Neuroevolution & Tarea 3

Alexandre Bergel
abergel@dcc.uchile.cl
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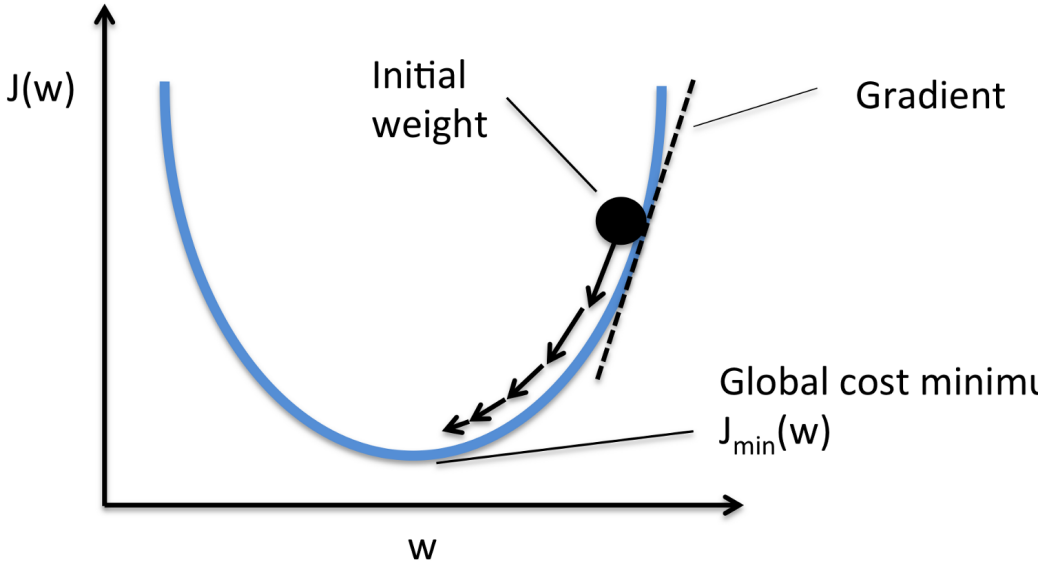
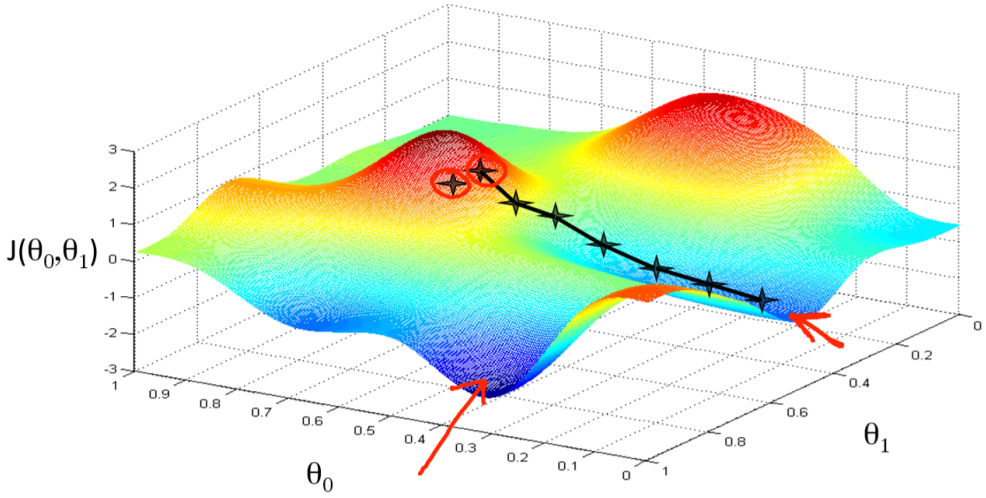
Gradient decent

Gradient descent is commonly used to make a neural network “learn”





