



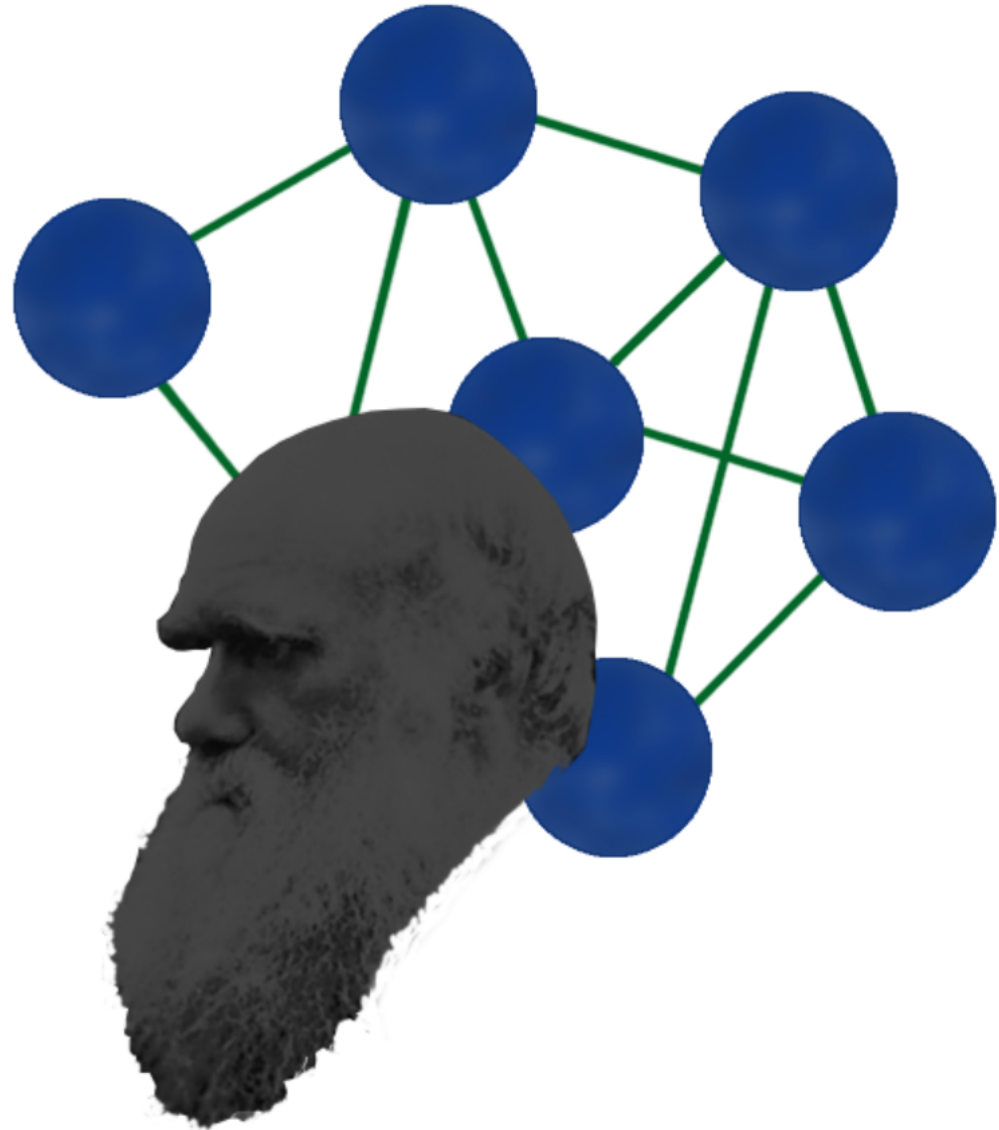
PHUSE EU Connect 2020

Charles Darwin goes AI – Evolving neural networks



Dominik Habel

PHUSE Paper ML04 / November 2020





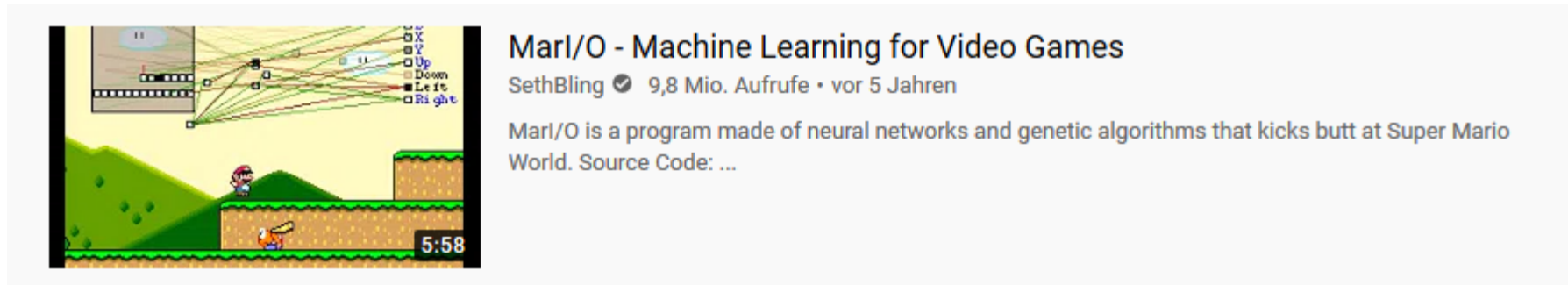
Agenda

- // **Motivation**
- // **Learning through Evolution**
- // **Evolution of Neural Networks**
- // **Conclusion**



Motivation

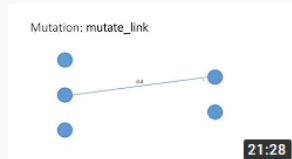
Motivation



NEAT

NeuroEvolution of Augmented Topologies

Motivation

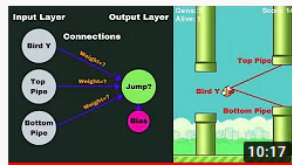


NEAT - Introduction

Finn Eggers • 36.600 Aufrufe • vor 2 Jahren

Please give me some feedback. Again, my mic quality is not amazing but I hope
Marl/O: ...

21:28

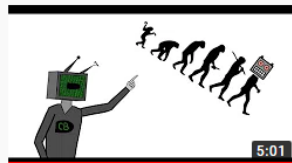


AI Teaches Itself to Play Flappy Bird - Using NEAT Python

Tech With Tim • 81.080 Aufrufe • vor 1 Jahr

Watch an genetic/evolutionary algorithm slowly progress and teach itself to fl
learns to play this game using ...

10:17



How Artificial intelligence learns | Genetic Algorithm explained

Code Bullet • 226.508 Aufrufe • vor 2 Jahren

Evolution has crafted the most intelligent beings on earth. In this video I explain
scientists simulate evolution to train ...

5:01

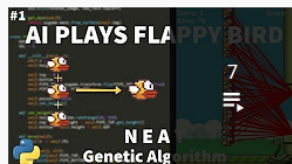


Python Flappy Bird AI Tutorial (with NEAT) - NEAT Configuration Explanation

Tech With Tim • 33.829 Aufrufe • vor 1 Jahr

Welcome to part 5 of the AI plays flappy bird tutorial series. In this video we dis
in depth and start talking ...

20:22



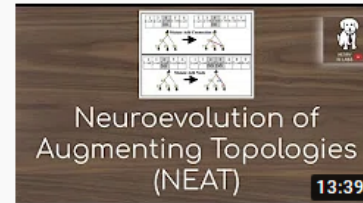
AI Plays Flappy Bird - NEAT Python

Tech With Tim •

Python Flappy Bird AI Tutorial (with NEAT) - Creating the Bird • 12:55

Python Flappy Bird AI Tutorial (with NEAT) - Moving Birds • 18:27

KOMPLETTE PLAYLIST ANSEHEN

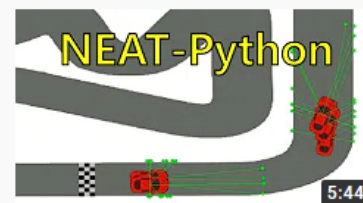


Neuroevolution of Augmenting Topologies (NEAT)

Henry AI Labs • 6803 Aufrufe • vor 11 Monaten

This video explains the NEAT algorithm! This algorithm (published in 2001) lays the g
evolution of neural ...

