**[TITLE]**

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#### **Introduction**

The field of artificial intelligence has advanced rapidly in the past decade, with deep learning and reinforcement learning emerging as key areas of research. In this proposal, we aim to tackle the problem of developing an AI agent that can learn to play Atari games at a superhuman level, using deep reinforcement learning and Q-learning algorithms.

#### **Problem Statement**

The problem statement for this proposal is to develop an AI agent that can learn to play Atari games at a superhuman level. 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.

#### **Application Domain**

The proposed AI agent has applications in the gaming industry, where it can be used to develop smarter and more efficient game bots. It can also be applied to other domains such as robotics and autonomous systems, where the agent can learn to navigate and perform tasks in complex environments.

#### **Plan to Tackle**

The proposed solution involves developing an AI agent using a combination of deep reinforcement learning and Q-learning algorithms. The model will be trained using a large dataset of human-expert demonstrations and further refined through trial and error by playing against itself.

The first step in developing the AI agent is to implement a deep reinforcement learning algorithm that can interpret the game state and take actions to maximize the score. The algorithm will use a neural network as a function approximator to estimate the action-value function. The Q-learning algorithm will then be used to update the parameters of the neural network based on the rewards received by the agent.

To improve the performance of the AI agent, we will explore the use of Exponential Moving Average Based Multiagent Reinforcement Learning Algorithms, which can help the agent learn more efficiently by leveraging the experiences of multiple agents. We will also explore Reinforcement Learning with Augmented Data, which involves using generated data to supplement the training dataset, further improving the performance of the AI agent.

#### **Artificial Intelligence Techniques**

The AI agent will be developed using various artificial intelligence techniques such as deep learning, reinforcement learning, and Q-learning. We will use deep neural networks to estimate the action-value function, which maps the state of the game to a value representing the expected reward. Q-learning will be used to update the parameters of the neural network, which helps the AI agent learn to take actions that maximize its score. Additionally, techniques such as experience replay and target networks can be used to improve the stability and performance of the AI agent.

In conclusion, our research aims to develop an AI agent that can play Atari games at a superhuman level using Q-learning and deep reinforcement learning techniques. We plan to analyze the performance of the AI agent and compare it with state-of-the-art algorithms. Our research has potential applications in game development, entertainment, and education.

**References**

1. Mnih, Volodymyr, Kavukcuoglu, Koray, Silver, David, Graves, Alex, Antonoglou, Ioannis, Wierstra, Daan, and Riedmiller, Martin . "Playing atari with deep reinforcement learning." arXiv preprint arXiv:1312.5602 (2013).
2. Li, Yuxi. "Deep reinforcement learning: An overview." arXiv preprint arXiv:1701.07274 (2017).
3. Jang, Beakcheol, Kim, Myeonghwi, Harerimana, Gaspard, and Kim, Jong Wook. "Q-learning algorithms: A comprehensive classification and applications." IEEE access 7 (2019): 133653-133667.
4. Awheda, Mostafa D., and Schwartz, Howard M.. "Exponential moving average based multiagent reinforcement learning algorithms." Artificial Intelligence Review 45 (2016): 299-332.
5. Laskin, Michael, Lee, Kimin, Stooke, Adam, Pinto, Lerrel, Abbeel, Pieter, and Srinivas, Aravind. "Reinforcement learning with augmented data." Advances in neural information processing systems 33 (2020): 19884-19895
6. Mnih, Volodymyr, Kavukcuoglu, Koray, Silver, David. et al. "Human-level control through deep reinforcement learning." Nature 518, 529–533 (2015).
7. Machado, Marlos C., et al. "Revisiting the arcade learning environment: Evaluation protocols and open problems for general agents." Journal of Artificial Intelligence Research 61 (2018): 523-562.