Gradient descent requires examples

Examples are required to train a neural network

With the logical gates, we use 4 examples

Picture recognition *may require millions* of pictures

Requiring a large number of training examples may be problematic

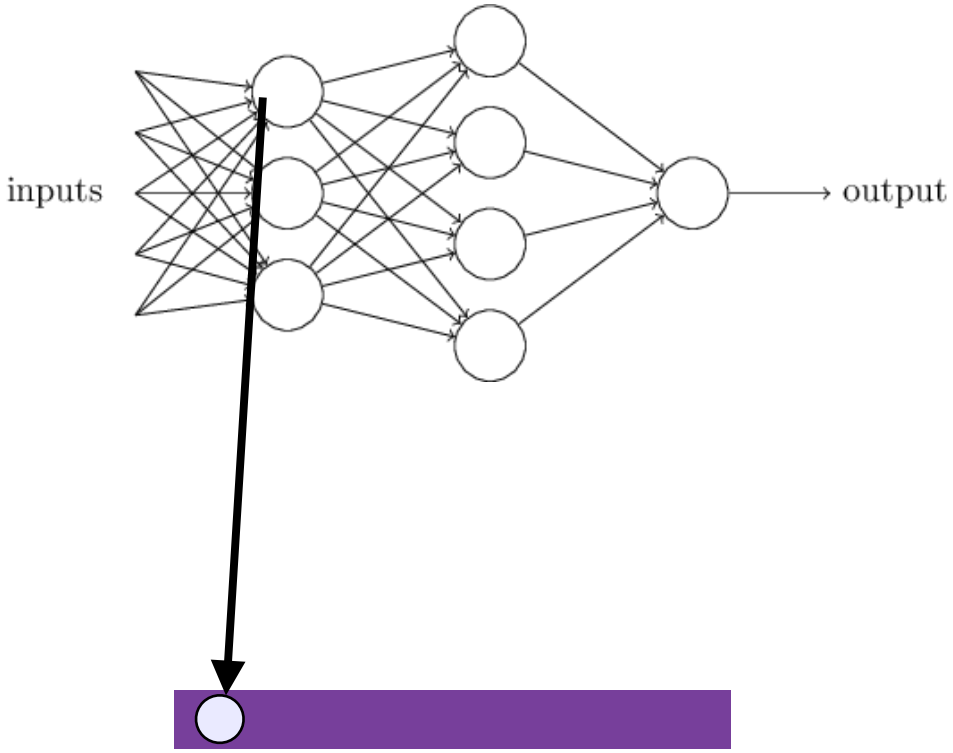
e.g., video games, self-driving cars

Neuroevolution

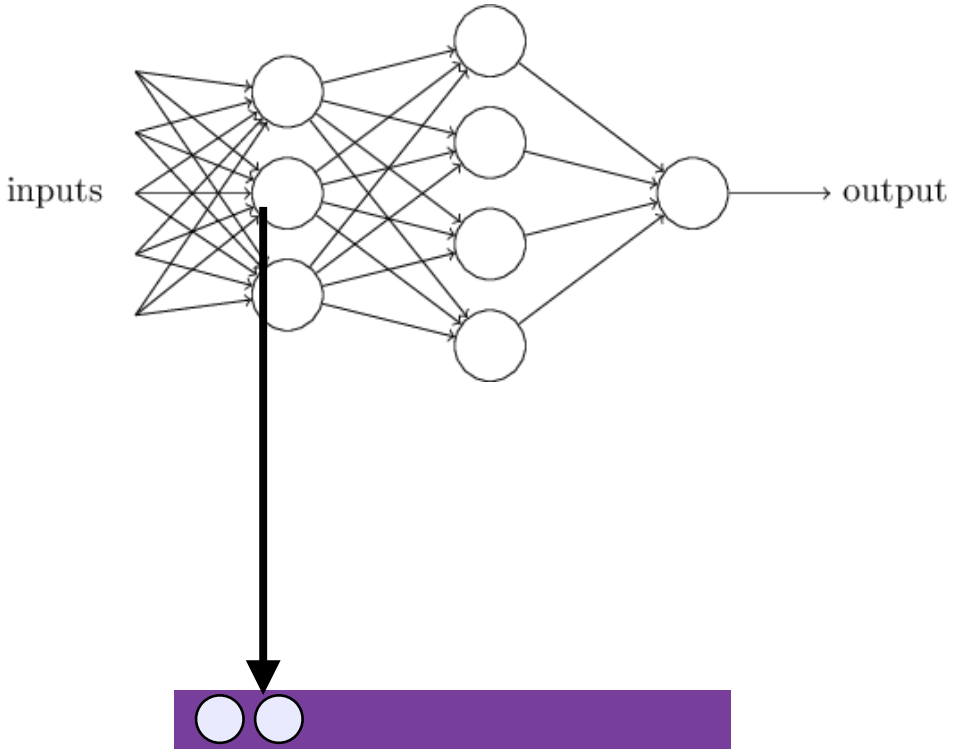
"Neuroevolution is a form of artificial intelligence that *uses evolutionary algorithms* to generate *artificial neural networks*, parameters, topology and rules. It is most commonly applied in artificial life, general game playing and evolutionary robotics."

