

# SOC :- Reinforcement Learning: Train a Kung-Fu Master

Final Project Report

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In this project, I built and trained a Deep Q-Network (DQN) agent named **Agent Jackie** to play the Atari game **Kung Fu Master**. The agent observes the game using raw pixel input and learns through trial and error without knowing the game mechanics or reward function in advance.

Training was done using OpenAI Gymnasium's **ALE/KungFuMaster-v5** environment. The algorithm includes epsilon greedy algorithm and Q-learning. Experience replay was also incorporated in the project.

Some issues I ran into the project with:

1. *Dependency errors*: Some imports were not able to resolve and there were version conflicts. I solved this by using a virtual environment.
2. *Long training time*: A high epsilon decay rate made the agent too random for too long. I had to adjust it from 0.99 to 0.995 to balance exploration and exploitation.
3. *Heavy storage and memory*: I initially recorded too many videos — which slowed down training. Fixing the frequency helped.

Finally, after many hours of training, Jackie had a decent performance where it defeated several enemies. Changes in epsilon and decay values, as well as several more days of training would make Jackie beat the game too.

This SOC was the most hands-on I've ever gotten with reinforcement learning. It was messy, slow, and a bit frustrating at times — but seeing Agent Jackie actually *get good* at the game was incredibly satisfying. This project really brought together everything we learned: theory, implementation, debugging, and tuning.