

# CartPole-v1 by Genetic Alg.

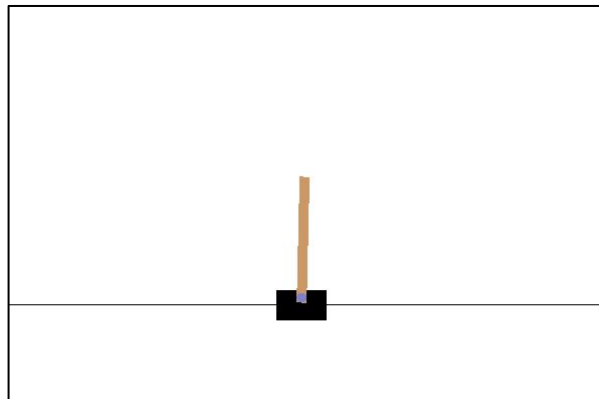
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Group: “Me, Myself, and Zack”

# Environment

- Pole is attached by an un-actuated joint to a cart, which moves along a frictionless track
- Controlled by applying a force of +1 or -1 to the cart
- Pendulum starts upright, and the goal is to prevent it from falling over
- Reward of +1 is provided for every timestep that the pole remains upright
- Episode ends when the pole is more than 15 degrees from vertical, or the cart moves more than 2.4 units from the center



# Libraries

1. OpenAI Gym
2. NumPy
3. Python Std Lib
  - a. Random
  - b. Math
  - c. Bisect

# Solution(s)

## 1. Genetic Algorithm

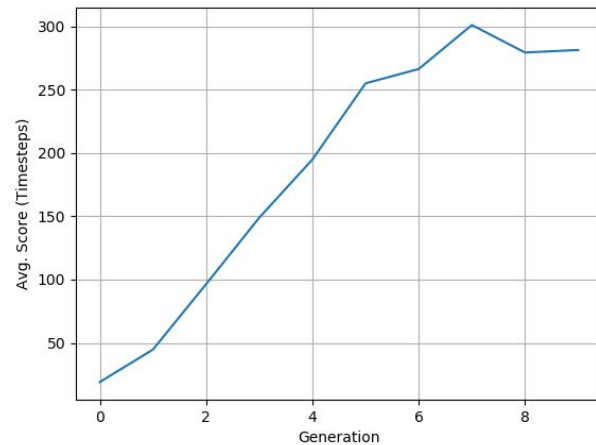
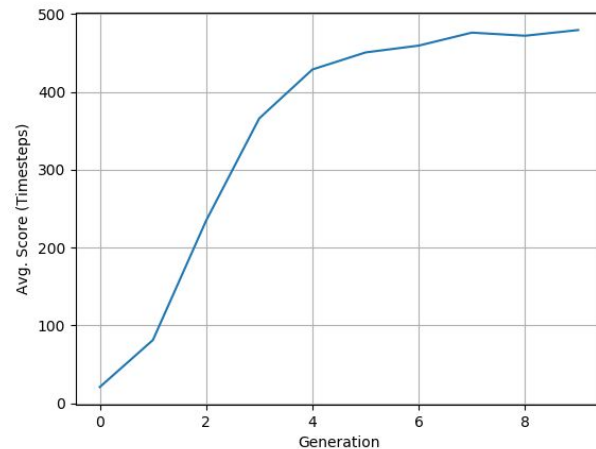
- a. Generate random population
  - i. Each child has a set number of actions
- b. Test each node in population
  - i. Record fitness value
- c. Generate new population from previous
- d. Repeat for each generation

