

NEAT + Novelty Search for PCG generates comparable video game levels **faster** with **less domain knowledge** and **no data requirements**.

PCGNN: Using NEAT and Novelty Search for Diverse and fast level generation
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Introduction

Video games are popular, but content is **slow** and **expensive** to develop manually. Procedural Content Generation (PCG) can help with this.

Problems – Current Methods

- Slow [1, 2]
- Need Data [3]
- Domain Specific Reward Engineering [4]

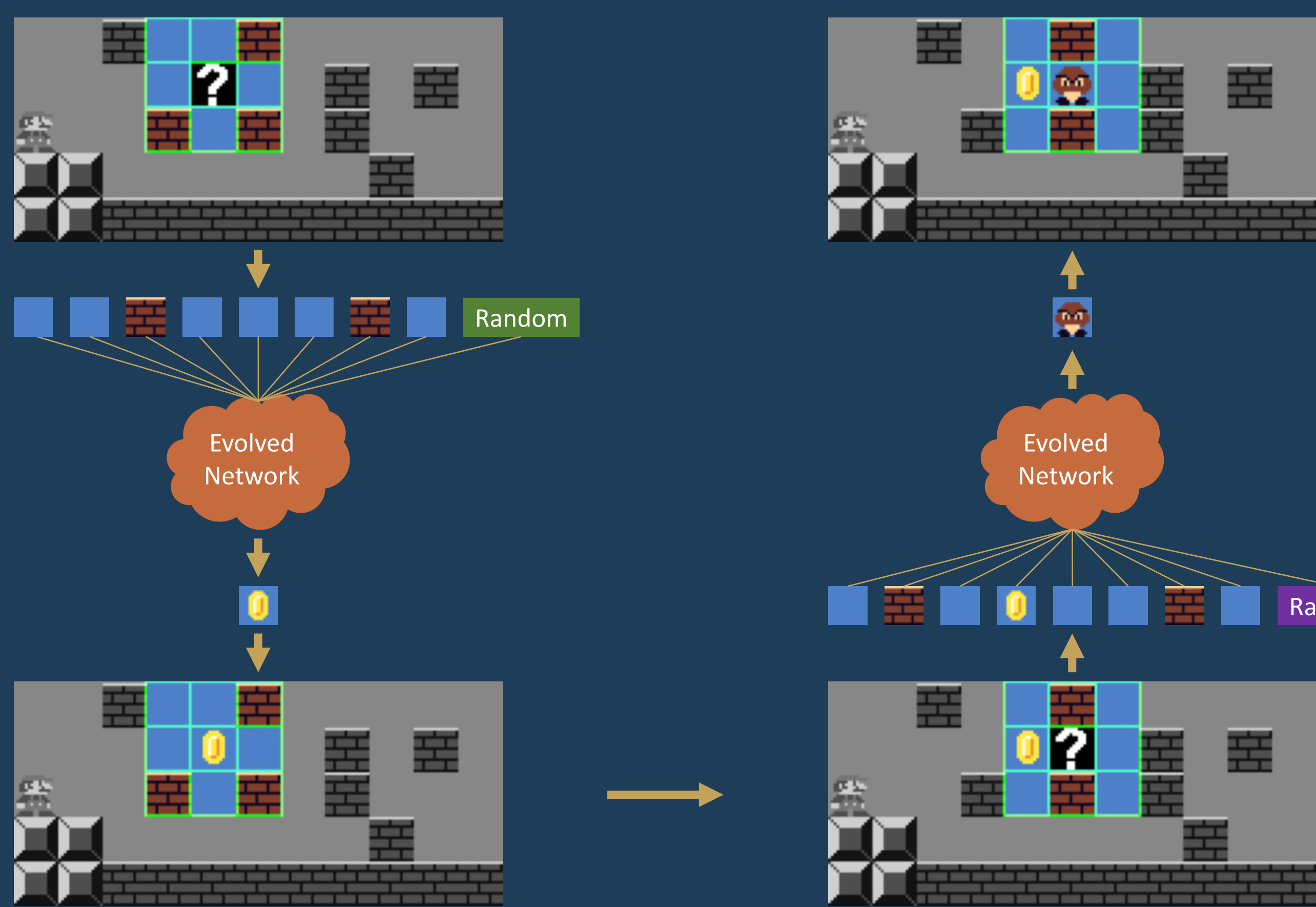
Method - Solutions

- Learn a **Neural Network**
- Evolve it using a **Genetic Algorithm** (NEAT)
- Fitness functions – **solvability & novelty**
- Novelty: Reward **Diversity**

- Fast generation**
- No data requirements**
- Domain independent**
- Exploration + diverse levels**

