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ENPM 808F: Robot Learning

Summer 2017

Project Proposal

Title of the Project

Ball catching mobile robot simulation

Goal or Objective

To create a simulation of a wheeled mobile robot with a camera and a single degree of freedom manipulator that can catch a ball thrown at it.

Machine Learning method to be used

Reinforcement Learning

Brief Description of the robot/simulation/plant to be controlled

The entity to be controlled is a small, wheeled autonomous robot equipped with single degree of freedom manipulator and an on-board camera. Using object tracking through vision, the robot learns to move appropriately to catch the incoming ball. This entire robot setup would be a simulation on the Gazebo simulator.

Method of control used

Image processing using opencv library would be used to detect and track the incoming ball. Once the robot estimates the trajectory of the incoming object, it used inverse control technique to move appropriately and catch the ball.

How the ML technique will be used to learn the control mapping

The sensorimotor relations are generally non-linear in nature. The inputs to the controller after the image processing would be the position and velocity vectors of the object. The controller output has to be the value function and wheel velocity. These parameters generally have a non-linear relationship between them. Hence, the control mapping would be approximated to an artificial neural network. The weight parameters of the network would be adjusted by the “trial and error”, using an actor -critic reinforcement learning.

The combination of the outputs from actor and critic allow the system to perform an exploration. This is how Reinforcement Learning can be used to learn the control mapping

Programming language to be used

Python