

Rogues Gallery – OpenAI Gym Team (Spring 2023)

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Introduction & Goals

Introduction

The Neuromorphic Team specializes in neuromorphic, also known as brain-inspired, computing applications.

Semester Goals

- Develop and compare neuromorphic and non-neuromorphic approaches to classic control problems in the Open AI Gym Environment.
- Introduce new members to neuromorphic tools and concepts.

Key Concepts & Results

OpenAI Gym

Exploring scenarios/problems in which neuromorphic algorithms are preferable solutions over traditional approaches.

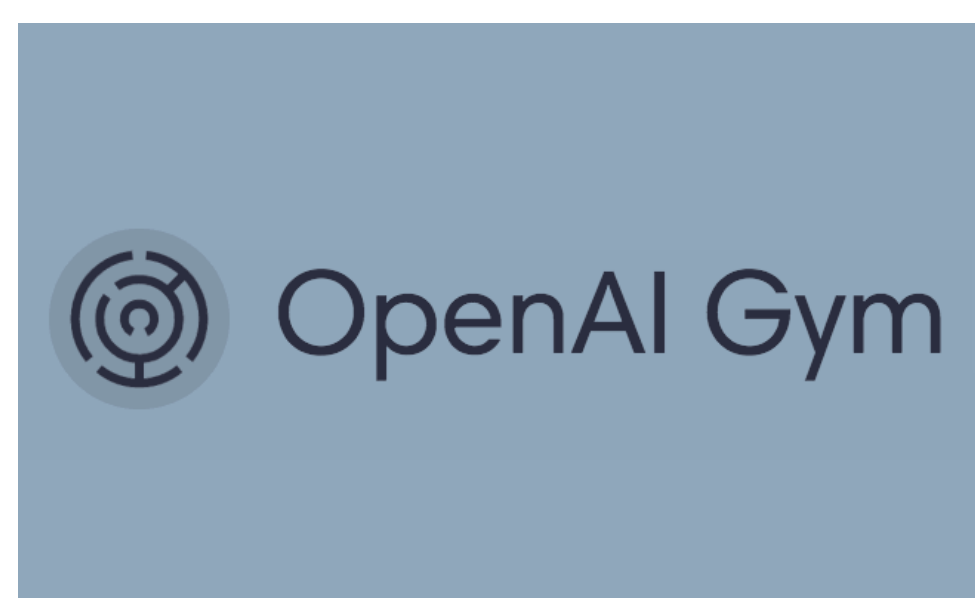
Nengo

- Python package that supports the creation of neuromorphic algorithms
- Allows for the construction of brain-mimicking neural networks



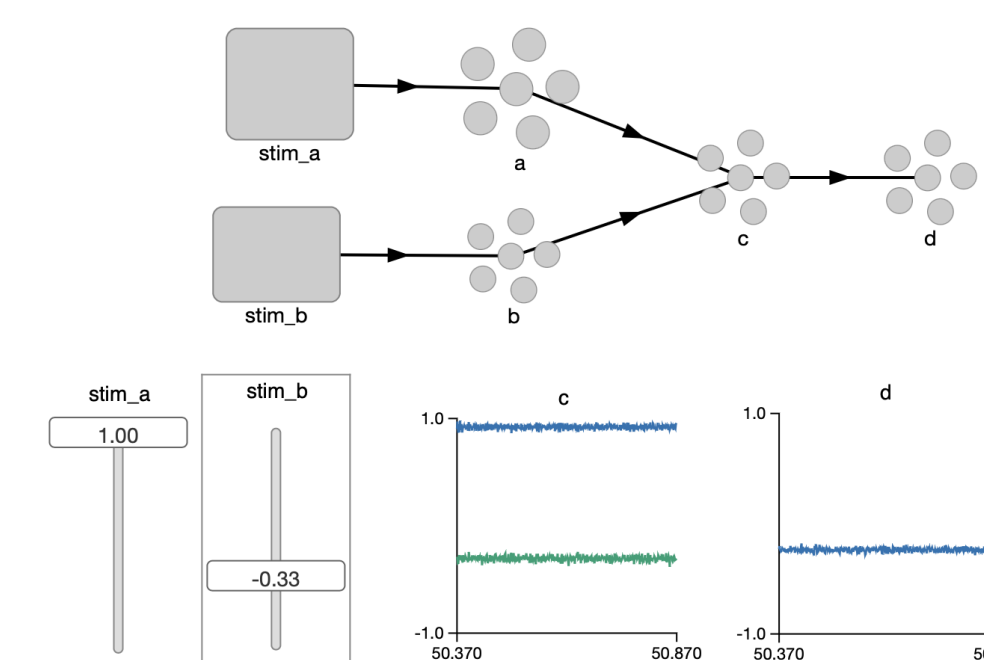
OpenAI Gym

- Open source Python API containing a collection of environments to run learning agents on
- Offers discrete and continuous action simulations of control problems, MDPs, and more