13:39

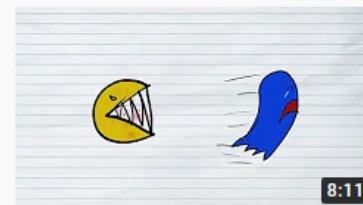


5:44

Simple AI Tutorial with NEAT-python

Cheesy AI • 3645 Aufrufe • vor 3 Monaten

Let's make a simple AI with NEAT-python. Github: <https://github.com/monokim/frame/tree/master/neat> NEAT: ...

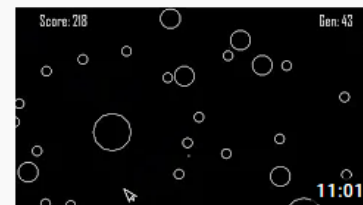


8:11

AI learns to play PACMAN using NEAT

Code Bullet • 2 Mio. Aufrufe • vor 2 Jahren

I trained an AI to play pacman, also voice reveal!!! Become a patron to support my fi
well as sneak peaks of whats ...



11:01

AI learns to Play Asteroids | part 2 NEAT is awesome

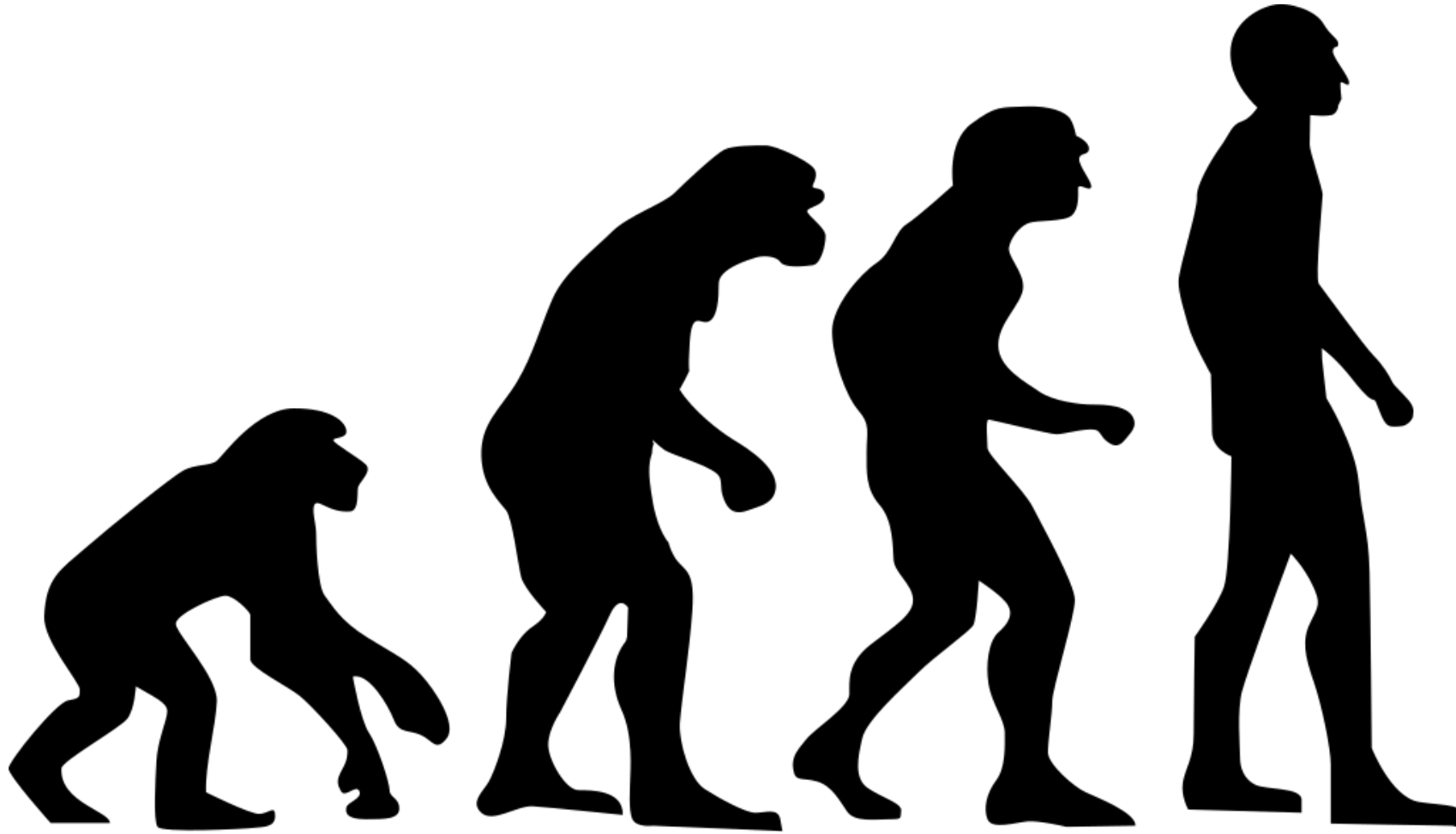
Code Bullet • 381.950 Aufrufe • vor 2 Jahren

I coded NEAT and attached it to my Asteroids and results are epic. Big thanks to Brill
supporting this channel check ...



