

The background of the slide is a stylized representation of a Pong game. It features a blue rectangular field with a dashed white line in the center. At the top, the score '6 9' is displayed in large, pixelated white digits. On the left and right sides, there are vertical white lines representing paddles. A small white ball is visible in the center of the field. The entire scene is framed by a dark blue border with a circuit-like pattern of lines and circles on the left side.

# INTRODUCTION TO AI

## COMPARING RL ALGORITHMS IN PONG GAME

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# INTRODUCTION TO PONG GAME



- The Pong game in the RL Baselines3 Zoo is a classic Atari environment used for benchmarking reinforcement learning algorithms.

Setup: The agent controls a paddle, aiming to hit the ball past an AI opponent's paddle.

Rewards: +1 for scoring; -1 when the opponent scores.

Observations: Provides stacked pixel frames as input, often preprocessed.

Actions: Move up, move down, or stay stationary.

Game End: The game ends when either the agent or the opponent scores 21 points.

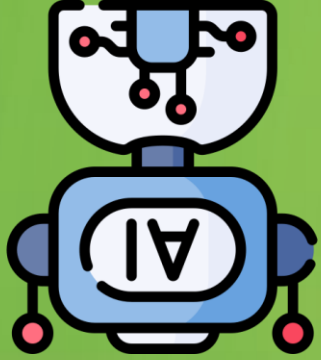
Pong's simplicity and challenge in timing and spatial awareness make it ideal for evaluating RL algorithm performance.

- In the field of deep reinforcement learning, numerous algorithms have been developed, each offering distinct advantages. However, determining the most effective algorithm for specific environments remains a challenge. This project aims to evaluate three widely used algorithms (PPO, DQN, A2C) by testing them in a controlled sample environment (Pong Game). Through a comparative analysis of their performance, we seek to identify and understand the strengths and limitations of each approach.

## STATEMENT OF PROJECT OBJECTIVES







# APPROACH

- The following algorithms have been selected from the available developed methods for this study:
  - Proximal Policy Optimization (PPO)
  - Deep Q-Network (DQN)
  - Advantage Actor-Critic (A2C)
- These algorithms will be evaluated in the Pong environment utilizing the rl-baselines3-zoo repository.
- The primary tool used for this project is Jupyter Notebook.
- The project code incorporates the following libraries:  
gym, stable-baselines3, box2d-py, pybullet\_envs\_gymnasium, cloudpickle, plotly, panda-gym, wandb, moviepy, pyvirtualdisplay, pandas, swig, cmake, ffmpeg.

# DELIVERABLES

## GitHub Repository

- Introduction of Pong game
- Step-by-Step implementation instruction for training and evaluating an RL agent in pong environment using our algorithms using rl-baselines3-zoo repository.
- The hyperparameter files of each algorithm
- Final diagrams and comparisons

## Project Showcase

- A YouTube video with the description of the analysis of the diagrams and the code.



# EVALUATION METHODOLOGY

- After obtaining the results in a CSV file, we will utilize the Matplotlib to visualize the data by plotting reward-steps diagrams for each algorithm under investigation. By comparing these diagrams, we will get the following performance metrics:
    - Average Reward
    - Stability
    - Final Performance
    - Sample Efficiency
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