

Hyperspectral Imaging

ROOM D002

Nathan Slembrouck

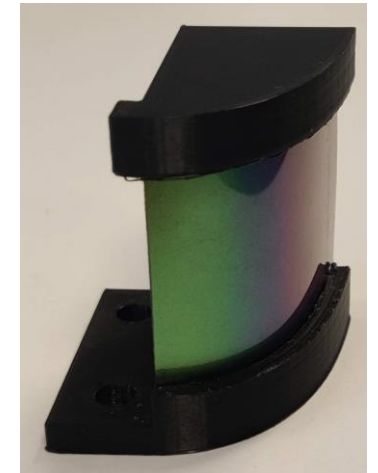
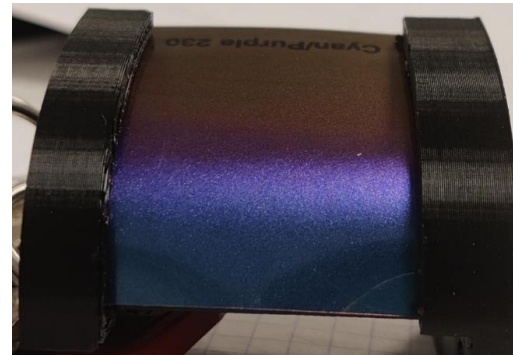


Content

- Presenter introduction
- What is it
- Hyperspectral imaging techniques
- Applications in various industries
- Research in the lab

Presenter introduction

- Nathan Slembrouck
- PhD researcher in the metrology division
- Topic: Image-based appearance metrology

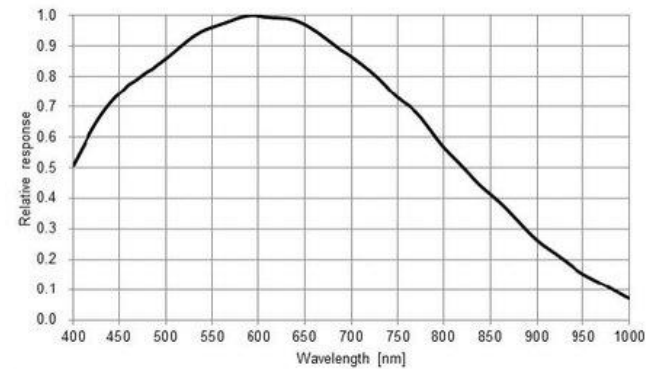


What is it?

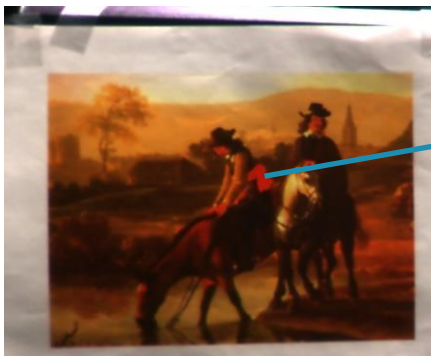
- Black and white: only spatial information



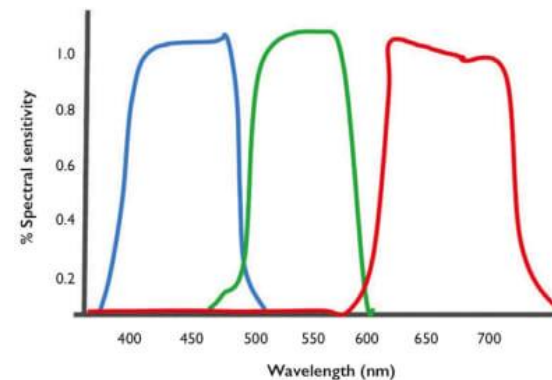
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- RGB: color information

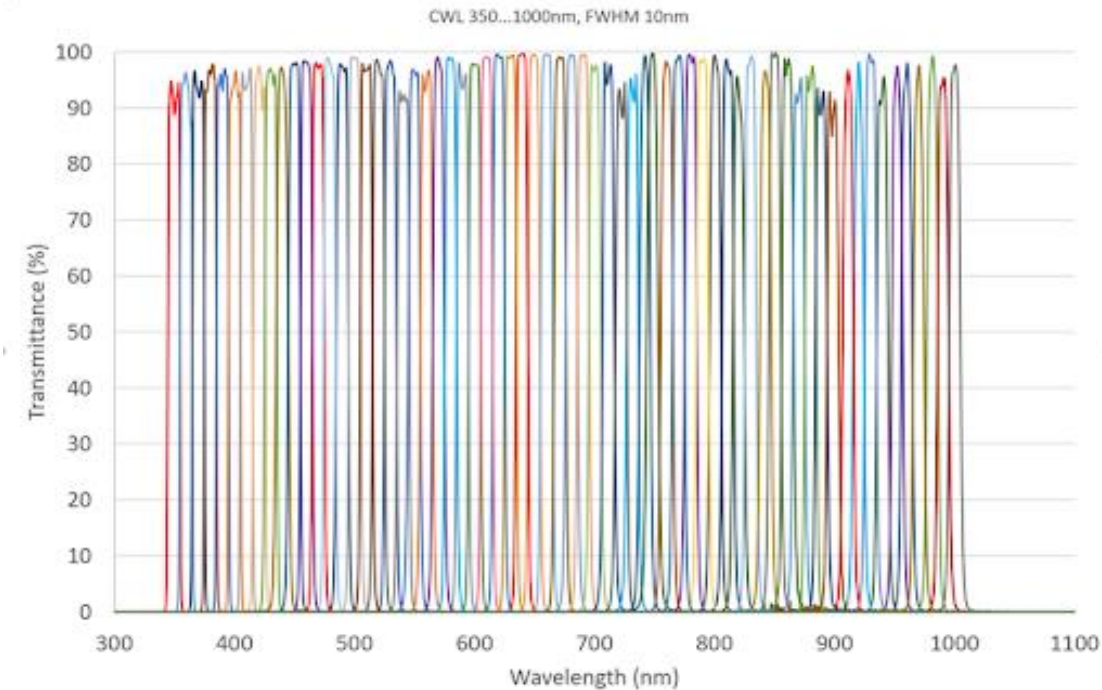
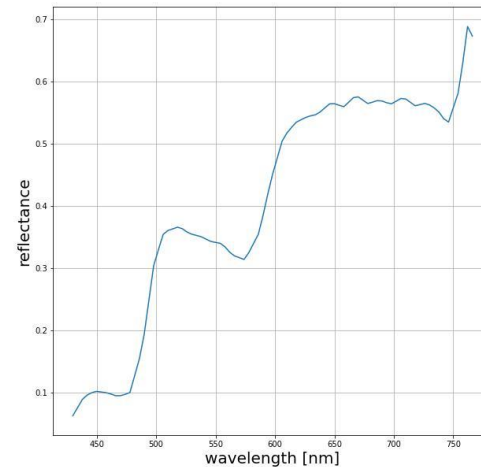
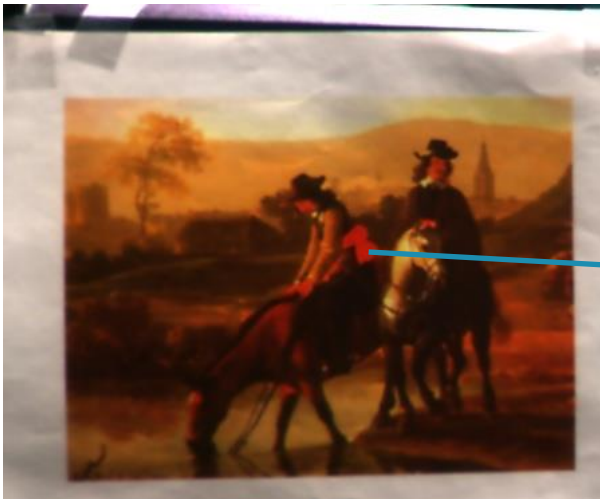


