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Logistics Box Recognition in Robotic De-Palletizing System with Combination of Cycle-GAN and Mask-RCNN

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Extended Abstract

In an automated box de-palletization system that utilizes robots, vision-based box recognition on the pallet plays the main role in providing picking guidelines. The complexity of the working condition and the target object, particularly the cluttered arrangement and various outer surfaces of the boxes, significantly affect the quality of the outcome. Typically, a large-scale vision dataset is required to train a deep learning object-detection model. However, considerable effort and time is required to achieve this. Therefore, this study proposes a Mask R-CNN-based detection approach for box objects, which is supported by a cycle generative adversarial network (Cycle GAN). The purpose of the Cycle-GAN is to optimise the outer surfaces of boxes by automatically erasing tags, stickers, labels, and symbols that exist on the boxes before loading them to the Mask R-CNN for detection. Subsequently, the obtained result was combined with the output from the developed boundary-enhancing technique that was applied to a depth map. Consequently, the box detection performance was significantly improved, and it was confirmed through experiments with a practical robot system in picking tasks. In the experiments, the success rate of the proposed method was validated using 200 cases of orderly and disorderly arrangements of boxes, respectively. Furthermore, the metric of the mean absolute error between the predicted picking point and the ground truth values for the test cases in the implementation process for the robot operation was also researched.

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