

Computational pathology & Spatially-Integrated Omics

 Konstantinos Zormpas-Petridis

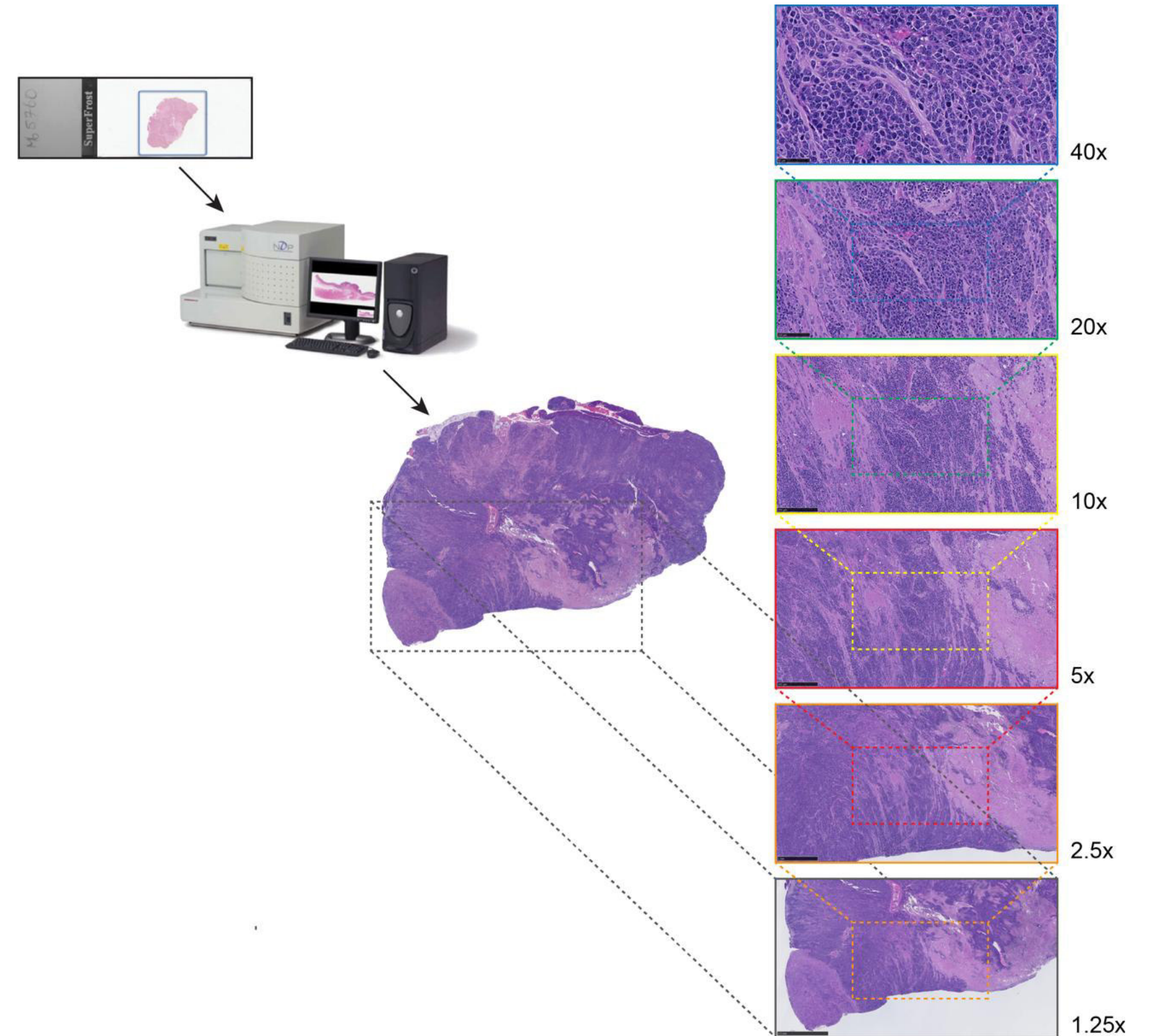
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 Rome Italy, 27/10/2025



