Humanoid Robot: Throw Ball At A Target

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1 Objective

The objective of our project is to teach a humanoid robot(Aldebaran Nao) to identify the target in a cluttered environment and throw the ball towards the target. If the target is beyond the range then the robot conveys it's inability to do so.

2 Motivation

Field of robotics is shifting towards performing more complex actions to fulfill tasks such as rescue and search, or military operations and also for entertainment activities. Thus robots are becoming more mobile and capable of performing human actions. Synonymous to human body, humanoid robots have carved a niche into the robotics world due to the fact that they can closely imitate humans in every task be it cleaning home,playing football or dancing. Throwing an object to a particular target has it's application in military operations like targeting explosives, and also in natural disasters to supply food and necessary things in the affected areas. It also has many applications in entertainment field as throwing a ball at a target is the basic skill required in several games like basketball and throwball.

3 Our Approach

Our framework includes three tasks:

- **Identification of target:** For target detection the RGB image derived from Nao's forehead camera will be used. It will be first converted to HSV(Hue Saturation Value) space and then morphological image processing operations. Finally the center of the target is found from it. The distance of target from the robot can be estimated using the ratio of the pixels of the image of the target perceived by a predefined value.
- **Adjust position and Performing throwing action:** Given an estimate of the target, NAO robot will calculate the desired trajectory for it's arm using a kinematics and dynamic model. For the robotic arm to move in this trajectory the desired configuration is obtained by inverse kinematics for the Aldebaran NAO humanoid robot [3] .
- **Feedback learning:** The vision system of the NAO will measure where the ball lands with respect to the target. Based on the error, the NAO will optimize its motion using task level learning [1].

4 Evaluation

There is no gold set of correct instances for this task. Instead, we can approximate the success rate by performing random experiments. Precision of the throw can be estimated by measuring the deviation from the center of the target.

References

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