

: Predator/Prey Simulation



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Simulation description:

We are simulating a Dinosaur ecosystem. We include Pterodactyls, Velociraptors, TRexs, Brachiosauruses, and Stegosauruses. There are also two species of plants, Ferns and Redwood. The plants remain stationary and grow linearly, being affected by the weather.

Meanwhile, the dinosaurs roam the field looking for food. Some dinosaurs (like the Pterodactyls) sleep when it is not morning, so they don't move. For the dinosaur which eat plants, their reach needs to be long enough to reach the plants height, otherwise they aren't able to eat the plants. Dinosaurs which feed upon other dinosaurs attack those on cells around it. Whenever they encounter a dinosaur around, there is a probability that the attack is successful. When Dinosaurs find others of the same species, but opposite sex, they have a probability of successfully breeding and creating offsprings. Fern grows back on the field every 30 steps, and redwood every 220.

The following interactions take place between the dinosaurs and plants :

- A "Pterodactyl" can attack and win against a Stegosaurus
- A "Brachiosaurus" does not attack any dinosaur but consumes "Redwood" as its main food source. Its reach needs to be equal to or greater than the plant's height.
- A "Trex" can attack and win against a "Stegosaurus", "Brachiosaurus", "Velociraptor" and a "Pterodactyl"
- A "Velociraptor" can attack and win against a "Trex", "Brachiosaurus" and a "Pterodactyl".
- A "Stegosaurus" does not attack any dinosaur but consumes a "Fern" as its main food source.

Weather and Dinosaur:

- Only the "Brachiosaurus" is affected by the weather. It does not move if its raining.

Weather and Plant:

- If it is Sunny ,Redwood increases its height twice as much on every step.
- The Fern only increases in height when it is raining.

Time of Day and Dinosaur:

- Pterodactyl sleeps if it is not morning time, thus doesn't move nor mate.
- Stegosaurus sleeps if it is not the morning, so it does not move nor mate.

Extension tasks:

Plants grow at given rate and don't move. They are eaten by instances of Brachiosaurus and Stegosaurus. If the two previously mentioned Dinosaurs don't find plants they will die. Each plant has a height and age, which are incremented on every step. They grow at a regular rate, which is modified by the current weather. For a dinosaur to eat a plant, their reach needs to be long enough to get to the plants height.

Weather is implemented as an Enum, with possible values "Sunny", "Rainy" and "Windy". We extended the Field Object array to a 3d array with dimensions depth, width, and two (new Object [depth] [width] [2]). Where the third dimension sets a height of 2 to the array, where index 0 represents the ground where the Dinosaurs and Plants are, and index 1 represents the sky where we store the current Weather. This was made so it can easily be extended to have greater height as to include flying behaviour to Dinosaurs such as Pterodactyls. The weather changes on each cell, on every step.

Disease is implemented so that every Dinosaur has a small probability of being spontaneously infected. After being infected there is a higher probability of the disease being spread to other nearby Dinosaurs. Currently, nothing happens to infected Dinosaurs, but this may be easily implemented if desired (for example, make the dinosaur die in certain amount of steps).

We implemented a Herbivore interface as all Herbivores shared methods that dealt with them reaching the plants. We did not need to implement a carnivore interface as all the needed methods were provided from the Dinosaur super class.

There are no known bugs in our code.

Only problem we currently have is the speed our simulation is running at, which isn't significantly fast. We identified that the speed of our code is being held back as we have multiple objects looping through their surroundings repeatedly in order to interact with adjacent objects, as well as we made dynamic weather that changes on every step at each cell, instead of a single weather for the whole field. We also extensively use the Random object. Every dinosaur infected by disease loops through all its surroundings to spread the disease again. Having a lot of our array covered by plants also slows down the simulation, as they each have to grow. Conjunction of these factors made our simulation run at a lower speed.