

REINFORCEMENT MAN VS. GHOSTMASTER

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THE SCENARIO



Two RL-agents compete

- Maze-like environment
- Fully observable, deterministic

States:

- Single game frames



The Wanderer

- Is faster than ghosts
- Anticipation needed

Rewards:

- ++reward for collecting coins
- -reward for not collecting coin
- --reward for being caught

Action space:

- [up, down, left, right]¹



The GhostMaster

- Ghosts are slower than Wanderer
- Coordination needed

Rewards:

- ++reward for catching Wanderer
- -reward for not catching Wanderer

Action space:

- [up, down, left, right]⁴

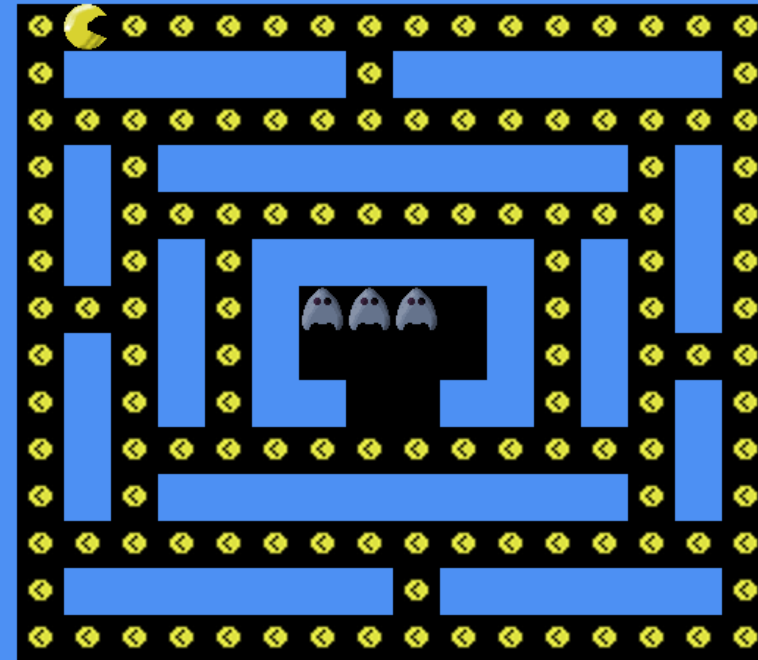
OK YOU GOT US...

...we're playing PacMan.

... but also the ghosts.

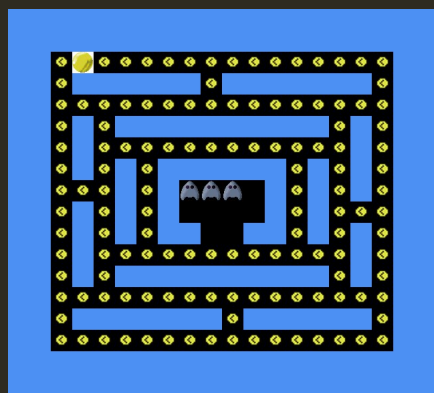
THE IMPLEMENTATION

- The Game Environment
 - PyGame
- Reinforcement Learning
 - Deep Q-Learning
 - off-policy control
 - ϵ -greedy action selection
 - Q-Function Approximation using a convolutional neural network
 - Tensorflow & Numpy



DEEP Q-NETWORK (OF THE WANDERER)

S_0



[vector of pixels] (state)

