

The background is a dark, deep space scene. In the upper right, the planet Saturn is visible, showing its characteristic rings and a brownish, banded surface. The scene is filled with numerous small, dark, irregularly shaped asteroids or rocks of varying sizes, scattered across the field of view. The overall lighting is dim, with some subtle highlights on the surfaces of the celestial bodies.

AI LUNAR LANDER

ALEX SMITH AND SHREYA MODI
CS 4100

GOAL

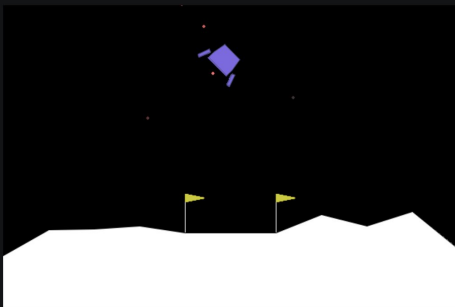
Train a model to successfully land the lander in the target area.

WHAT IS OUR ENVIRONMENT?



Gymnasium

An API standard for reinforcement learning with a diverse collection of reference environments



A

ACTIONS

- Left Thruster
- Right Thruster
- Main Thruster (up)
- Nothing

B

STATE

Horizontal Position (x)	Angular Velocity (ω)
Vertical Position (y)	Left Leg Contact (l)
Horizontal Velocity (v_x)	Right Leg Contact (r)
Vertical Velocity (v_y)	
Angle (θ)	