— Wikipedia

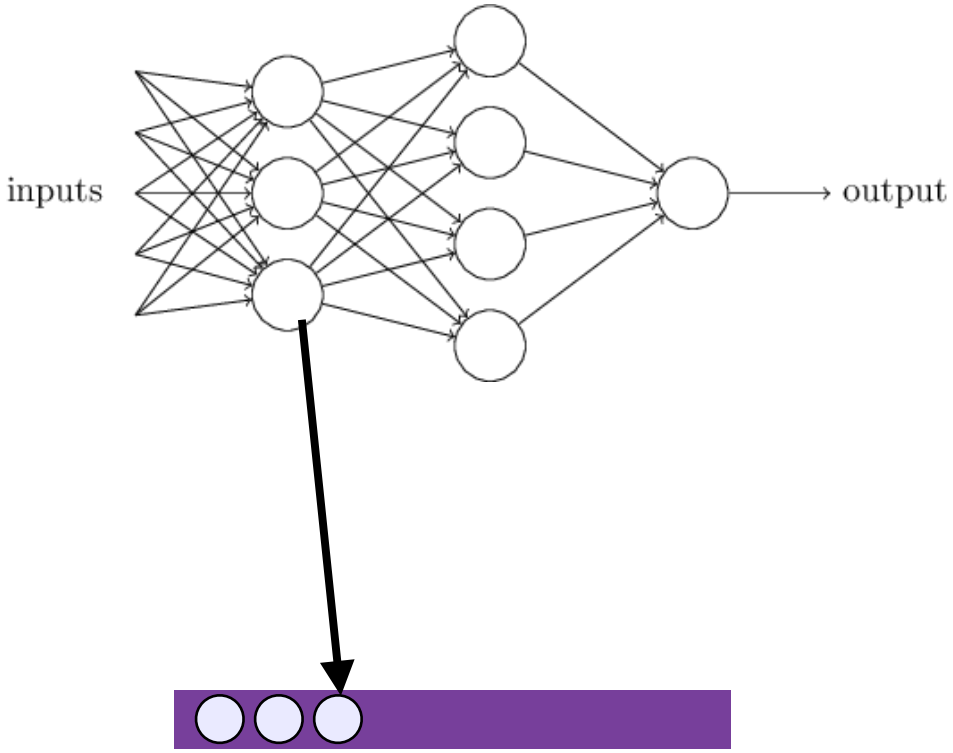
Neuroevolution



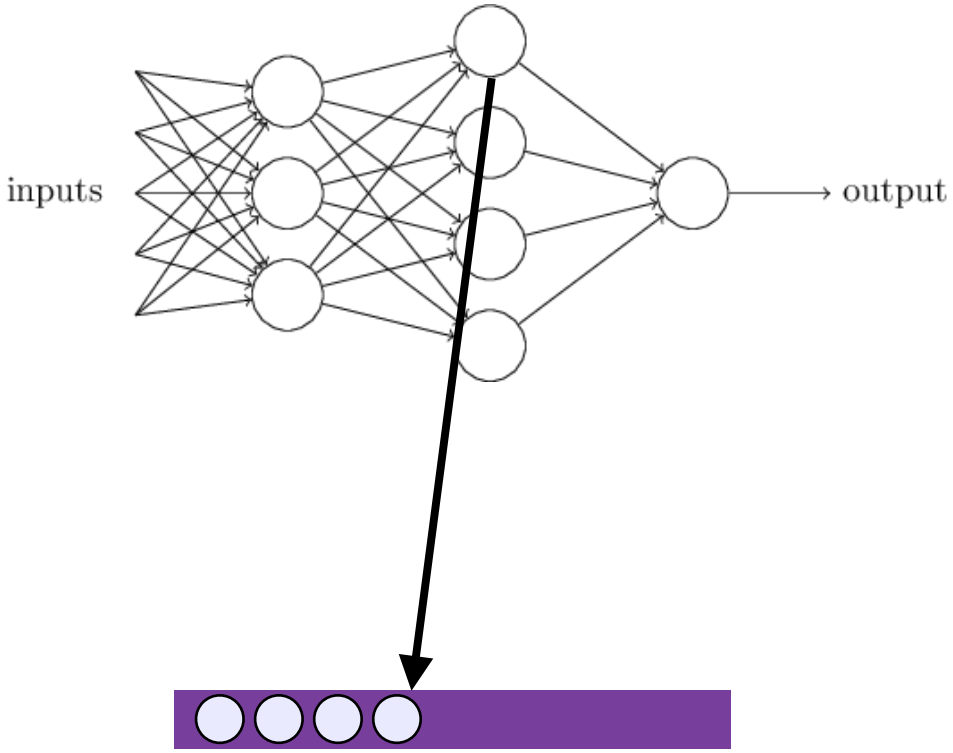
Neuroevolution



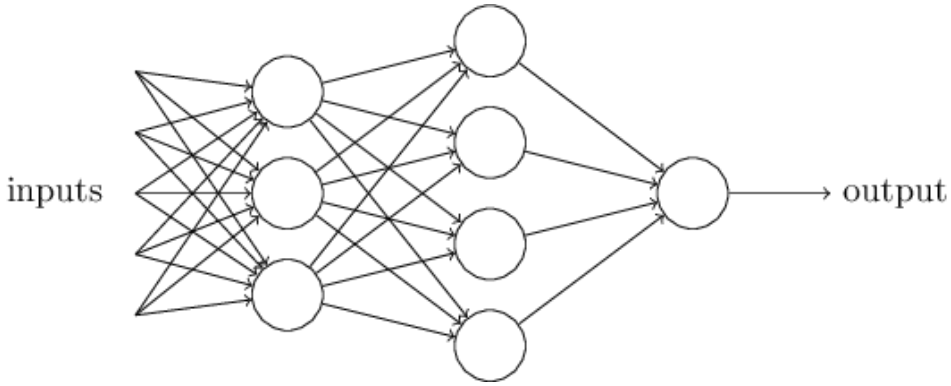
Neuroevolution



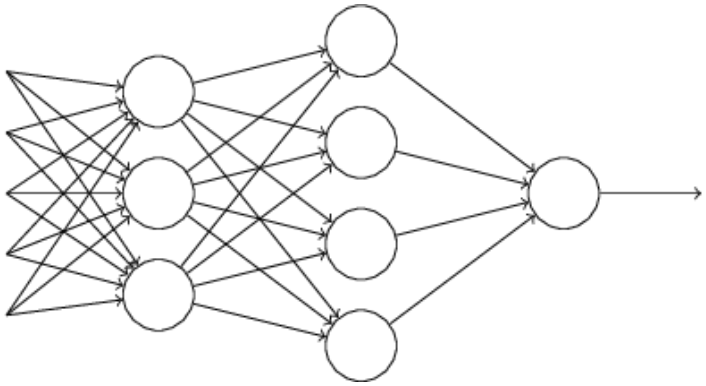
Neuroevolution

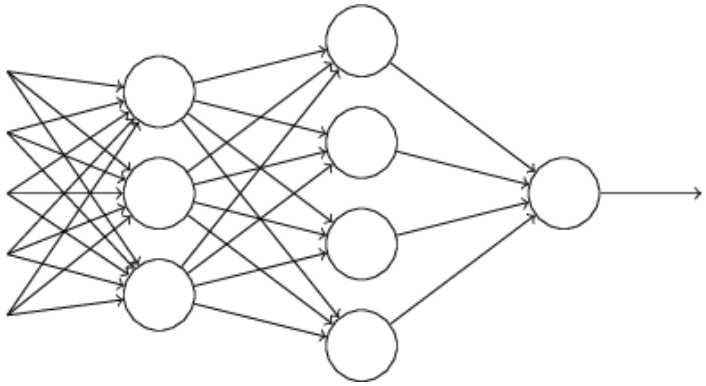


Neuroevolution

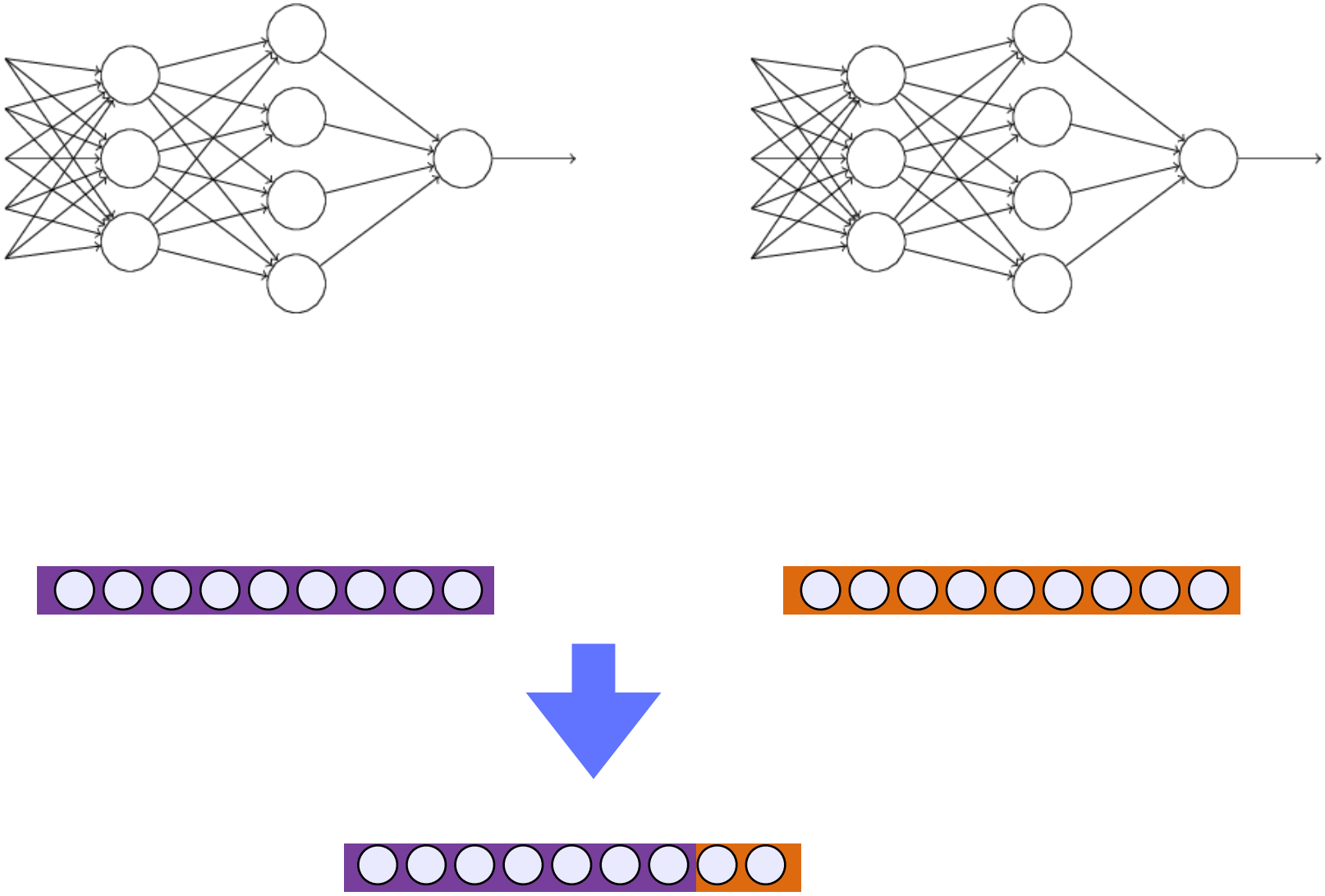


