**Final Project Proposal: Using Deep Reinforcement Learning to Teach a Robot Fine Motor Skills**

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**Problem Statement:**

With this rise of helper robotics in companies like Boston Dynamics, one of the most common problems found in these types of robots are fine motor skills like balance, walking, and interaction with the real world. [1,2] In our project, we aim to develop a reinforcement learning algorithm that can teach a robotic arm to carefully push out blocks, one-by-one, from a prebuilt Jenga tower. The main objective of this project is to see which DRL algorithm will be most successful at playing this game in a continuous 3D space.

**Approaches:**

To teach our robot a fine motor skill, we plan to use existing physics engines such as PyBullet, which is a powerful tool for simulating real-life physics in Python. By placing a robotic arm controlled by an agent in a physical environment, we can create a realistic and interactive Jenga game that the robot can learn to play with. To achieve this, we will be using algorithms such as Deep Q Networks (DQNs) and Double Deep Q Networks (DDQNs), which are DRL algorithms that have been successful in various domains, including game playing. DQNs and DDQNs learn a value function that estimates the expected cumulative reward for each action in each state, and then use this value function to select actions that maximize the expected cumulative reward.

**Expected Experimental Results:**

We expect to produce tables and graphics highlighting the rate of success of both the DQN and DDQN methods’ attempts at playing Jenga. Along with this, we will also produce other statistics highlighting run-times, resources used, as well as performances of each algorithm used. Another crucial component of our experimental results section will include a comparison of our results to previous papers that have also attempted to simulate this game.

**Potential Contributions:**

We aim to recreate the work of a previous research paper, with the potential to extend it, by grabbing Jenga blocks and placing them on top of the tower as our contribution to this project. [3] We hope that this paper will contribute to control systems innovations in the robotics space by teaching it the human touch. We believe that exploring a continuous control system as trivial as Jenga using DRL can help solve other real-world problems.

**References:**

[1] Jennifer Chu | MIT News Office. “MIT Robot Combines Vision and Touch to Learn the Game of Jenga.” MIT News | Massachusetts Institute of Technology, <https://news.mit.edu/2019/robot-jenga-0130>.

[2] Heaven, Will Douglas. “Forget Boston Dynamics. This Robot Taught Itself to Walk.” With AI, MIT Technology Review, 9 Apr. 2021, <https://www.technologyreview.com/2021/04/08/1022176/boston-dynamics-cassie-robot-walk-reinforcement-learning-ai/amp/>.

[3] Bauza, Samuel & Castillo, Juan & Nanz, August & Kambalur, Bharat. (2017). Deep Q-Learning Applied to a Jenga Playing Robot.