02-05: Detection of anomalies in bulk materials using hyperspectral imaging

Julius Krause[1], Jürgen Hock[2], Robin Gruna[2], Thomas Längle[2]

[1]*Karlsruhe Institute of Technology, Vision and Fusion Laboratory, Karlsruhe, Germany*
[2]*Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB, Karlsruhe, Germany*
E-mail: Julius.krause@kit.edu

Optical spectroscopy in the electromagnetic spectrum from 780 nm to 2500 nm is an established laboratory method in science and quality control. Hyperspectral imaging camera systems with a sensitivity in this measurement range can be used in visual inspection and sorting systems [1].

However, in a measured spectrum, signals from different origins are superimposed. In addition, the spectrum in hyperspectral images changes depending on the viewing angle of the surface of a sample and its scattering properties [2]. Therefore, the absolute value of a spectral band can often not be used directly and data pre-processing methods are required for further analysis.

The presented approach of a pre-processing and feature extraction method has the idea to decompose the spectrum into its absorption bands. Based on a physically motivated signal model, the parameters of the absorption bands are estimated [3].

Compared to classical methods of spectral signal processing, the description of the spectrum using the absorption bands offers some advantages, especially for calibration transfer between sensors with different characteristics. This approach also enables the development of better interpretable classifiers. In particular, single class classifiers can be created with a minimum of training data. A promising sorting application is the detection of anomalies in the N-H absorption bands, which can be caused by pyrrolizidine alkaloids in plant material.

References

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