Prey System

Computer Systems Lab 2009-2010

Neelesh Shrivastava

April 8, 2010

1 Abstract

This project aims to use an agent-based system to model two different predator-prey systems. The first is in Cartesian x,y , the second is in Polar r,θ . From there, any differences between the predictions of the models will be ascertained.

2 Introduction/Goal

The purpose of this project is to ascertain any differences between choosing Polar coordinates or Cartesian coordinates for a predator-prey model.

3 Background

Understanding of different ways to model population and a cursory understanding of the Lotka-Volterra equations is essential to understand population modeling in general. The Lotka-Volterra equations are a set of differential equations governing how population behaves when the two interact with each other. It assumes simple exponential growth/decay for each group, the predator and the prey, and adds a factor to decrease, for the prey, or increase, for the predator, the populations based on interactions between the two populations. Polar and Cartesian are the two most common ways to

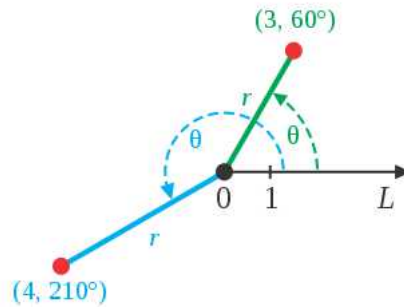


Figure 1: Some vectors in Polar Coordinates

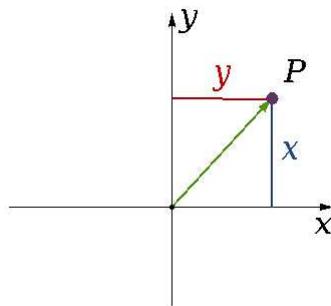


Figure 2: Cartesian Coordinates

express coordinates in two dimensions. Cartesian expresses coordinates in terms of x , horizontal distance traveled, and y , vertical distance traveled. Polar expresses coordinates in terms of r , distance from the origin, and θ , counterclockwise angle from the Polar axis, the x -axis in Cartesian.

4 Procedure

Python was used to implement the simulations and TKinter for a graphical model. Differences, if any, between the Cartesian and Polar models will be found. Because of the way computers handle coordinates, x increases as you move right, but y increases as you move down the screen. Similarly, r

increases as you move away from the top left-corner, the origin in cartesian, and theta will increase in a clock-wise direction.

5 Results

This project should find any differences between choosing Polar and Cartesian for representing the predator-prey system. This will hopefully help when trying to pick a coordinate system to run a Predator-Prey model in. Potentially, this could be expanded to any agent-based modeling simulation. This could also be expanded into 3D comparing Cartesian, Spherical, and Cylindrical Coordinate systems

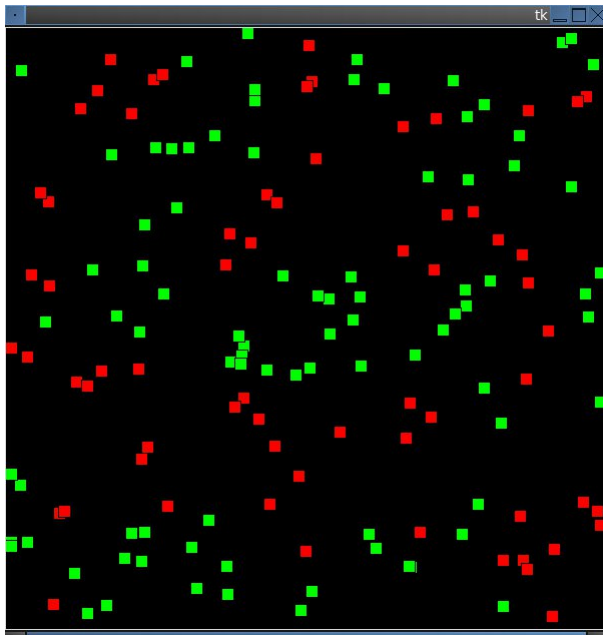


Figure 3: A picture of the Cartesian program

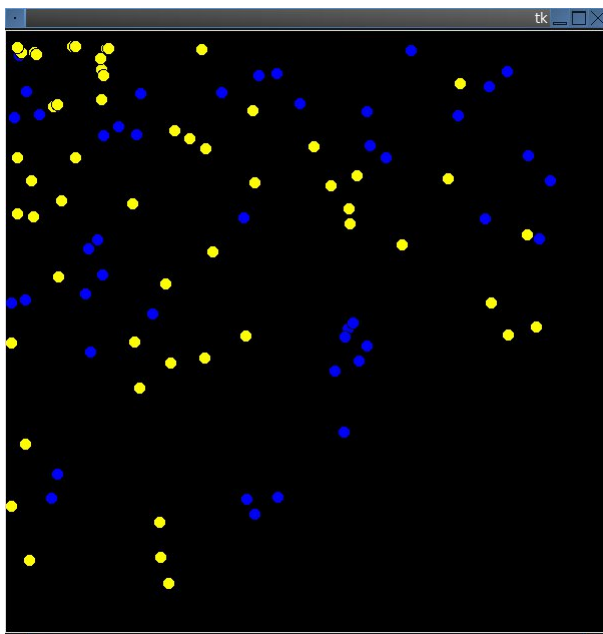


Figure 4: A picture of the Polar program