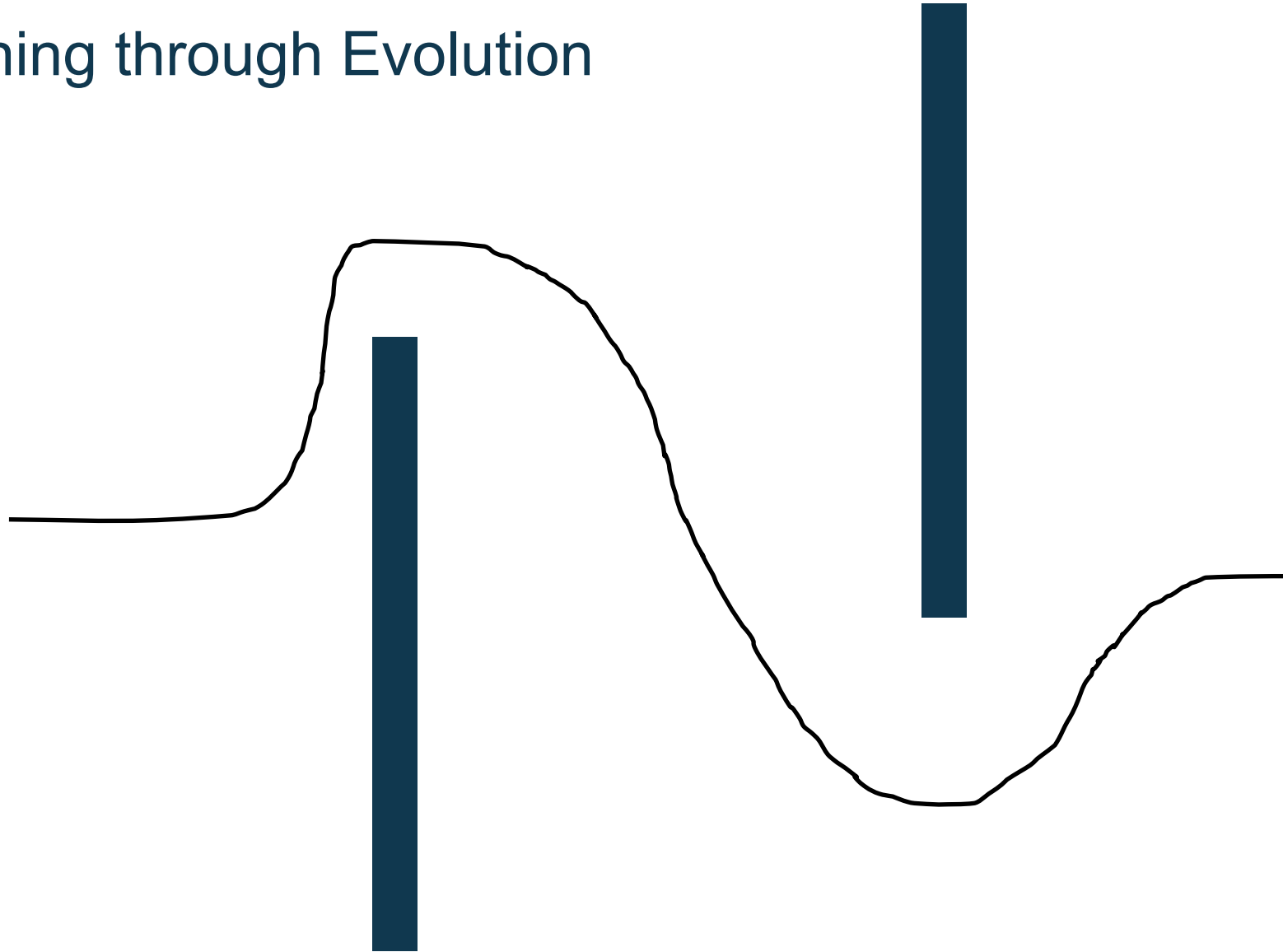
Learning through Evolution

Learning through Evolution

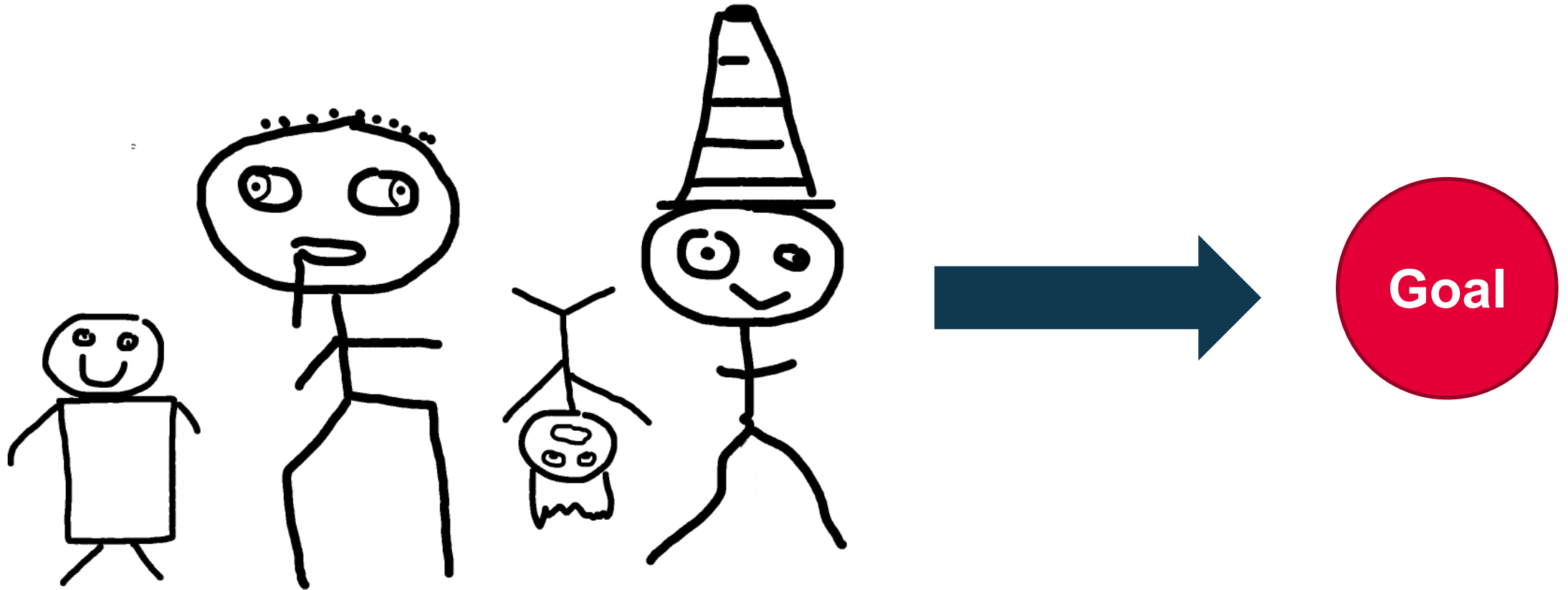




