This factsheet is a result of the first Wageningen University & Research (WUR) Data Science and AI Fellowship programme, organised in 2021. With this programme we aim to further integrate and improve our expertise on DS/AI throughout the entire organisation. The variety in the projects shows DS/AI is, or can be, applied within all WUR domains.

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Bits & bites: hyperspectral food recognition

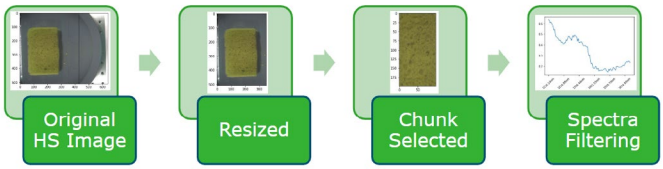
Objective

Determine whether hyperspectral imaging allows recognizing commonly consumed foods which are unsuited because of obscured contents for recognition based on the normal visual spectrum.

Method

Sandwiches were chosen as test food, because it is impossible to see the topping from the outside. 48 sandwiches were analyzed using Near Infrared Reflectance (NIR) analysis and subsequently 24 sandwiches using a hyperspectral camera.

NIR: The reflectance data was combined from 9 measurement points on each sandwich and clustered. Unsupervised machine learning was applied to cluster the data.

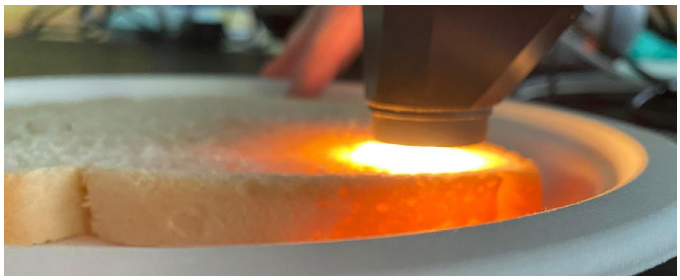


Hyperspectral: The data was preprocessed by selecting the food item and disregarding the plate and surrounding picture areas. Data was analyzed using a Multi Layer Perceptron.

Results

NIR: Results indicated near 100% accuracy in clustering between cheese, meat and jelly toppings.

Hyperspectral imaging: Custom accuracy score calculated ~0.81% recognition of different sandwich types. Difficulty was in distinguishing highly similar toppings, example: cheese vs cheese and butter.



By measuring different food items we can create an open access databse for future research, within and outside of the WUR.

Impact

The impact of the fellowship has been the complete development of an analysis pipeline for this new application of hyperspectral imaging. This has led to new grants and to further investments by research granting institutions. Additionally, this has led to a lasting cooperation between AFSG and WFSR in this area, as well as an initiative to work together with WUR IT research engineers to create an open-access hyperspectral food database for all scientists to work with interested in this field.

Future plans

We hope to create an open database of hyperspectral images of commonly consumed foods to allow other groups to train their own algorithms.

Additionally, we hope to include hyperspectral based food recognition in portable eating behavior/dietary assessment tools, to automate the measurement of intake.

Further information

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Project duration: January – September 2021