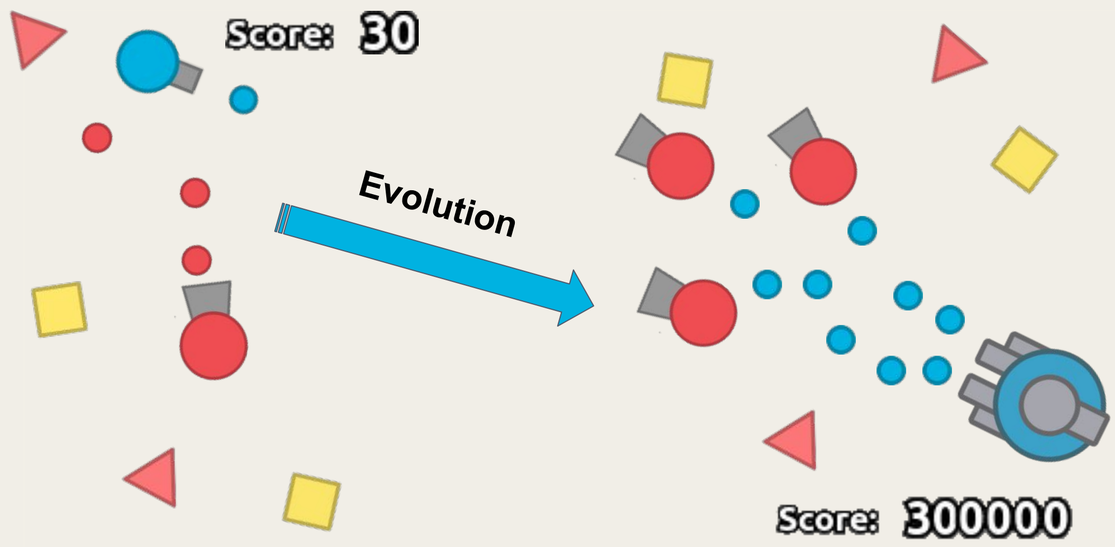
Application of CNN-LSTM to develop a bot for diep.io

Jay Ashworth, Andrew Mueller

Introduction/Motivation

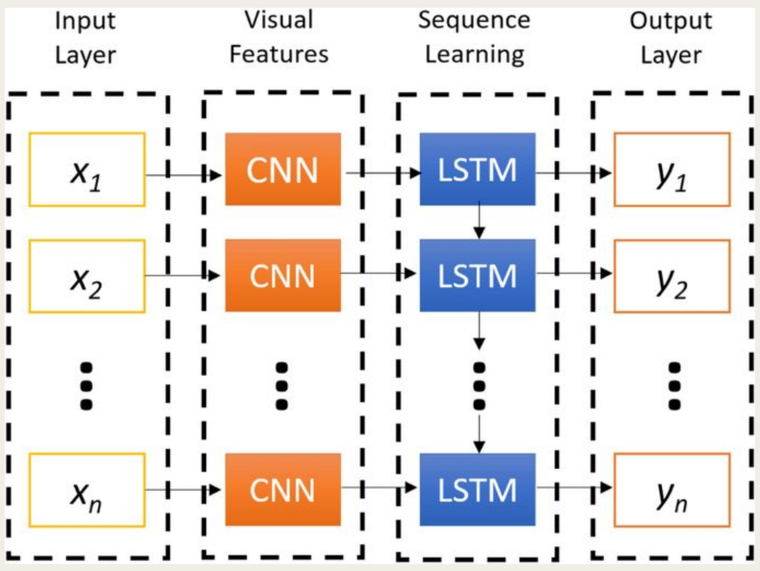
- Diep.io is a browser game focused around 2D tank warfare
- Given the game's distinct challenges, it presents an opportune platform for the application of bio-inspired computational concepts to create an unstoppable bot.
- Will be applying hybrid neural networks, and evolutionary algorithms



Methodology / Approach

Hybrid CNN-LSTM network

- Convolutional neural network, and long short-term memory network



- CNN allows for feature extraction, like game elements, and enemy tanks
- LSTM gives spatial, and time context for game elements, such as element positions over time.

DEAP EA

- Using a simple EA model, where the fitness function is as follows:

```python
def fitness_function(score, time_alive):
    # Normalize the score and time_alive by dividing by the maximum possible values
    normalized_score = score / 100000
    normalized_time_alive = time_alive / 36000

    # Assign weights to each component
    weight_score = 0.8
    weight_time_alive = 0.2

    # Calculate the fitness value
    fitness = weight_score * normalized_score + weight_time_alive * normalized_time_alive

    return fitness
```

- Score and time based
- Favors score over time
- Evaluated over three lives.

Learning

- Unsupervised learning will be used, as there is not much data to pre-train the models with, as well as giving this a unique approach.
- Live learning will be deployed as this is a live multiplayer game.
- The best population is based on three iterations of the game to account for luck as well as score/level carry over lives.

Challenges

- The presence of various bot countermeasures in diep.io presents a significant challenge for running the game effectively.
- Unsupervised training,requires a considerable amount of time, especially considering we must train in real time.
- Processing of images for the CNN-LSTM model consumes substantial computational resources, adding to the computational demands of the game.

THE UNIVERSITY OF TENNESSEE KNOXVILLE

[1] F´elix-Antoine Fortin, Franc¸ois-Michel De Rainville, Marc-Andr´e Gardner, Marc Parizeau and Christian Gagn´e, “DEAP: Evolutionary Algorithms Made Easy”, Journal of Machine Learning Research, pp. 2171-2175, no 13, jul 2012.

[2] TensorFlow Developers. (2023). TensorFlow (v2.13.0-rc0). Zenodo. https://doi.org/10.5281/zenodo.7916447