CartPole by Genetic Alg.

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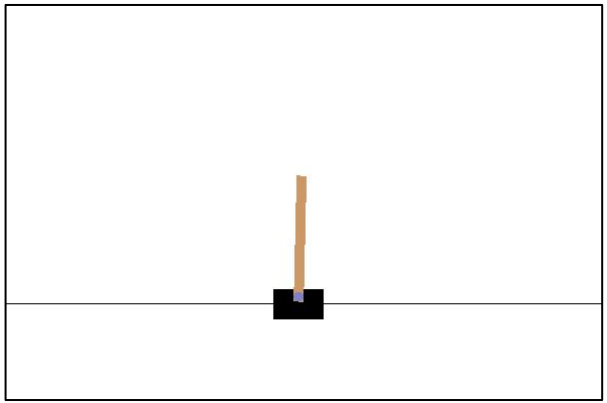
Environment

- 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

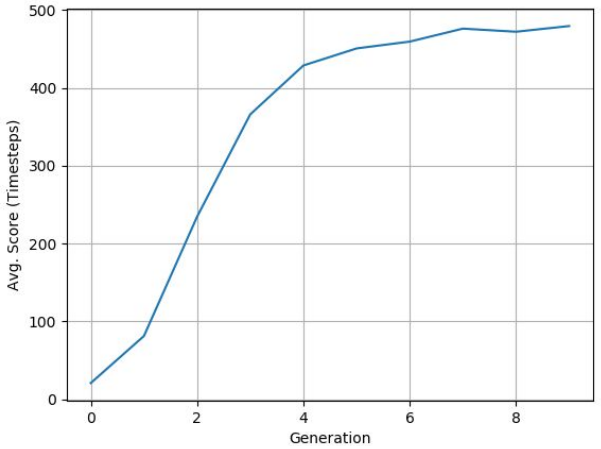
1. OpenAI Gym
2. NumPy
3. Python Std Lib
    a. Random
    b. Math
    c. Bisect

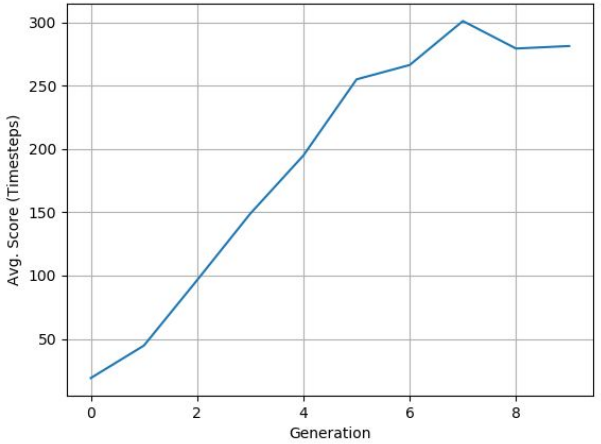
Solution(s)

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
2. Neural Network
    a. Used for choosing next actions
    b. Based upon other solutions

Demonstration 1

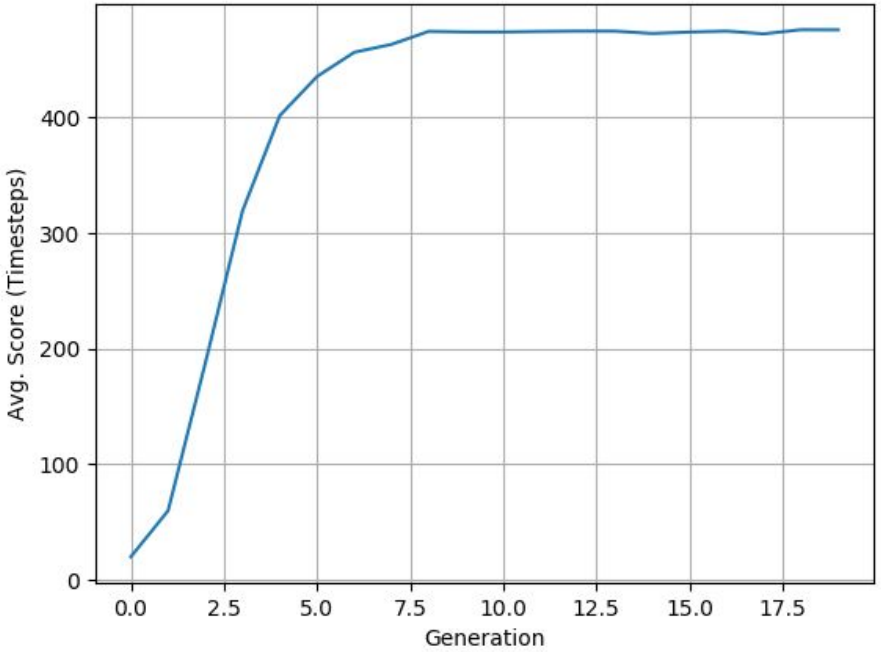
- GENERATIONS = 10
- MAX_STEPS = 500
- POPULATION_COUNT = 200
- MUTATION_RATE = 0.01





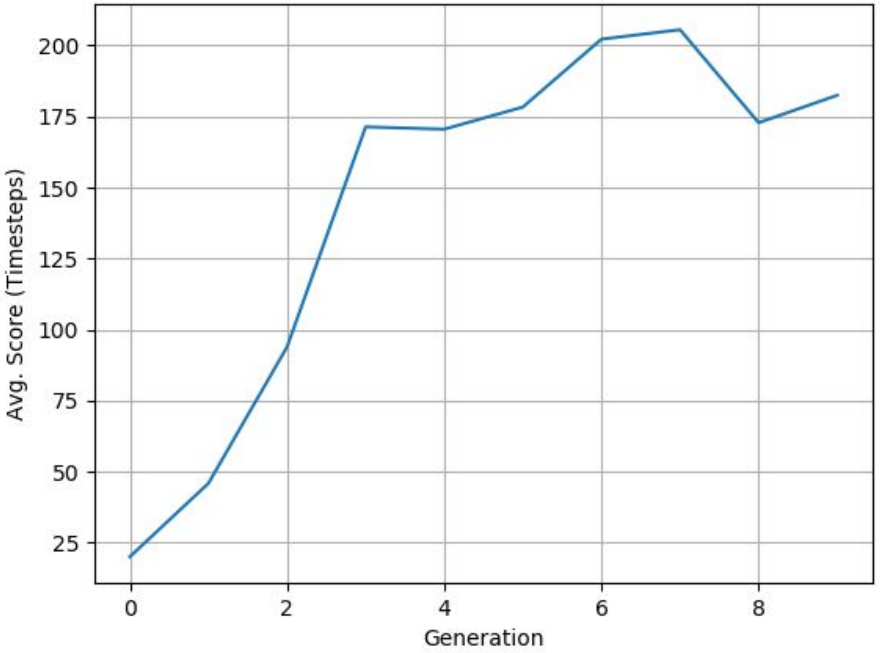
Demonstration 2

- 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