Natural Selection Process

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ABSTRACT

The natural selection is a process to understand some patterns and behaviours of any creature, to survive in the real world. This simple simulator explain which are the correlation between the reproduction rate and the probability to improve the lifetime of the creature, avoiding the extincion.

Methods

The implementation of this simulator has some preliminary steps. The simulator has some actors to be initialized: Specie and Measure object. The Specie object has features to maintain trace information about how this object is linked to its "father", to initialized this structure, the object needs some parameters, an ID to count in the simulator the number of elements created, the generation number to understand for which generation belongs the object, time born to keep the moment in which the object in created in the simulation, a father object to hold characteristic of its parent to estimate the lifetime of the object. The lifetime of the father is modeled as an expotential distribution. The Measure object saves the statistics regarding the simulation.

A. Future Event Set

The future Event Set manages the events in the simulation using only 2 typology: Born and Death event. The Born event takes the time system of that moment in the simulation and a Specie object that is its generator. This event generates the own Specie object and others events related to the generation of its child and its death. For each new child the simulator inserts a new event and try to improve the expected life time, following the rule:

$$Lifetime(k) = uniform(Lifetime(d(k)), Lifetime(d(k)) * (1 + alpha)) \quad (1)$$

$$Lifetime(k) = uniform(0, Lifetime(d(k))) \quad (2)$$

When the equation 1 is chosen, the simulator improve the lifetime of child using a uniform distribution that has as boundary for the right side the lifetime of the father and for the left the lifetime of the father multiplied of a factor alpha. Instead, for the equation 2, the lifetime is chosen uniformly from 0 and the maximum lifetime of the father. Therefore, the Death event removes the Specie object with a specific id from the batch population and the simulator inserts it in a variable called "graveyard".

B. Event Loop

The simulator uses to evaluate the events a for loop, to extract each time an event. If the simulator Future Event Set is empty, then the simulation consider the population as extinct and it consider the last element generation death in the graveyard and the extinction time. If the population grow up, event set evaluate the population for 10000 loops, to avoid asymptotic trend toward infinity.

Results

The Table 1 shows the correlation between the reprodution rate and the probability of improvement. For lower values of reproduction rate the population of the simulation is extinted, in particular this value has a strong impact for the growing of the population, likewise, the improve probability has an impact but for a reproduction rate major of 1 is notably to observe that the population has the ability to survive and improve the overall value of their lifetime.

Reprod. rate	improve prob.	Ext.	Ext. Time	Gen.	Born	Death
1	0.3	True	6.281	1	14	14
1	0.4	True	298.329	5	25	25
1	0.5	True	315.775	3	15	15
1	0.6	True	95.059	3	22	22
1	0.7	True	238.290	9	37	37
1	0.8	True	9618.594	11	83	83
1	0.9	True	187.551	5	46	46
2	0.3	True	44.462	2	17	17
2	0.4	True	105214.190	14	90	90
2	0.5	True	7.820	120	3073	3073
2	0.6	False	Null	Null	5856	4144
2	0.7	False	Null	Null	6399	3601
2	0.8	False	Null	Null	6972	3028
2	0.9	False	Null	Null	7410	2590
3	0.3	True	23.540	6	36	36
3	0.4	False	Null	Null	5759	4241
3	0.5	False	Null	Null	6643	3357
3	0.6	False	Null	Null	7373	2627
3	0.7	False	Null	Null	7934	2066
3	0.8	False	Null	Null	8240	1760
3	0.9	False	Null	Null	8625	1375

Table 1: Correlation between Reproduction rate and improve prob.