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Multivariate statistics on hyperspectral images: challenges and importance of interpretability in textile sorting

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Hyperspectral imaging is an instrumental method that allows obtaining images where each pixel contains information in a specific range of the electromagnetic spectrum. Initially used for military and satellite applications, hyperspectral imaging has expanded to agriculture, pharmaceuticals, and the food industry. In recent decades, there has been an increasing focus on such analytical techniques as a rapid and non-destructive approach to gather significant insights into textiles.
Automatic identification and segmentation of textile fibers are extremely important since textile material sorting is interesting for reuse and recycling as it can guarantee added value to the recycled material. However, the extensive variety of fibers utilized in textile production naturally complicates the process of analysis and identification. Textile samples are challenging due to their complex chemical composition and diverse physical characteristics. The optical and physical characteristics like thickness, surface texture, color, and transparency affect data acquisition, carrying information that would increase the overall variance of the data.
This study employs multivariate statistics to address technological and practical tasks for the textile recycling industry. Samples of different textile compositions were analyzed using hyperspectral NIR imaging. Various preprocessing techniques and statistical methods were employed for data exploration, classification, and regression analysis. The research also focuses on the potential assessment of elastane content in cotton fibers, considering its prevalence in the textile industry and challenges in recycling processes. Statistical methods, including Principal Component Analysis and Multivariate Curve Resolution are calculated to analyze the data and extract the maximum amount of information.

Type of presentation

Talk

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Mainly application

Keywords

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