



imec

Spectral imaging on-chip:
A game-changer for surgical vision

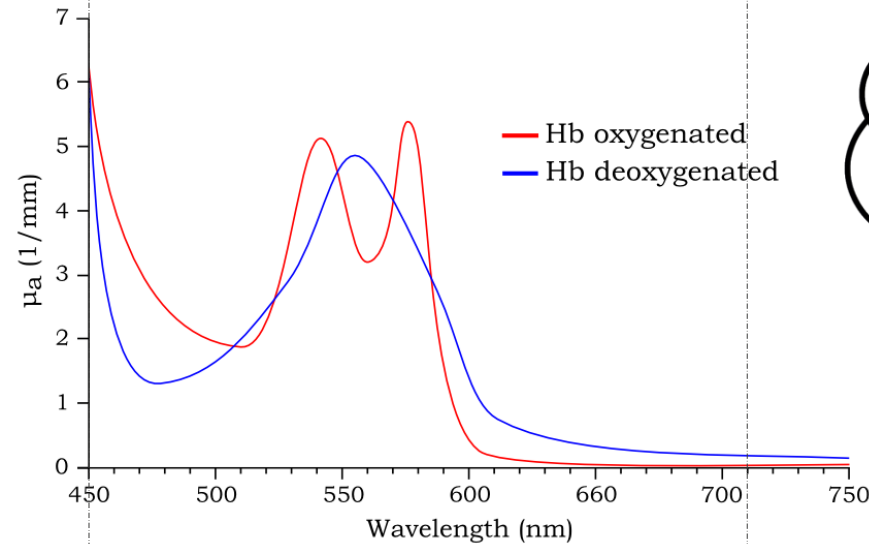
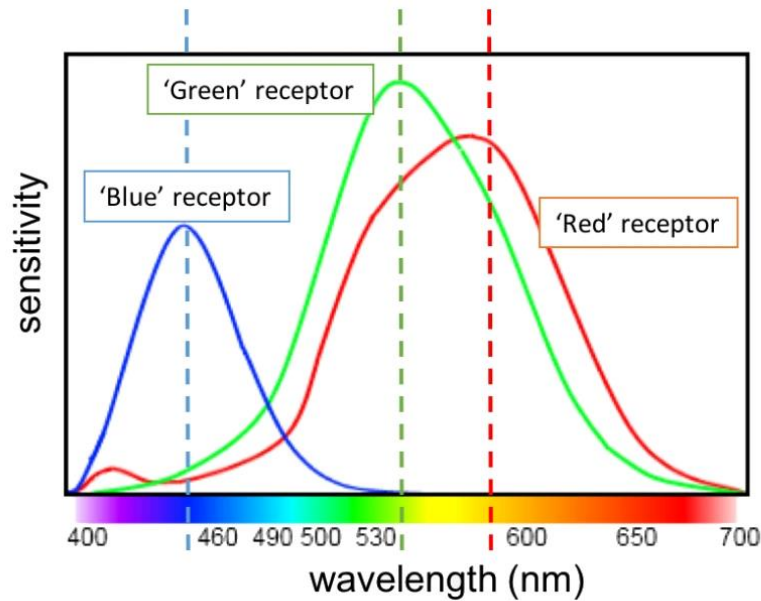