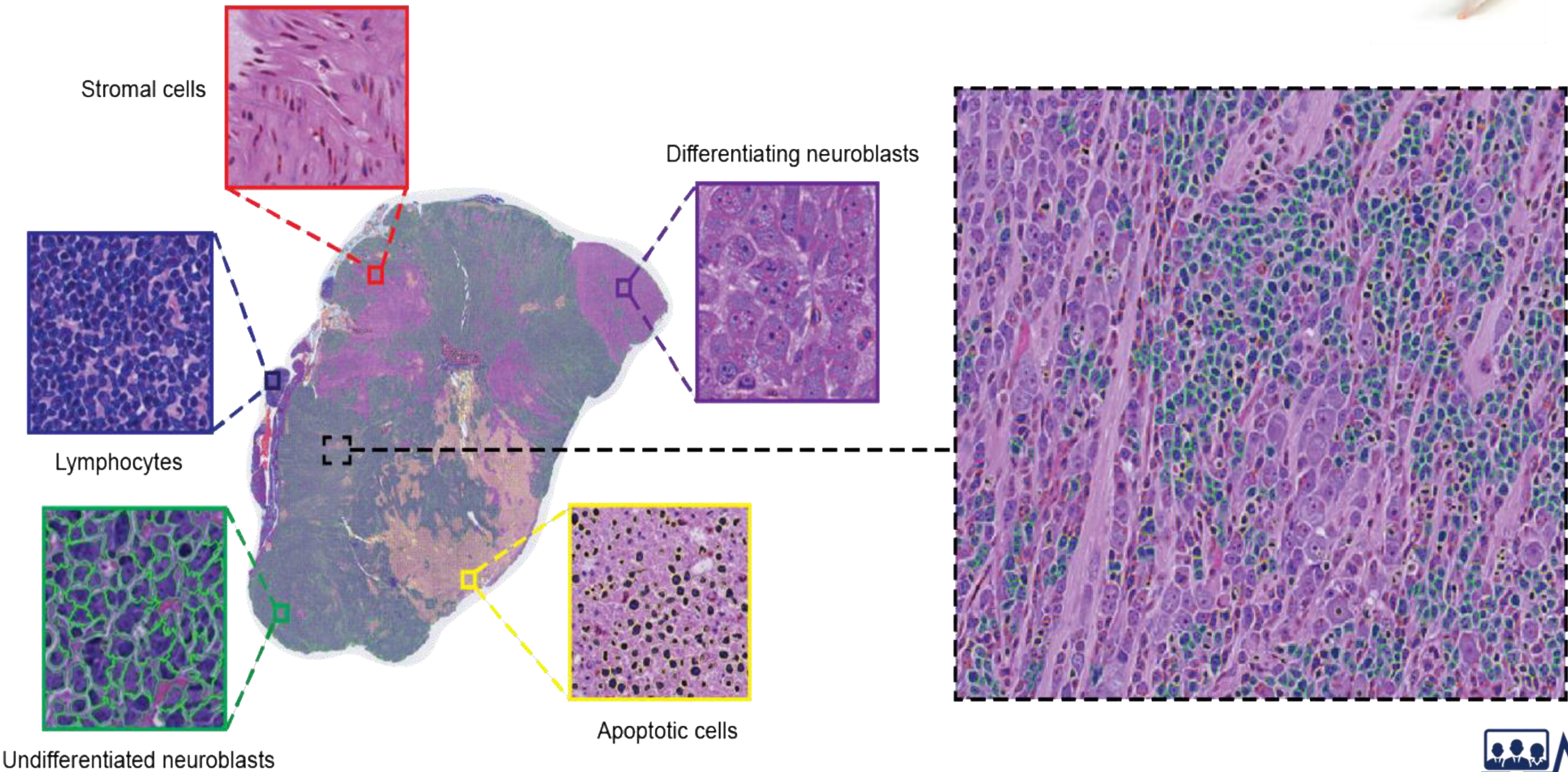
Digital Pathology

- Analysis of tissue samples under the microscope by pathologists – the “gold-standard” of patient management
- Qualitative or semi-quantitative
- The new era of digital pathology
- Going forward: Full digitization
e.g. The PathLAKE consortium



