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Classification of Shiitake Mushrooms by Using Convolutional Neural Networks

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1. Introduction

Mushrooms have high commercial value, such as fruits have high-end products. Product value is determined by various factors such as roundness, thickness, and size. The quick way to find product value of shiitake mushrooms is whether the caps is open or not. Currently, people are deciding whether or not the cap is open. It is necessary to classify automatically by using AI.

In this study, we improve classification accuracy by using edge detection called the Canny method. We classify images with edge detection by using convolutional neural networks(CNN)[1]. We aim at emphasizing the difference between characteristics of shiitake mushrooms.

2. Proposed system

We propose the method to classify the caps of shiitake mushrooms.

First, we process images with edge detection by using the Canny method in Fig. 1. We create 3 types of images with different threshold values. The data sets have each 220 images with edge detection. They are 110 images with the open cap and 110 images with the closed cap.

Second, we classify images with the standard CNN with 4 convolutional layers and 2 pooling layers.
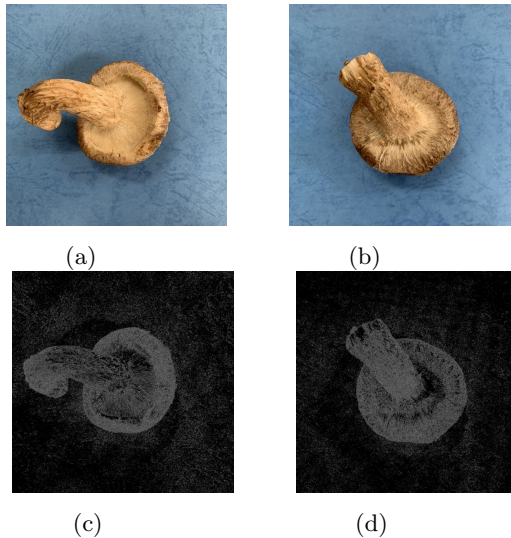

(a)   (b)

(c)   (d)

Figure 1: Original images and images with edge detection.
(a) A original image of a open cap.
(b) A original image of a closed cap.
(c) A image with edge detection of a open cap.
(d) A image with edge detection of a closed cap.

3. Results

We compare the learning and test accuracies of 4 data sets of images or images with edge detection. The first data set has original images which are 110 images with the open caps and 110 images with the closed caps. The second data set has images with edge detection, which are 110 images with the open caps and 110 images with the close caps. They are made from the first data set by using the Canny method. The threshold for this data set is 60. The third data set and forth data set have images with edge detection as well as second data set, and the threshold for these data set is 50 and 40, respectively.

The all data set are classified whether the caps are open or not by using the convolutional neural networks which has 4 convolutional layers and 2 pooling layers.

Table 1 summarizes the simulation results. The test accuracy of the classification for the forth data set is 0.94. This score is higher than the score of the first data set. It is considered that the difference in caps is more emphasized.

Table 1: Test accuracies.

data set	Test accuracy
original images	0.91
edge detection (threshold is 60)	0.65
edge detection (threshold is 50)	0.69
edge detection (threshold is 40)	**0.94**

4. Conclusion

In this study, we have investigated comparison of the classification whether the caps of Shiitake mushrooms is open or not with the 4 data sets. The first data set has original images. The other data sets has images with edge detection using the different threshold values.

From these simulation results, we confirmed that the proposed system is effective for classifying caps of shiitake mushroom. However, the test accuracies of the second data set and third data set are lower than the test accuracy of the first data set, so we will investigate the the effects of difference of the threshold.

References

[1] A. Krizhevsky, I. Sutskever and G. Hinton, "ImageNet Classification with Deep Convolutional Neural Networks", Neural Information Processing Systems(NIPS), pp. 1097-1105, Dec. 2012.

Acknowledgement