UPennalizers

UNIVERSITY of PENNSYLVANIA

Penn Engineering

GRASP LABORATORY

General Robotics, Automation, Sensing & Perception Lab

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Abstract

The UPennalizers is a Robocup team affiliated with the General Robotics, Automation, Sensing & Perception Laboratory at the University of Pennsylvania that competes in the Standard Platform League (SPL). The team focuses on integrating computer vision, machine learning, motion control and artificial intelligence to achieve the task of making a multi-agent team of humanoid robots play soccer autonomously. This work describes developments made in the UPennalizers' behavior, team coordination, vision and locomotion modules in preparation for the RoboCup 2019 SPL competition in Sydney, Australia.

Behavior

Strategic still states were introduced to our behavior Finite State Machine to reduce overheating in motors and to improve the geometric mapping of visual landmarks.

New free-kick strategies were implemented to improve our global ball model, vary our attacking approaches and add a reliable non-symmetric landmark to the field for robot orientation adjustment.

Vision

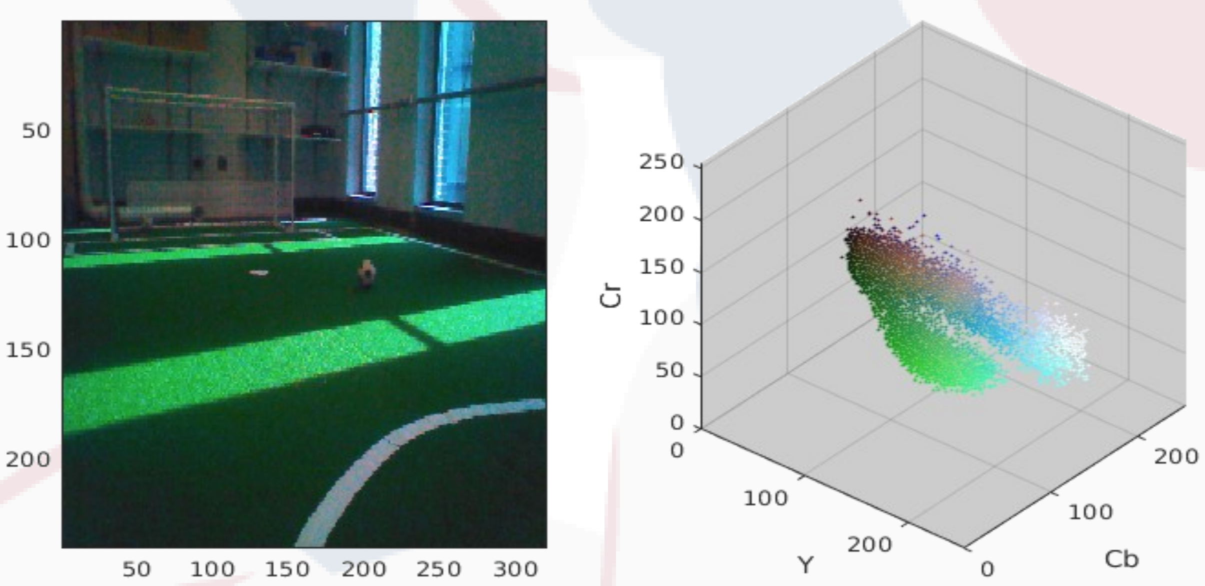

Figure 1: Camera tool results

A new tool was created to quickly find the ideal camera settings for challenging lighting scenarios. Using a handcrafted starting point, the camera's exposure time, gain, and saturation settings are updated with gradient descent until the mean of the row and column maximums of the Y channel (YCbCr) match a desired maximum brightness setting. With a high enough gamma setting, this tool ensures that color-based methods stay operational even in difficult scenarios.

Team Coordination

A cognitive dissonance model was utilized to make optimal team decisions in situations of noisy and adversarial data. Internal dissonance was calculated via a particle filter for localization while external dissonance was based on analyzing teammate ball readings.

Team decisions and roles are determined internally on each robot with the decision related parameters sent between robots to decrease the number of packets needed to be sent to update team behavior.

Locomotion

Work was done to decrease asymmetric motor use by alternating between support sides while performing motion tasks. In addition to using a stable leg to support a resting other leg, the robots also keep track of internal motor temperatures to determine which side to push off of during the getup motion.

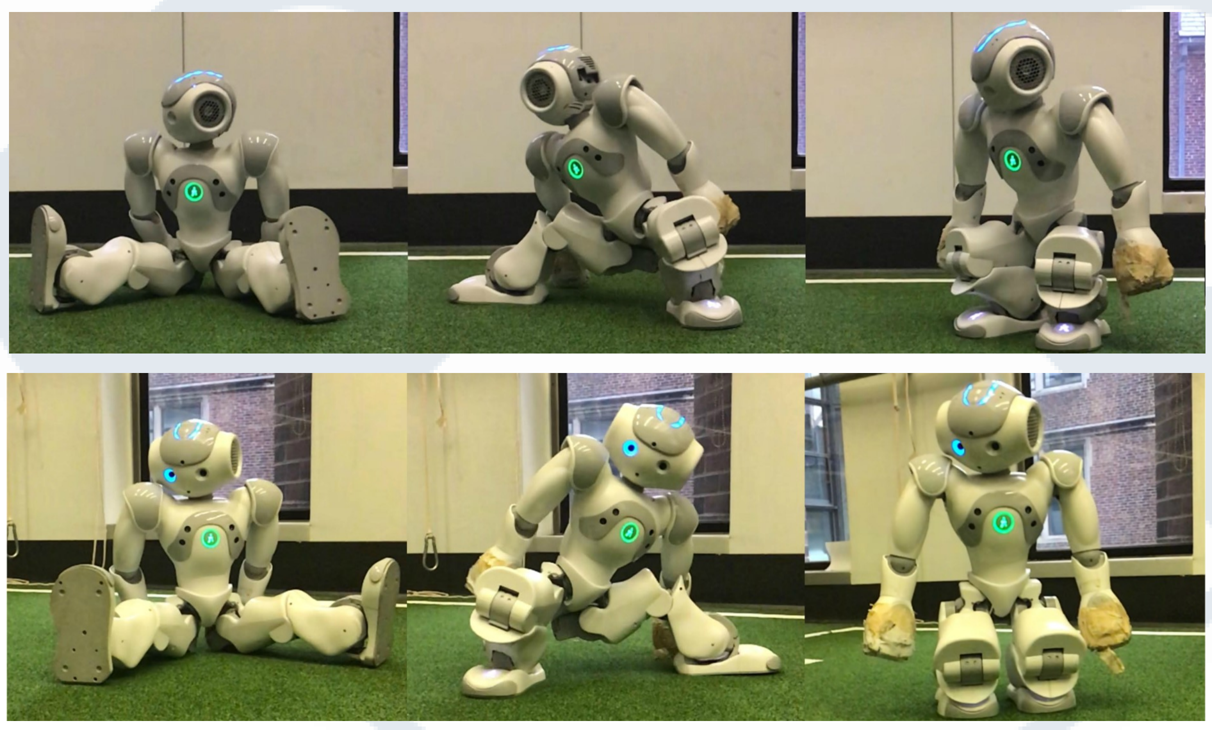

Figure 2: The get-up motion alternating support side

Acknowledgements

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