Generation

Generate levels for 2D tilemaps using a Neural Network

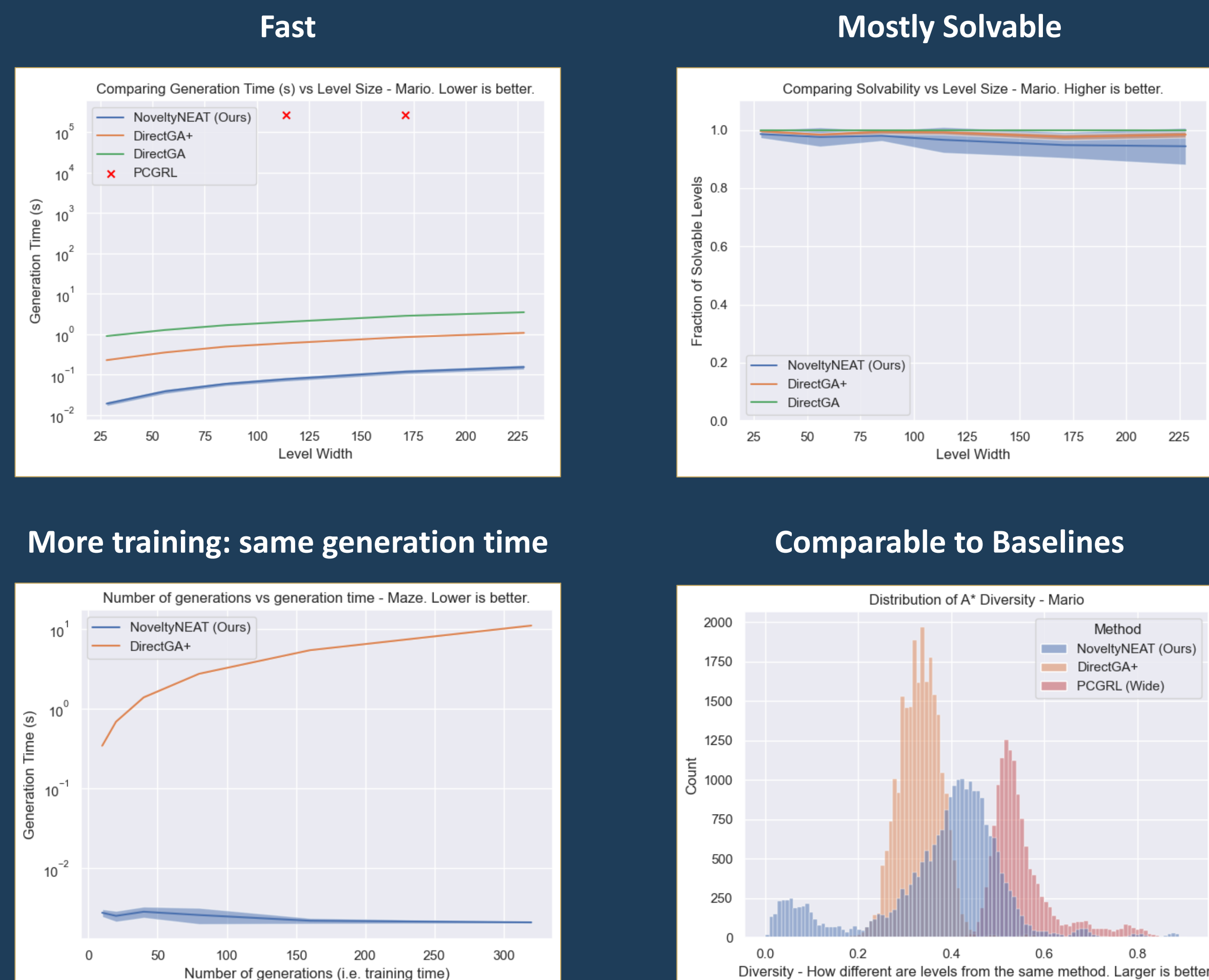


Performed sequentially for all tiles **using previous predictions as input + random perturbations**

Results

Fast, Comparable, Generalisable

Generates arbitrary sized levels with no retraining



References

- [1] Preuss, Mike, Antonios Liapis, and Julian Togelius. "Searching for good and diverse game levels." *2014 IEEE Conference on Computational Intelligence and Games*. IEEE, 2014.
- [2] Liapis, Antonios, Georgios N. Yannakakis, and Julian Togelius. "Constrained novelty search: A study on game content generation." *Evolutionary computation* 23.1 (2015): 101-129.
- [3] Schrum, Jacob, Vanessa Volz, and Sebastian Ris. "CPNP2GAN: Combining compositional pattern producing networks and gans for large-scale pattern generation." *Proceedings of the 2020 Genetic and Evolutionary Computation Conference*. 2020.
- [4] Khalifa, Ahmed, et al. "PCGRL: Procedural content generation via reinforcement learning." *Proceedings of the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*. Vol. 16. No. 1. 2020.

Levels

