WrightOcean Team Description for RoboCup 2017

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Abstract. The paper introduces the information of WrightOcean team, and presents our techniques that would be used in RoboCup 2017. We have developed novel approaches to detect black and white ball and middle circle based on B-Human code release 2016. Furthermore, we have improved the robots' walking stability using walking engine from UNSW Australia team.

Keywords: RoboCup, vision, motion, behavior control

1 Introduction

WrightOcean, a team which belongs to Lab of Robotics, School of Information and Electrical Engineering, Ludong University in China, was established in April 2012. It is a young and passionate team, and all of the members are undergraduates keen on robotics.

The team consists of the following numbers.

1. Instructors: Fei Liu, Gaohuan Lv
2. Students: Yanbin Wang, Chunxue Li, Shuai Ma, Xinkai Wang, Yimin Wei

The WrightOcean team participated in the Standard Platform League of RoboCup China Open in 2013 for the first time, and we were the runner-up to the TJArk team from Tongji University in a team competition. In 2014, we took part in three technical challenges and shared the third place with Dalian University of Technology. In 2015, we firstly took part in RoboCup International SPL and won the third place in technical challenges and one of best drop-in only teams in drop-in player competition[1]. In 2016, we took part in Pre-RoboCup Asia-Pacific Competition in Beijing and we firstly used black and white ball to participate in the team competition. We are very excited that we can participate in RoboCup 2017. We really hope that the RoboCup 2017 will continuously improve the evolution of the culture of AI and robotics in China and will attract more students in our university.

This paper is organized as follows: Sect. 1 is about our team and team members' information. Sect. 2 is about a new algorithm for ball recognition. Sect. 3 is about middle circle detection. Sect. 4 and 5 is about biped walk and kick. Finally, we do a conclusion.

2 Ball Recognition

For improving recognition efficiency of black and white ball[2], we present a method that combines the SVM classifier with the HOG feature of local area in the image. The recognition process is divided into several aspects as follows.

1. Find out not-green areas in the image.
2. Calculate the size of the green areas and remove the area if it is too big or too small.
3. Calculate the center of each not-green area.
4. Calculate HOG descriptor of each not-green area.
5. Use well-trained SVM model to select the real ball.

3 Middle Circle Detection

In order to improve the detection of middle circle, we do lots of changes about the algorithm based on B-Human 2016 code release[3]. We strengthen the detection of lines and then judge whether these lines belong to the circle. We present one method to synthesize a circle. If the line can synthesize a circle, a circle is found, or intersections are found. If the intersections are two small X or T types, they need to be verified. We add the middle line to verify so that we can improve the detection of middle circle.

4 Walking

This year we have decided to improve robots' walk stability based on a walking engine[4] from UNSW. We have refactored the walking engine's code, integrated many data types, and made changes to speed control, foot trajectory generation, and balancing so far.

At present, we have made progress in walking gait of NAO. In our test process, we test the speed of robot on two types of filed which are the artificial grass (the height of glass is 8 mm) and the carpet. On the filed of carpet, the forward speed of the robot has reached 22.5 cm/s, the back speed to 24 cm/s and the lateral speed is 12.5 cm/s. On the artificial grass, the speed is relatively slow, the forward speed of the robot has reached 20.5 cm/s, the back speed to 23 cm/s, and the lateral speed is 9 cm/s.

5 Kick

Now we design the kick actions by using a kick engine algorithm and replaced the special action using key frame algorithm. The mainly advantage of kick engine is that it uses the inverse kinematics and make the action smooth, so it can't make more damage to the robot. There are mainly three kinds of kicks (FASTKICK, MEDIUMKICK and LONGKICK). The FASTKICK is used to achieve the function that grabs the ball, the MEDIUMKICK is used to pass ball between the teammates, and LONGKICK is used to achieve shot over a long distance.

6 Behavior Control

At present, we choose to avoid obstacles in the way of reactive avoidance. According to obstacle model and goal position, we choose whether we should avoid obstacles. And we will optimize the path planning algorithm in the future.

In order to get the best defensive position, we add the algorithm to select the best point based on the ball's position. Taking Keeper for example, we found that when the goalkeeper standing on this point, the probability of success of the defense is high. We are trying hard to enrich our decision. In the next step, we are going to add a algorithm to compute free goal direction.

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