AGENT

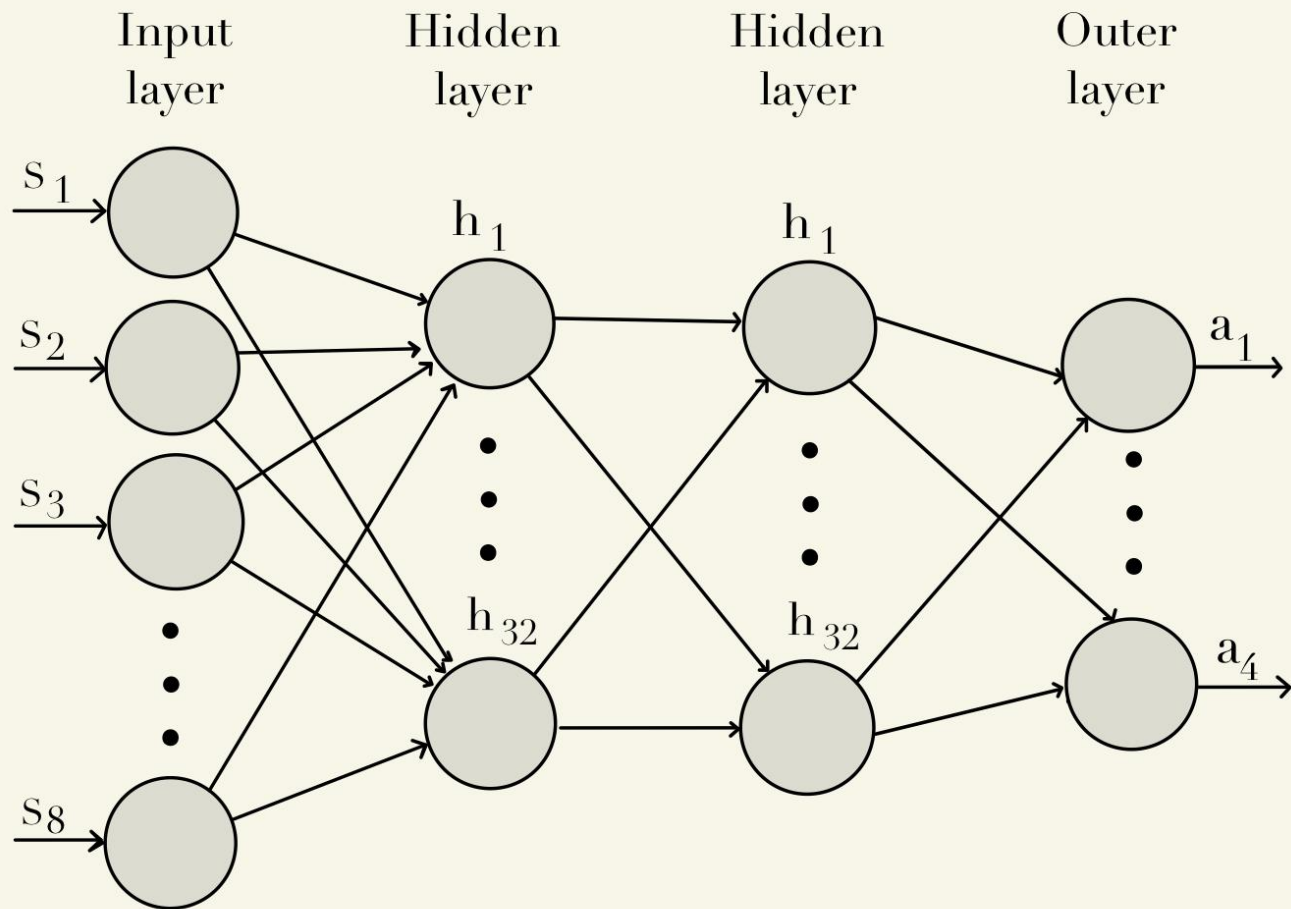
DEEP Q NETWORK

$$Q(s, a) = Q(s, a) + \alpha(r + \gamma \max_{a'} Q(s', a') - Q(s, a))$$

HYPERPARAMETERS

Learning rate α , Gamma γ , Epsilon ϵ ,
Epsilon Decay Rate,
Update_Frequency,
Hidden layer width,
Replay buffer

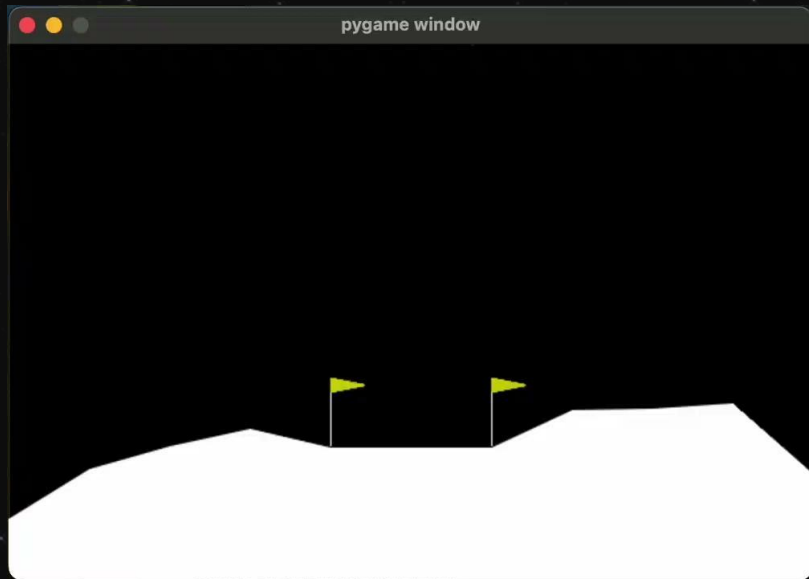
Neural Network Structure



REWARDS

- MEASURE THE POINTS PER EPISODE.
 - +100 TO +300 FOR LANDING SUCCESSFULLY BETWEEN THE FLAGS (CENTERED HIGHER)
 - +10 FOR EACH LEG MAKING CONTACT WITH THE GROUND
 - - 0.3 POINTS FOR EACH STEP TAKEN
 - A CRASH IS -100

