MRL Team Extended Abstract for Humanoid Kid Size League of RoboCup 2023

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Abstract. This paper highlights the major problems we have faced during RoboCup 2019 including reflection of direct sunlight from objects in the drop-in field of play, robot's collision, and positioning of each role in the field. Moreover, our plans to solve the problems are described.

Keywords: RoboCup, Kid Size Humanoid League

1   Introduction

Participating in RoboCup competition during previous years has been an opportunity to test and debug and sharing information with other teams. It also informs us of the problems in software and hardware, which are described in the following sections.

2   Vision

One of the major changes we had planned was the use of the Stereolab Zed mini stereo camera, which could provide accurate depth information. But due to the high price of this camera, we will use the Sony eye camera this year. Since we are trying to implement our object detection system in full resolution input size, another planned change is to use Nvidia jetson nano embedded pc which dose benefits from a modern GPU and results to faster run time of neural network modules.

Reflection of direct sunlight from objects in the drop-in field is one of the major issues we are trying to solve. Direct sunlight on the grass can cause misclassification in our semantic segmentation module. Currently, we are trying to solve this by retraining the network with more data. Another major problem that we faced in RoboCup 2019 was too many collisions of robots. Every collision can cause damage to the robot or lose an opportunity for scoring a goal. Therefore, one of the planned changes for RoboCup 2023 is to detect robots and consider this information in action planning with the goal of reducing robot collision.

3 Behavior

Last year we introduced the Active Head action selector module which controls the viewpoint of the robot in order to improve localization and modeling the surrounding objects i.e. other robots or landmarks. The module, however, faced some problems main of which is the localization error because the robot chooses the action that minimizes the entropy on current localization data [1]. This year we are looking forward to using a deep reinforcement learning algorithm in which the robot learns to move its head in the direction that will have the most observations from raw input image. Also, this year we are working on better positioning of each role in the field in order to better blocking the way of ball to the own goal and more convenient reaching to opponent goal using the information shared by other robots and perceptions observed by the robot itself.

4 Mechanical design and dynamical analysis

Due to the new rules of RoboCup 2023 and integration of Kid Size and Teen Size into one league, we decided to design a new platform of the humanoid robot. The previous platform was made by entirely aluminum which makes the weight of the robot heavy [2]. For this reason, we're going to use a combination of carbon composite, 3D printer filament and aluminum for the robot's body structure. The dynamical analysis before manufacturing of the robot is needed to reduce costs and errors [3]. Since the new platform of MRL humanoid robot is being designed, the use of simulator for dynamical analysis purposes is required. MRL-HSL real-time simulator [4] is a virtual humanoid robot which helps to dynamical analysis with considering forces on mechanical parts.

References

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