

Automated Design of the Field-of-View, Illumination, and Image Pre-processing Parameters of an Image Recognition System

As machine vision technology becomes more widely applied in industrial fields, designers have been attempting to tune the parameters for different kinds of vision system. In the object recognition system of a pick-and-place robot, for example, the camera position needs to be set to allow the robot to determine how many target objects have been captured, to adjust the illumination level, and to tune the image pre-processing parameters in the recognition algorithm. As this creates a number of conflicting variables, the design process must be reiterated until acceptable results are obtained. This is a time-consuming task, even when carried out by experts, and even a simple pick-and-place vision system usually takes several days to design.

In this study, we proposed a system that is capable of automatically designing the field-of-view of an image recognition system, based on the relationship between the camera and the target objects, the illumination conditions, and the image pre-processing parameters. We reformulated the design problem as an optimization problem, and used a multi-start nearest neighbor search method to solve it. Two evaluation experiments were conducted, with different distances between the target objects. The results demonstrated that the system was able to choose an appropriate field-of-view, illumination conditions, and image pre-processing parameters, taking account of the distance between target objects and the required accuracy of recognition.

Keywords: vision, recognition, parameter optimization, illumination, field-of-view, pre-processing

Reference

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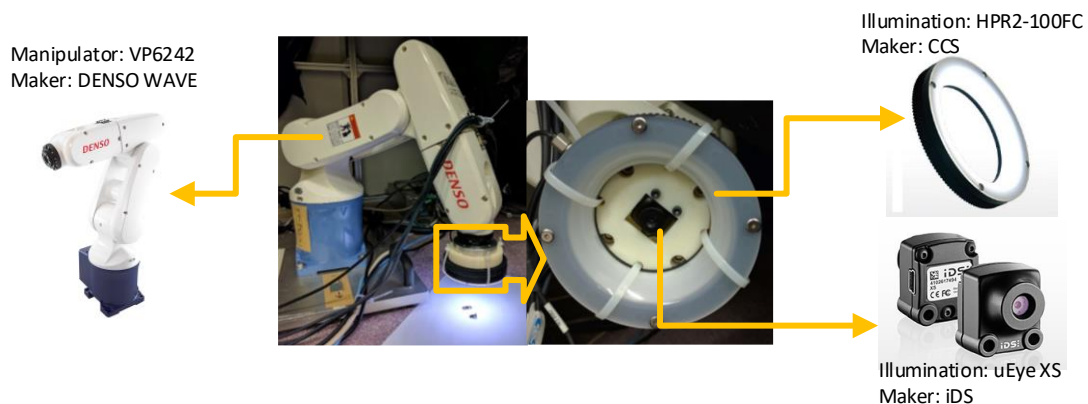


Figure 1. Experimental devices: ring-shaped illumination could change illumination from strength and color, manipulator make it possible to tune field-of-view by moving the position of camera.