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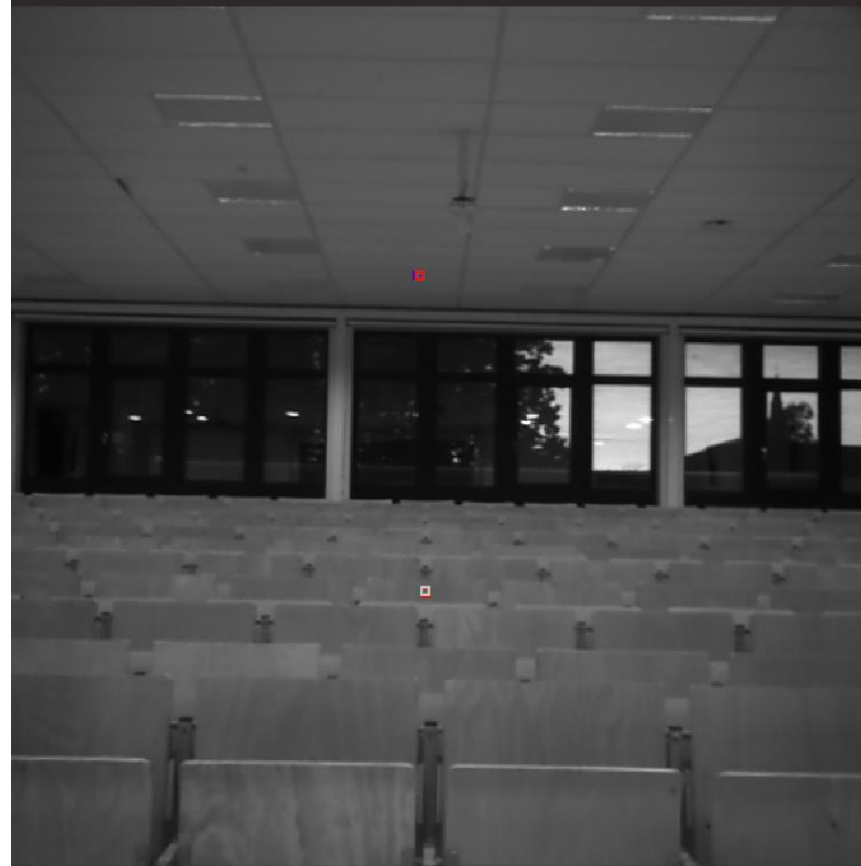


What is it?

