Image Analysis for X-ray Imaging of Food

X-ray imaging systems are increasingly used for quality and safety evaluation both within food science and production. They offer non-invasive and non-destructive penetration capabilities to image the inside of food.

This thesis presents applications of a novel grating-based X-ray imaging technique for quality and safety evaluation of food products. In this effort the fields of statistics, image analysis and statistical learning are combined, to provide analytical tools for determining the aforementioned food traits.

The work demonstrated includes a quantitative analysis of heat induced changes in microstructure of meat products. A segmentation framework is presented, from which geometrical parameters are assessed. The grating-based method embraces the complicated microstructure of the meat products, allowing for an analysis of the full three dimensional structure. The results illustrate that the combination of grating-based X-ray imaging and advanced analysis provides a valuable tool for microstructure analysis. Thus, the method can be considered as an alternative to other existing imaging techniques.

Furthermore, the thesis presents the application of grating-based X-ray imaging for novelty and defect detection in food. Compared to the complex three dimensional analysis of microstructure, here two dimensional images are considered, making the method applicable for an industrial setting. The advantages obtained by grating-based imaging are compared to conventional X-ray imaging, for both foreign object and defect detection. The results further emphasize the applicability of grating-based imaging for evaluation of food quality and food safety.