# Reinforcement Learning für Chrome Dino Run

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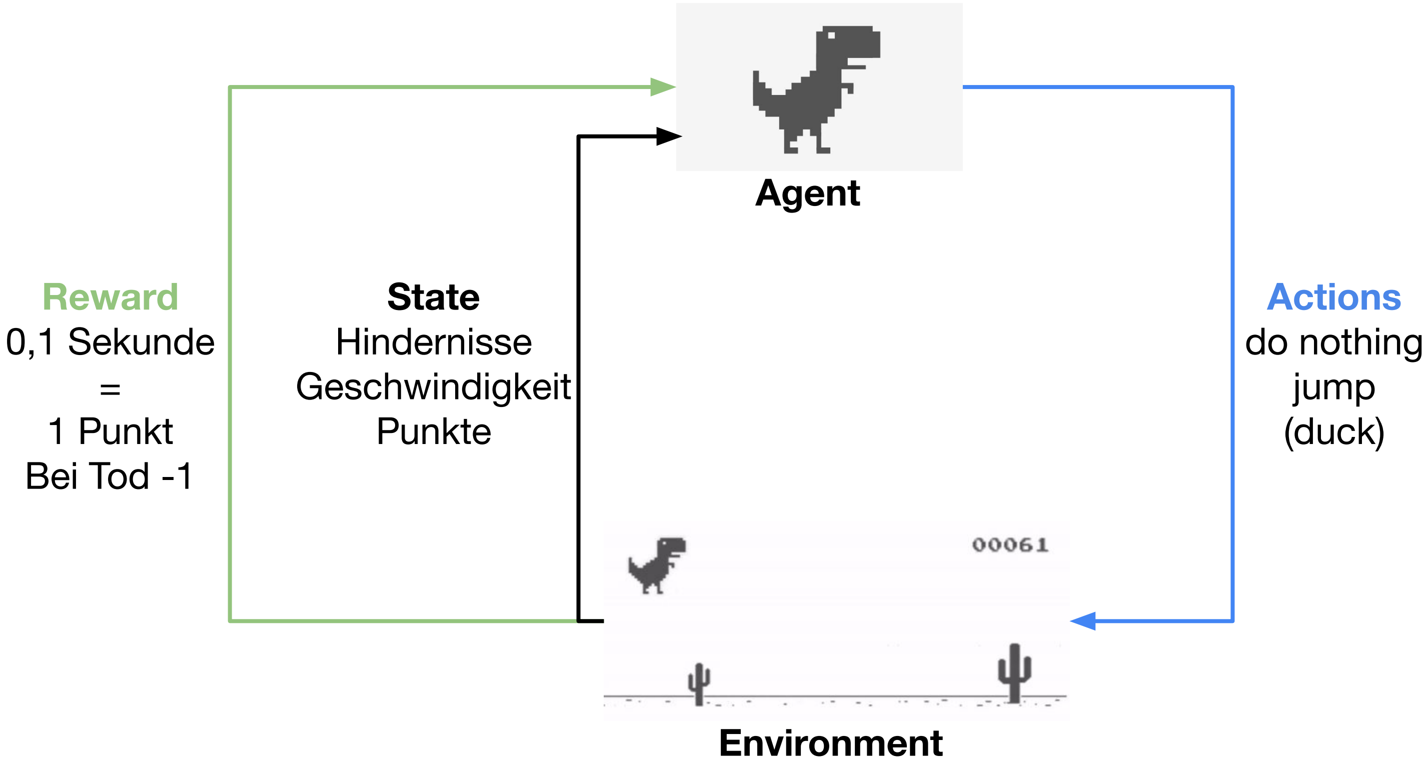
# Chrome Dino Run