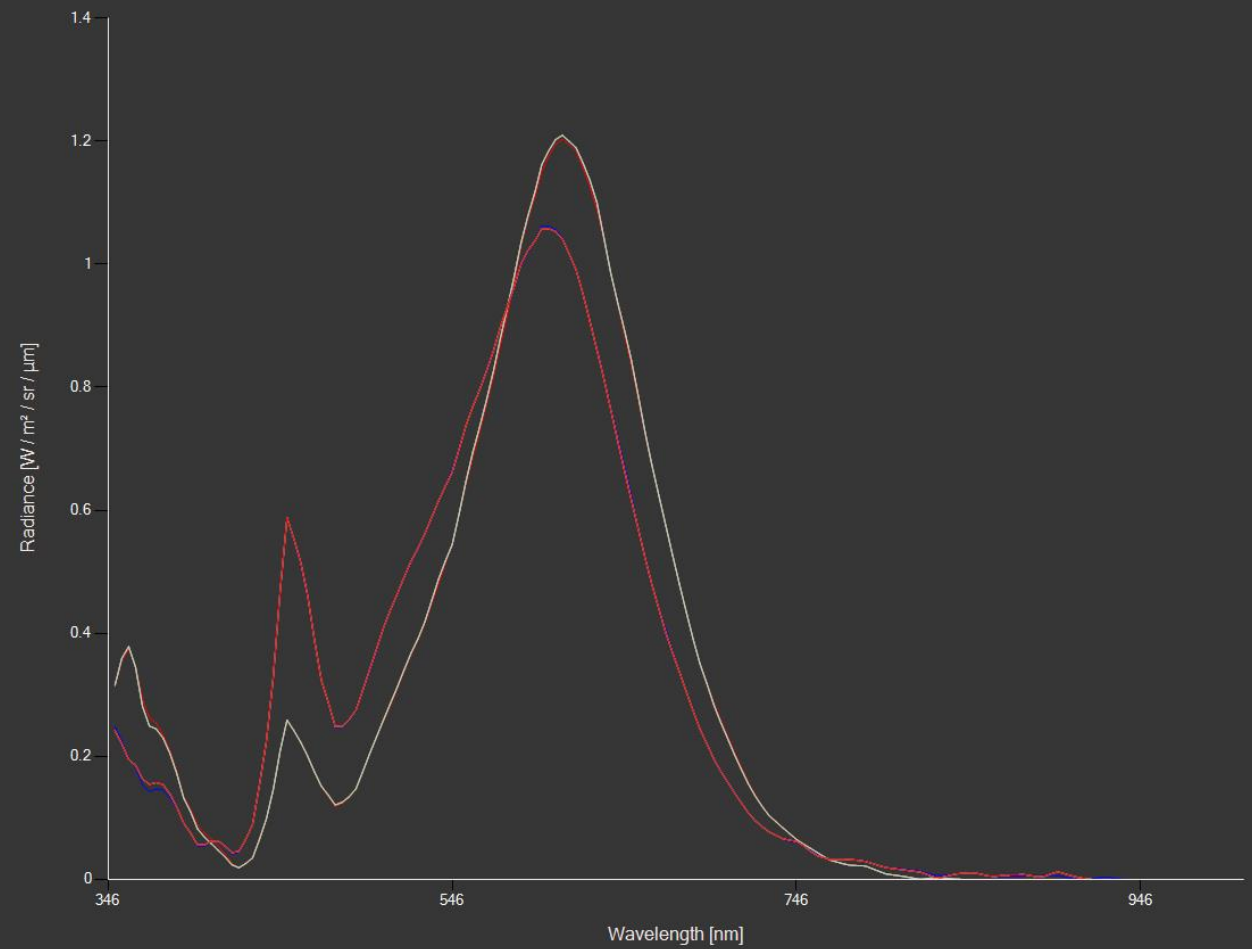
- Hyperspectral Imaging (HSI) captures both spatial and spectral information with high resolution
- For each pixel in the image, the spectrum is measured



session_000_008_snapshot.cu3

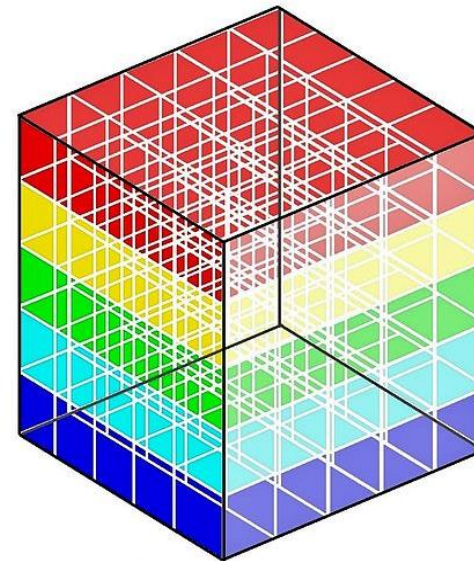
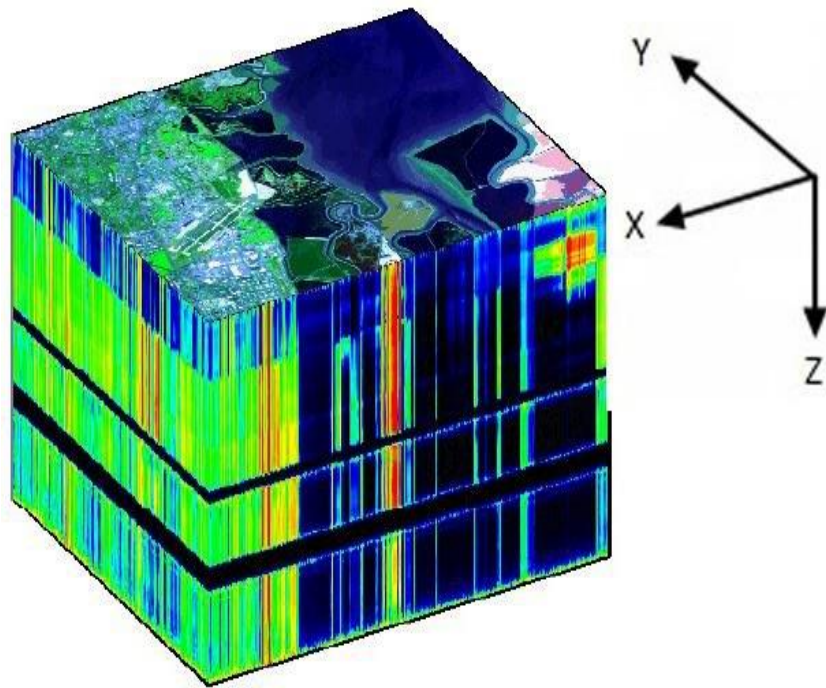


Radiance



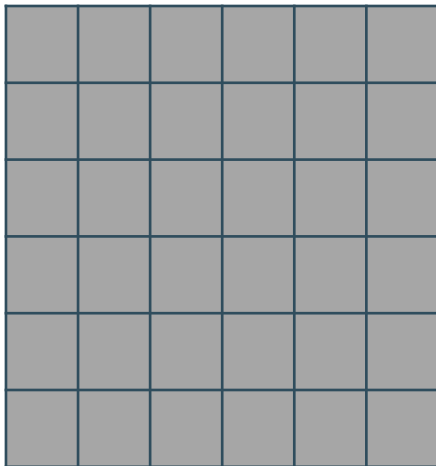
Hyperspectral datacube

- x-y plane: spatial information (wavelength slice)
- z axis: spectral information

