

Clustering-based automated data reduction for the processing of hyperspectral data on paintings

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The present study describes a multivariate strategy that can be used for the automatic processing of NIR hyperspectral imaging data obtained during investigation of paintings. The chemometric strategy is based on the integration of principal component analysis (PCA) with a clustering approach in the space subtended by the three lowest-order principal components, by means of the density-based spatial clustering of applications with noise (DBSCAN) method. The strategy allows the analyst to automatically identify the regions of interest (ROIs) of the area investigated and to extract the average spectra related to each ROI. The approach was applied on real case studies; namely, mock-up paintings (egg tempera on wood) were scanned with a NIR hyperspectral imaging system working in the SWIR spectral region (1000-2500 nm). In more detail, HSI-NIR data were acquired by a push-broom system composed of an SWIR3 hyperspectral camera working at 5.6 nm spectral resolution (Specim Ltd, Finland). The instrumental setting was characterized by three halogen lamps (35 W, 430 lm, 2900 K each) as the illumination sources and a horizontal line scanner (40 × 20 cm moving stage) on which samples were laid down. Prior to each measurement, dark (closed shutter) and white (99% reflectance Spectralon® rod) images were automatically recorded and used to compute the spectral reflectance value (R) for each pixel and wavelength.

Keywords: near-infrared hyperspectral imaging (NIR-HSI), clustering approach, artworks