Neuroevolution

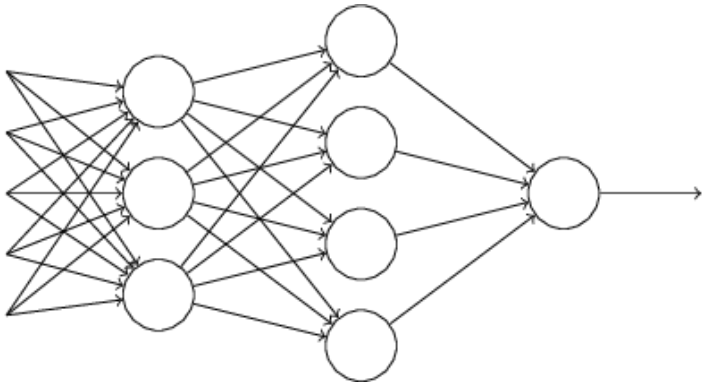


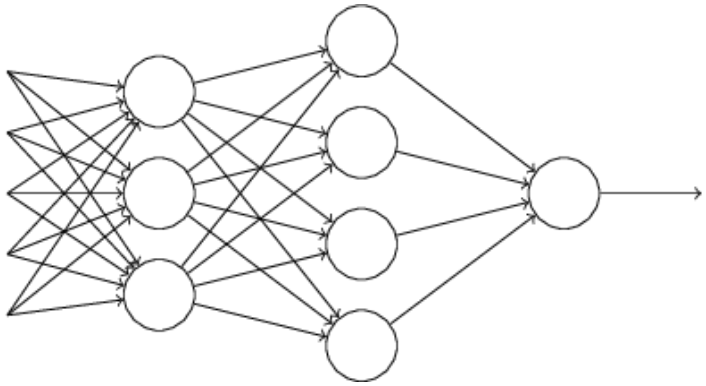


Neuroevolution

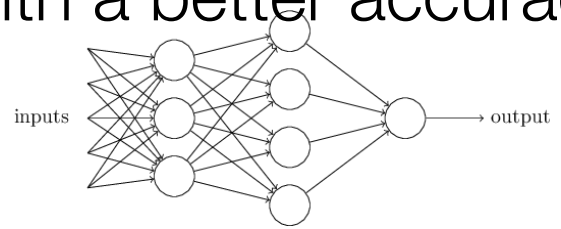


Neuroevolution





New neural network
With a better accuracy



Genetic operations

Applying genetic algorithm to find weights and bias of a neural network involves particular genetic operations

The cross-over operations must consider the neuron as a whole

ie. Crossover should not divide the genetic information obtained from a neuron

Cross-over happens only at a limit of a neuron

Genetic operations

We can add another genetic operation, in addition to the mutation and the crossover (preserving neuron integrity)