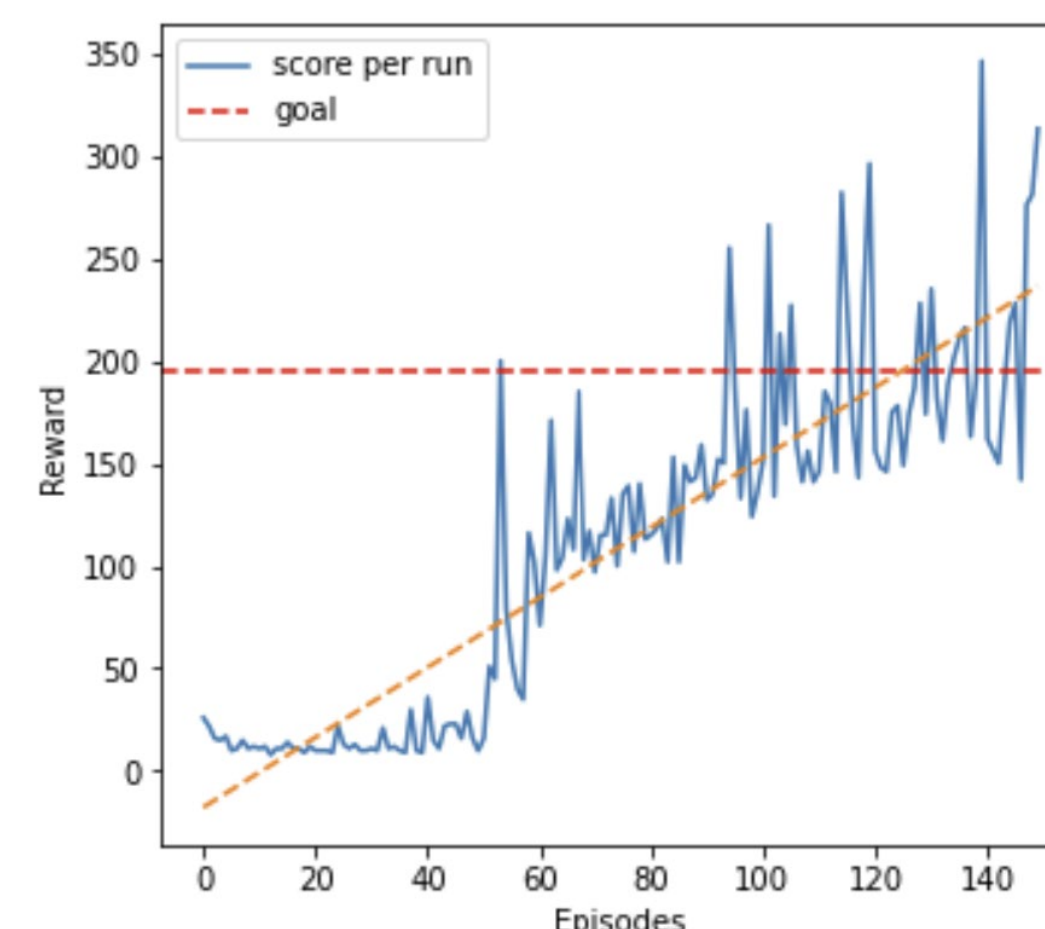
Nengo GUI

- Visualizer for Nengo networks
- Allows users to modify and tweak stimuli to change inputs
- Documented tutorials and notes for future use and onboarding