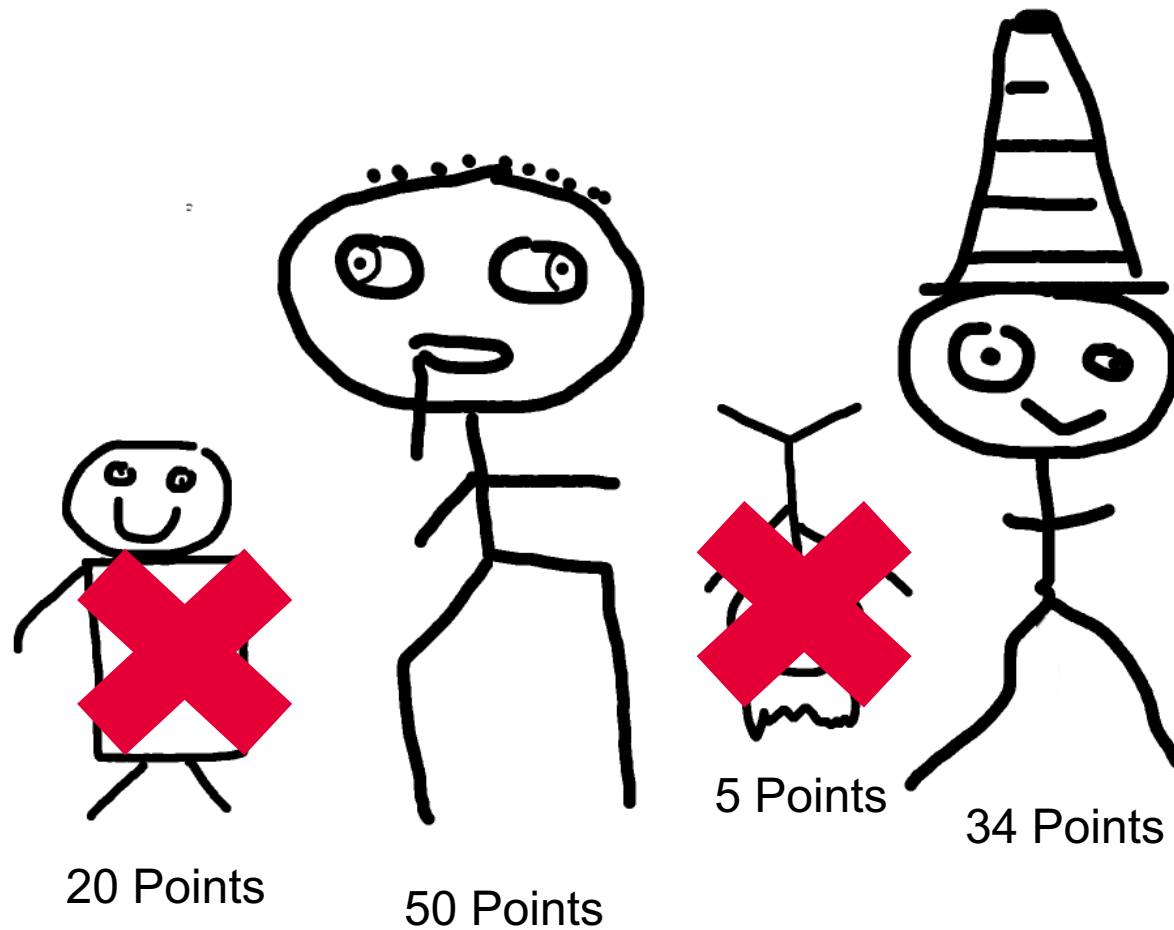
Learning through Evolution



Learning through Evolution

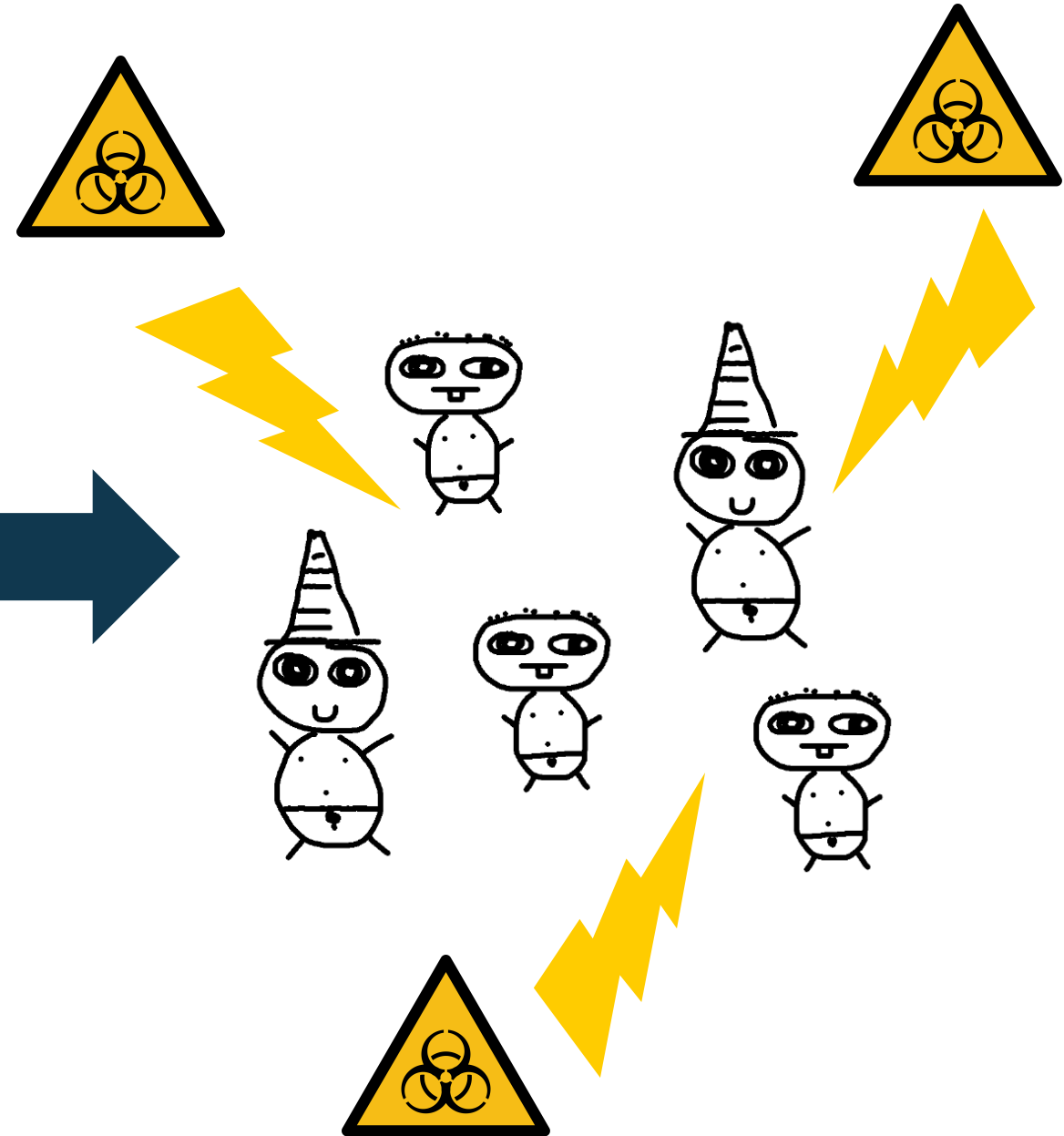
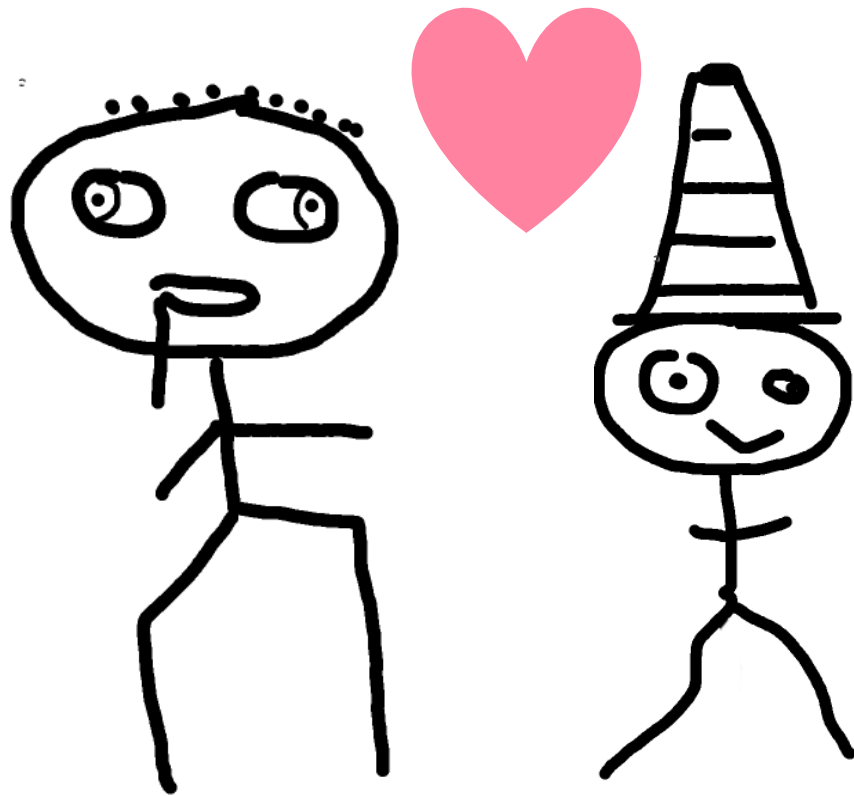


