TDT4137 - Cognitive Architectures

Assignment 3

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1-D: Emergence

1.13

Slime molds are a interesting form of complex system. Even though the number of cells in a colony of slime molds are huge, they are self organizing, and show adaptability and emergent behavior. They create complex and efficient networks to connect to food sources.

Another complex system which is very complex is the earths climate system. It depends on interactions between a huge number of properties, such as the atmosphere, oceans and human interaction. What makes it so interesting is its impact, and how we humans induce perturbations which throws the system into chaos.

1.14

The plots can be seen in figure 1. If we look at the two lower plots, they have the same $r = 3.9$, however x_0 is slightly different. We can see the sensitive dependence on initial conditions, because even though they have almost the same initial conditions, they are very different.

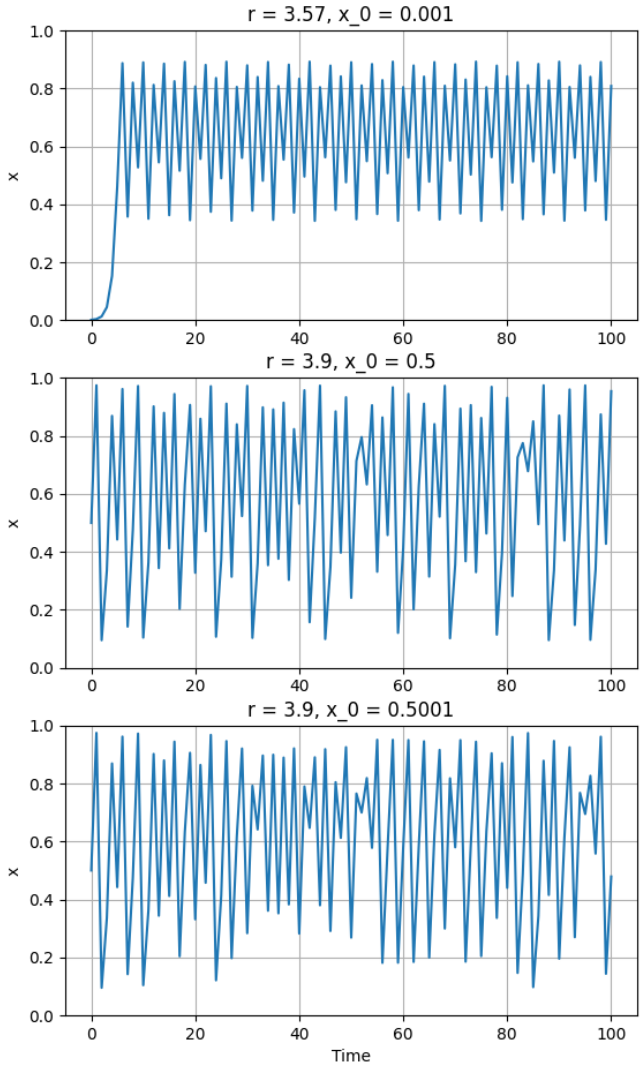

Figure 1: Logistic map plots

1.15

The edge of chaos is a state where in a complex system most small perturbations are stable, but a few can produce chaos in the system. If we look at a system where we add one grain of sand at a time, and plot the frequency of the avalanches in the sand. We can see that some perturbations lead to small avalanches, but some lead to large avalanches.

1.16

Deacon's first order of emergence are high level patterns, often described by properties such as temperature, viscosity and color. It is a type of synchronic emergence.

Deacon's second order of emergence are high level patterns created by amplification of asymmetry.

It is a type of diachronic emergence, it is history dependent and happens across time. Examples of second order emergence are snowflake patterns, which depends on the history of the atmospheric passage.

Lastly Deacon's third order of emergence involved both information or memory. Previous high order structures are stored and then re-presented to recreate the pattern. Information can also be selectivly ampliflied or dissipated, as in evolution.

1-E: Boids

1.17

To make the animation more fluent, I made the boids avoid edges, so that they turn around instead of just disappearing and reappearing. I also removed the wandering, to remove the flutter in heading.