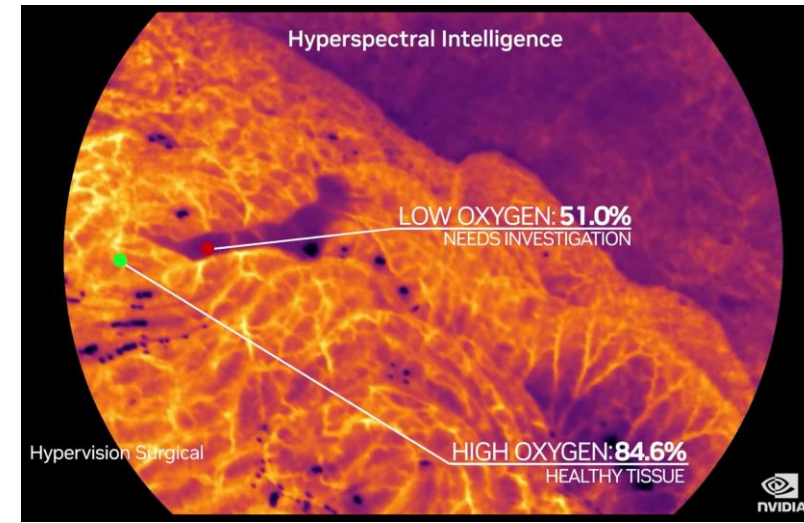
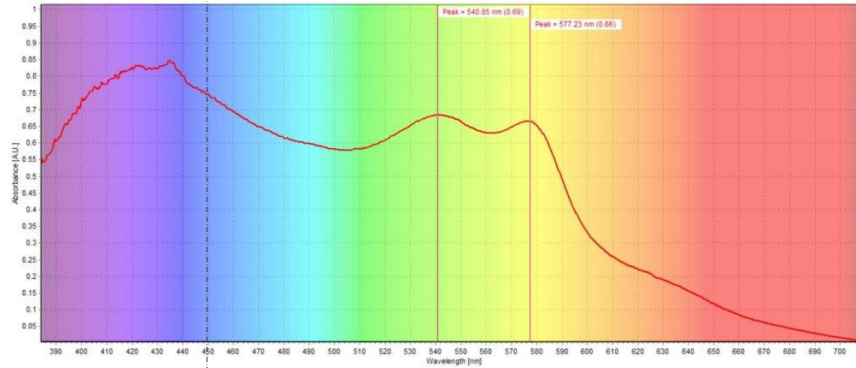
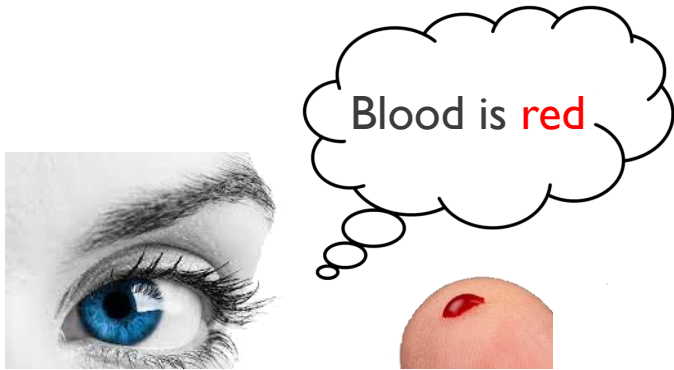
Wouter Charle