# Unser Vorgehen

## Setup

❌ keine Beschleunigung

❌ keine Vögel

→ nur 2 Aktionen

→ auto. Steuerung mit Selenium

## Training

1. Baseline: Agent springt immer

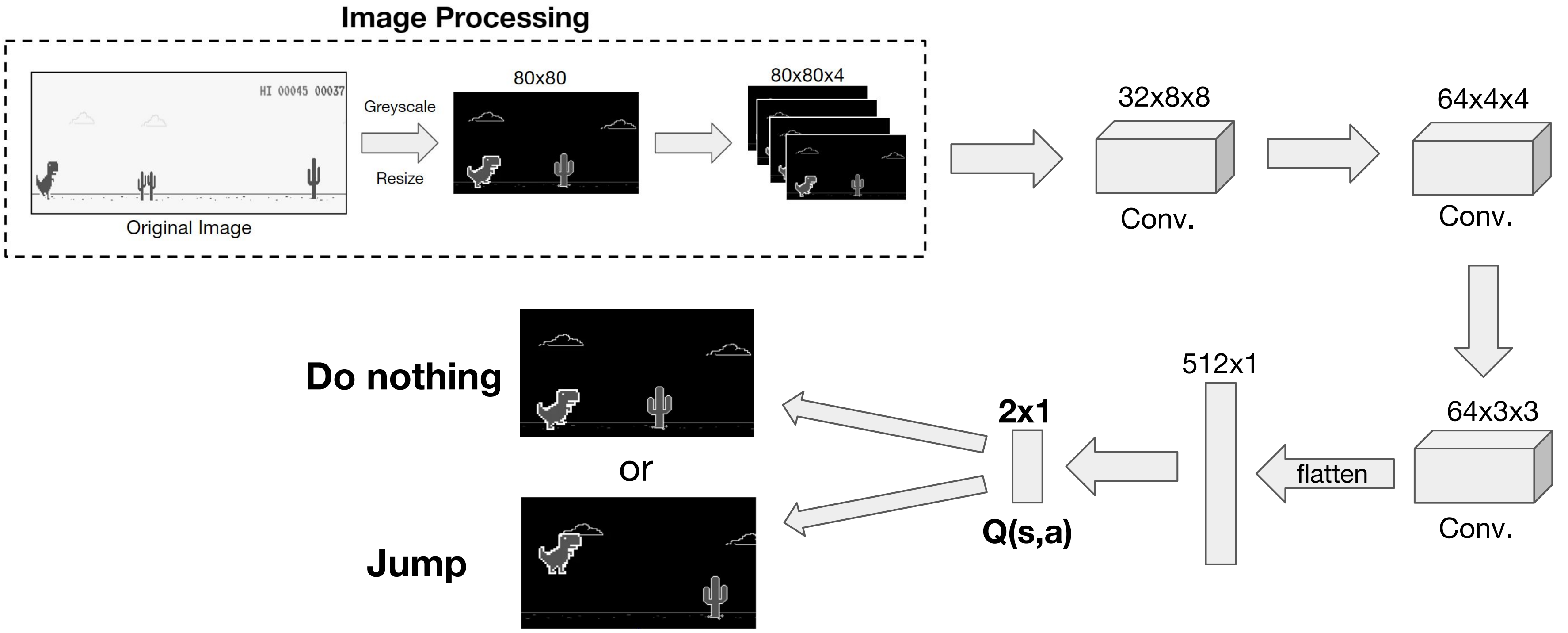
2. DDQN (3 Varianten)
   - Variante 1: Initial
   - Variante 2: Prioritized Experience Replay
   - Variante 3: Höhere Learning Rate

## Test

20 Runden in einer neuen Environment

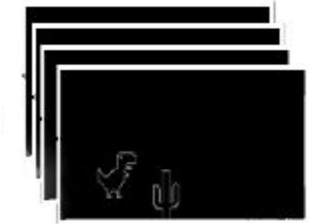
Messung von:
- Max. Score
- Avg. Score
- Median Score
- Standard Deviation