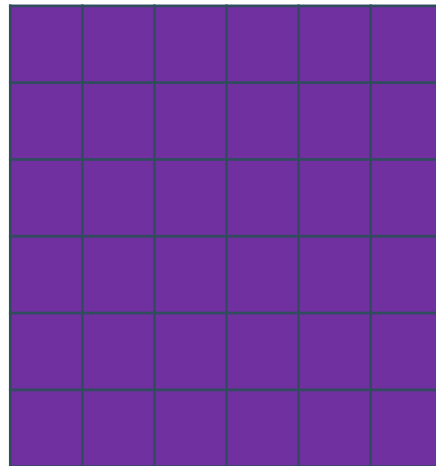


Hyperspectral imaging techniques

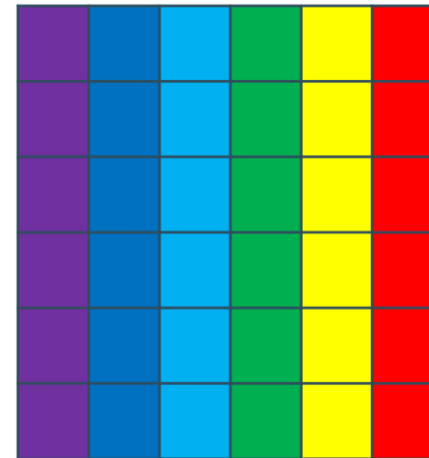
- One pixel on the sensor can only be used for one location and one spectral slice
 - Trade-off between spatial and spectral resolution



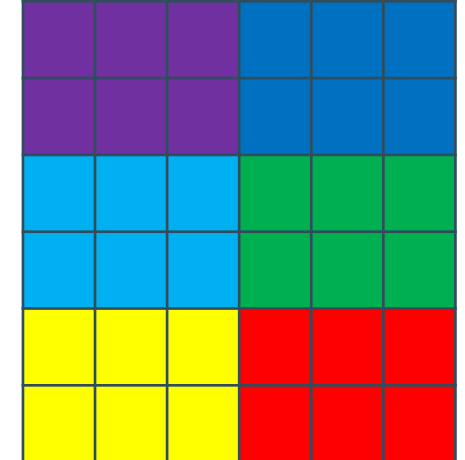
CMOS sensor



Spectral scanning



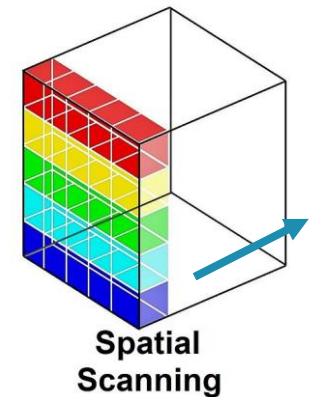
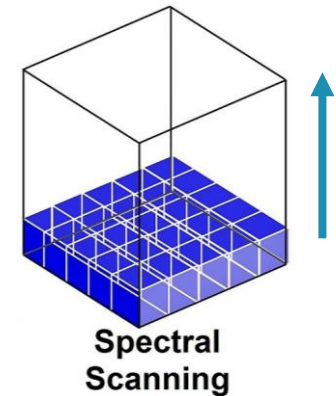
Spatial scanning



Snapshot

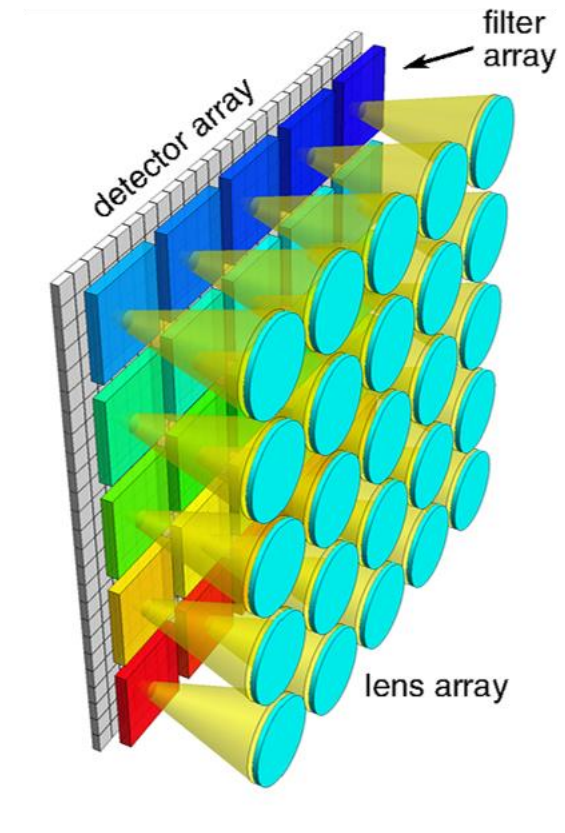
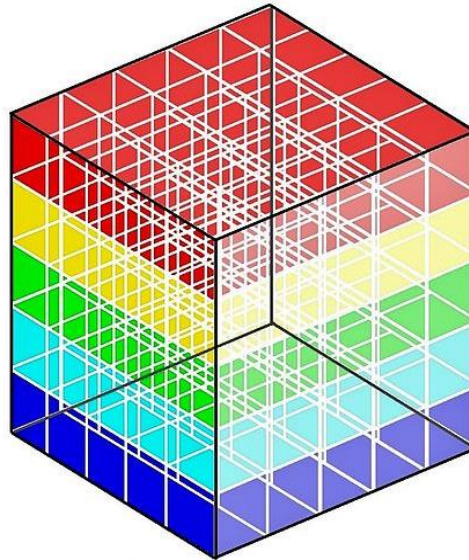
Hyperpsectral imaging techniques

- Spectral scanning
 - Image one wavelength slice per shutter time
- Spatial scanning
 - One line of spatial information is captured per shutter time