Program Manager

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What our eyes (don't) see in colors

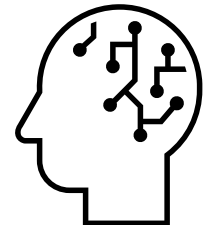
A practical example of the power of spectral imaging



■ Blood is red

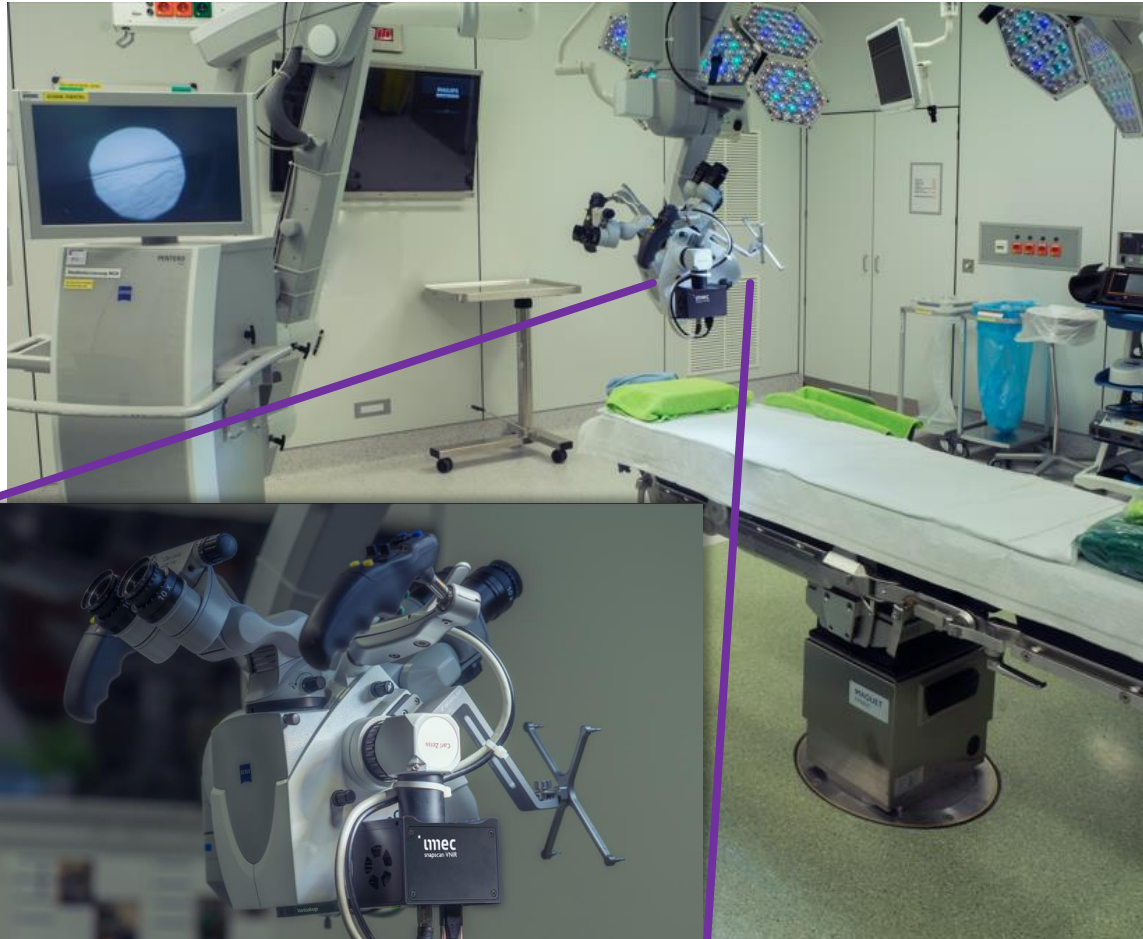
AND

- Volume
- Perfusion
- Oxygenation

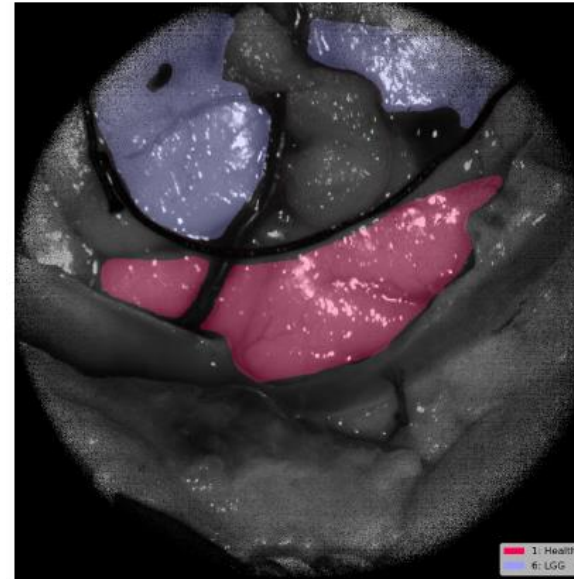


Spectral imaging in the surgical theatre

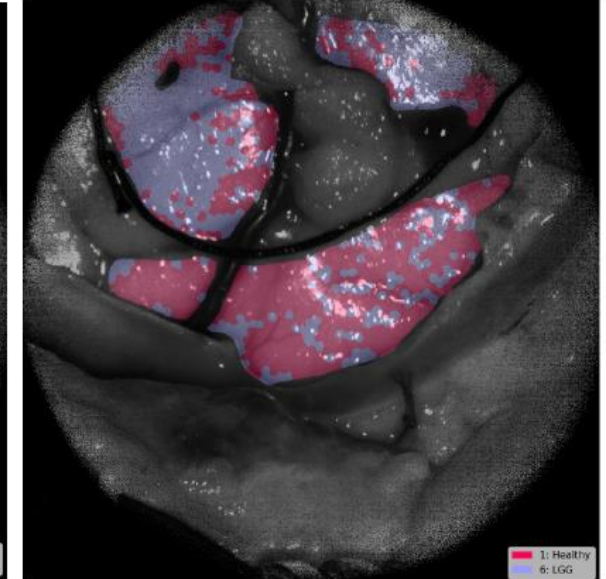
Clinical demonstration of label free LGG detection



Ground truth



80% detection accuracy



Label free detection of **Low grade glioma** on 5 patients

Deep learning methods yield > 80% accuracy

Accuracy of 75% in center of field of view is sufficient to adopt the technique as-is

