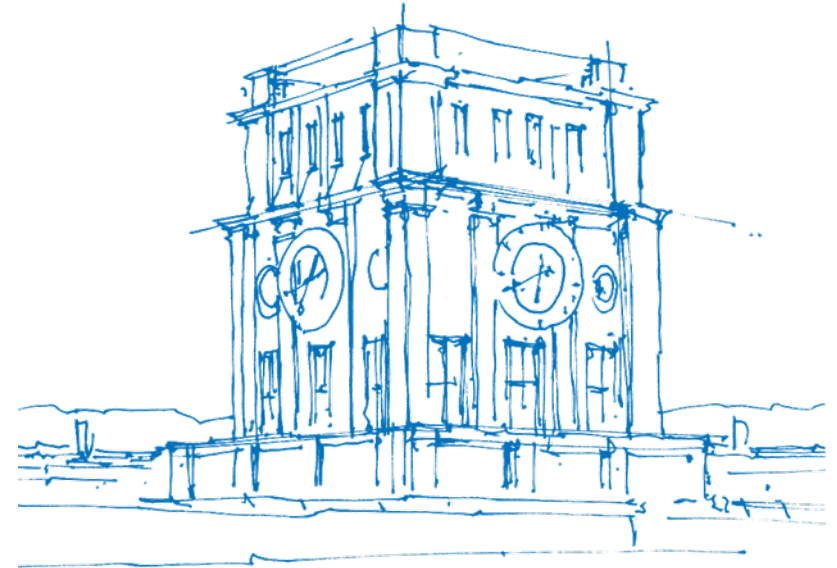


Checkmate with AI

Alexandros Stathakopoulos, Mohanad Kandil
Technische Universität München
Heilbronn, 29. Januar 2025



TUM Uhrenturm

Agenda

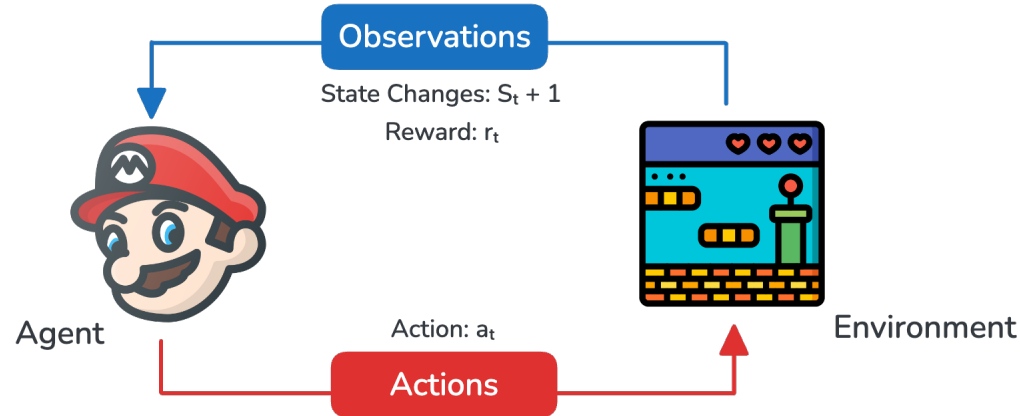
1. Introduction
2. Model Overview
3. Algorithm Explanation
4. Code Structure & Implementation
5. Algorithm Performance & Results
6. Implications & Limitations
7. Conclusion & Q&A

Introduction - Background

- Problem Statement: Implement an AI, which can play checkers against the player
- Why is reinforcement learning important?
- Project Goal: Train a RL gent, which can play checkers

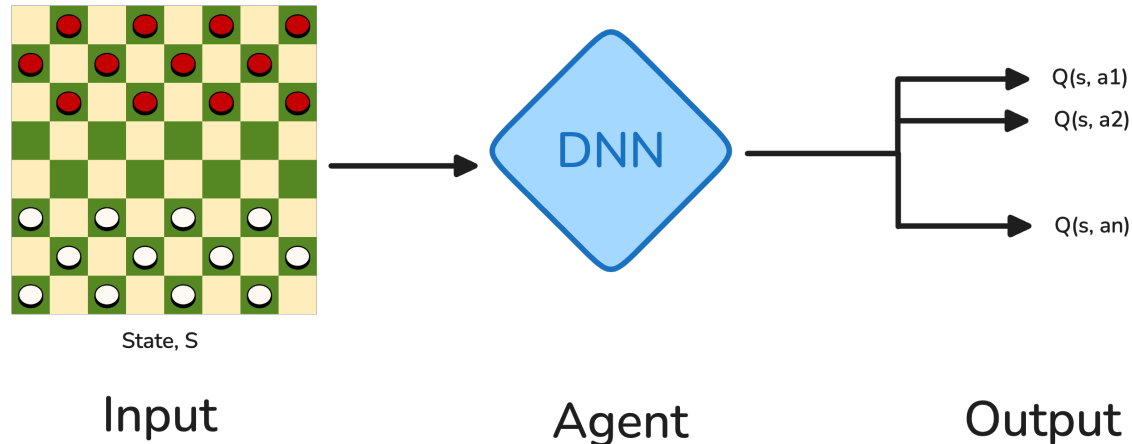
Model Overview

- What is our RL model trying to achieve?
- Type of RL Model: Q-Learning & Deep Q-Network (DQN)
- High-Level Concept: Interaction between Agent and Environment