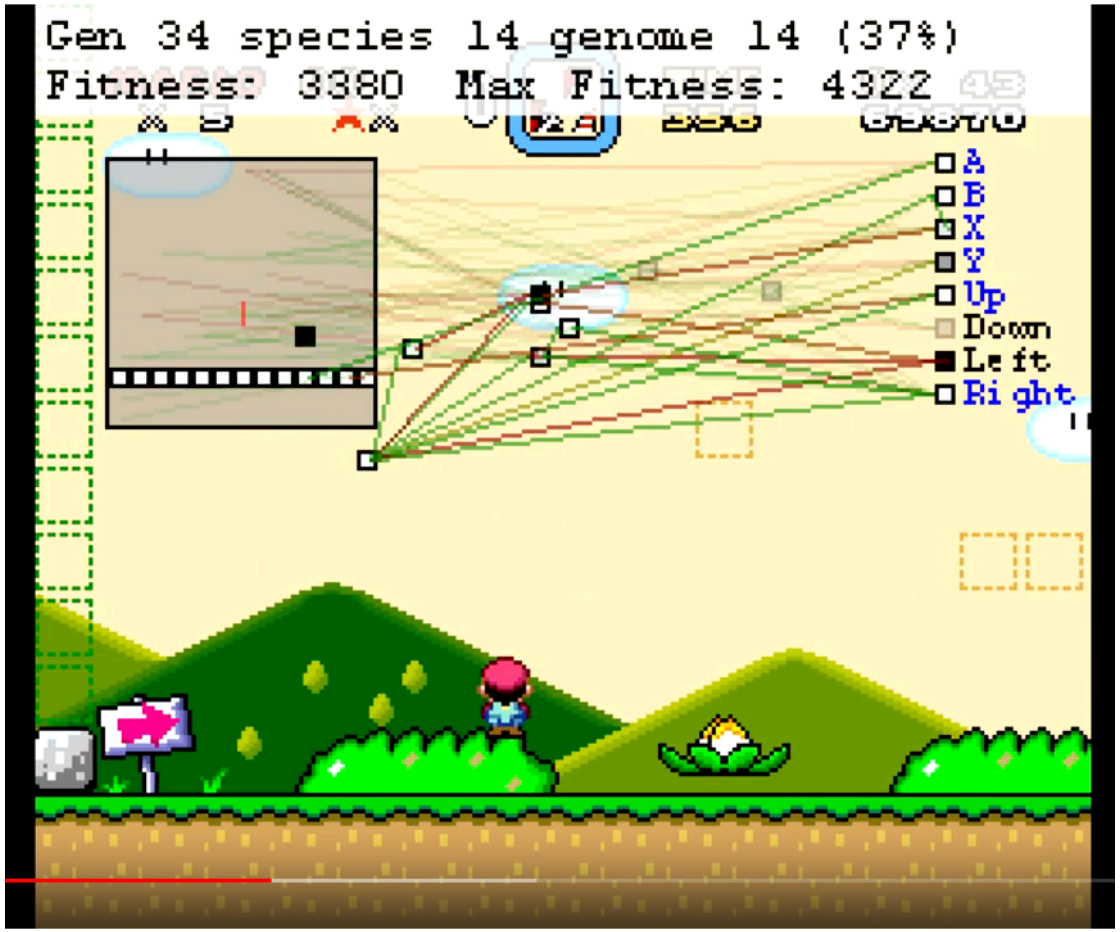
You can also have an additional second cross-over operations considering the layer

