

1 Model quality assurance application:
Online identification of different roast
qualities of coffee beans.
Photo: Udo Seiffert

AUTOMATIC QUALITY ASSUR- ANCE WITH HYPERSPECTRAL IMAGE ANALYSIS

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Hyperspectral Imaging: A Look Behind the Scenes

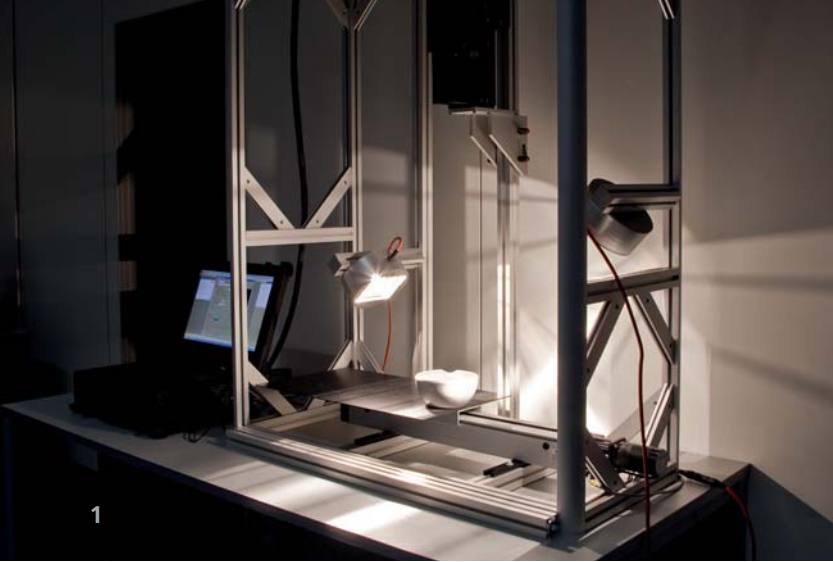
Precise and rapid in-line identification of a product's properties is the heart of every quality assurance systems. Frequently, the chemical composition of biological (intermediate) products is needed. The composition of solid and semi-solid substances is often spatially variable and therefore requires a spatially resolved quantitative analysis from a quality assurance system.

The systems developed at the Fraunhofer IFF identify constituents in real time without contact, spatially resolved and reproducibly. Hyperspectral imaging, or more precisely imaging reflectance spectroscopy, captures absorption properties very precisely in several hundred spectral channels in the visible and near-infrared spectrum, thus supplying a variety of information in new quality.

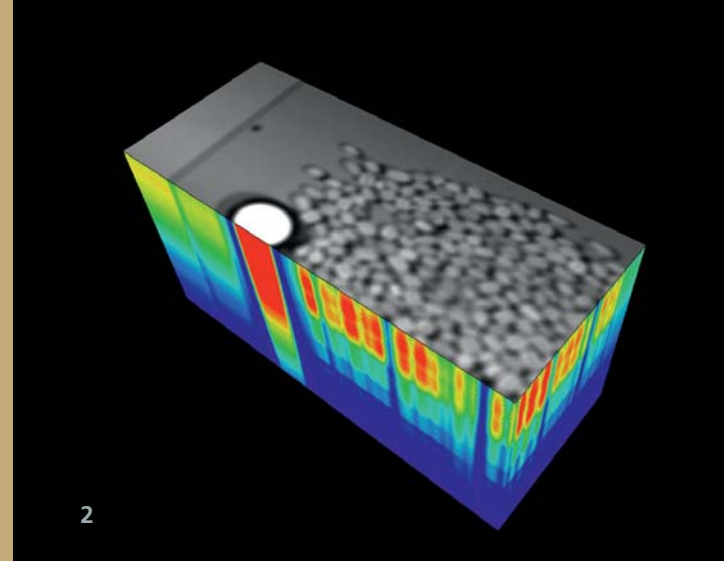
Evaluation with Artificial Intelligence

The challenge is to interpret the complex, high-dimensional signal patterns generated during hyperspectral imaging. Creating models that use a reference database for quantification and evaluation is time consuming and not very reliable.

The Fraunhofer IFF relies on another more efficient approach. We take advantage of the potentials of self-learning systems to model the correlation between spectral signatures and dependent variables, whether this is identity or chemical composition. We implement intelligent data processing by means of machine learning as a key component. Based on systematically acquired sample data, models are generated, which make it possible to process spectral data in a production process in real time.



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This enables us to create solutions customized to your needs in next to no time. In addition, the necessary spectra and potential single wavelengths can be identified, which are needed to meet your needs. This opens the door for reasonably priced and customized measurement systems that monitor your products.

Applications

- Online quality assurance based on a product's biochemical properties directly in the production process
- Real-time sorting system control

Our Services

The Fraunhofer IFF is your partner for the development and implementation of quality control systems customized to your needs. Our development may entail the following stages:

Systematic Data Acquisition

First, we use the sensor to systematically acquire hyperspectral data at your facilities or in our spectral laboratory. If necessary, supporting dependent variables can be acquired by a contracted food chemistry laboratory. The data acquired will cover your specified needs.

Measurement Model Development

Based on the data acquired, a measurement model is created, which calculates the non-trivial correlation between spectrum and dependent variables, e.g. the material identity or chemical properties. A range of methods of machine learning is resorted to and the best model is selected for or adapted to your needs.

Model Validation

We validate the measurement model's performance extensively so that we are able to provide information on the expected measuring accuracies, processing times and necessary spectra. This validation is the foundation for the subsequent development of the system.

System Development and Integration

Based on the findings from the model's validation, we create a quality control system customized for you, which is based on spectral data and optimized data evaluation. This system can be integrated in your existing production systems.

Value Added for You

- **Automated:**
Analysis is performed during running operations without any manual procedures.
- **Online:**
Data is evaluated in the production cycle and can be used to immediately mark or sort items or to intervene in the production process.
- **Integration:**
The system uses compact and rugged sensors, which can be integrated in the production process. Results of data evaluation can be integrated in existing data acquisition and control systems.
- **Noninvasive:**
This method of measurement does not damage your product.
- **Optimized:**
You receive a control system with hardware and software customized to your needs.

- 1 Measurement setup: hyperspectral camera with adjustable platform
- 2 Huge number of channels for hyperspectral imaging, Photos: Udo Seiffert