Learning through Evolution

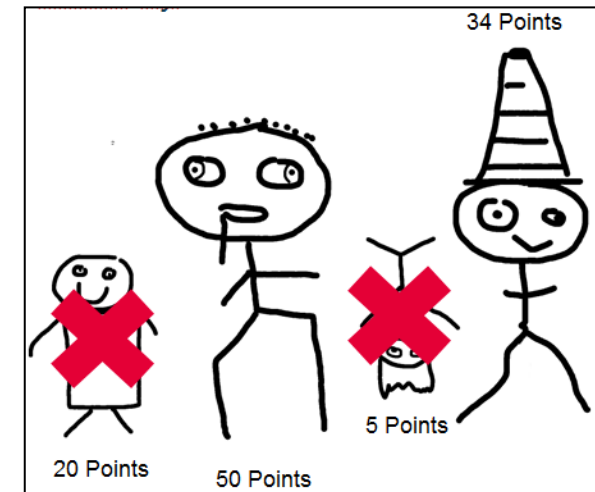
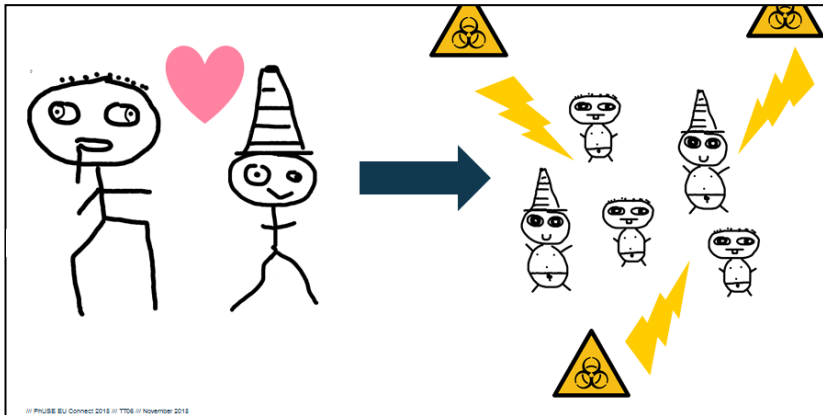
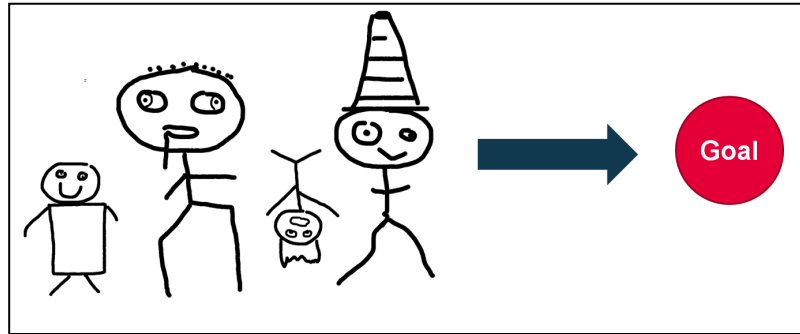
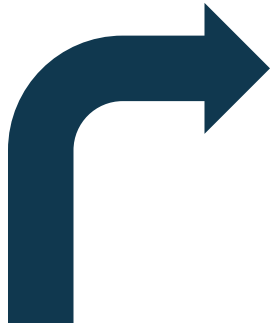