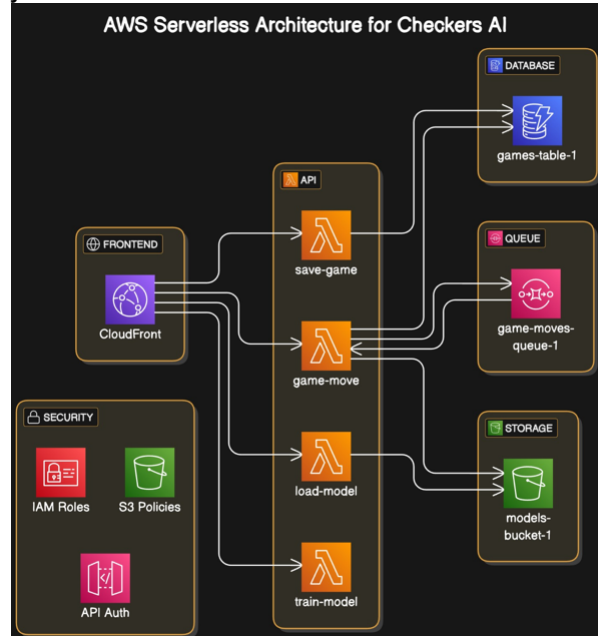
Algorithm Explanation - Deep Q-Learning

- Reinforcement learning technique to find optimal action-value function $Q(s, a)$
- Uses a neural network instead of a Q-table
- Action Selection: ϵ -greedy policy for exploration vs exploitation
- Experience Replay to improve stability



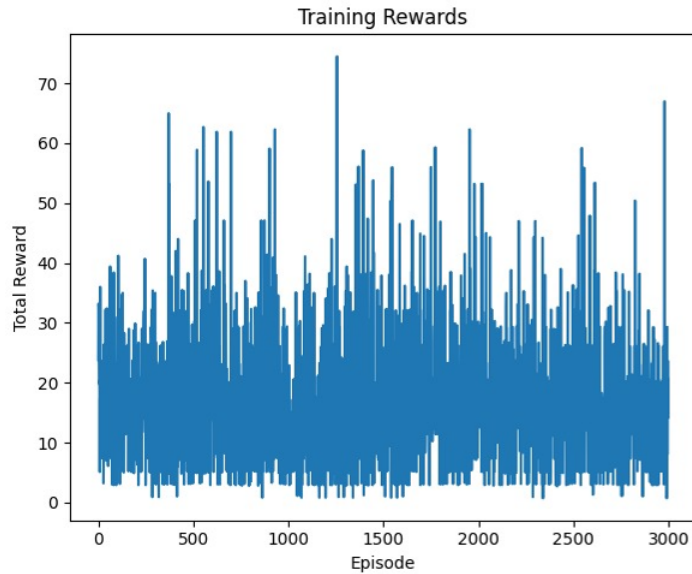
Code Structure & Implementation

- Overview of Repository Structure
- Key Libraries: Python, PyTorch, NumPy
- Training and Evaluation Pipeline



Algorithm Performance & Results

- Performance Metrics: Reward over Episodes



Implications

- Application in Finance, Robotics, Gaming, and Cloud Optimization
- Enhancements for real-world decision-making
- Future research directions: Combining RL with Transformer models

Limitations

- High computational cost (even with latest GPUs)
- Inefficiency
- Generalization issues across different environments

NVIDIA-SMI 565.57.01			Driver Version: 565.57.01		CUDA Version: 12.7		
GPU	Name	Persistence-M	Bus-Id	Disp.A	Volatile Uncorr. ECC		
Fan	Temp	Perf	Pwr:Usage/Cap	Memory-Usage	GPU-Util	Compute M.	MIG M.
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Conclusion & Summary

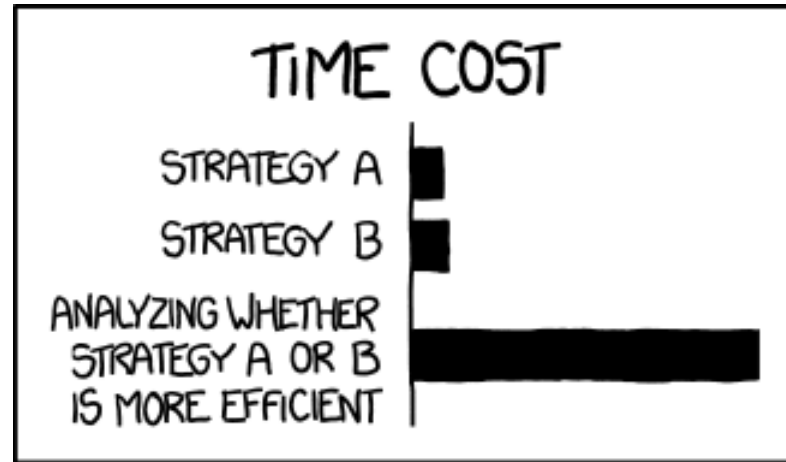
- Key Takeaways: Insights from Model Performance
- Challenges & Future Work

Conclusion & Summary

- Key Takeaways: Insights from Model Performance
- Challenges & Future Work

Any Questions?

Thank You



THE REASON I AM SO INEFFICIENT

xkcd 1445