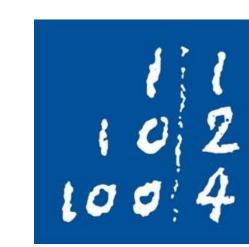
# Grid World Transfer Learning from Small to Large Environments





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Poster Presentations in context of Reinforcement Learning Lecture

# TL;DR

- We compare transfer learning and curriculum learning to baseline training for DQN agents in grid environments with different sizes.
- Transfer learning: Faster convergence, fewer training steps than baseline.
- Curriculum learning: Outperforms both baseline and direct transfer in most cases.

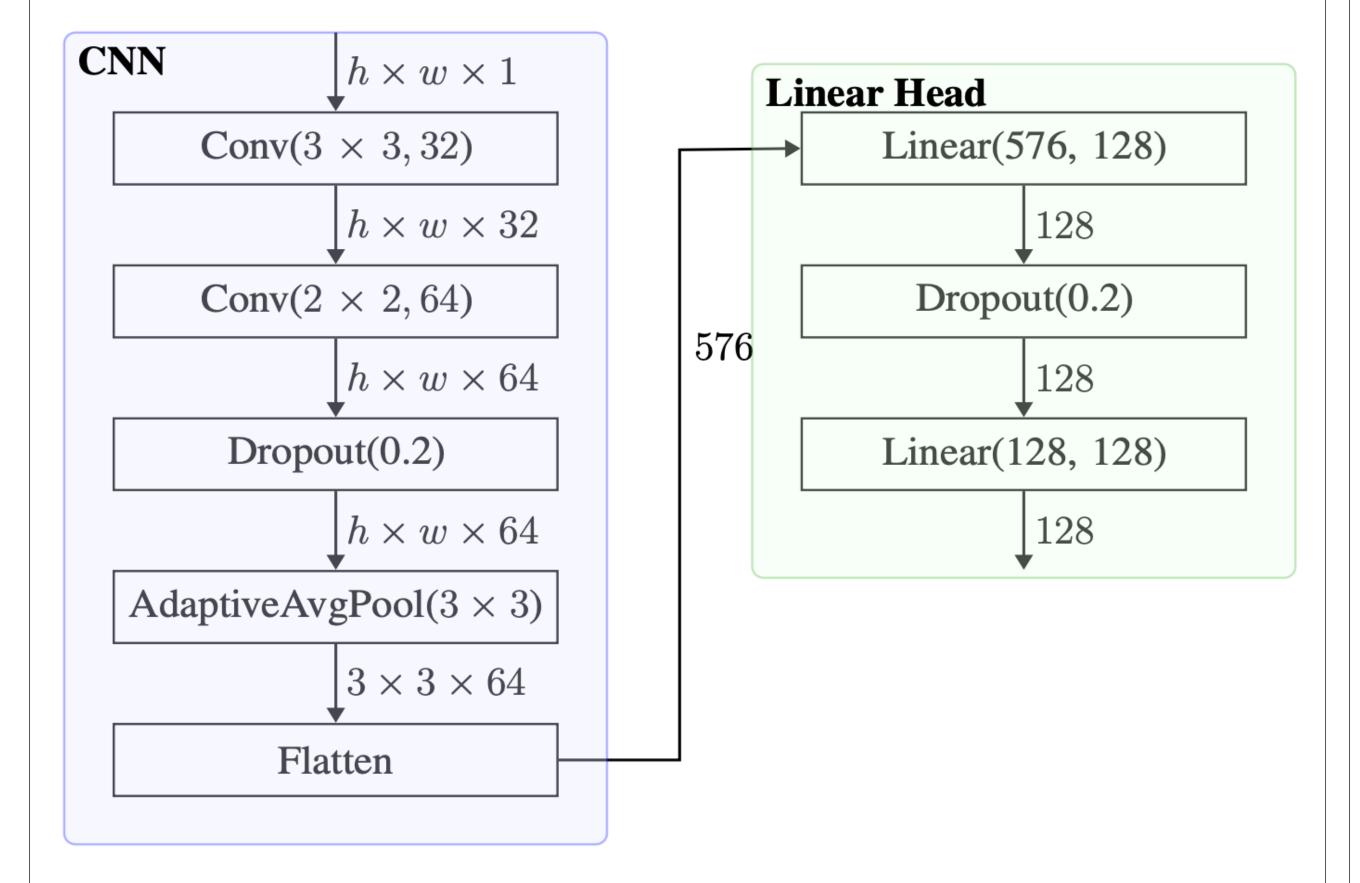
# **Motivation & Problem Setting**

#### **Motivation**

- DRL agents (e.g., DQNs) need long training times for good performance.
- Grid worlds are simple but ideal for controlled DRL experiments.
- Transfer learning has been proven to speed up learning for other agents such as PPO [Chevalier-Boisvert et al. 2023].
- Goal: Reduce training time without sacrificing performance.

