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| Term Paper |
| Machine Learning |
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Teaching A Robotic Arm In A 3D Simulated Environment

# Introduction:

In recent years, robotics has advanced incredibly fast but the software aspect has lacked behind. To perform a variety of tasks by the robot, programming the machine for each and every possible situation is not possible, it won’t cut it. To solve this particular problem, people have turned to machine learning, particularly reincforcement learning which tries to mimic humans way of learning through rewards.

Reinforcment learning is based on psychology and the feedback of an entities reaction to a reward. An entity, when given a reward on particular behaviour, is more likely to reproduce that action to attain the positive reward. One of the common uses of reinformcent learning is also found while training dogs, to learn to sit down or wait patiently for food. If a common dog, determined to have the intelligence of a two year old human baby can be trained to accomplish task using positive reward feedback, then so can a robot.

# Problem statement:

One of the challenges of robotics is to grab a target object, to solve his, we have trained a robotic arm in a 3D simulated environment using reinforcement learning.

# Methadology:

To train the robotic arm, we have used Gazebo and Robotics Operating System (ROS) as a simulated 3D environment and interface to train the agent. The robotic arm present in the 3D simulated environment is composed of six joints which we control and a robotic head. The reward generated for this problem is based on the distance ***d*** of the robotic head from the target object, the closer it is to the target object, the more rewards are generated. Similarly, if the robot fails to move closer to the target object over time ***t***, negative rewards are generated for the agent. After certain epochs, the agent will learn that applying positive or negative angles to specific joints will move the robotic head closer to the target object, completing the required task.

# Result:

We simply apply Q-learning technique and try to train our robotic arm.+10 reward is given to robot when Euclidean distance between the robotic arm the obstacle decreases.-5 is incase of wrong move. A practical demo will be uploaded on YouTube soon.