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Projects referenced: https://github.com/techwithtim/Pong-Python
https://nn.cs.utexas.edu/downloads/papers/stanley.gecco02_1.pdf
https://neat-python.readthedocs.io/en/latest/

Project V1

Directions to use: in terminal python3 tutorial.py, tutorial.py is the ai code to train and develop.

Project that teaches a neural net to play pong and train against other neural nets. Highly incorporates the neat algorithm to train multiple generations of neural nets against each other choosing the best one and at times using mutations. Just as natural selection removes the weaker population and breeds a better one through mutations and survival of the fittest, my implementation on a specific level does that. I start out doing 50 different generations for the sake of time and a reasonable ai because of the game inputs not being as complex. After every generation, I save them with pickles in python so it can be reverted back to a set generation.

Data analysis:

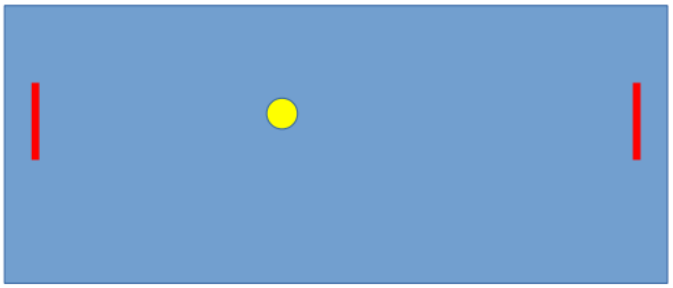
```
Hello from the pygame community. https://www.pygame.org/contribute.html

 ****** Running generation 0 ******

Population's average fitness: 3.74000 stdev: 3.35744
Best fitness: 13.00000 - size: (5, 21) - species 1 - id 10
Average adjusted fitness: 0.187
Mean genetic distance 2.468, standard deviation 0.447
Population of 50 members in 2 species:
   ID   age  size  fitness  adj fit  stag
  ====  ===  ====  =======  =======  ====
     1    0    41     13.0    0.296     0
     2    0     9      1.0    0.077     0
Total extinctions: 0
Generation time: 242.583 sec
Saving checkpoint to neat-checkpoint-0
```

Average fitness: Avg of how much each net hits the ball, higher fitness = better
Mean genetic distance: How different each neural network
ID: neural net one and two, Size: amount of neural nets trained, fitness = best one for each neural net, Stag: how long it's been stagnant for 0, since it's first generation

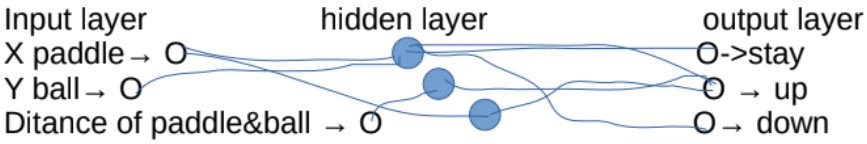
NEAT algorithm



What to feed neural network?

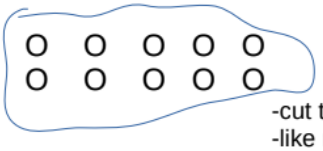
-Location of the paddle, y of paddle (x is constant)
-Location of the ball, y of ball
-Closing in the the top 2, so distance of paddle to ball

Neural network



NEAT:

-Starts with multiple neural networks.
EX: start with a population of 10 neural nets with different params



-grading each net (ball) by amount they hit the ball
-cut the neural nets with lowest score, bundle the best
-like natural selection and mutations

Improvements:

Maybe utilize cuda coders, gpu power to accelerate acceleration. Due to the training taking a long time

Change the config.txt and ai params to train the best ai, a lot of prams such as population size, score limiter.

Train multiple nets in parallel to converge more than 2 neural nets at once.