

# Agent Jackie: Reinforcement Learning on Kung Fu Master

Environment: `ALE/KungFuMaster-v5`

Algorithm: Deep Q-Learning (DQN)

## What Worked Well

- The Deep Q-Network (DQN) architecture using stacked grayscale frames and a CNN worked effectively for interpreting pixel input.
- Frame preprocessing (84×84 grayscale + 4-frame stack) helped capture motion and context.
- The pipeline was modular and clean : with `main.py`, `agent.py`, `memory.py`, and a separate `play_and_record.py` for evaluation.
- After training for 20 episodes, Agent Jackie was able to defeat the first 2–3 enemies, showing learned movement and action patterns.

## What Didn't Work Well

- The epsilon value was **always fixed at 0.1**, which led to **very limited exploration** -especially in early training.
- With only 10 episodes in the first run, rewards were often **0**, and the agent failed to learn effective strategies.
- The action selection stayed greedy too early due to no epsilon decay, possibly overfitting suboptimal moves.
- Limited training time made it hard for the agent to reach higher levels or adapt to new enemy types.

## Agent Jackie's Improvement

Training Run	Episodes	Avg Reward	Notes
Run 1	10	~0.0	Very limited learning
Run 2	20	Improved: up to 900-1400	Agent started defeating 2–3 enemies

- Jackie started performing consistently by episode 15+ in the second run.

- The model saved after the 20-episode training was used to record the final gameplay video.

## **Summary**

Agent Jackie, trained via DQN on raw pixels for only 20 episodes, learned to survive the early waves of *Kung Fu Master*. While Jackie's combat skills are still basic, this project successfully demonstrates the foundation of reinforcement learning using Gymnasium's Atari environments.