Prof. dr. De Vleeschouwer – UZ Leuven

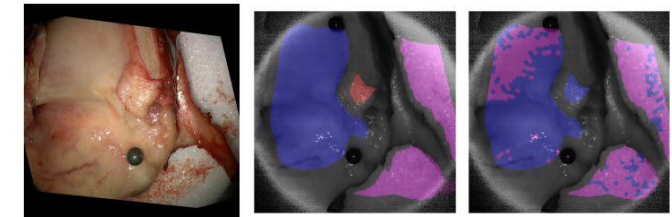
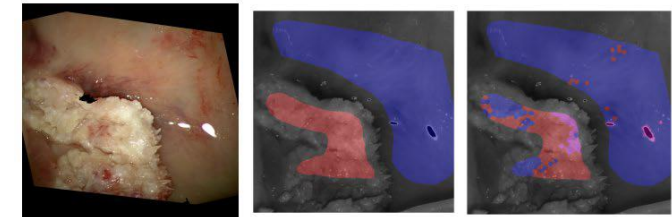
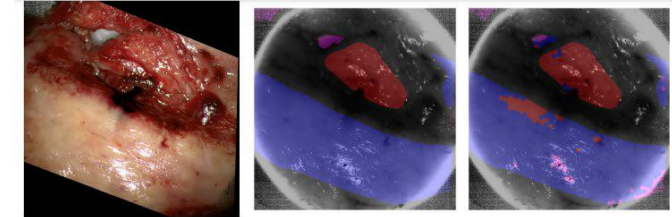
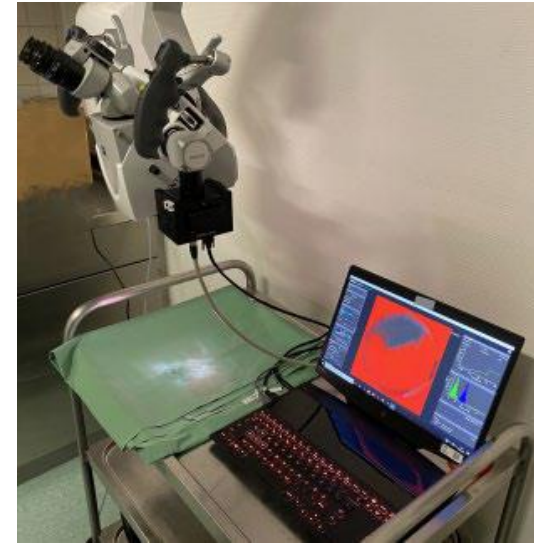
Roeland Vandebriel (imec) - integrating hyperspectral imaging in an existing intra-operative environment for detection of intrinsic brain tumors

Xiaohan Zhang (Carl Zeiss AG) - Paper 12373-5 - Intra-operative brain tumor detection with deep learning-optimized hyperspectral imaging

Ex-vivo validated tumor detection with HSI

Head and Neck Cancer detection with imec technology

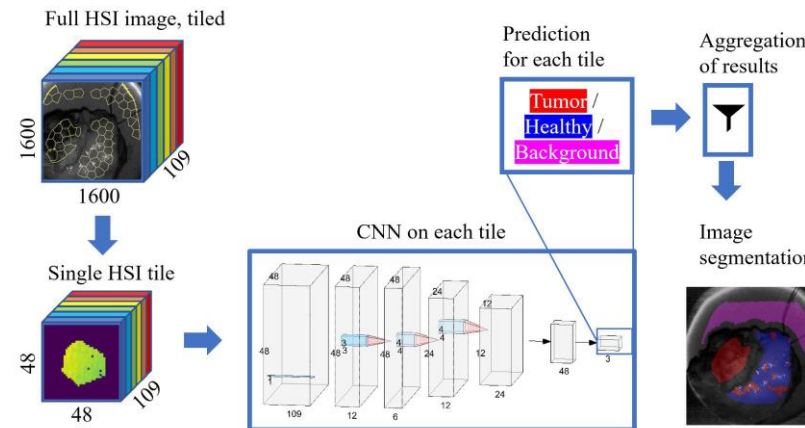
- HNC is 7th most prevalent cancer
- Low patient survival rates
- Only identified by pre-operative diagnostics, intraoperative pathology consultation and surgeon's experience
- CNN on HSI data achieves
 - > 80% overall accuracy
 - on unseen patients
 - after training on 20 patients



raw RGB images

Ground truth

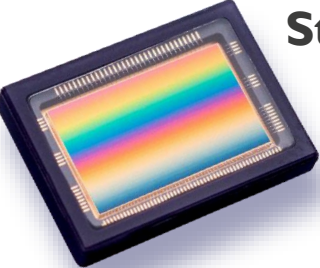
Prediction from 18 patients' model on an unseen patient



