Identification of Objects for Robotic Bin Picking Applications

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**Abstract**

This paper presents methods for segmenting an image of isolated and overlapping objects such that each segment contains only one object. Segmentation is accomplished by a two-step process. The first step uses morphological techniques to quickly identify isolated objects, and the second step uses eigenobject identification techniques to find overlapping objects.

Keywords

image processing, robot, eigenvector, principle component analysis, bin picking, morphology, object identification

# INTRODUCTION

# Preprocessing

Size

ROI

# Identifying Isolated Objects

Isolated objects can be identified quite easily by morphological methods, and doing so in advance simplifies searching for grouped objects. In some situations, the image may only contain isolated objects, and the segmentation task ends after this step.

To find isolated objects, the first step is to select the color channel in which the objects stand out best against the background. Since the objects are white bottle caps and the background is brown, the objects appeared clearly in the saturation plane of a hue/saturation/value (HSV) image.

Once the saturation plane was chosen, Otsu's method was used to find a threshold level to convert the image to a binary image. The resulting image consisted of black blobs representing the bottle caps against a white background. The image was inverted so that the objects were white against a black background.

Once the binary image had been generated, the blobs were eroded using a circular ("disk") structuring element. The structuring element was 30 pixels across, about one fifth of the average size of the bottle caps. This size was chosen to be as large as possible without completely removing any of the bottle caps from the image. Eroding served two purposes. Eroding the image removes the noise in the image, leaving only large blobs. Eroding also severs any "bridges" between objects that are barely touching each other.

After eroding the image, the remaining blobs were classified by their area. Blobs that were larger than a certain minimum area and smaller than a maximum area were determined to contain one and only one cap.

These chosen blobs were individually dilated by the same structuring element that they were originally eroded by, returning them to approximately their original size. Once each blob was dilated, it was added to a label matrix. The label matrix is a matrix of integers the same dimension as the original image. It stores labeled regions by filling in the pixel values with integers (labels) corresponding to each region. Since regions are discretized, it is easy to pick out individual regions for further processing or display.

In addition to marking the found caps in the label matrix, the cap blobs were added to an image mask. This mask was used to remove the caps from the original image so that they could be ignored during the next step.

# Identifying Grouped Objects

# Results and discussion

Summary

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References