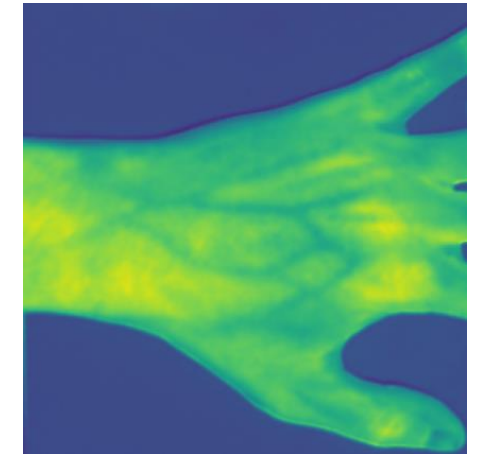
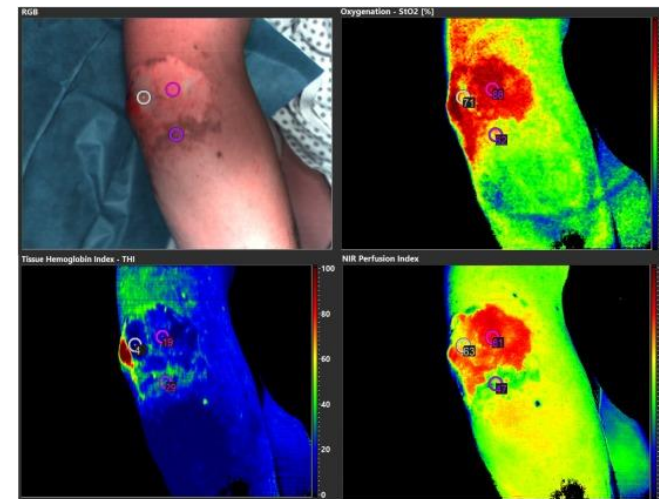
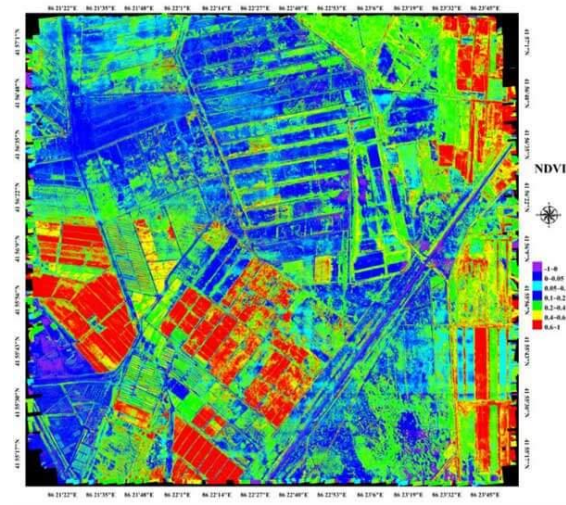
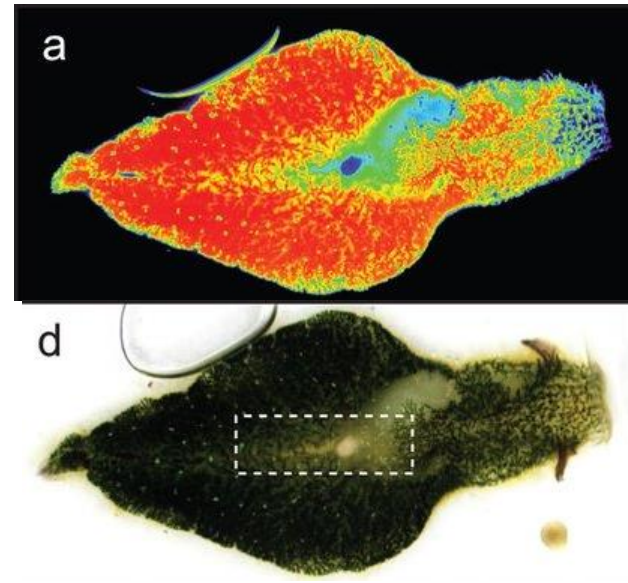
Hyperspectral imaging techniques

- Snapshot
 - All information is captured at once



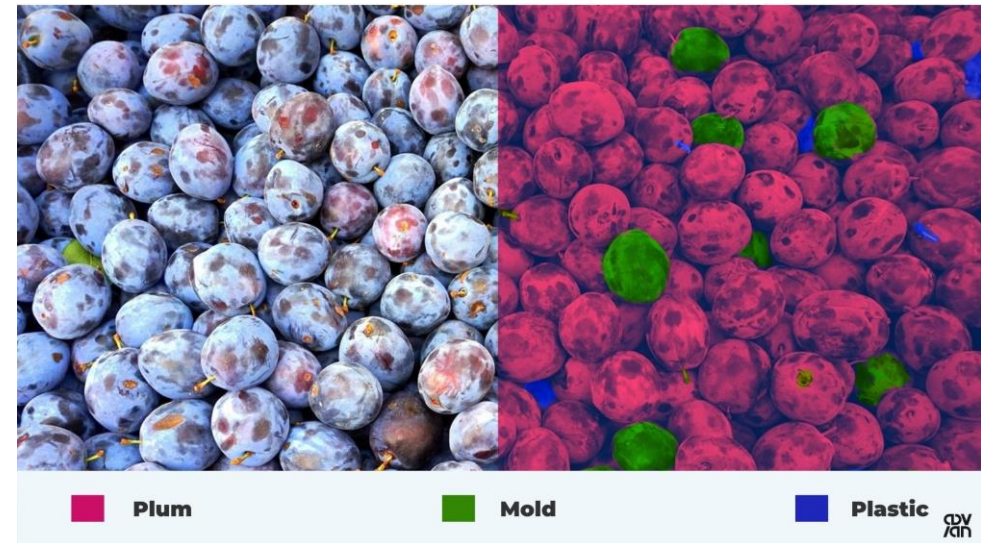
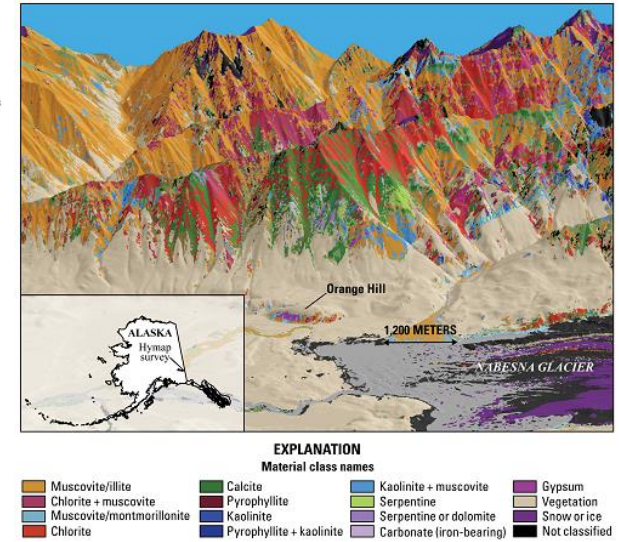
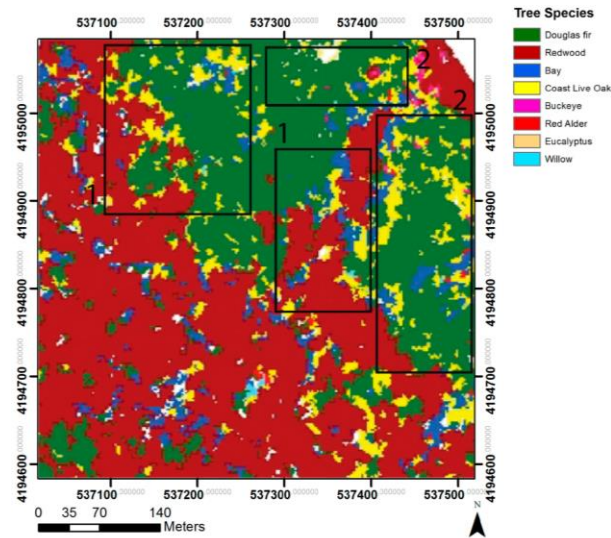
Applications

