# Identification of dried meat floss and dried meat powder using computer vision

Meng-Han HU[1], Qing-Li DONG[1*], Yang-Tai YANG[1], Bao-Lin LIU[1], Fang-Fang WANG[2]

(1.School of Medical Instrument and Food Engineering, University of Shanghai for Science and Technology, Shanghai 200093, P.R. China; 2.China Agriculture Press, Beijing 100125, P.R. China)

* dongqingli@126.com

**Abstract - In this paper, a rapid nondestructive test method was established by computer vision and back propagation (BP) artificial neural network to identify dried meat floss and dried meat powder. The images of sixty dried meat floss and dried meat powder were converted to gray and cut into 899 × 772 pixels. The gray mean, the total entropy, the standard deviation of gray scale matrix and contrast, correlation, energy and homogeneity based on gray level co-occurrence matrix were extracted from the cut gray images and the fractal dimension was extracted from the cut binary images. These eight texture indicators of forty-five dried meat floss and forty-four dried meat powder pre-processed images were used as the training set in training BP artificial neural network, and the rest samples were used as the test set. Results demonstrated that the total classification accuracy of the final BP artificial neural network was 80.65%. Two dried meat floss and four dried meat powder were miss classified. The study provided a rapid nondestructive analytical system for identifying dried meat floss and dried meat powder.**

## I. INTRODUCTION

Dried meat product has been divided into three types according to the processing technologies, including short dried meat floss, dried meat floss and dried meat powder [1]. The protein content of dried meat powder is much lower than that of dried meat floss, and hence, the price of dried meat floss is more expensive. Although dried meat floss and dried meat powder are flocculent and loose granular in appearance, respectively, it is difficult for consumers to distinguish using their naked eyes.

Dried meat floss and dried meat powder can be identified by using the starch content as the quality indicator. However, this chemistry method is time-consuming and not suitable for the quick and non-destructive detection at the point of sale. Computer vision is one of the non-destructive testing techniques, which has been widely used in the quality inspection of raw meat [2-3] and meat product [4-5]. Therefore, computer vision technology using back propagation (BP) artificial neural network as classifier to identify the dried meat floss and dried meat powder is used in this study.

## II. MATERIALS AND METHODS

Seven pork dried meat product brands (three brands each having twenty samples for dried meat floss and four brands each having fifteen samples for dried meat powder) purchased from a local market in Shanghai, P. R. China, were used in the following experiments. Each sample was made as a rectangle shape with a size of 9 cm× 6.5 cm on the sample platform. Three images for one sample were taken and the mean value of image features were calculated for input of

BP artificial neural network.

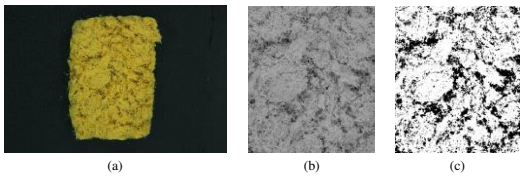
The computer vision system in this study is similar with the reference [6]. The properties of obtained images are 2592×1728 resolution, 400 ISO, 1/100s exposure time, 43 mm focal distance and 5 aperture values.

All the acquired images were subjected to the gray transformation, image cutting and image binaryzation. The resulting resolution of images was 899 × 772. Subsequently, the eight texture indicators were extracted from the processed images, namely gray mean, total entropy, standard deviation of gray scale matrix and contrast, correlation, energy and homogeneity based on gray level co-occurrence matrix and fractal dimension based on binary image. Finally, these image features of eighty-nine samples (forty-five and forty-four, respectively, for dried meat floss and dried meat powder) were input into the BP artificial neural network to train the classifier, and the image features of the rest samples were applied for the verification of the trained classifier.

## III. RESULTS AND DISCUSSION

The typical pre-processed images are shown in Fig. 1.

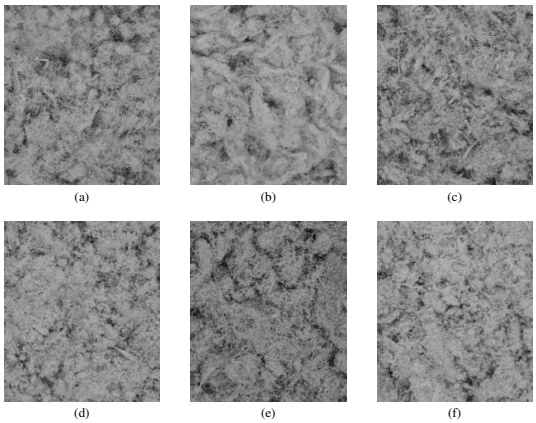
Fig.1- The cut typical grayscale and binary image of dried meat floss




(a) Original image; (b) Cut grayscale image; (c) Cut binary image

The gray images of the rest brands are shown in Fig. 2.

Fig. 2- The cut grayscale images of dried meat floss and dried meat powder




(a), (b) and (c) are dried meat floss and (d), (e) and (f) are dried meat powder

The normalized typical texture features of dried meat floss and dried meat powder are shown in Table 1.

The final classification accuracies are shown in Table 2.

In further study, the classification accuracy could be improved by adding the spectral imaging techniques in the traditional computer vision, such as multi-spectral imaging and hyper-spectral imaging.

## IV. CONCLUSION

The classifier on the basis of the BP artificial neural network and computer vision was developed for the identification of dried meat powder and dried meat floss. The total classification accuracy was acceptable (80.65%).

## ACKNOWLEDGEMENTS

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Table 1 A normalized typical texture features of dried meat floss and dried meat powder

| brand / texture feature | Dried meat powder | | | | Dried meat floss | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Gray mean | 0.673 | 0.834 | 0.136 | 0.575 | 0.772 | 0.963 | 0.611 |
| Total entropy | 0.464 | 0.228 | 0.680 | 0.702 | 0.268 | 0.218 | 0.697 |
| Contrast | 0.242 | 0.220 | 0.237 | 0.247 | 0.265 | 0.245 | 0.253 |
| Correlation | 0.676 | 0.663 | 0.695 | 0.688 | 0.645 | 0.666 | 0.687 |
| Energy | 0.294 | 0.301 | 0.236 | 0.271 | 0.303 | 0.289 | 0.272 |
| Homogeneity | 0.737 | 0.736 | 0.735 | 0.738 | 0.736 | 0.736 | 0.738 |
| standard deviation of gray scale matrix | 0.782 | 0.729 | 0.836 | 0.819 | 0.724 | 0.757 | 0.817 |
| fractal dimension | 0.373 | 0.344 | 0.740 | 0.643 | 0.780 | 0.371 | 0.646 |

Note: in the table, number 1, 2, 3 and 4 are dried meat powder; number 5, 6 and 7 are dried meat floss.

Table 2 The classification results of the training set of dried meat floss and dried meat powder

| Category | Sample number | Classification result | | Accuracy/% | Total accuracy /% |
|---|---|---|---|---|---|
| | | Dried meat floss | Dried meat powder | | |
| Dried meat floss | 15 | 13 | 2 | 86.67 | 80.65 |
| Dried meat powder | 16 | 4 | 12 | 75.00 | |