A031. Near-infrared hyperspectral imaging and chemometrics to classify different rice varieties

Elena Cazzaniga[1], Nicola Cavallini[1], Francesco Savorani[1], Francesco Geobaldo[1], Adrian Gómez-Sanchez[2], Anna De Juan[2]
[1] Polytechnic of Turin, Department of Applied Science and Technology, Corso Duca degli Abruzzi 24, 10129, Torino, Italy
[2] Universitat de Barcelona, Department of Analytical Chemistry, Carrer de Martì I Franquès 1-11, 08028, Barcelona, Spain

E-mail elena.cazzaniga@polito.it

Hyperspectral imaging (HSI) is a non-destructive, highly informative analytical technique that provides both spectral and spatial information about the analysed samples. The advantages of this technique allow its application in many fields [1], one of which is the agro-food field. In this context, the possibility not to compromise samples and avoid their manipulation or descruction during the analyses is of particular interest, because it prevents wastes and allows to re-use the food samples.
As another advantage, HSI allows to analyse a large number of samples, making it is possible to eventually obtain their chemical fingerprint. Moreover, an additional source of information comes from the morphological features extracted from the images: it is possible not only to discriminate samples based on their chemical profile, but also considering structural parameters. In the present work, HSI was used to analyse 47 different rice varieties.
For each variety, one image with 15 rice grains and one image with 100 grains were taken. For this purpose, a NIR-HSI camera (SPECIM FX17, Finland) connected with a motorized scanning bed (LabScanner Setup 40×20 cm) was used. The images were pre-processed to remove light scattering and optical effects due to the round shape of the camera's lenses. The data were then converted from reflectance to absorbance and merged to obtain an individual data file gathering the information from both collected images (15 and 100 grains).
In order to handle the complex and plentiful amount of information, this technique is usually combined with multivariate analysis and deep-learning tools [2,3]. Multivariate data analysis was applied to inspect and model the data under MATLAB environment. Firstly, Principal Component Analysis (PCA) was used to gather a general idea of the information carried by the samples, both for spectral and morphological features. Then, different classification methods were applied to build robust and reliable models aimed at distinguishing among the varieties, with the perspective of counteracting food-fraud. To do that, Partial Least Squares-Discriminant Analysis (PLS-DA) and hierarchical classification models were exploited. The obtained results provided interesting insights into the chemical and structural differences occurring among the rice varieties under examination, which could also be clustered into macro-groups according to their similar morphological and spectral features.

[1] N.A. Aviara, J.T. Liberty, O.S. Olatunbosun, H.A. Shoyombo, S.K. Oyeniyi, Potential application of hyperspectral imaging in food grain quality inspection, evaluation and control during bulk storage, J. Agric. Food Res. 8 (2022) 100288. https://doi.org/10.1016/J.JAFR.2022.100288.
[2] Y. Bao, C. Mi, N. Wu, F. Liu, Y. He, Rapid Classification of Wheat Grain Varieties Using Hyperspectral Imaging and Chemometrics, Appl. Sci. 2019, Vol. 9, Page 4119. 9 (2019) 4119. https://doi.org/10.3390/APP9194119.
[3] L. Wang, D. Liu, H. Pu, D.-W. Sun, W. Gao, Z. Xiong, Use of Hyperspectral Imaging to Discriminate the Variety and Quality of Rice, (n.d.). https://doi.org/10.1007/s12161-014-9916-5.