FIBER CLASSIFICATION BY DEEP LEARNING USING REGIONS OF INTEREST BASED ON VISUAL EVALUATION

Kanya Kuramoto[1], Einosuke Honda[2], Saori Kitaguchi[3]

[1] *Kaken Test Center, Osaka, Japan, e-mail: kanya_kuramoto@kaken.or.jp*
[2] *Kyoto Institute of Technology, Kyoto, Japan, email: m3682031@edu.kit.ac.jp*
[3] *Kyoto Institute of Technology, Kyoto, Japan, email: kitaguchi@kit.ac.jp*

Abstract: One of the methods for fiber identification is the microscopic testing method, in which fibers are visually identified based on their shape using a microscope. Our previous studies [1,2] have attempted to classify flax and ramie, which are difficult to distinguish because they are the same hemp, using deep learning. In the previous studies, the images of flax and ramie were captured under a microscope (Figure 1(a)), and they were used to train and test the deep learning model derived to classify the two types of fibers. However, the results were not much better than a visual evaluation using the same images. In the actual microscopic testing, fibers are observed through the lens of a microscope while being moved by hand, rather than being judged by a still image. In order to improve the accuracy of the deep learning model, this study focused on specific regions of the fibers that the observers paid attention to when evaluating the fibers. The visual evaluation was performed by six observers. Each observer selected regions of the image in which flax or ramie characteristics were evident (Figure 1(b)). All characteristic regions were selected from a single image, not just one region. In the deep learning experiment, each extracted region of an image was scaled so that the long side of the region was 256 px, and the margins were filled with noise images to create a square image of 256x256px (Figure 2(a)). These images, 1,293 in total (725 flax and 568 ramie images), were used as training data. A total of 127 images (66 for flax and 61 for ramie) were used as test data (Figure 2(b)), which were the image data of flax and ramie that had a 100% correct rate in the visual evaluation by the same six subject using microscopic images. The result of the validation accuracy in the deep learning experiment was about 72% on average, but the breakdown of correct answers was about 51% for the flax images and about 95% for the ramie images (Table 1). The correct answer rate for the flax image was lower than in the previous study. However, the ramie image was predictable with high accuracy.

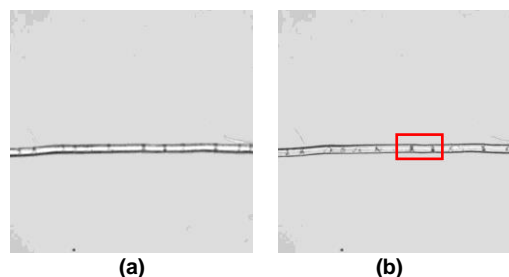*Keywords: fiber identification, deep learning, visual evaluation, flax, ramie*

Figure 1 (a) An image of a fiber taken under a microscope (b)Example of region selection within a microscope image.
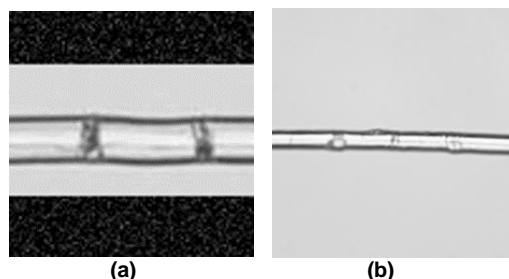

Figure 2 (a) Example of training data, (b) Example of testing data

Table 1 Validation accuracy in deep learning experiments

		Number of images	(%)
Correct	linen	34	51.52
	ramie	58	95.08
	total	92	72.44
Wrong	linen	32	48.48
	ramie	3	4.92
	total	35	27.56

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