Predator-Prey Simulation Using Boids Model

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Collective behaviour course research seminar report

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ToDo: Add abstract.

Collective Behaviour | Boids | Simulation | Prey-Predator | Escape patterns

Introduction

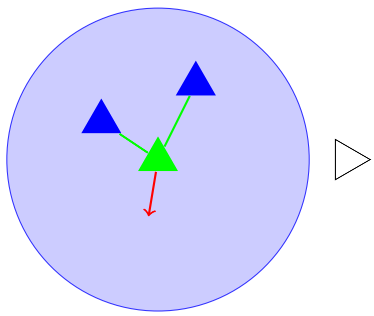
In 1987, Reynolds [2] proposed a simple algorithm to model the flocking behavior of birds, herding of sheep, and similar phenomena, known as the Boids (Bird-oid objects) model. In contrast to controlling the interactions of the entire flock, the Boids simulation focuses on dictating the behavior of each individual boid. Despite consisting of a few simple rules, this algorithm produces complex and lifelike behaviors similar to those observed in nature.

We will present how we implemented such Boid simulation, with an additional step which will make simulating different Boids (prey, predator) easier.

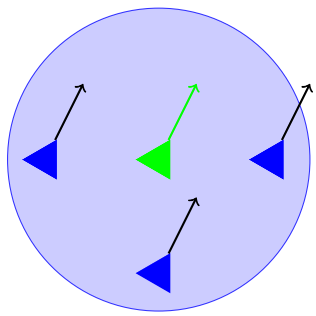
Methods

As a starting point, a basic boids model has been implemented, which is based on three simple rules:

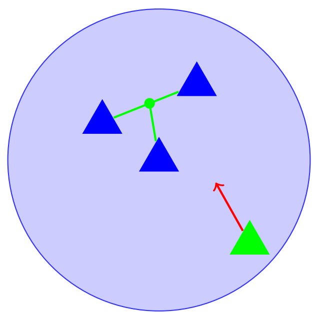
1. Avoid collisions.



2. Maintain the same heading and speed as the neighboring boids.



3. Gravitate toward the center of the flock.



Procedural generation of a tropic island and coral reef

In computer graphics there is frequent need for displaying large vistas of natural looking terrain. Designing such terrain by hand is typically time consuming. With procedural generation, on the other hand, larger areas of natural looking terrain can be generated with or without minimal intervention in a relatively short time. In this work we present a process of procedural generation of a tropical island with the associated corral reef. We start by generating a heightmap for the base terrain. The heightmap is then transformed by simulating the processes of hydraulic and thermal erosion to achieve a more natural look of the terrain. As coral reefs often grow around tropical islands, we also simulate their growth as part of the last step. Real-time visualization is enabled during the simulation, so that one can observe the evolution of the terrain. Here we dynamically apply textures to the terrain based on its local characteristics. The result is a natural looking model of the textured tropical island and corral reef.

Procedural generation | Terrain generation | Thermal and hydraulic erosion | Coral reef | Simulation | GPU

Collision avoidance (1), also known as *separation*, has been achieved by summing all the distance vectors $\overrightarrow{BB_i}$ within boid B's vicinity and then using the resulting negative vector as its new direction.

When computing *alignment* (2), we first compute the average velocity of the neighboring boids, denoted as $\overrightarrow{v_{avg}}$. If $\overrightarrow{v_B}$ is considered the velocity vector of boid B, the intention is to direct it towards the vector $\overrightarrow{v_B v_{avg}} = \overrightarrow{v_{avg}} - \overrightarrow{v_B}$. The resultant velocity vector $\overrightarrow{v_B v_{avg}}$ obtained in this manner is then divided by a constant to make the alignment more gradual.

To achieve *cohesion* (3), we summed the distance vectors $\overrightarrow{BB_i}$ from boid B to its neighbors, which was then divided by a constant. This was done experimentally to reduce the cohesion force, aiming for a more natural movement.

Results

ToDo: Add Results.

Discussion

ToDo: Conclusion/Discussion.

CONTRIBUTIONS. ToDo: division of work.

Bibliography

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2. Reynolds CW (1987) Flocks, herds and schools: A distributed behavioral model in *Proceedings of the 14th annual conference on Computer graphics and interactive techniques.* pp. 25–34.