- Visualisation of 'hidden' features
 - Vegetation monitoring: NDVI
 - $NDVI = \frac{NIR - VIS}{NIR + VIS}$
 - High NDVI = high photosynthesis
 - Medical imaging
 - Clearer distinction between different parts
 - Examination of wound tissue



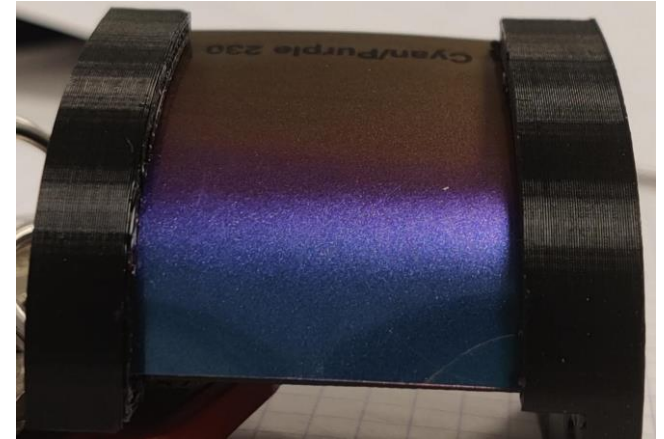
Applications

- Computer vision – classification tasks
 - Geological charts
 - Forest control
 - Food quality control
 - Skin and breast cancer detection



Research in the Light&Lighting Laboratory

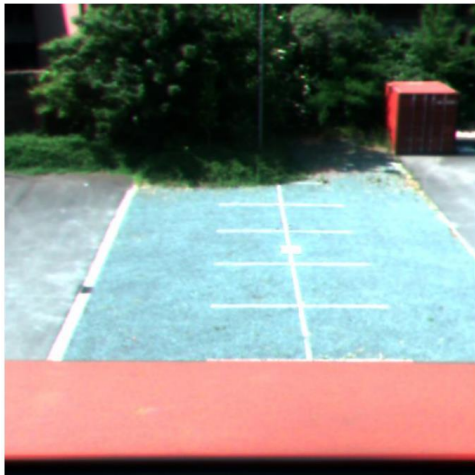
- PhD: image-based appearance metrology
 - Hyperspectral imaging allows the capture of spatial and spectral information at the same time
 - Spectral: color
 - Spatial: visual texture effects
 - Measurements have to match the human response
 - Psychophysical experiments



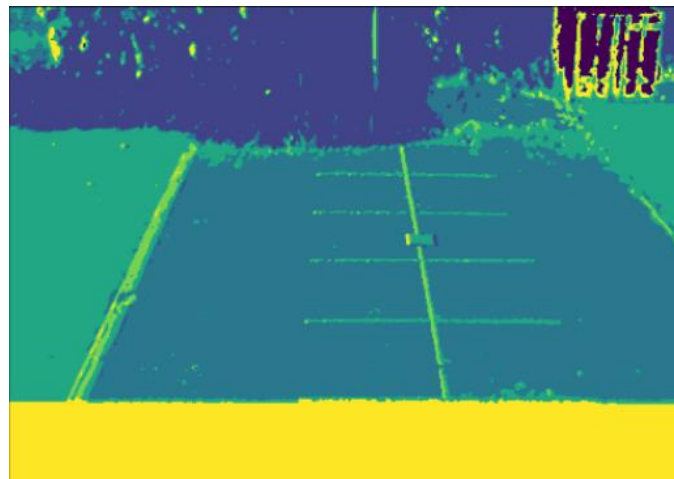
Research at Light&Lighting Laboratory

- Calibration of the Specim IQ for spectral radiance
- Measuring outdoor sports lighting with the cubert ultris x50 (Pinky Diatmiko, masters thesis)

