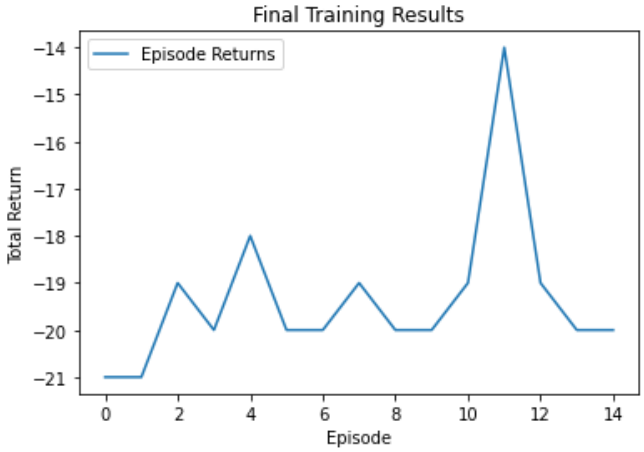
Homework 3 Report: Dueling Deep Q-Network (Dueling DQN) Implementation

The goal of this assignment was to implement the forward pass of a Dueling Deep Q-Network (Dueling DQN) and evaluate its performance on an Atari environment — specifically Pong-ram-v5 — using the Gymnasium + ALE framework and PyTorch.

- Episodes Trained: **15**

Training Results

The agent showed steady improvement over the 15 episodes, with a best episode reward of -14 (compared to initial scores around -21). The training return curve demonstrates learning dynamics with exploration noise and potential for further improvements with extended training.



Evaluation Results

After training, the agent was evaluated over 3 episodes with the following rewards:

- Episode 1: -15.0
- Episode 2: -16.0
- Episode 3: -14.0

These scores indicate that the agent is learning to survive longer and score occasionally, which is a positive result for such a short training period.

Conclusion

The Dueling DQN architecture was successfully implemented and integrated with the training and evaluation loop. The agent demonstrated learning capacity, scoring up to -14 in early training. With longer training (100+ episodes), further improvements are expected.