Evaluate the
FITNESS
&
Select the
BEST

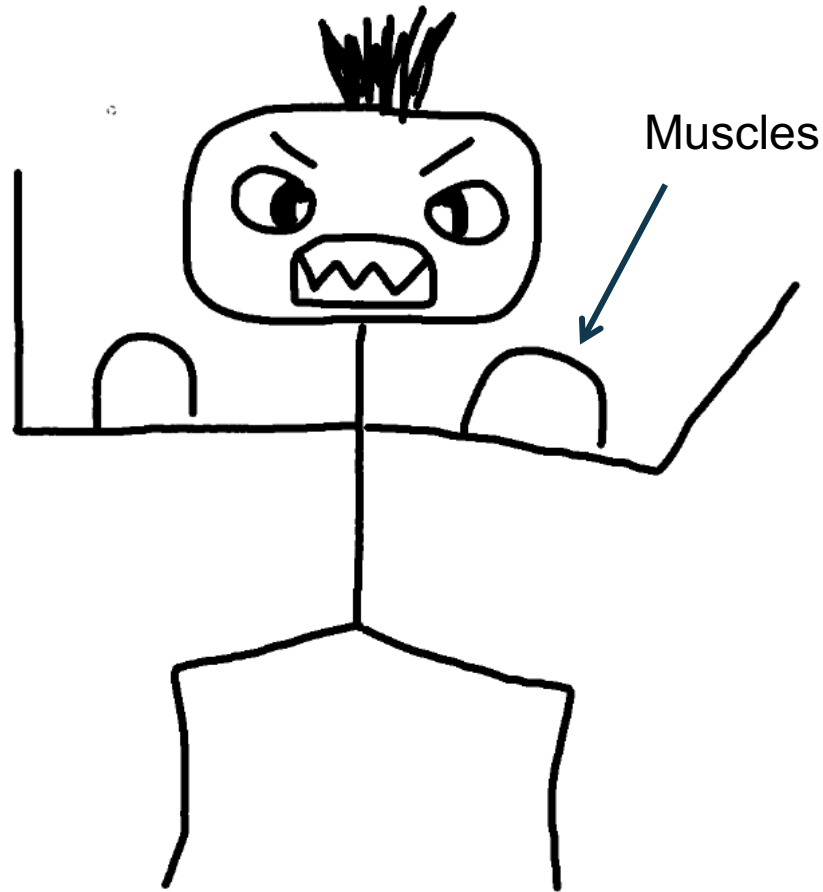
Learning through Evolution



Learning through Evolution

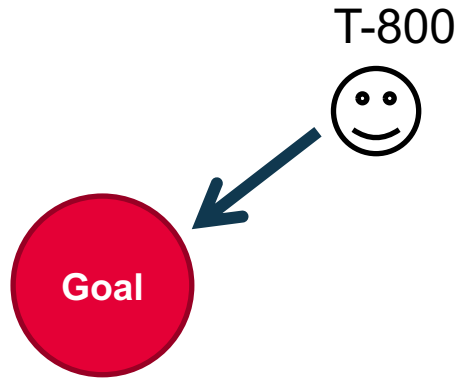


Learning through Evolution

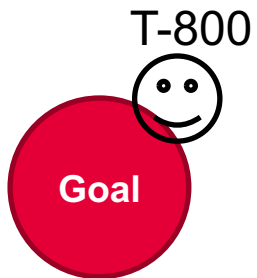


The
FITTEST
wins

Learning through Evolution



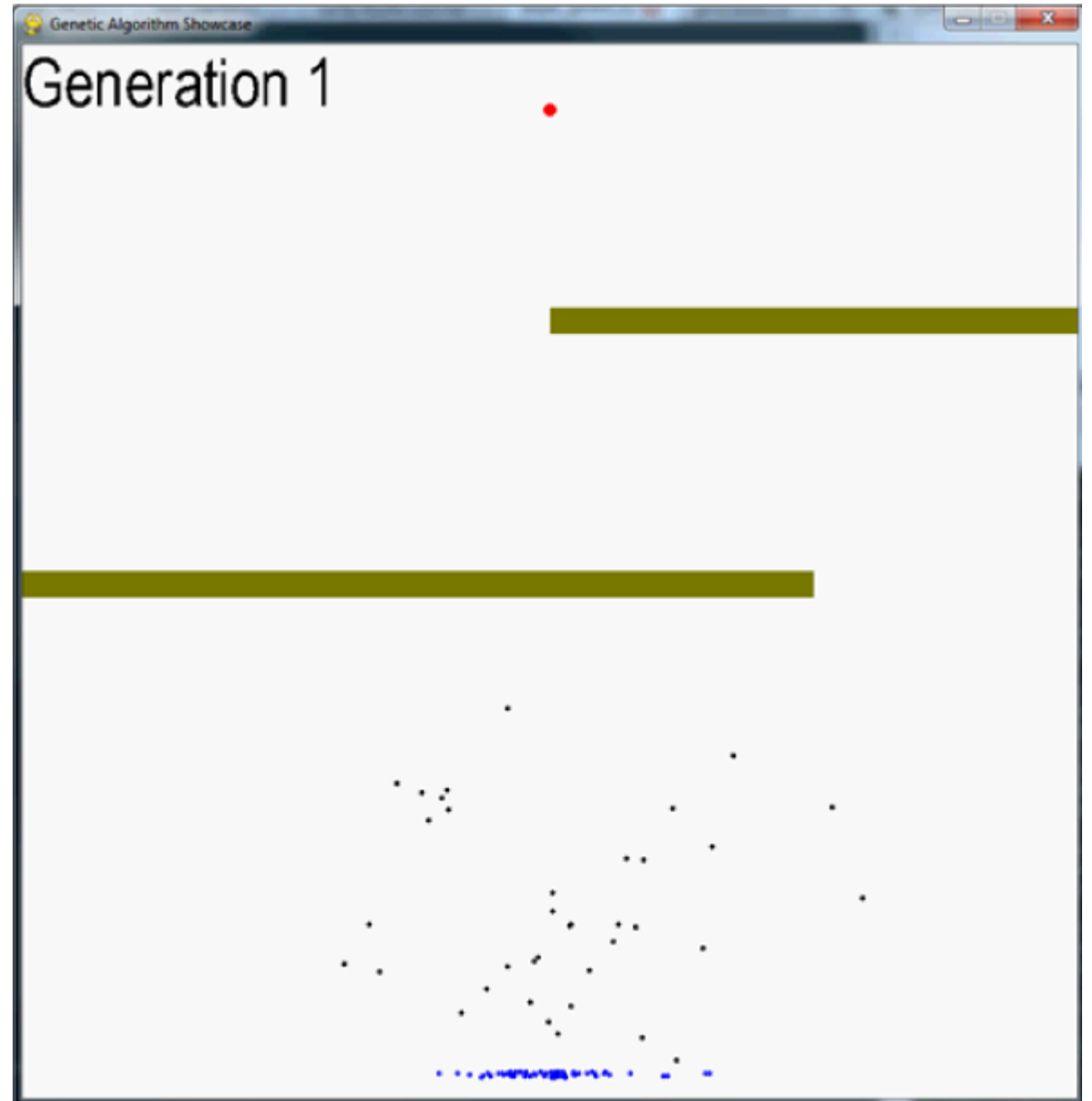
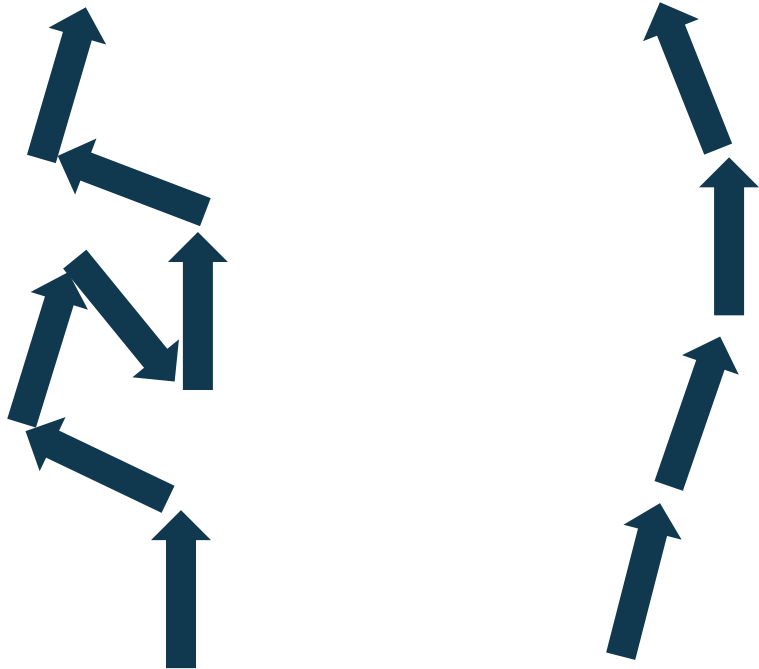
$$\text{FITNESS} = 1 / \text{DISTANCE} * \text{DISTANCE}$$



