**Introduction**

Reinforcement Learning techniques can be traced back to last century. It is a subfield of artificial intelligence and machine learning that focuses on how an agent can learn to make decisions in an environment to maximize a reward signal. It is inspired by the way humans and animals learn through trial and error. In late 2013, a then little-known company called DeepMind achieved a breakthrough in the world of reinforcement learning: using deep reinforcement learning, they implemented a system that could learn to play many classic Atari games with human (and sometimes superhuman) performance.

This project is intended to develop an Artificial Intelligence agent, by this, we do not mean to solve the general problem of AI(i.e to develop an AI agent to deal with problems of the real world), but to build a simple AI agent that uses Deep Reinforcement Learning algorithm that can complete a task of some sort of successful ability. Our task is to use a standard environment such as Gymnasium(open source Python library for developing and comparing reinforcement learning algorithms, developed by the Farama Foundation) and build an agent to learn in this environment. Our focus is on developing an agent that can play an Atari 2600 game(the game environment will be updated once we start making progress in our project), which has a wide range of applications in the field of Reinforcement Learning and AI. The AI agent must learn to identify the game environment, interpret the game state, and take actions that maximize its score. The challenge lies in designing a reinforcement learning algorithm that can learn complex strategies and overcome obstacles in real time. The solution requires using deep neural networks as function approximators to estimate the action-value function and the Q-learning algorithm to update the parameters of the neural network.

Atari Games:

Atari games hold a special place in the history of video gaming, having been developed by Atari, Inc. during the 1970s and 1980s. These games, such as Space Invaders, Pac-Man, and Breakout, are known for their simplicity and addictive gameplay. They provide diverse challenges and serve as an ideal platform for testing and developing AI algorithms. The project focused on utilizing Atari games as a testbed to train an agent capable of achieving high scores and surpassing human-level performance. The wide variety of Atari games available ensured a rich and diverse training environment for the agent.

Models:

Various models were employed in the project to enhance the performance of the Atari game-playing agent. Deep reinforcement learning (DRL) algorithms and neural networks played a crucial role in training the agent. DRL algorithms, such as Deep Q-Network (DQN) and Proximal Policy Optimization (PPO), were utilized to learn optimal strategies through interactions with the game environment. Neural networks were used to represent game states and approximate the Q-values, enabling more efficient decision-making by the agent. These models demonstrated their effectiveness in improving the agent's gameplay and overall performance.

Gymnasium Library:

The OpenAI Gymnasium library served as a valuable resource throughout the project. OpenAI Gym is an open-source Python library that provides a standardized interface for interacting with various game environments, including the Atari 2600 series. Gymnasium offered a wide range of Atari game environments, ensuring a comprehensive training and evaluation platform for the agent. It provided utilities for preprocessing game frames, receiving rewards, and performing actions within the game environment. The library's standardized interface streamlined the development process and allowed for easy integration of the agent with different Atari games, making it a powerful tool for training AI agents.