# Deep Q Network (DQN) - Implementierung



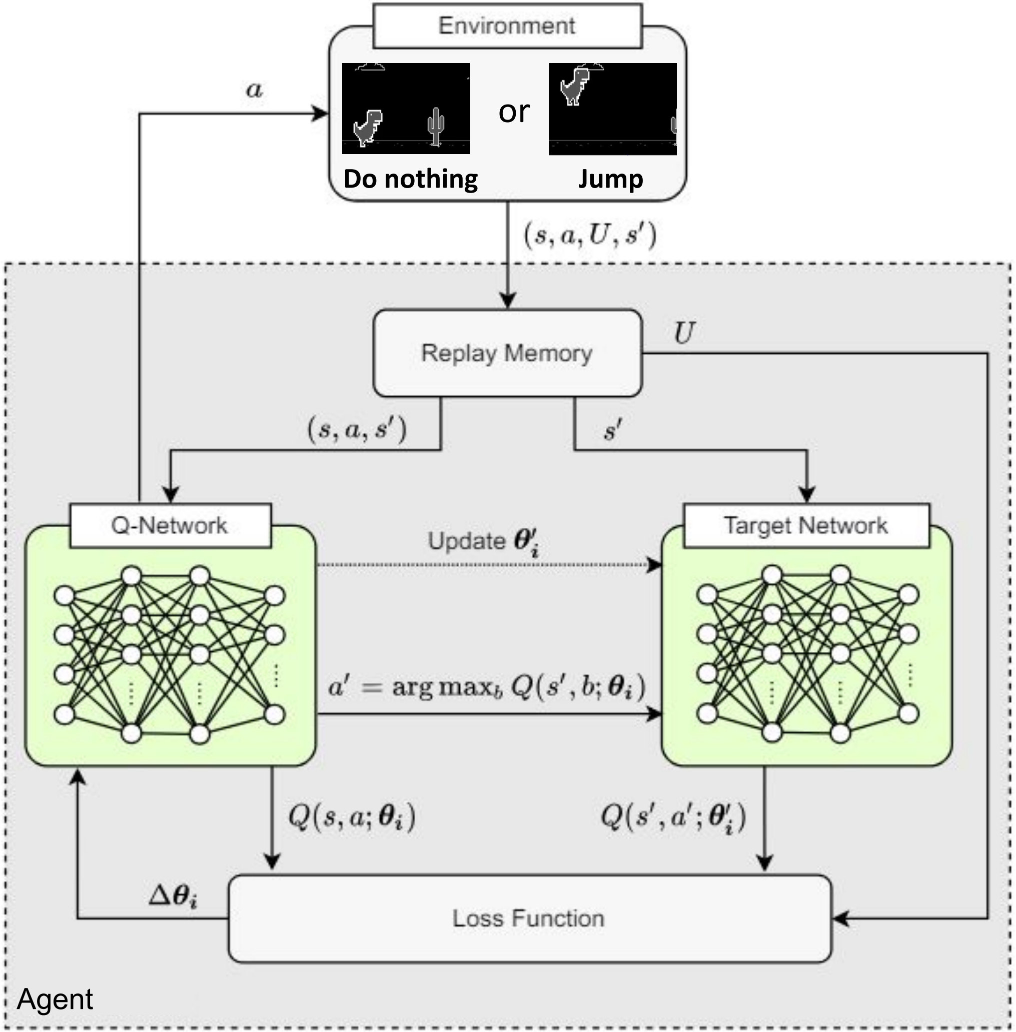
# Double Deep Q Network (DDQN) - Implementierung