$$\text{FITNESS} = 10000 / \text{STEPS} * \text{STEPS}$$

Learning through Evolution

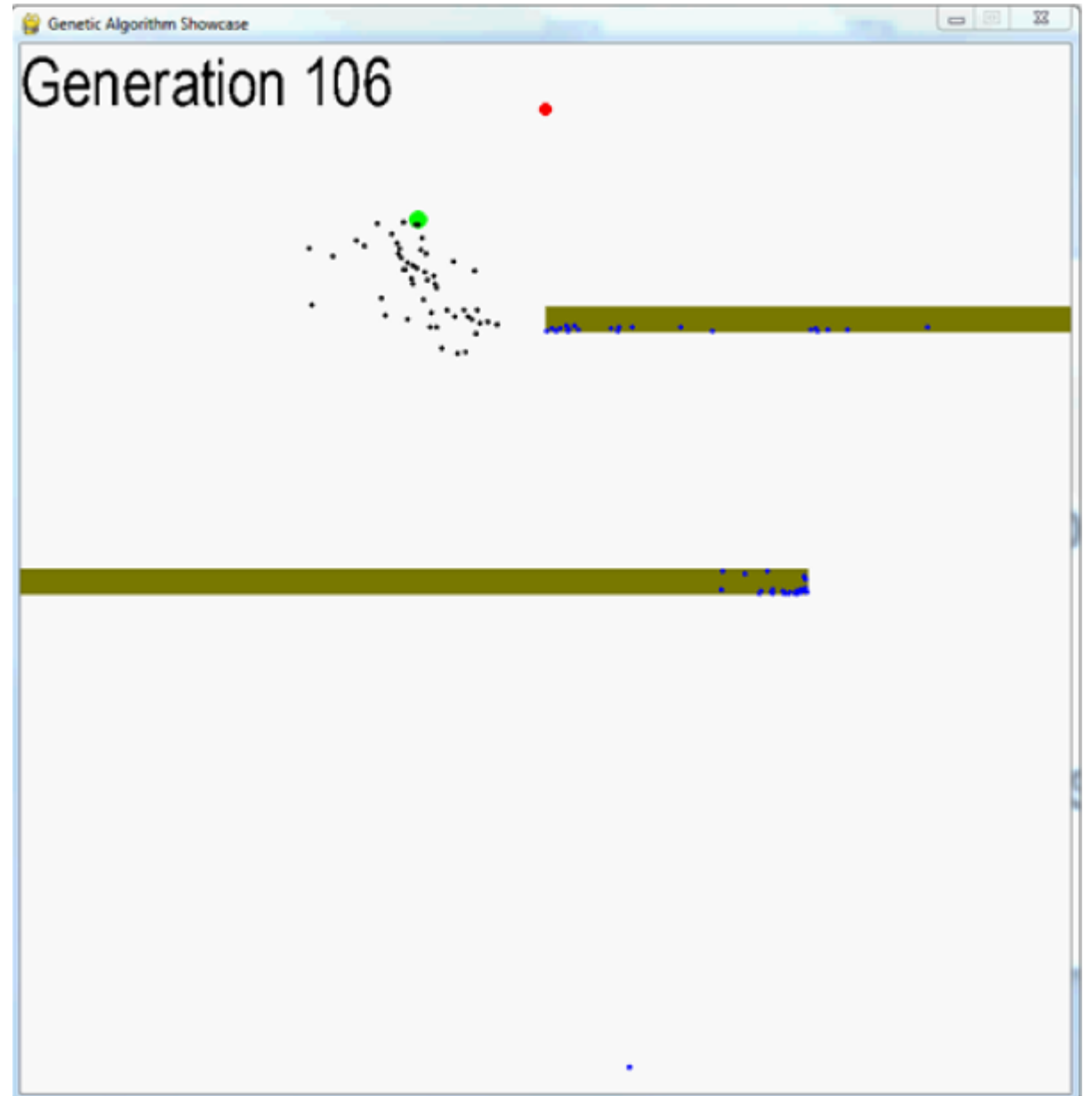
- Dots have set of random directions





Learning through Evolution

- Best of previous generation is marked green

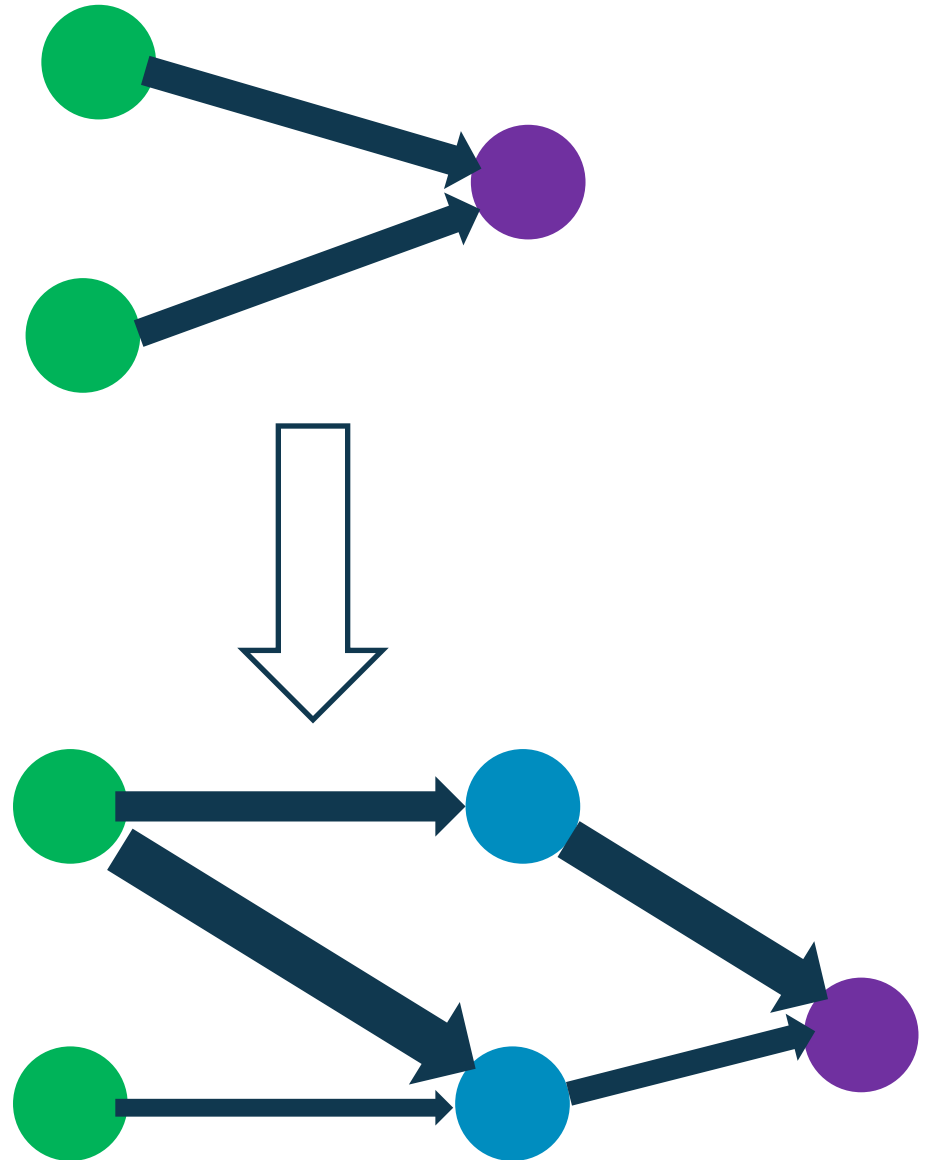
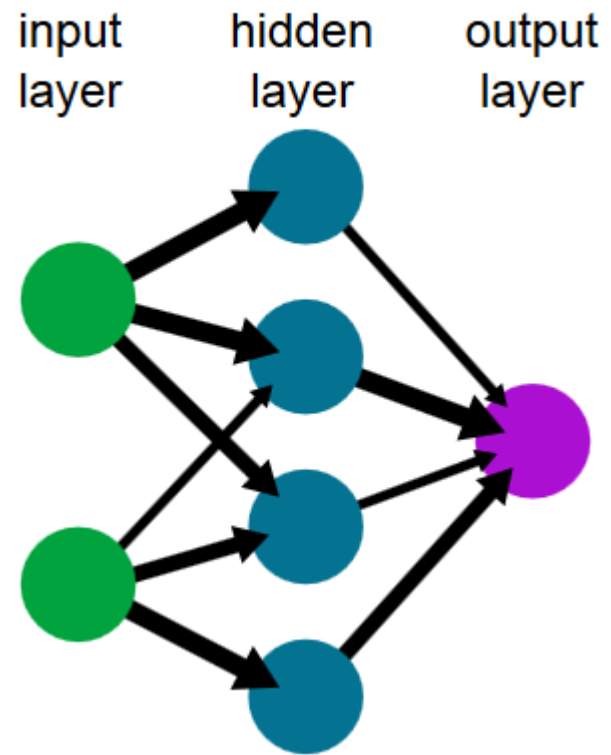


