Population Genetic Simulator

Parameters

UI Control Label	Name	Default Value
Number of Rows	numRows	8
Number of Columns	numCols	8
Initial Population Size	numOrganisms	100
<none>	initialMean	0
Initial Genetic Variation	initialVariation	1
Max Offspring	maxOffspring	5
Stabilizing Selection Variance	stabilizingSelection	2
Carrying Capacity	softCap	100
Number of Loci	numLoci	100
Mutation Rate	mutationRate	0.05
Mutation Range	mutationRange	0.025
Death Chance Per Generation	deathChancePerGeneration	0.2
Offspring Migration Rate	offspringMigrationChance	0.0001
Adult Migration Rate	adultMigrationChance	0.0001
Environmental Cue Noise	observationNoise	0.1
Plasticity Effect Size	plasticityStepSize	0.5

Initialization

1. Create a grid environment consisting of [**numRows** × **numCols**] cells with spatially and temporally dynamic target phenotypes.
2. Create an initial population:

a. In select cells a population of **numOrganisms** organisms is created using **numLoci** alleles pulled from a normal distribution (**initialMean**, **initialVariation**).

Main Simulation Loop

While the simulation is running these steps are repeated for each generation:

1. The **generationCounter** is incremented.
2. Environment updates target phenotypes in each cell based on dynamics.
3. For each organism in each cell:
    a. **Plasticity**: Organism adapts phenotype towards the perceived target.
        i. Organism's perceived target is the actual target plus noise (generated for the organism at birth using a normal distribution around mean 0 with standard deviation **observationNoise**).
        ii. Organism phenotype is adjusted by adding a value sampled from a normal distribution with mean and standard deviations **plasticityStepSize**.
    b. **Reproduction**: Organism fitness and cell population determines the number of offspring.
        i. The default number of offspring per organism is computed from their distance *d* from the target phenotype and this formula (where *v* is **stabilizingSelection**):
        $$e^{-d/v}$$
        ii. This value (between 0 and 1) is multiplied by **maxOffspring** and then a penalty (**population/softCap**) is subtracted based on the current population to give a real number of offspring that we can break into the integer component and the non-integer remainder.
        iii. The integer component determines the number of offspring created, and the non-integer remainder is used as a probability that an additional offspring is created.
        iv. Each gene in the offspring has a **mutationRate** chance of adding a value from a normal distribution with mean 0 and standard deviation **mutationRange**.
    c. **Mortality**: Organism has **deathChancePerGeneration** of dying.
    d. **Migration**: Offspring migrate to a neighboring cell with **offspringMigrationChance** chance and adults migrate to a neighboring cell with **adultMigrationChance** chance.