# Solution(s)

2. Neural Network
  - a. Lots of research
  - b.

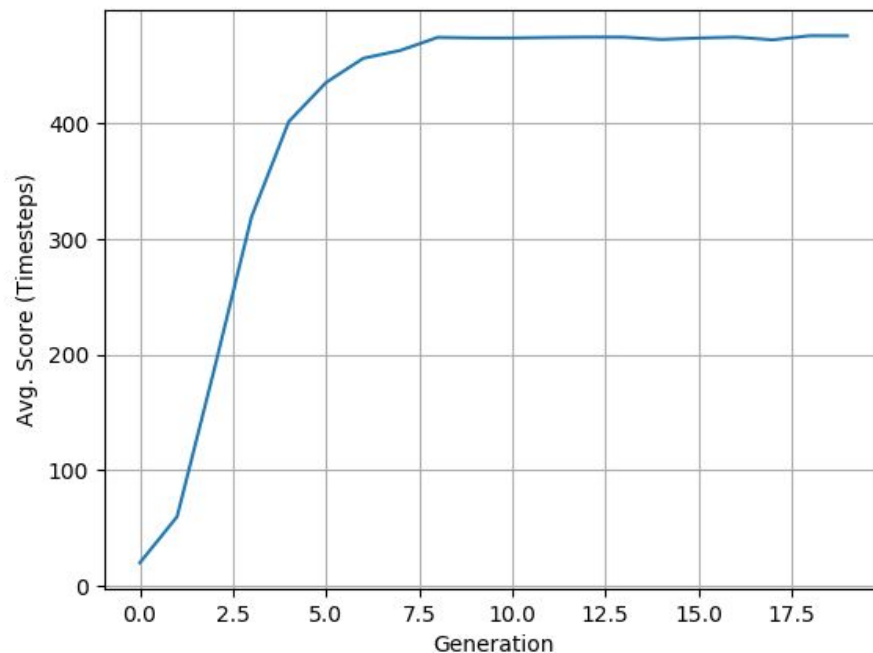
# Demonstration 1

- GENERATIONS = 10
- MAX\_STEPS = 500
- POPULATION\_COUNT = 200
- MUTATION\_RATE = 0.01



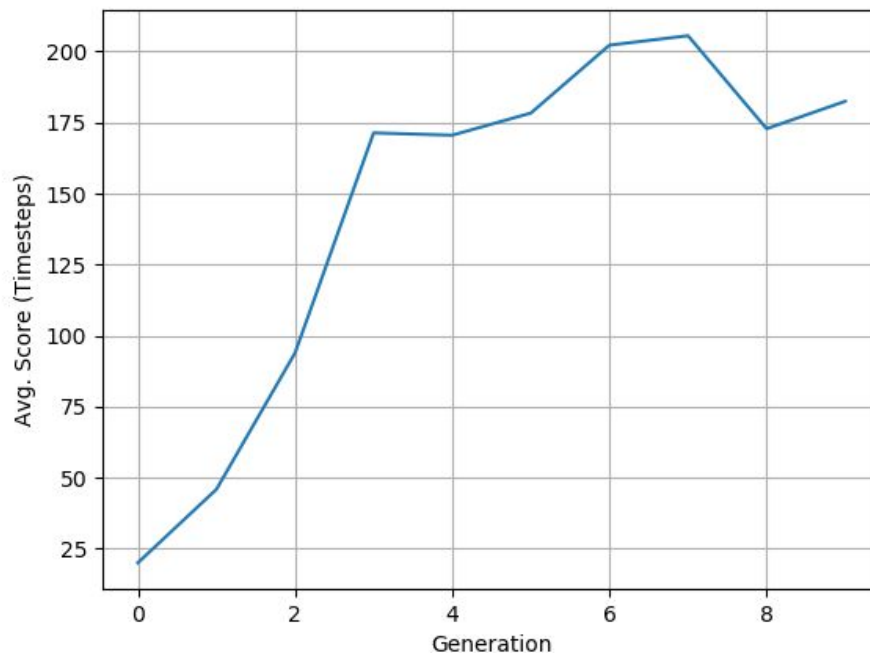
# Demonstration 2

- GENERATIONS = 100
- MAX\_STEPS = 500
- POPULATION\_COUNT = 2000
- MUTATION\_RATE = 0.01



# Demonstration 3

- GENERATIONS = 10
- MAX\_STEPS = 500
- POPULATION\_COUNT = 200
- MUTATION\_RATE = 0.20





# Future Goals / Changes

- Better understanding of Neural Networks
- Make use of Keras, PyTorch, etc.

# Works Cited

- A Quick Introduction to Neural Networks
  - <https://ujjwalkarn.me/2016/08/09/quick-intro-neural-networks/>
- Evolve a Neural Network with a Genetic Algorithm by Matt Harvey
  - <https://blog.coast.ai/lets-evolve-a-neural-network-with-a-genetic-algorithm-code-included-8809bece164>
- Genetic Algorithms + Neural Networks by Suryansh S.
  - <https://towardsdatascience.com/gas-and-nns-6a41f1e8146d>