Evolution of Neural Networks

Evolution of Neural Networks

Starting minimally

A simple neural network



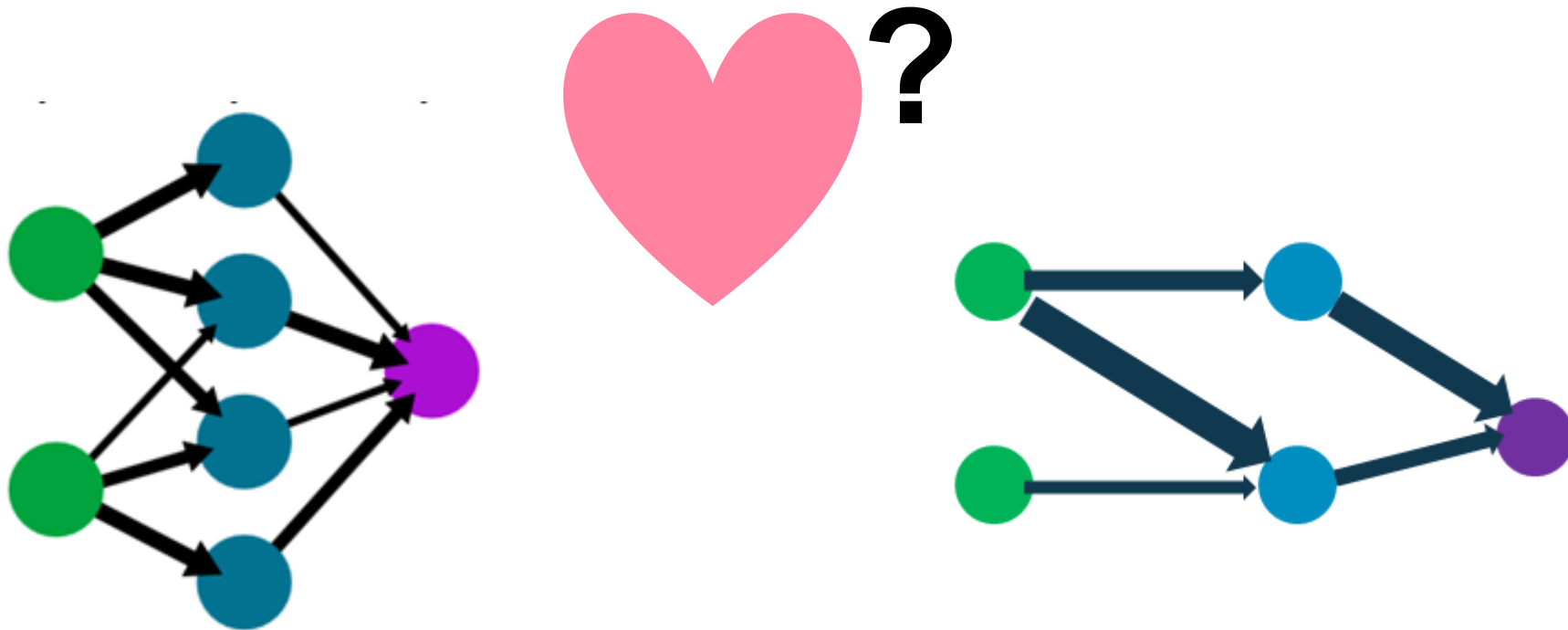
Evolution of Neural Networks

Speciation



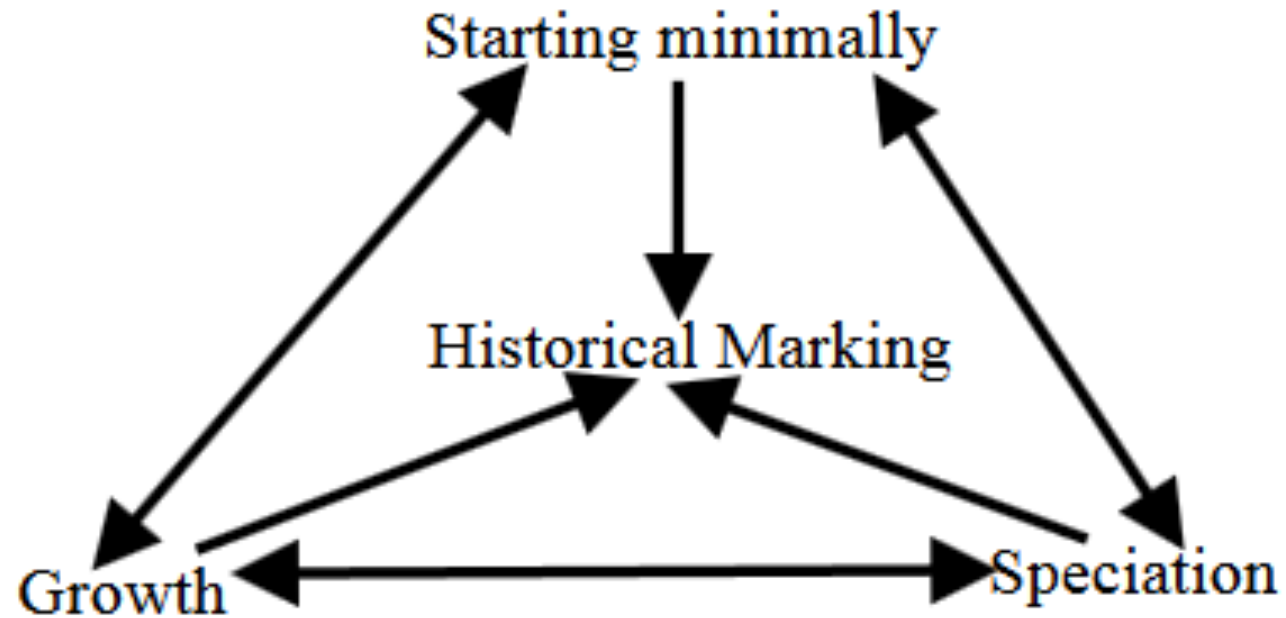
Evolution of Neural Networks

Crossover



Evolution of Neural Networks

Interaction between components





Showcase



Conclusion



Conclusion

- NEAT Paper was released in 2002
 - still a powerful algorithm
- certain developments have been made
 - see HyperNEAT, ES-HyperNEAT, DeepNEAT
- Potential is seen in combining NEAT with principles in **Supervised Learning** like Backpropagation



Resources

Stanley & Miikkulainen: <http://nn.cs.utexas.edu/downloads/papers/stanley.ec02.pdf>

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

NEAT-Python: <https://neat-python.readthedocs.io/en/latest/>

Labyrinth Solving: <https://vbstudio.hu/en/blog/20190317-Growing-an-AI-with-NEAT>

Fundamental Concepts of Neuroevolution: <https://towardsdatascience.com/a-primer-on-the-fundamental-concepts-of-neuroevolution-9068f532f7f7>



Thank you!

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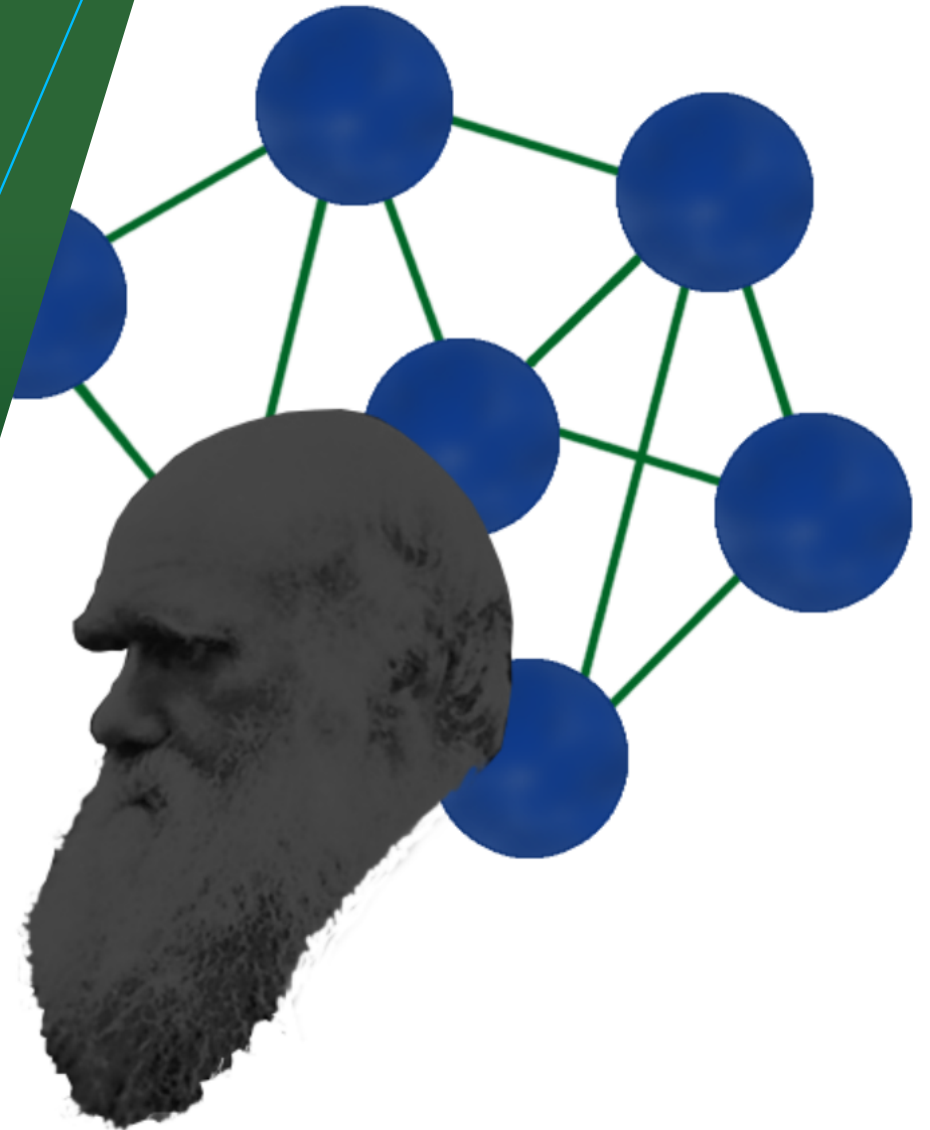
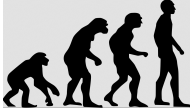
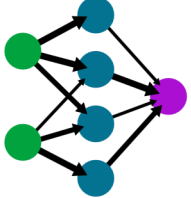


Image Attributions

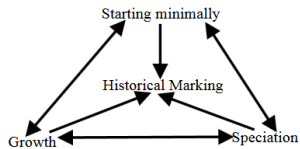


https://upload.wikimedia.org/wikipedia/commons/thumb/6/69/Human_evolution.svg/1024px-Human_evolution.svg.png

A simple neural network
input layer hidden layer output layer



https://upload.wikimedia.org/wikipedia/commons/9/99/Neural_network_example.svg



<http://nn.cs.utexas.edu/downloads/papers/stanley.ec02.pdf>



<https://upload.wikimedia.org/wikipedia/commons/thumb/f/f7/Biohazard.svg/686px-Biohazard.svg.png>

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