Cross-over happens at the junction of a layer

Examples of neuro-evolution

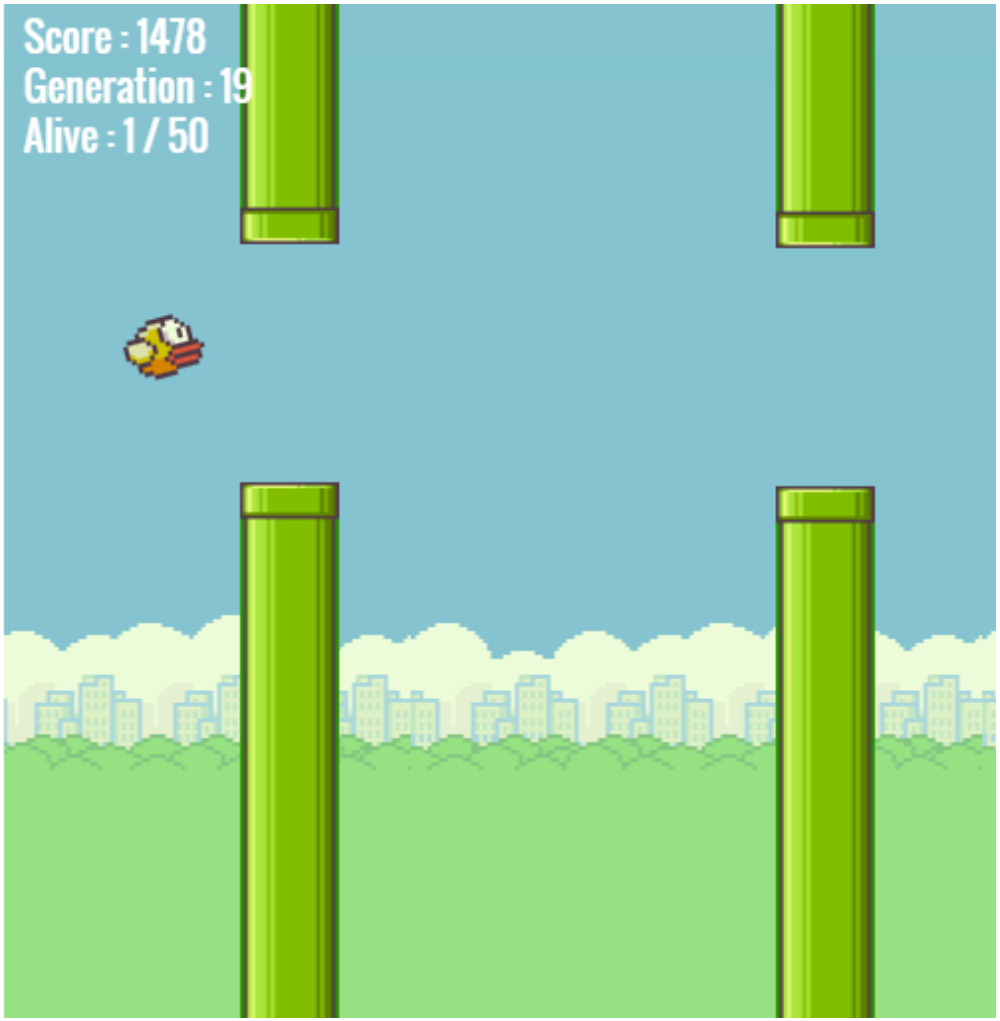
Neuroevolution

https://www.youtube.com/watch?v=qv6UVOQ0F44



Flappy Learning

https://github.com/xviniette/FlappyLearning



Tarea 3

Tarea 3

For tarea 3, you need to pick one of the topics proposed next

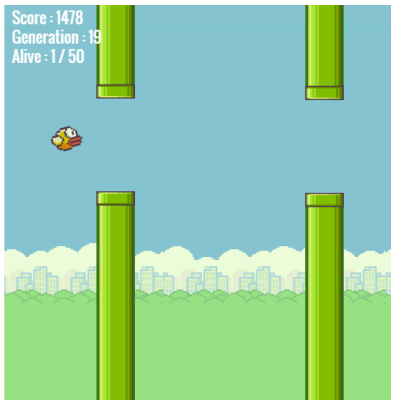
You can also propose your own topic

Similarly than Tarea 1 & 2, your code need to be accompanied with a short summary

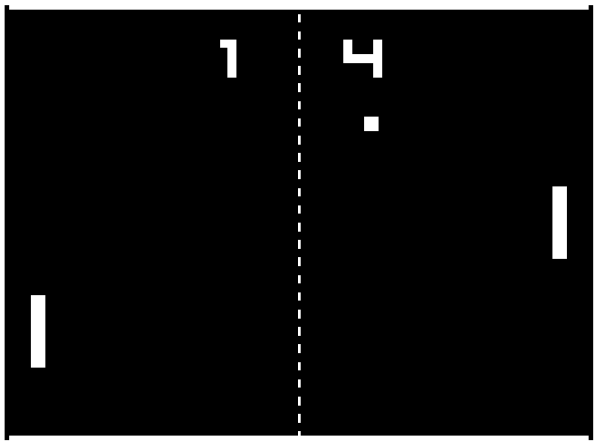
Games

Implement one the following games (involve neuroevolution)

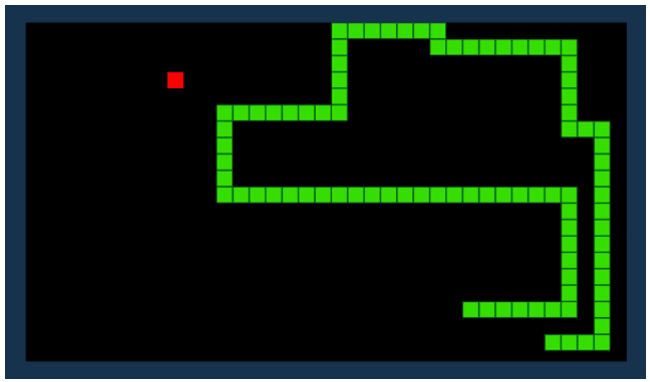
Flappy bird



Pong



Snake



Genetic Programming

We have seen that genetic algorithm handles the genetic information as an ordered collection

