Checkmate with AI
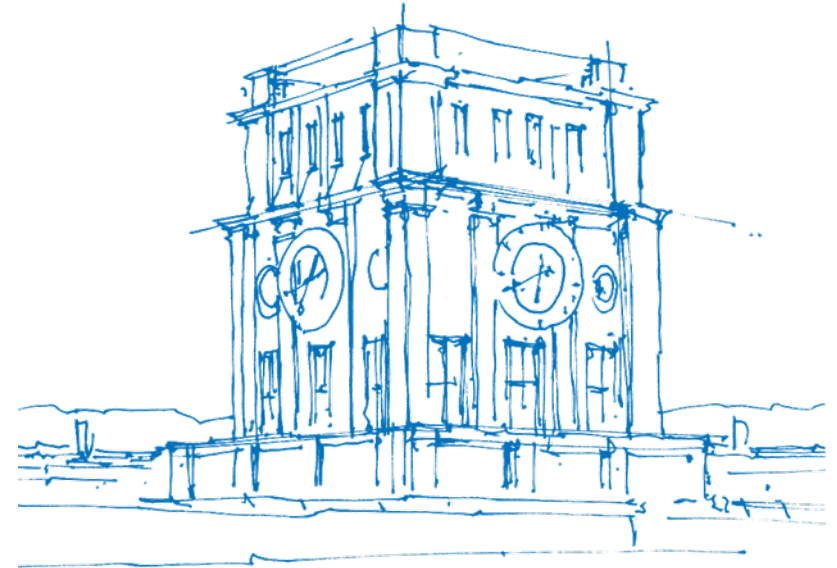
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Heilbronn, 29. Januar 2025

Agenda

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Introduction - Background & Motivation

- Problem Statement: What are we solving?

- Why is reinforcement learning important?

- Brief mention of prior research

- Project Goal: Train an AI agent using RL

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

Observations

State Changes: $S_t + 1$

Reward: r_t

Agent

Action: a_t

Actions

Environment
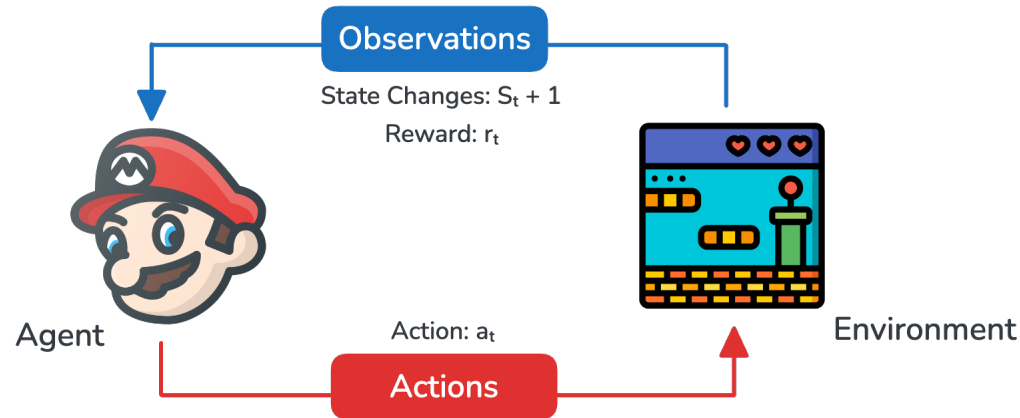
Algorithm Explanation - Deep Q-Learning

- 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, TensorFlow/PyTorch, NumPy, OpenAI Gym

- Training and Evaluation Pipeline

Algorithm Performance & Results

- Performance Metrics: Reward over Episodes

- Training Loss over Iterations

- Baseline Model Comparison

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

- Sample inefficiency

- Lack of interpretability

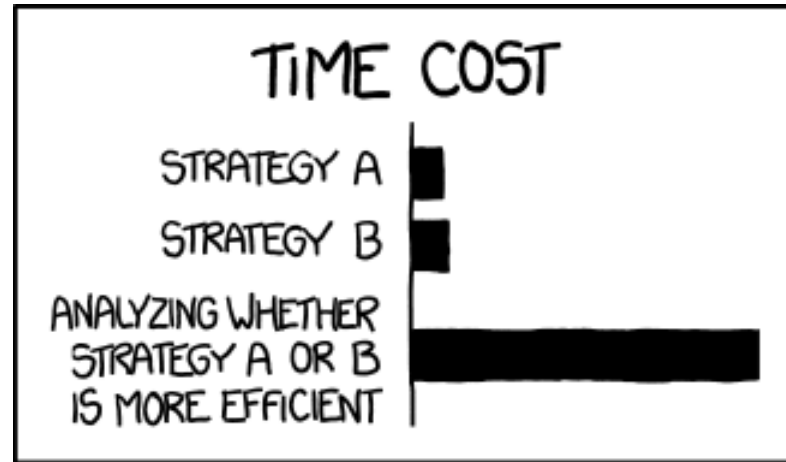- Generalization issues across different environments

Conclusion & Summary

- Key Takeaways: Insights from Model Performance

- Challenges & Future Work

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Conclusion & Summary

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Any Questions?

Thank You

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