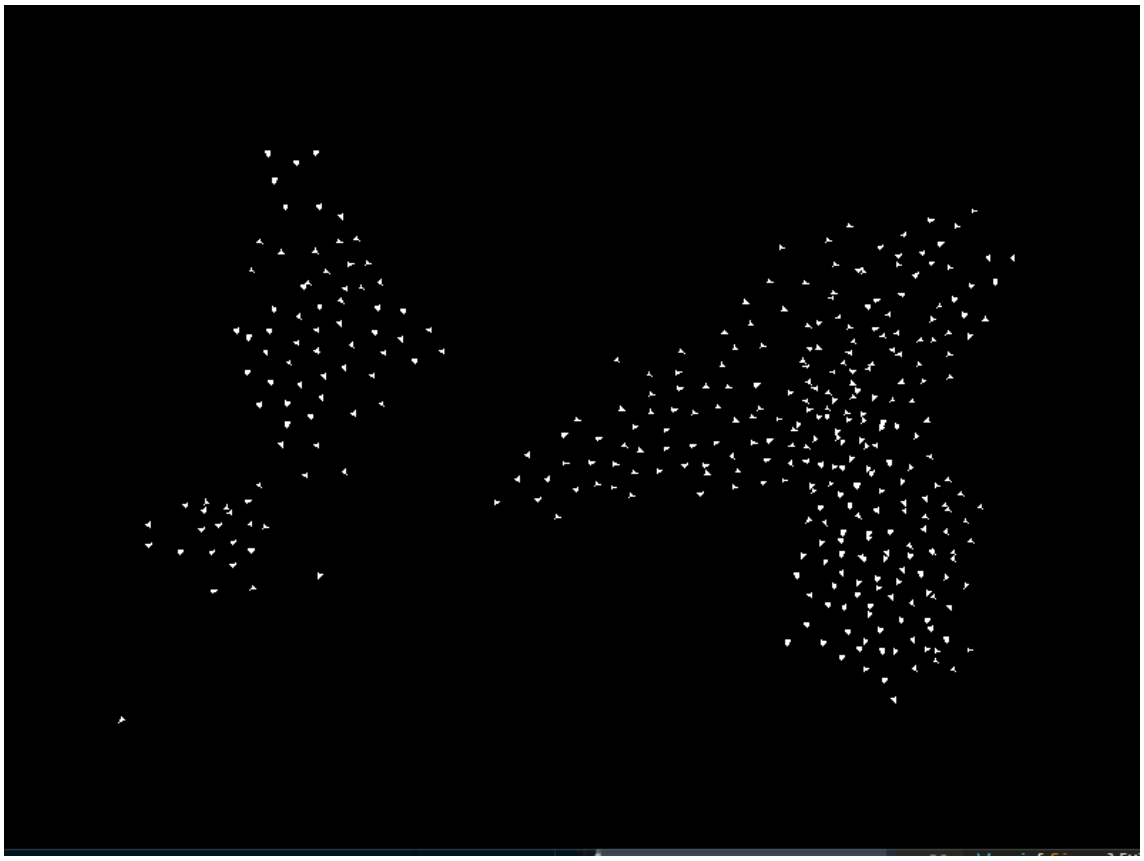

Figure 2: Boids implmenentation

1.18

Separation calculates the direction which best avoids the other neighboring boids. This means that with only separation, the boids will try to spread out as best as possible, as can bee seen in figure 3.

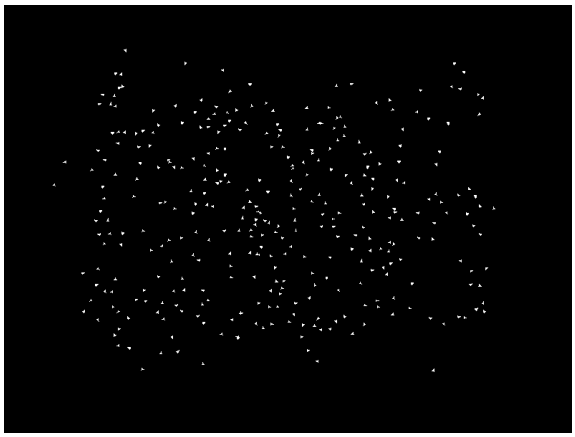

Figure 3: Boids with only separation

Alignment makes the boids head in the same direction as its neighboring boids. With only alignment the boids want to head in the same direction but does not care about collisions, which makes them into almost a line, as can bee seen in figure 4.

Figure 4: Boids with only alignment

Lastly cohesion makes the boid head into the average center of its neighboring boids. With only cohesion the boids create small groups where they try to make the groups denser. This can be seen in figure 5

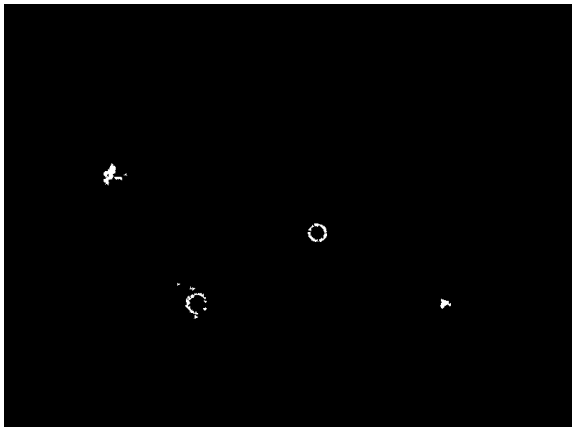

Figure 5: Boids with only cohesion

1.19

You can find the animation on imgur or among the submitted files.

https://imgur.com/a/S14oKmT