80x80x4



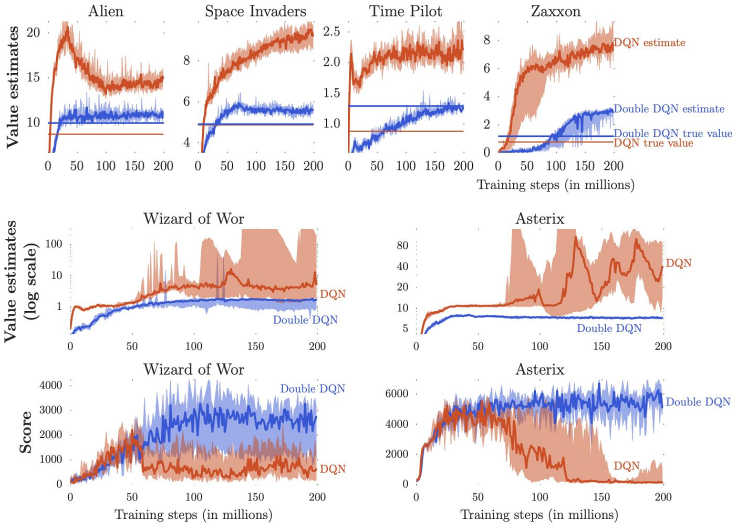
Stack of 4 images

input



# Double Deep Q Network (DDQN) - Warum?

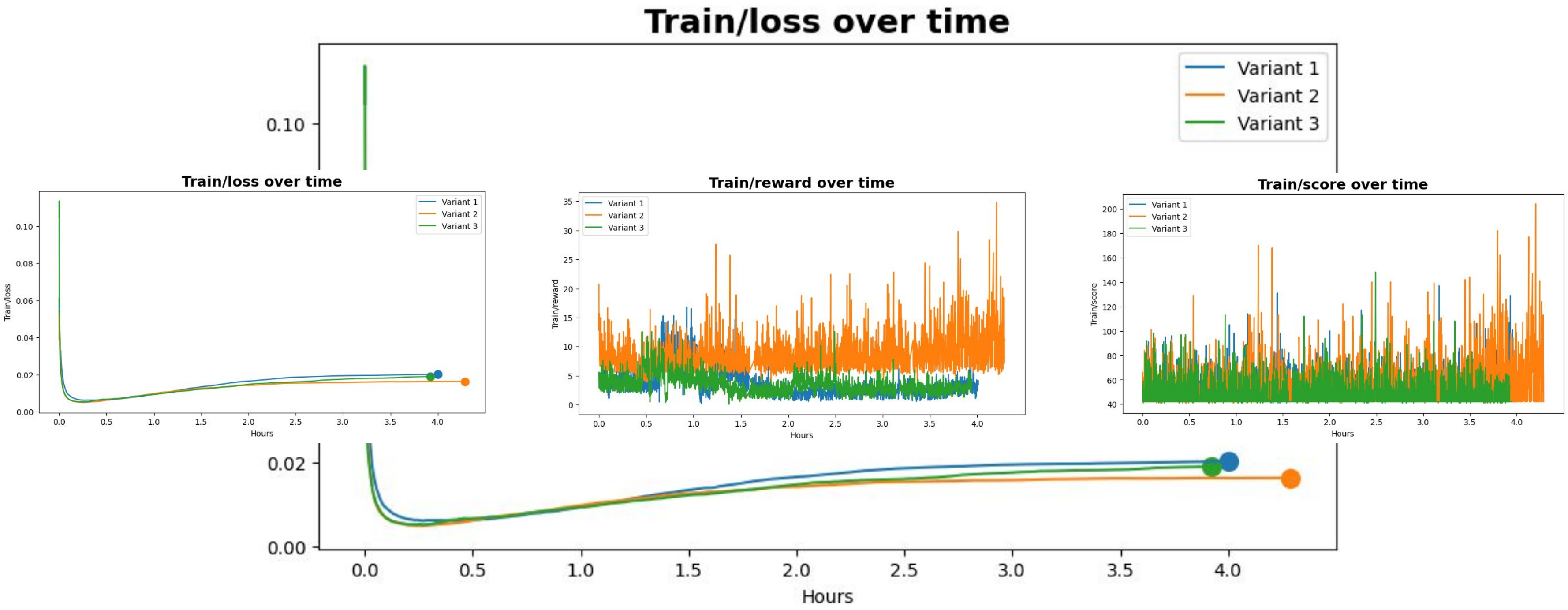
- Overestimation Bias in Q-Learning
- Stabilität und Performance im Vergleich zu DQN
- Bereits auf anderen Spielen getestet
- Lerneffizienz




| | DQN | Double DQN |
|---|---|---|
| Median | 93.5% | 114.7% |
| Mean | 241.1% | 330.3% |

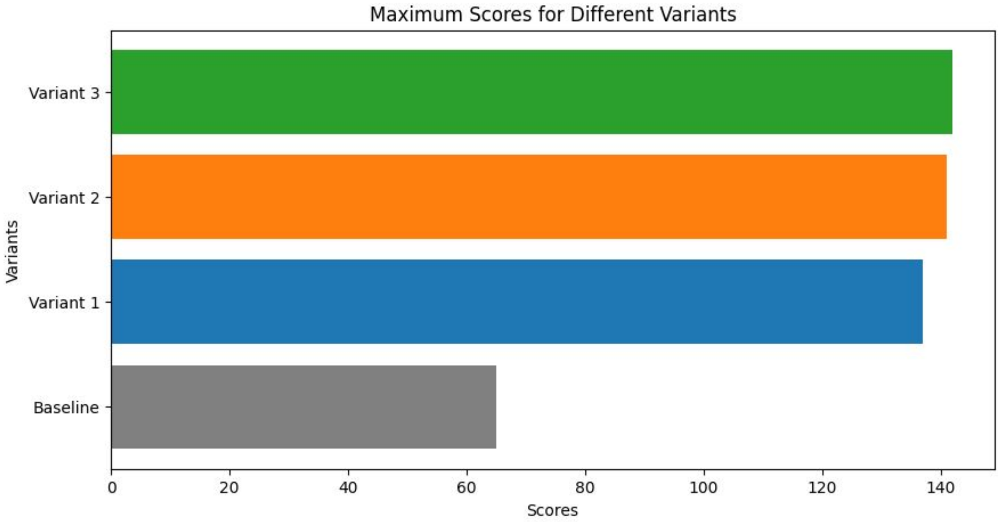
Table 1: Summary of normalized performance up to 5 minutes of play on 49 games. Results for DQN are from Mnih et al. (2015)

