

# Abstract

## Hyperspectral image analysis of grain kernels

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### Introduction

The quality of grain kernels can be assessed by evaluating the constituent distribution within the kernel. We present a method based on hyperspectral NIR imaging to extract information to visualise the distribution of constituents for further quality assessment.

### Materials and methods

Images of a set of wheat kernels were acquired using a hyperspectral NIR camera ranging from 900–1700 nm resulting in 165 bands, see Figure 1.

The acquisition is based on an InGaAs sensor, which shows poor response near the edges of the spectral range. Thus the ranges 900–950 nm and 1650–1700 nm were removed, leaving 145 bands. An example of an acquired hyperspectral image is shown in Figure 2 with an associated spectrum.

Due to the surface structure of the sample, the acquired spectra may suffer from scatter effects. To eliminate these scatter effects, the spectral data were subjected to linear detrending. The observed spectra can be considered as a linear mix of the constituents of the food. This linear mixing and a set of constraints results in a simplex structure of the data, where the vertices denote the spectral signatures. The linear detrending further preserves the simplex structure. We have developed an advanced algorithm for extracting these vertices as the pure constituents in hyperspectral images.

### Results and discussion

Our decomposition algorithm provides a fast method to achieve a visual distribution of the different constituents of grain kernels for further quality assessment. Figure 3 shows a typical distribution of the compounds of wheat kernels.



Figure 1. Acquisition of wheat kernels using the hyperspectral camera.

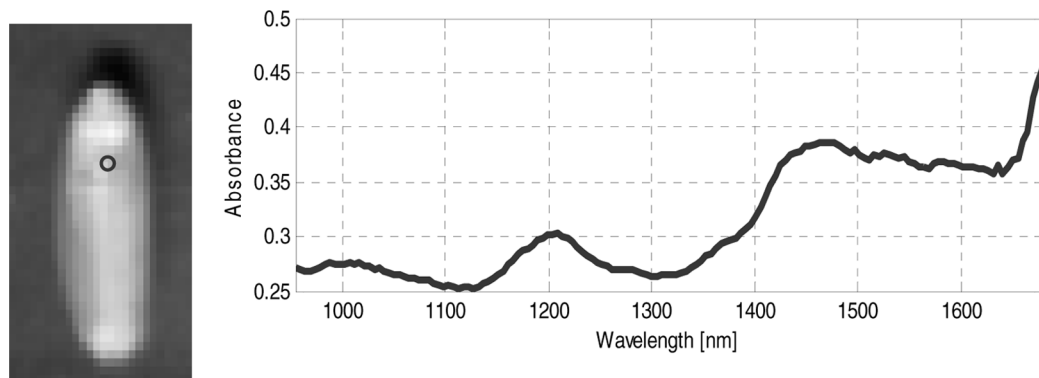


Figure 2. Typical absorbance spectra of a wheat kernel (no scatter correction).

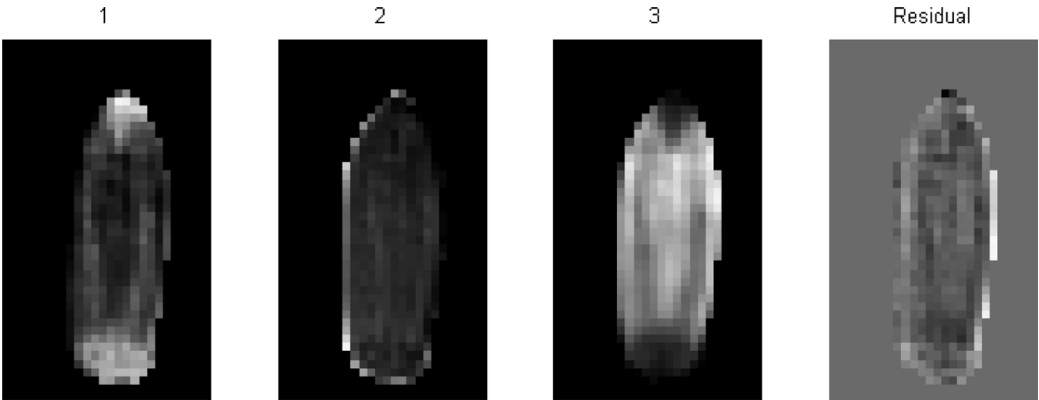


Figure 3. Distribution of the constituents of wheat kernels.