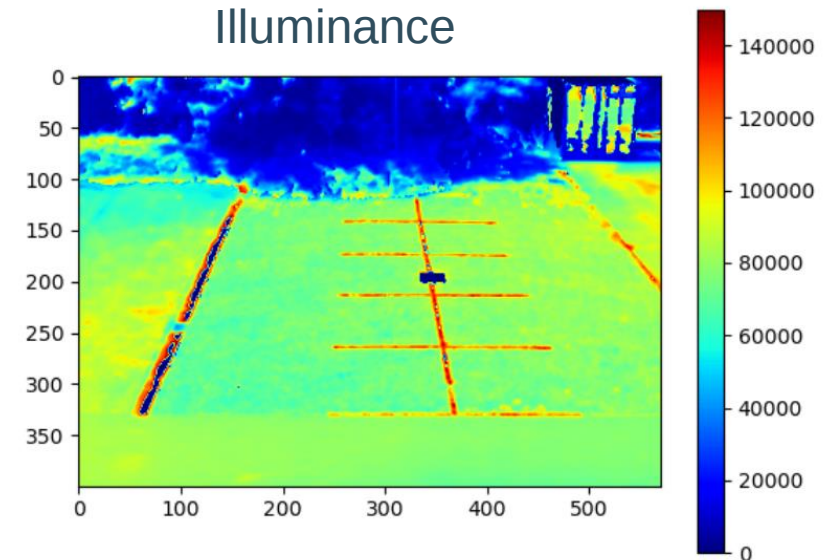
RGB image



Classification map

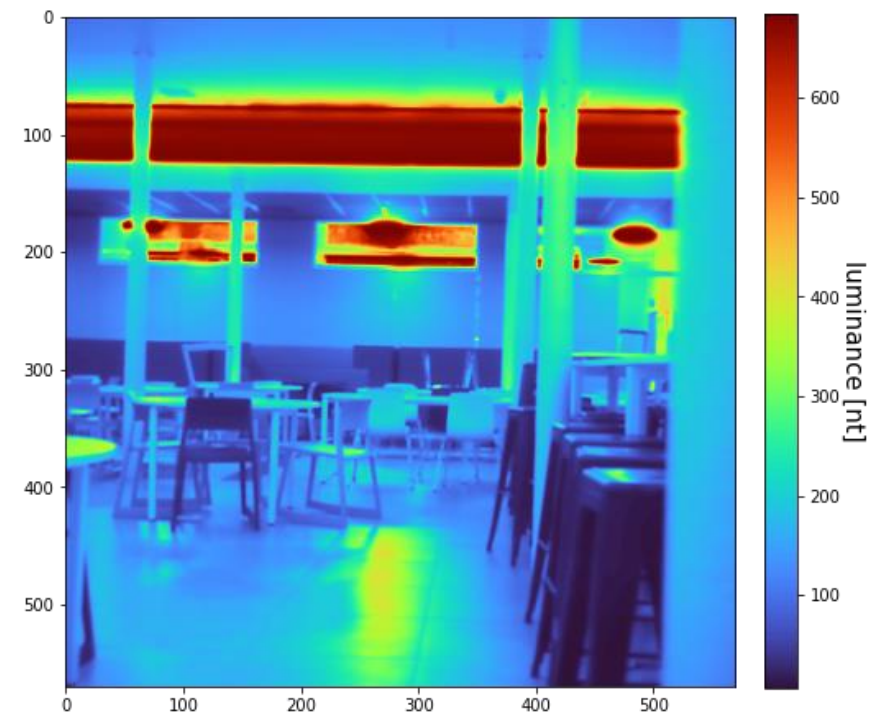
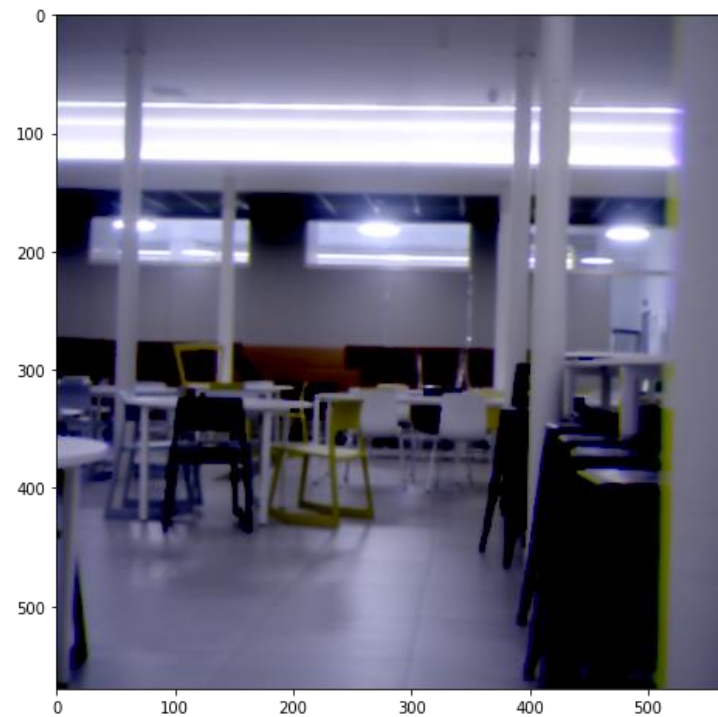