CMOS spectral filters patterned on image sensor wafers

Accurate, mass manufacturable and extremely compact

Striped filter pattern for high resolution scanning

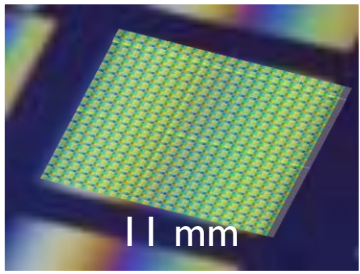
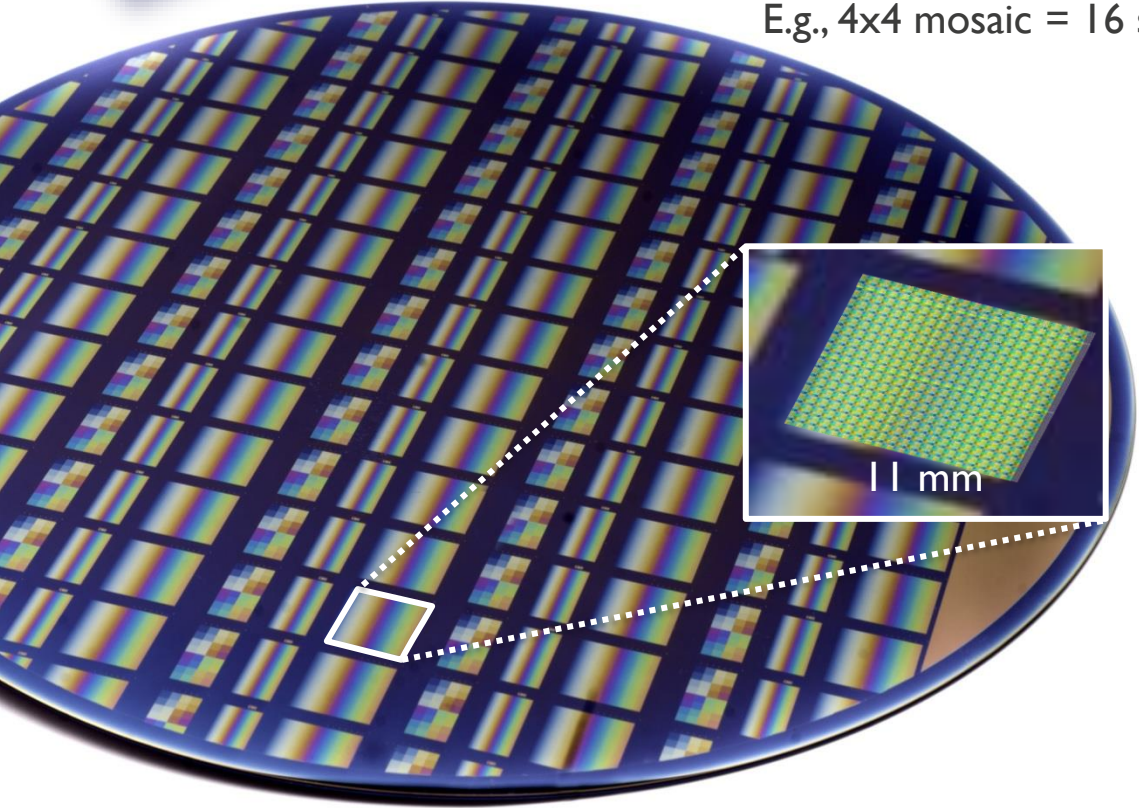


200 mm

465 nm	546 nm	586 nm	630 nm
474 nm	534 nm	578 nm	624 nm
485 nm	522 nm	562 nm	608 nm
496 nm	510 nm	548 nm	600 nm

Bayer-like for snapshot & video imaging

E.g., 4x4 mosaic = 16 spectral bands



11 mm



imec on-chip spectral imaging

Enabling advanced surgical vision

- Integrated solution for video rate spectral imaging
 - Compatible with existing optical and imaging systems
 - Fits in high constrained SWAP
 - Deals with inherent motions by definition
- Offering
 - Scalable and customizable technology to fit commercial needs
 - Design and manufacturing services from imec fab
 - Commercial EvK for evaluation and application research
 - Scanning, snapshot, VIS to SWIR + software and support
 - Special conditions for R&D groups furthering clinical demonstration!
- Contact us: hsi.sales@imec.be and wouter.charle@imec.be





mtec

embracing a better life