# Trainings-Ergebnisse



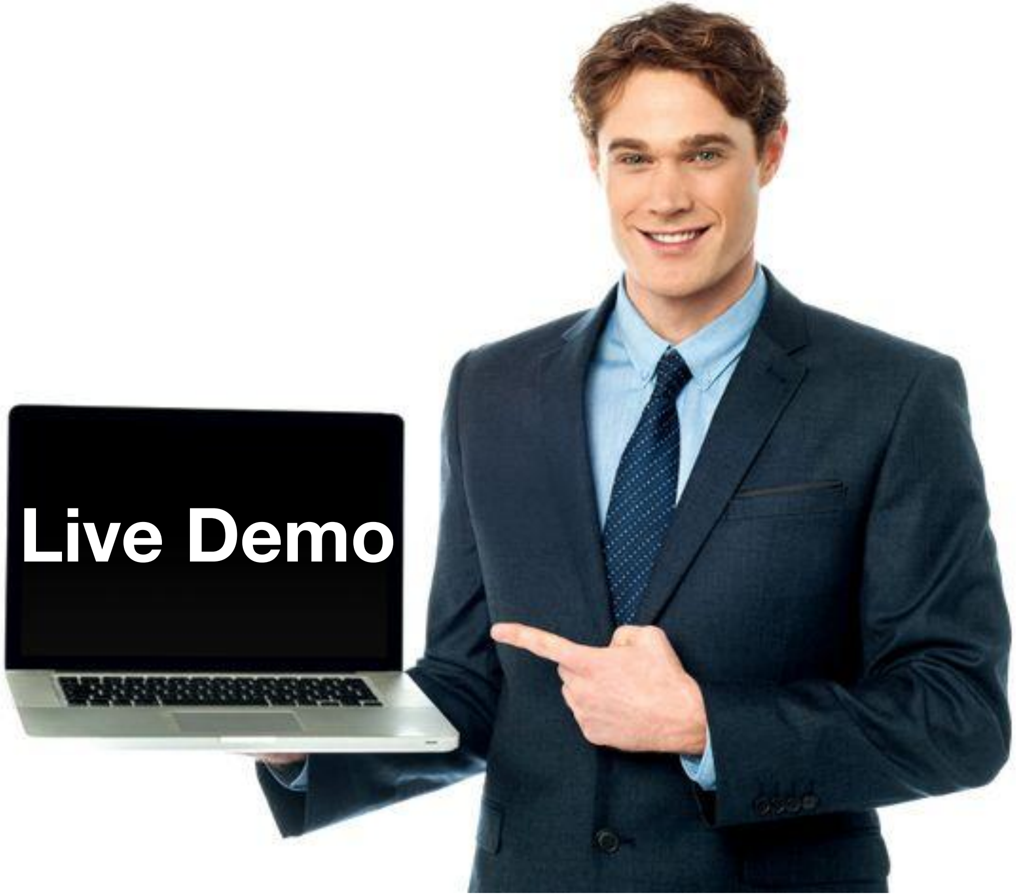
# Test-Ergebnisse

| Method | Max. Score | Avg. Score | Std | Median Score |
|---|---|---|---|---|
| Human Expert | 1399 | 922 | 324 | 850 |
| Baseline | 65 | 51 | 22 | 40 |
| Variant 1 | 137 | 52 | 25 | 43 |
| Variant 2 | 141 | 65 | 23 | 63 |
| Variant 3 | 142 | 61 | 15 | 51 |



# Fazit

- 3 Varianten getestet
- Aktuelle Modell-Leistung kommt nicht an Human-Expert ran
- Zukünftige Verbesserungen
  - Hardware-Upgrade
  - Algorithmische Anpassung
- Stufenweise Lernen
- Hyperparameter-Tuning


Live Demo

# Quellen


- van Hasselt, H., Guez, A., & Silver, D. (2016). Deep Reinforcement Learning with Double Q-Learning. *Proceedings of the AAAI Conference on Artificial Intelligence*, *30*(1). https://doi.org/10.1609/aaai.v30i1.10295

- Richard S. Sutton and Andrew G. Barto. 2018. Reinforcement Learning: An Introduction. A Bradford Book, Cambridge, MA, USA.