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GreenVision

Spectroscopic Imaging in Agriculture

Introduction

Spectroscopic imaging is an extension of classical imaging whereby images are measured over more than one wavelength interval (figure 1). The main advantage of these vision systems is that, besides the geometric information, material information can be obtained.

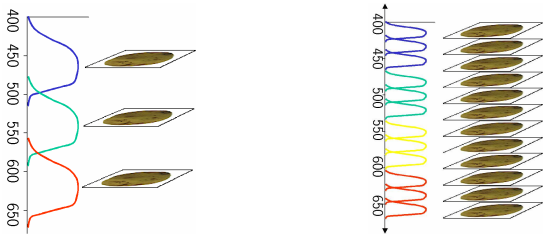


Figure 1. Traditional Red Green Blue imaging (left) integrates larger areas of the visible spectrum into three images whereas multispectral imaging (rights) uses multiple images of smaller bandwidth.

Application areas

Multivariate imaging is suited for the following tasks:

- Quality control: detection of latent defects in agro-products, e.g. vegetables and fruit
- Quantification of compounds: proteins, sugars, moisture etc.

Example 1: plastic detection in meat processing

Two fragments of transparent plastic packaging material (not visible) are placed on top of a meat sample. A multispectral imaging system (Imspector) is used to capture 96 images in the visible wavelength range from 430 - 900 nm.

Figure 2. a) Image plane where plastic fragments are not visible b) plastic fragments (surrounded by circles) can be seen but can not be separated from fat (visible as white spots).

With a multivariate analysis one can differentiate between the fat particles and the plastic fragments (Fig. 3).

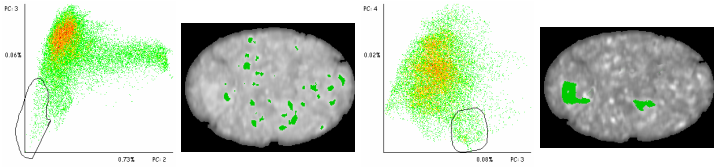
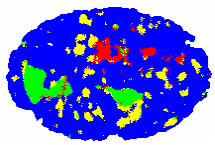


Figure 3. Fat (left part) and plastic (right part) selections in principle component analysis (PCA) plot and corresponding back projections in the image

Supervised classification based on a Linear Discriminant Analysis (LDA) model results in a classified image as shown in figure 4, where the plastic fragments are identified correctly.



Legend
Blue : dark-colored meat
Red : light-colored meat
Yellow : fat
Green : plastic

Figure 4. Segmented image of minced meat with plastic fragments. The plastic fragments are correctly identified correctly.

Example 2: Damage on Cabbage leaves

Figure 5 shows an image of a cabbage leave which contains the disease Mycosphaerella brassisicola.

Figure 5. Original cabbage leave (left), part of leave acquired in visual part of spectrum (middle) and part of leave acquired in Near InfraRed spectrum.

The disease is hardly visible in the RGB image, whereas the image taken in the Near InfraRed part of the spectrum clearly shows the small dark spots on the leave.

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