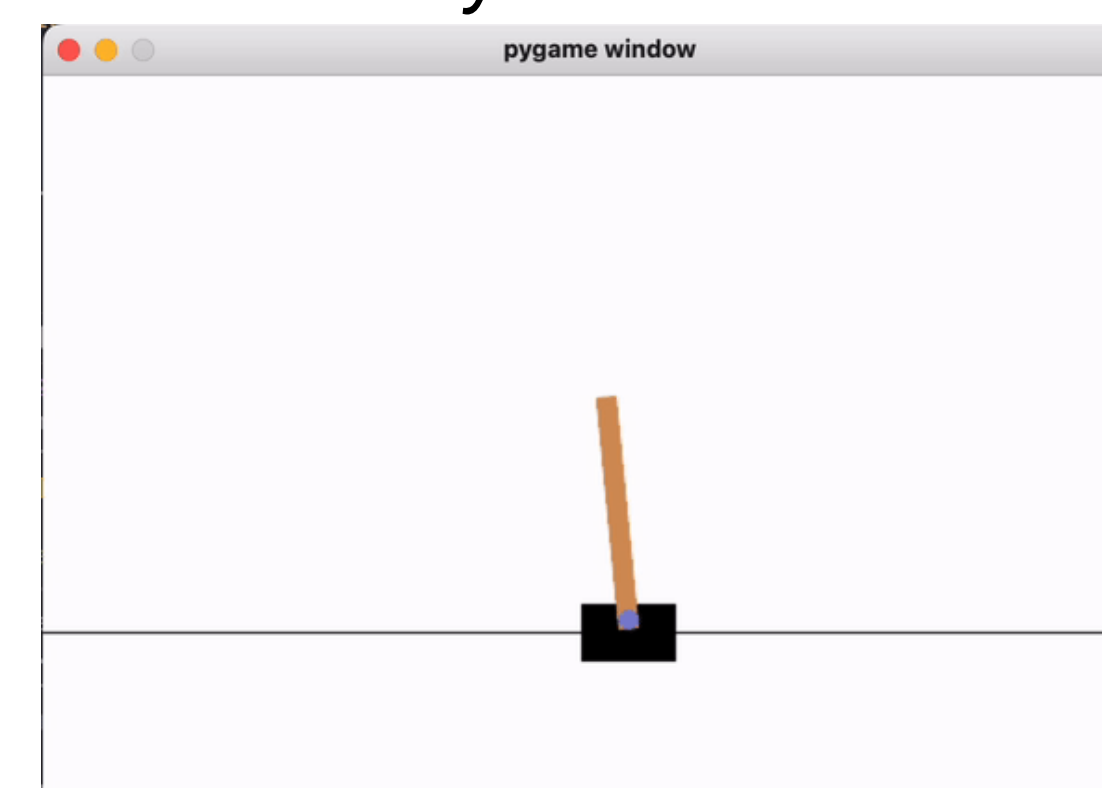


Cart Pole

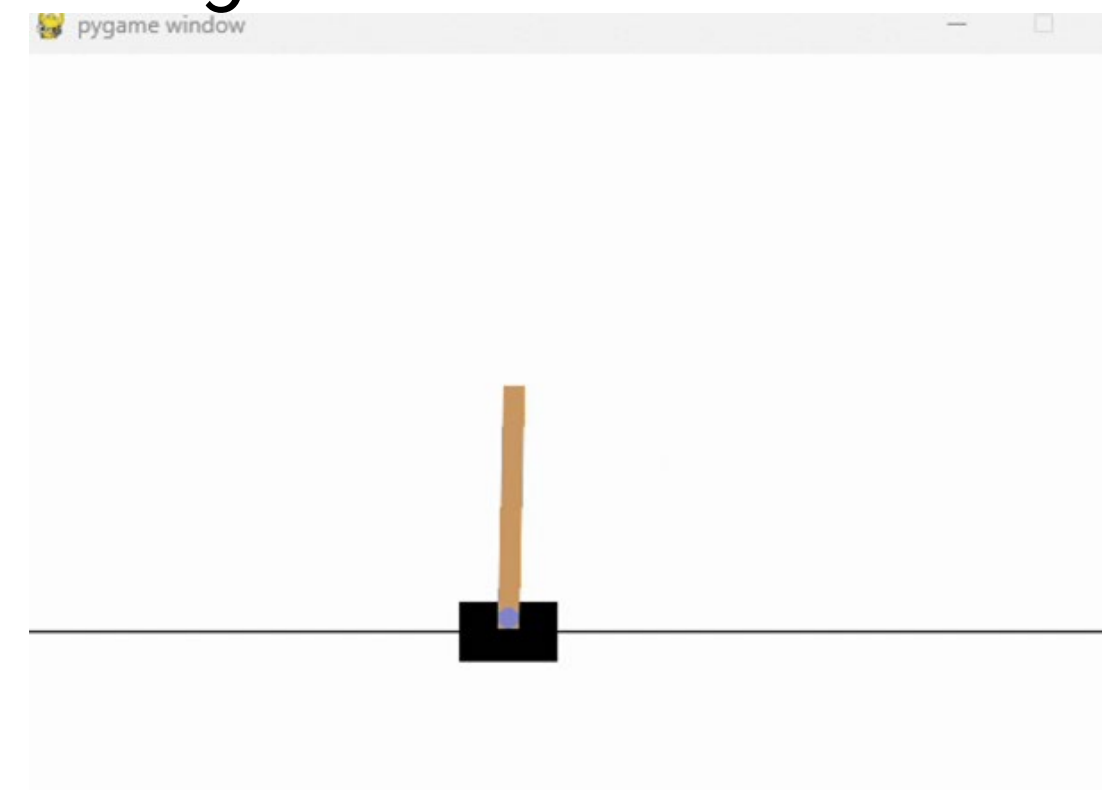
- Tested agents using traditional Q learning and DQL
- Developing neuromorphic implementation using Nengo