Illuminance



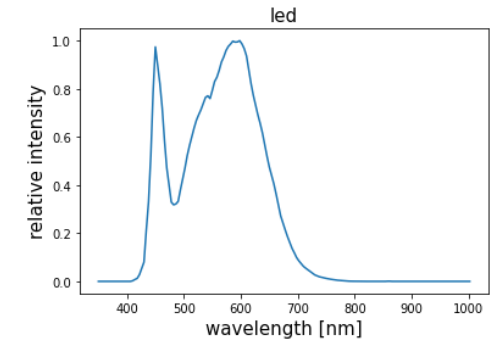
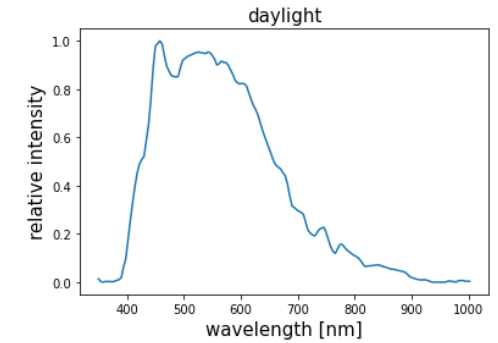
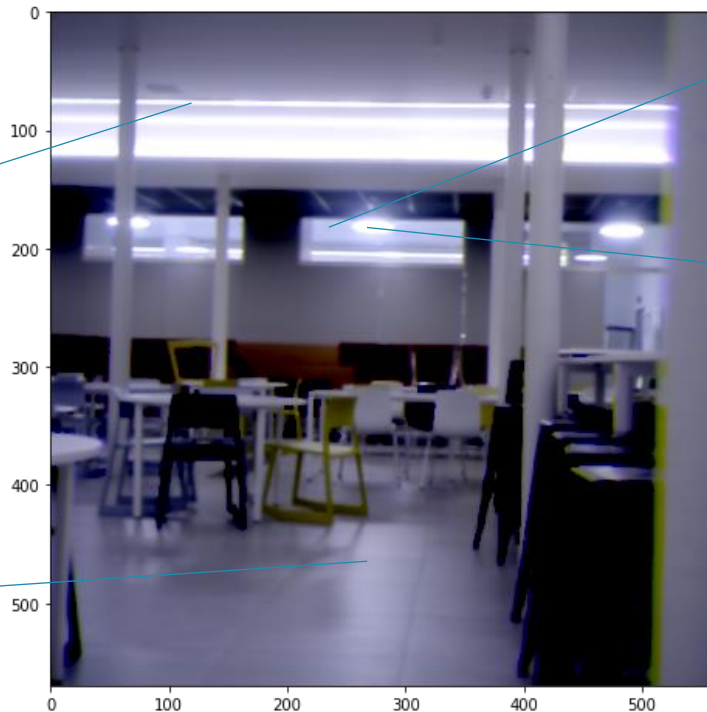
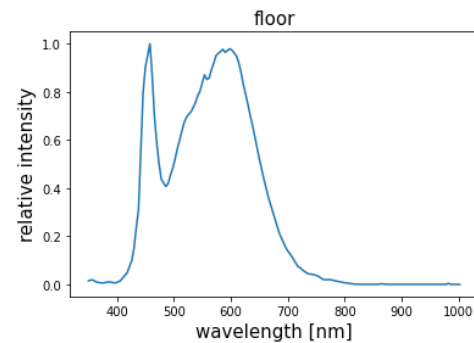
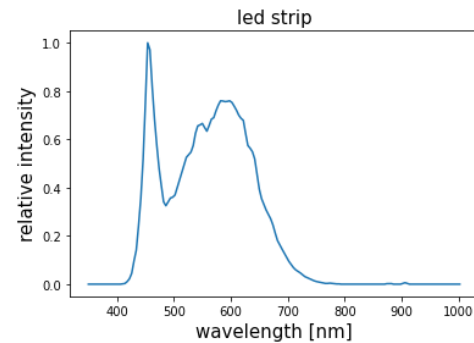
Lighting Measurement

- Luminance
- Type of lighting
- Melanopic luminance

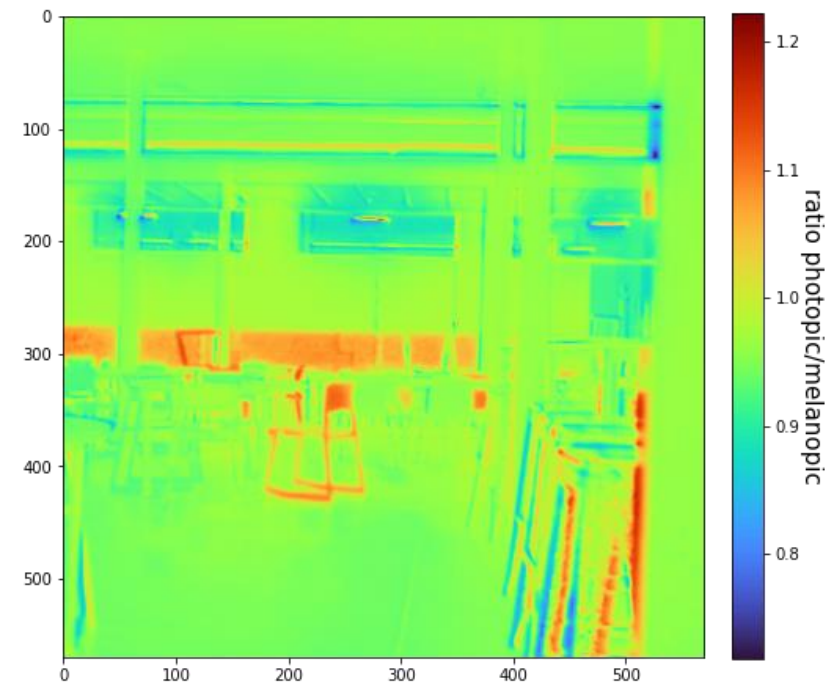
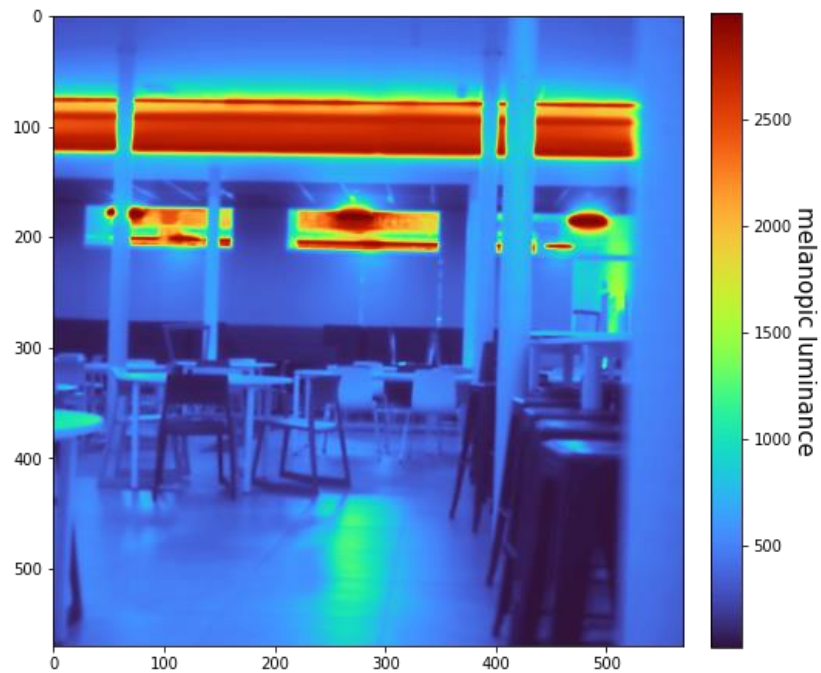


Lighting Measurement

- Identification of different light sources



Melanopic Luminance





Thank you!

Questions