Team Description Paper: BabyTigers - R 2016

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Abstract. From 1998 to 2004, BabyTigers which consisted of Osaka University, participated in SONY Legged Robot League. And from 2005 to 2010, BabyTigers-DASH[1] of Osaka City University and Ryukoku University participated in 4-Legged Robot League. And from 2011, BabyTigers - R[2] of Ryukoku University has participated in RoboCup Logistics League (which old name is Logistics League Sponsored by Festo).
Our laboratory has two research fields[4, 6, 7]; one is wireless communication[8, 9], and the other is artificial intelligence[10]. So in Logistics League, we aim to make communication system with each other robot like as multiagents.

Keywords: Logistics League, RoboCup, BabyTigers - R, robotino

1 Introduction

This paper describes BabyTigers - R 2016. Our team belongs to the Department of Electronics and Informatics, Ryukoku University.

This year, we use Fawkes[3] as a middle ware. And our robot system consistes of some external modules with a raspberry Pi. For example, controlling a gripper, recognizing lights states of a signal.

And in order to recognize MPSs we use stereo cameras. In this year we have two research themas; interfaces and object recognition.

2 About interface

In this section, we describe the interface using a Kinect for robotino[5]. Kinect is a device for Xbox360 that Microsoft released, and that has a RGB camera, a distance camera and four multi-array microphones. Kinect can extract skeleton information of a person by the distance camera. That is possible to obtain movements of a person in three-dimensional data. Microsoft Corporation has been published SDK(Software Development Kit) which is used in various fields. We made three interfaces (car type, motorcycle type and joystick type) using

Kinect for robotino. In the car type, we can change directions by twisting our arms like steering of car and run by putting our right foot out like pressing an accelerator. Acceleration of the motorcycle type is determined by longitudinal position of both hands, and we can change directions by bending our body. At last the joystick type, we can operate a robotino by longitudinal position of our right hand.

In this experiment, we operate a robotinos using the three existing interfaces. We made two courses which are a straight line and a wave line. The operators make a robotino moves on these courses using those interfaces. We evaluated impressions from use of these interfaces from operators (accelerator, steering, stability, etc). The result is shown at Figure 1. The motorcycle type and the joystick type were low evaluations about steering and stability performance. Sometimes the motorcycle type and the joystick type couldn't control movement directions. It is considered that was caused by unconscious tilt of body and position of hands. On the other hand, steering performance of the car type was better than others because operator can see them hands when they are operating a robotino. We have to modify recognition performance on Kinect for the future. And we need to consider about setting of suitable dead zone and a way to understand current operation.

In this section, we extracted of movement instruction to a robotino from virtual interfaces that we created. As a result, we could obtain superior operation and inferior operation from evaluations when operating a robotino using three interfaces. We will be able to extract better movement instruction method for robotino by adding evaluation criteria of reactivity for input operation.

3 About ojbect recognition

In this section, we describe the object recognition using two cameras. The robotino uses two cameras in order to recognize MPS stations without makers for openChallenge. The object recognition by images often uses pixel matching and image learning. Images necessary for learning are several thousand and it is not realistic to photograph in RCLL. Therefore we suppose the environment which the robotino can't take enough pictures, and extract image information except unnecessary image information for learning. We evaluated learning performance by image information except background image which is created by estimating distance to objects using two cameras. Stereo matching is a way of estimating distance to objects by taking a parallax of two images from two cameras. We can get a distance value from parallax by looking for elements of a right image corresponding to elements of a left image which is a standard.

We compared learning performance of regular images and learning performance of backgroundless images by misrecognition rate after learning. The robotino kept constant distance from a object, turned around and photographed it. The photography performed 20 times in total every 18 degrees. We selected a portable TV, a speaker and a coffee maker as the objects. The backgroundless images removed a background by painting in black more than the threshold value of dis-

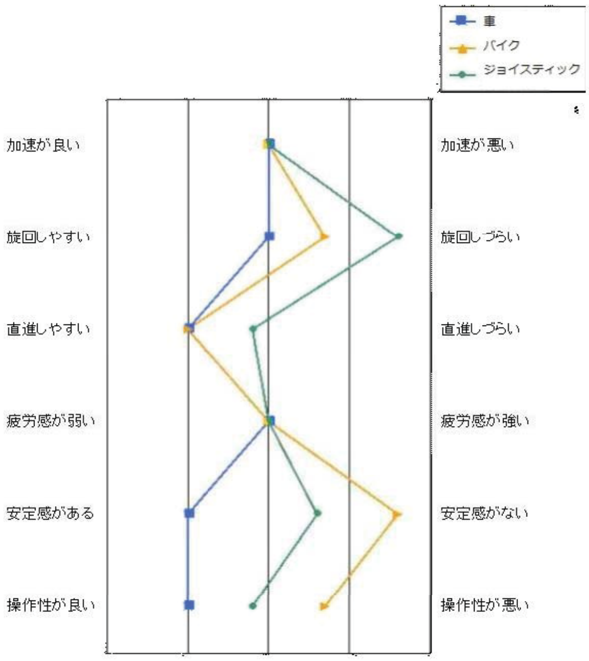

Fig. 1. Experiment results

tance image which made by image from left camera. We photographed learning images and evaluation images at another place in order to measure the influence of backgroundless images.

We used multilayer perceptron with backpropagation algorithm as learning method. We performed leaning until error values of learning results become less than a stop value or the leaning number of times become maximum since input learning images into perceptron. We input an evaluation image into the discriminator and output a discrimination result. Figure 2 shows recognition and error rate.

In case of regular images, we could not obtain high recognition rate. On the other hand, backgroundless images were obtained a higher result than regular image. We could make the discriminator which has enough recognition performance if we have some evaluation images. We will apply that to deep learning for future.

4 Conclusion

Our labolatory consists of two research fields, one is the wireless communication, and the other is the artificial intelligence. This year, we have two research themes. And we make our program using C++ on fawkes. Through RoboCup competitions, we would like to improve and exchange the technology.

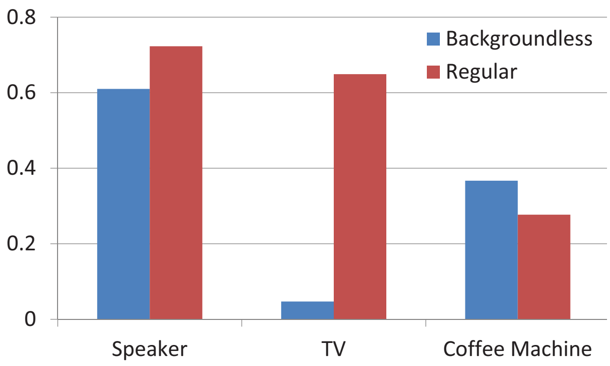

Fig. 2. Recognition and error rate

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