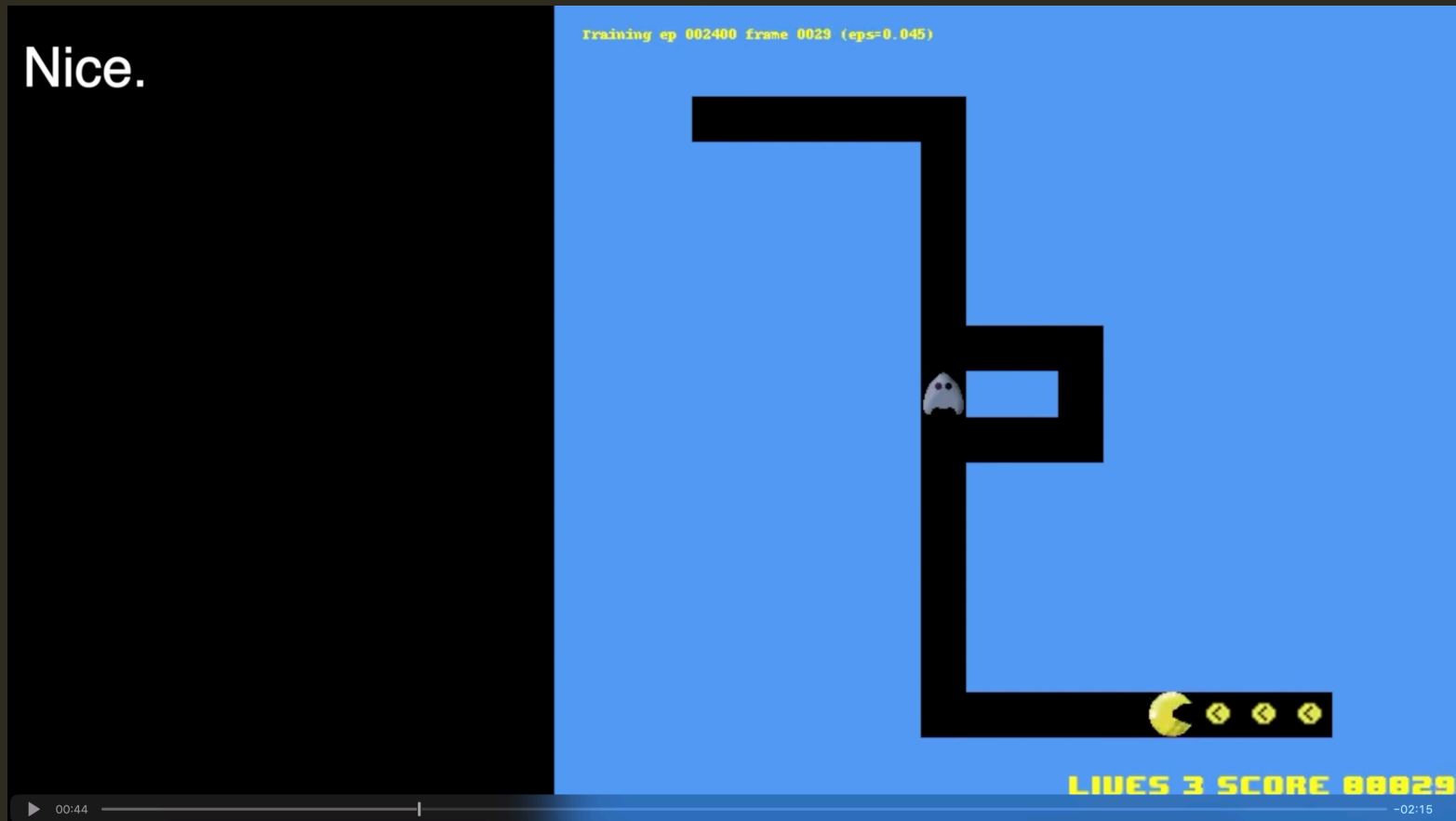


$[Q(S_0, A_0), Q(S_0, A_1), Q(S_0, A_2), Q(S_0, A_3)]$

→ e.g. [1.2, 200, 4.3, 0.1]

reward per action [UP, DOWN, LEFT, RIGHT]

VIDEO HERE



CURRENT STATUS

Implemented Features

- Environment
 - Multiple Levels with various difficulties
- Deep Q Learning for Wanderer
 - Learns perfect policy (minimal num steps) for levels with static ghost(s)
 - Performance with randomly moving ghosts could be better
 - Replay Buffer
- Train/Test Procedure, Video Out, Plotting

Missing

- GhostMaster agent(s)
- Play against trained Wanderer

IMPROVING WANDERER AGENT

- State becomes (previousFrame, currentFrame) to allow movement direction detection of ghosts
- Larger network?

OUTLOOK

TODOS:

- Find solution for large action space of GhostMaster controlling several Ghosts
- Implement The GhostMaster
- Train both agents in an adversarial fashion
- How does the behavior of the Wanderer change in such a setup?

WISHLIST:

Ghosts

- Tactical behavior like surrounding, covering choke points
- Maybe only limited vision (proximity)
- GhostMaster must coordinate

Wanderer

- Should avoid dangerous spots in the maze
- Should anticipate capabilities of the GhostMaster

Additional features:

- Power-ups for the Wanderer

THANK YOU!