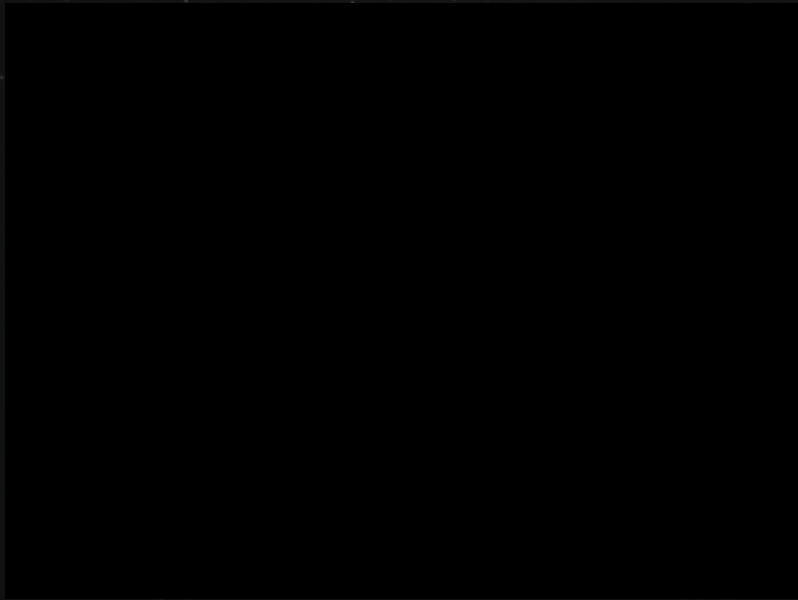
STARTING COMPLETELY RANDOM



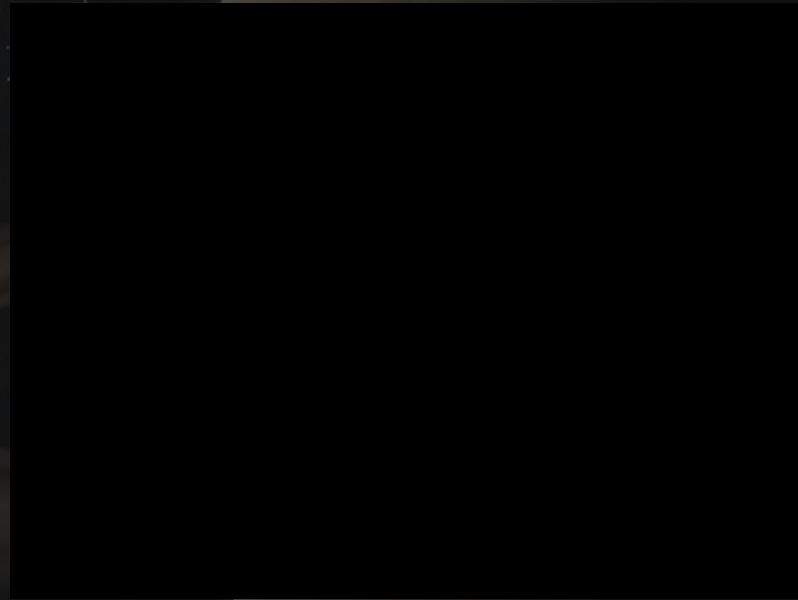
10 episodes



100 episodes

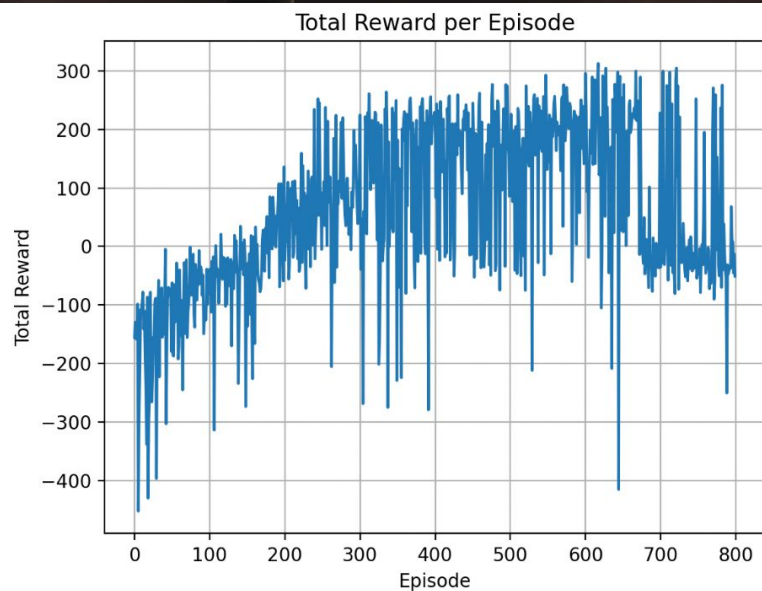


10 episodes

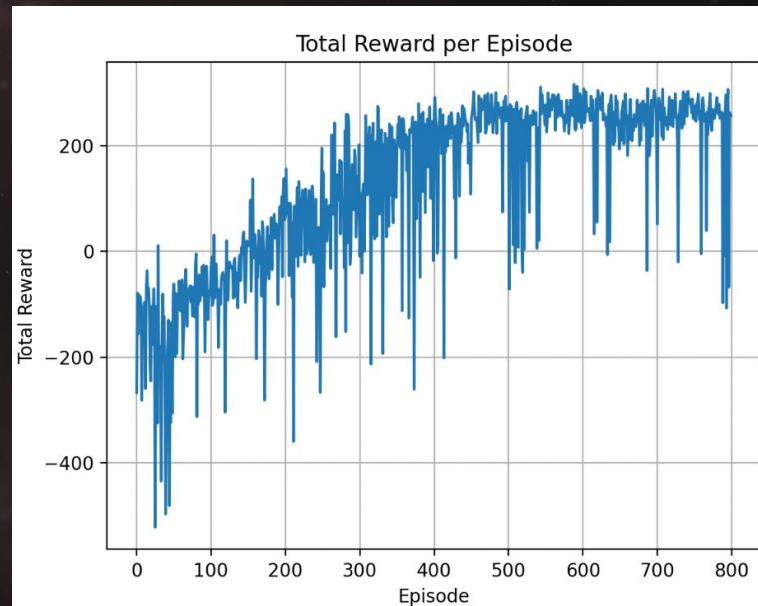


100 episodes

ISSUES WE FACED

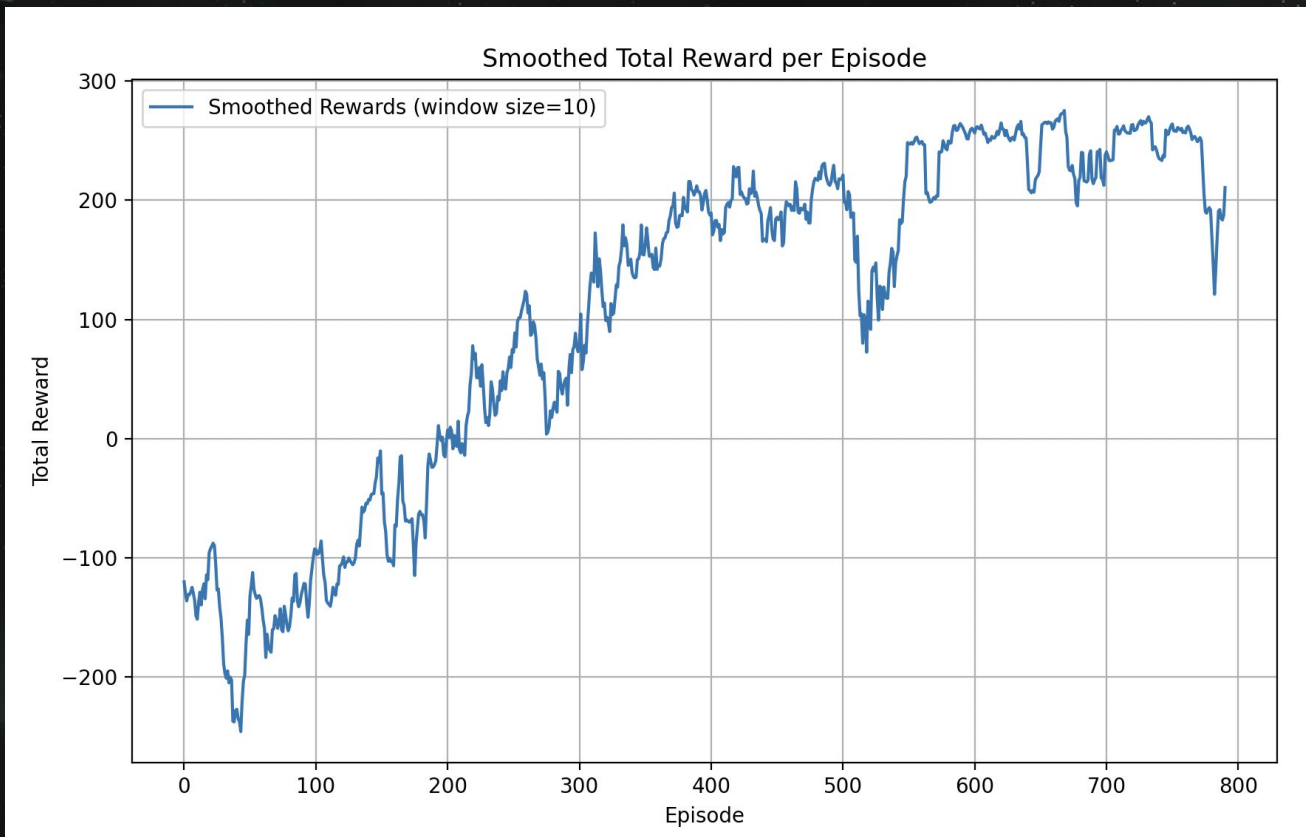


Update Frequency = 10



Update Frequency = 5

RESULTS AND ANALYSIS



DEMO



The background of the slide is a deep space image. It features a dark, star-filled sky. In the upper right, there is a bright, glowing green nebula. In the center, a large, dark planet with a thin white ring is visible. The overall color palette is dark with green and white highlights.

WHY IS THIS IMPORTANT?

Think about this application deployed on
a real scale

The background is a deep black space filled with numerous small, distant stars. In the lower-left quadrant, a large, dark, spherical planet with a prominent ring system is visible. The rings are a lighter, brownish-grey color and appear to be composed of many small particles. In the upper-right quadrant, a bright, glowing spiral galaxy is visible, its arms curving outwards from a central point. The overall scene is a cosmic landscape.

THANKS!
Q&A