Theta Policy



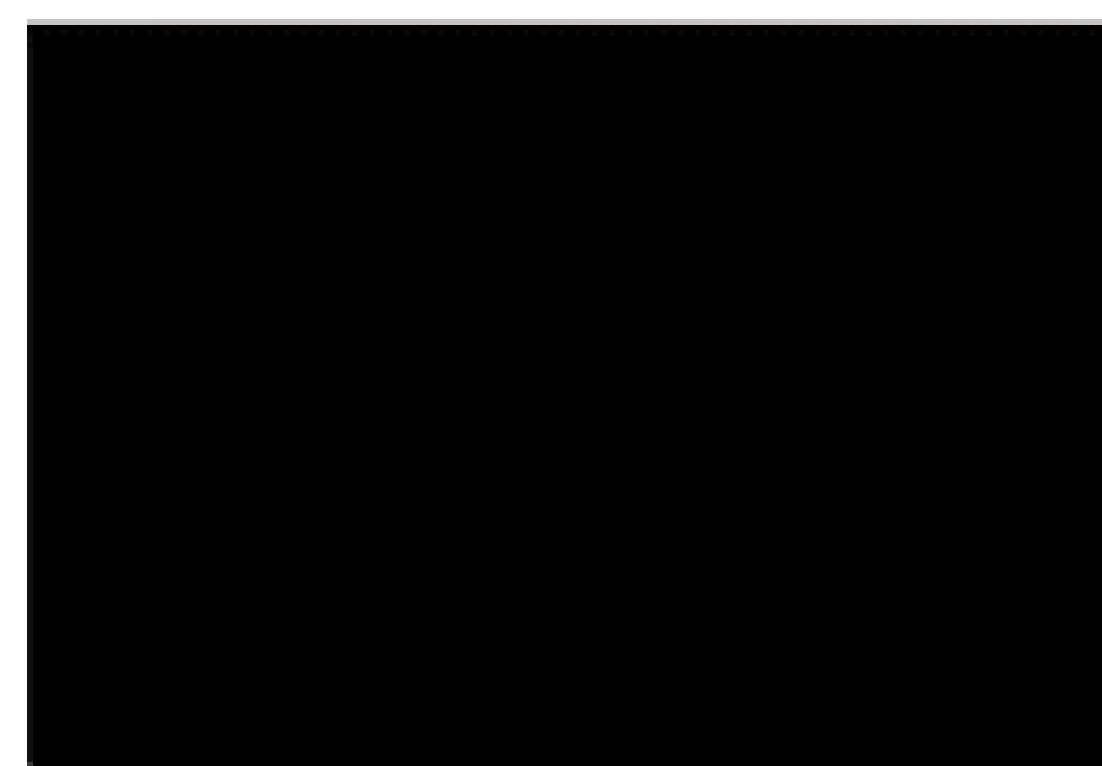
Nengo Network



Mountain Car

- Deterministic MDP with actions to accelerate car in either direction to reach the top of the goal state
- Developed functioning Q Learning simulation
- Collisions and transition dynamics make reward optimization crucial

Q Learning



Challenges & Next Steps

Challenges

- The documentation on Nengo and past Nengo projects is sparse. The general learning curve is very steep.
- Developing heuristics for each problem that the model can train on.

Next Steps

- Develop a standardized method of comparing various reinforcement learning approaches
- Compare the results of the Q Learning and neuromorphic Cart Pole implementations
- Develop a standard Nengo model framework/process that can be used across multiple problems