# Creepture

*Virtual Caterpillar-like Robot that Achieves Locomotion Automatically through Evolutionary Computation*

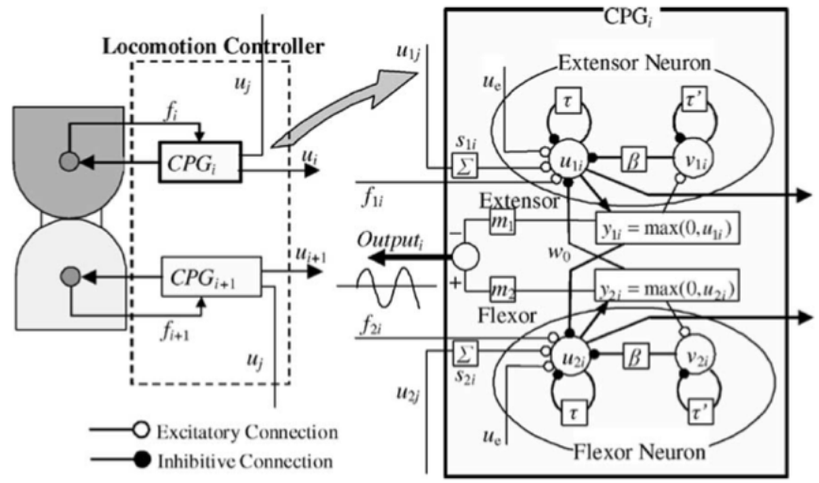
## GA Constants

| Parameter | Value |
|---|---|
| pop_size | 100 |
| max_gene | 150 |
| elites | 30 |
| xover_rate | 0.7 |
| mut_rate | 0.05 |

## GA Operations

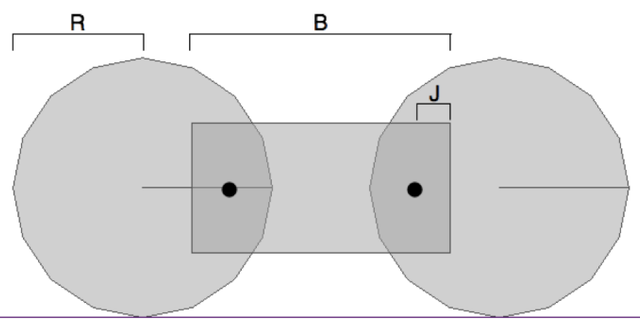
- Elites are not mutated and remain unchanged for each generation.
- Random crossover between elites and the rest of population (N-Point).
- Mutation of CPG weights will randomly choose values (-1, 0, 1)
- Mutation of initial neuron states is based on a random +/- percentage of current value.

## CPG Network




## Simulation Layer

*Box2D Physics Engine*




$$\text{fitness} = \text{distance} - \gamma \frac{\text{energy}}{\text{num}}$$

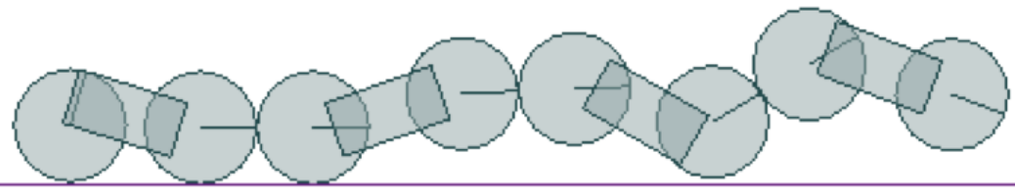
## Chromosome

CPG Network Weights

```
 0 -1 -1  1  0  1
 0  0  1 -1  0  1
 1  1  1  1 -1  1
 1 -1 -1  0  0  1
-1  0 -1  0  1 -1
 1 -1  0  0  0  0
```

Initial Neuron States

```
 0.393000 -0.390000 -0.095000 -0.950000
 0.644380 -0.281000  0.603000 -0.216000
-0.628000 -0.814000  0.705000 -0.354000
 0.063000 -0.032000  0.433000  0.843000
-0.320000  0.912000 -0.113000  0.707000
-0.072000 -0.238000 -0.132000 -0.145440
```



## Results

| Segments | 20s | 40s | 60s |
|---|---|---|---|
| 2 | 58 | 122 | 185 |
| 3 | 53 | 110 | 138 |
| 4 | 37 | 71 | 119 |
| 5 | 37 | 58 | 61 |

Distance traveled in seconds