Genetic Programming creates Abstract Syntax Tree

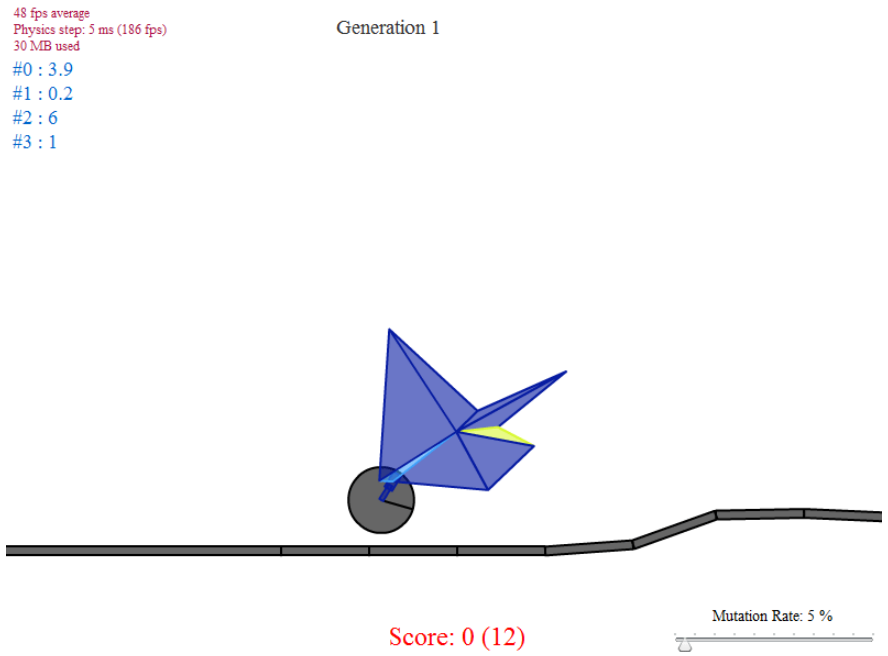
Genetic operations manipulate trees and subtrees

The genetic information is therefore a small program that can be executed

Making a random car drive a road

Application of Genetic algorithm

http://boxcar2d.com/about.html

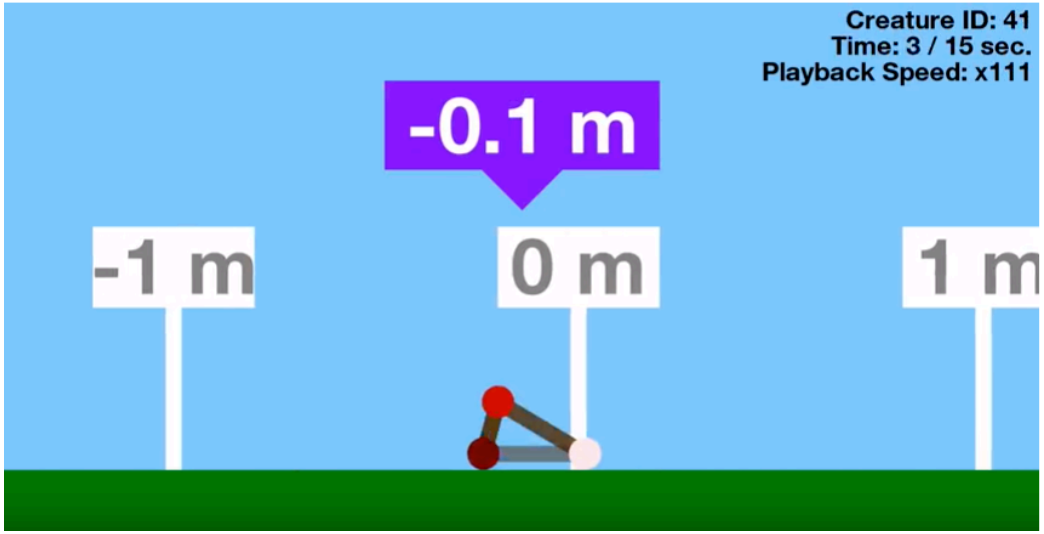


Join segmented Line creatures

Application of Genetic algorithm

https://www.youtube.com/watch?v=GOFws_hhZs8

https://www.openprocessing.org/sketch/377698



Evolving Virtual Creatures With Genetic Algorithms

https://www.youtube.com/watch?v=bBt0imn77Zg

Flexible Muscle-Based Locomotion for Bipedal Creatures

https://www.youtube.com/watch?v=pgaEE27nsQw