This project implements a **Deep Q-Network (DQN)** to train an agent to play the **Space Invaders** game using the **Gymnasium Atari environment**.  
The agent learns through reinforcement learning: it interacts with the environment, receives rewards or penalties, and updates its strategy to maximize long-term rewards.

* **Data Preprocessing:**  
  Incoming game frames are converted to grayscale, downsampled, and stacked (4 consecutive frames) to capture motion dynamics.
* **Q-Network Architecture:**
  + Three convolutional layers to extract visual features.
  + A fully connected layer for state representation.
  + An output layer that predicts Q-values for all possible actions.
* **Training Process:**
  + Experiences (state, action, reward, next state, done) are stored in a **Replay Buffer**.
  + Actions are chosen with an **Epsilon-Greedy policy** balancing exploration and exploitation.
  + The main network is periodically synchronized with the target network for stable learning.
  + The model minimizes the error between predicted Q-values and target Q-values.
* **Expected Results:**  
  After sufficient training episodes, the agent learns efficient playing strategies (e.g., dodging bullets, targeting enemies effectively), resulting in higher cumulative rewards.