#### (3) Approach

- We use an empty grid environment to pretrain our agent to navigate to a defined goal.
- For the grid environment we use Gym's Minigrid [Chevalier-Boisvert et al. 2023].
- For the agent we use the DQN implementation from Stable Baseline3 [Raffin et al. 2021].
- We used the built-in CnnPolicy but replace its default feature extractor with a custom designed neural network:



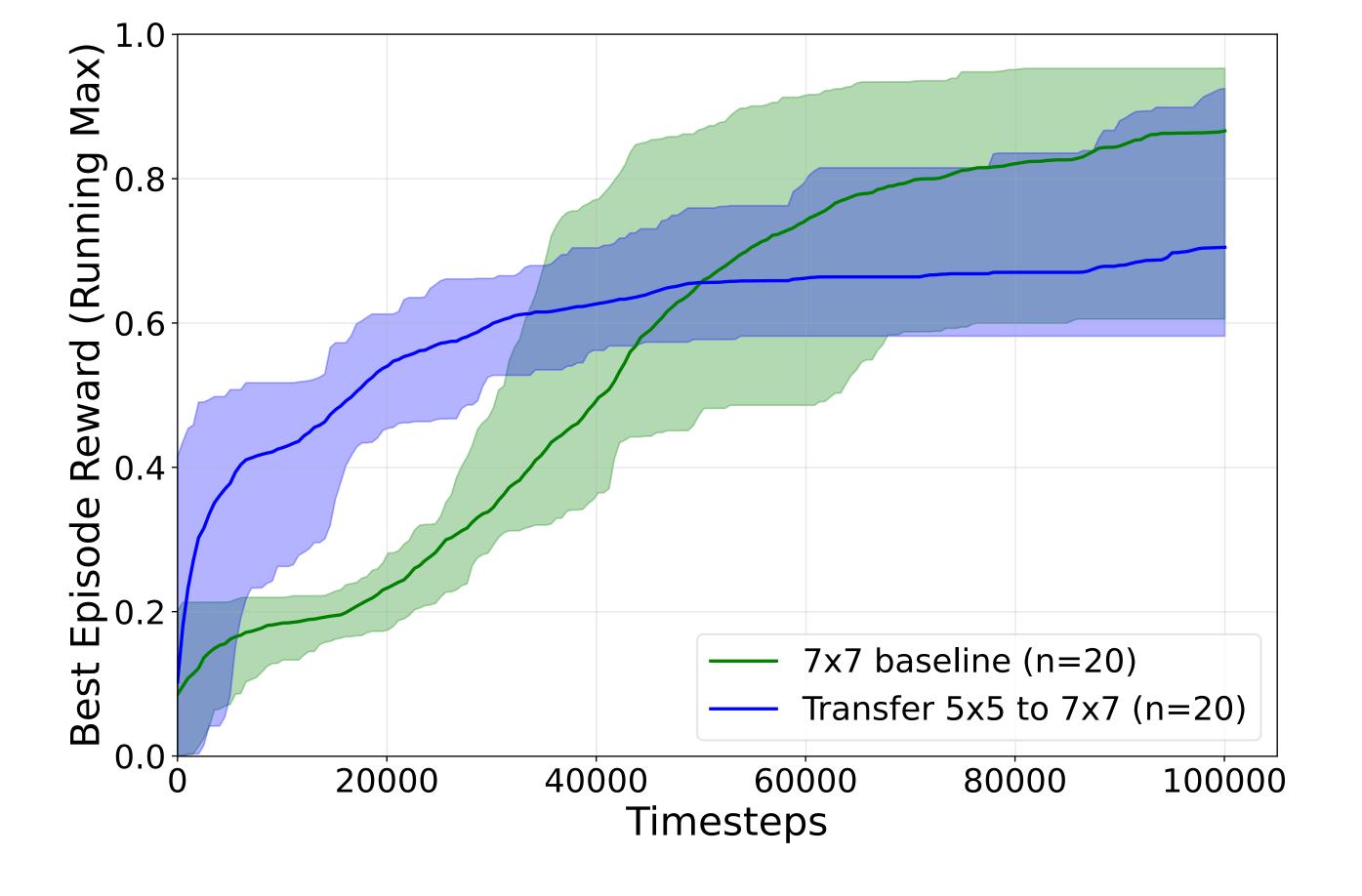
# **Key Insights**

### Performance metric:

- Log mean episode reward per step.
- Performance curves show running maximum rewards with 95% confidence bands across 20 seeds.

## **Transfer learning (Small → Medium):**

- Baseline: Train DQN from scratch on 7x7 grid.
- Transfer: Train on  $5x5 \rightarrow$  finetune on 7x7 grid.



- Same hyperparameter setup across all experiments.
- 100,000 training steps per experiment.
- 20 random seeds for statistical robustness.

## **Experiment setup:**

#### 5 **Future Works**

- Apply to more complex environments with obstacles like walls or lava.
- Explore reverse transfer (large → small) for robustness.

# Transfer and curriculum learning (Small → Large):

- Baseline: Train DQN from scratch on 9x9 grid.
- Transfer: Train on 5x5 → finetune on 9x9 grid.
- Curriculum: Train on  $5x5 \rightarrow transfer$  to  $7x7 \rightarrow transfer$  to 9x9 grid.