Computational Pathology – Phenotypic quantification

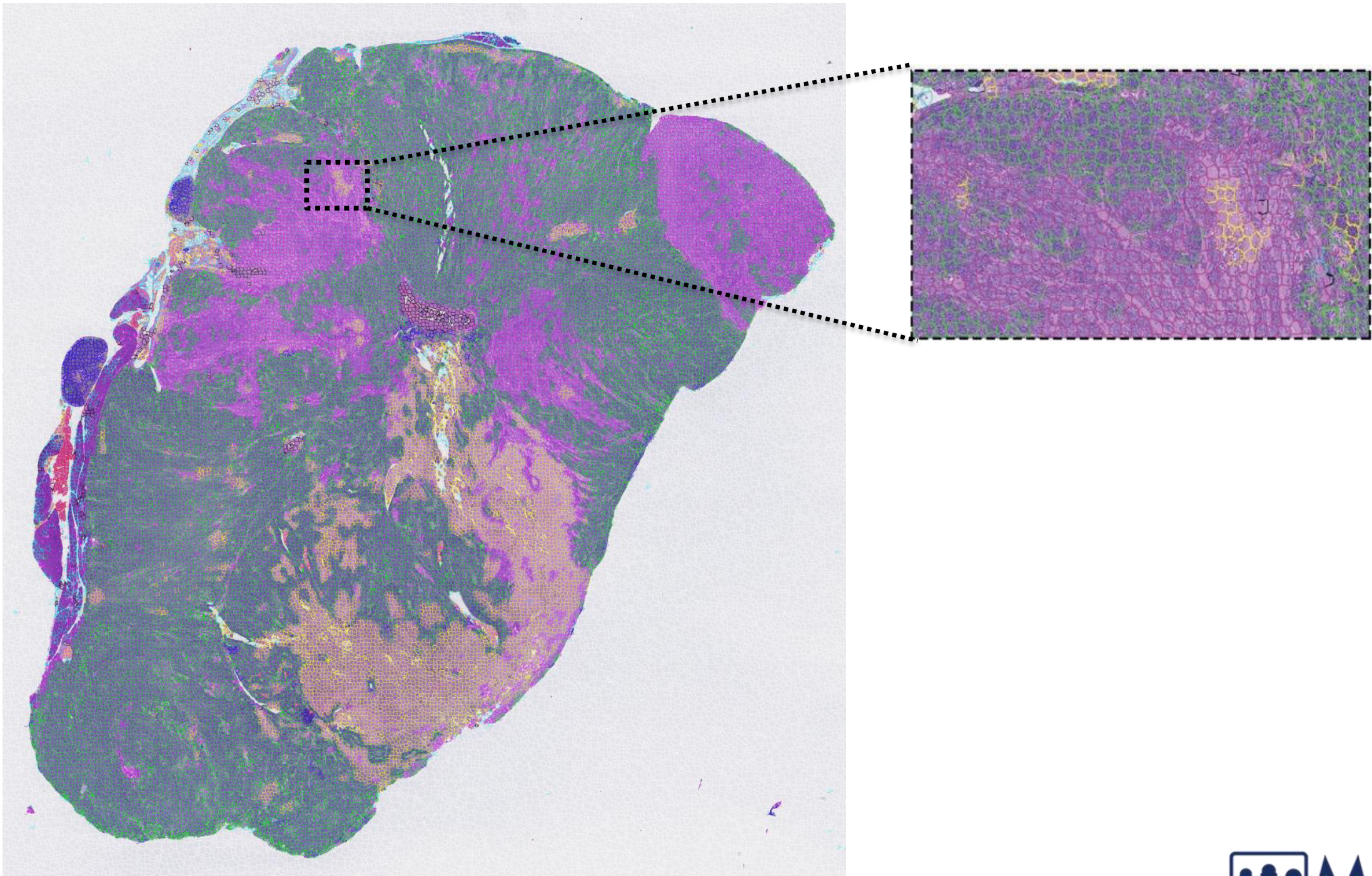
Cell segmentation / classification



Computational Pathology – Phenotypic quantification

Tissue / region level segmentation

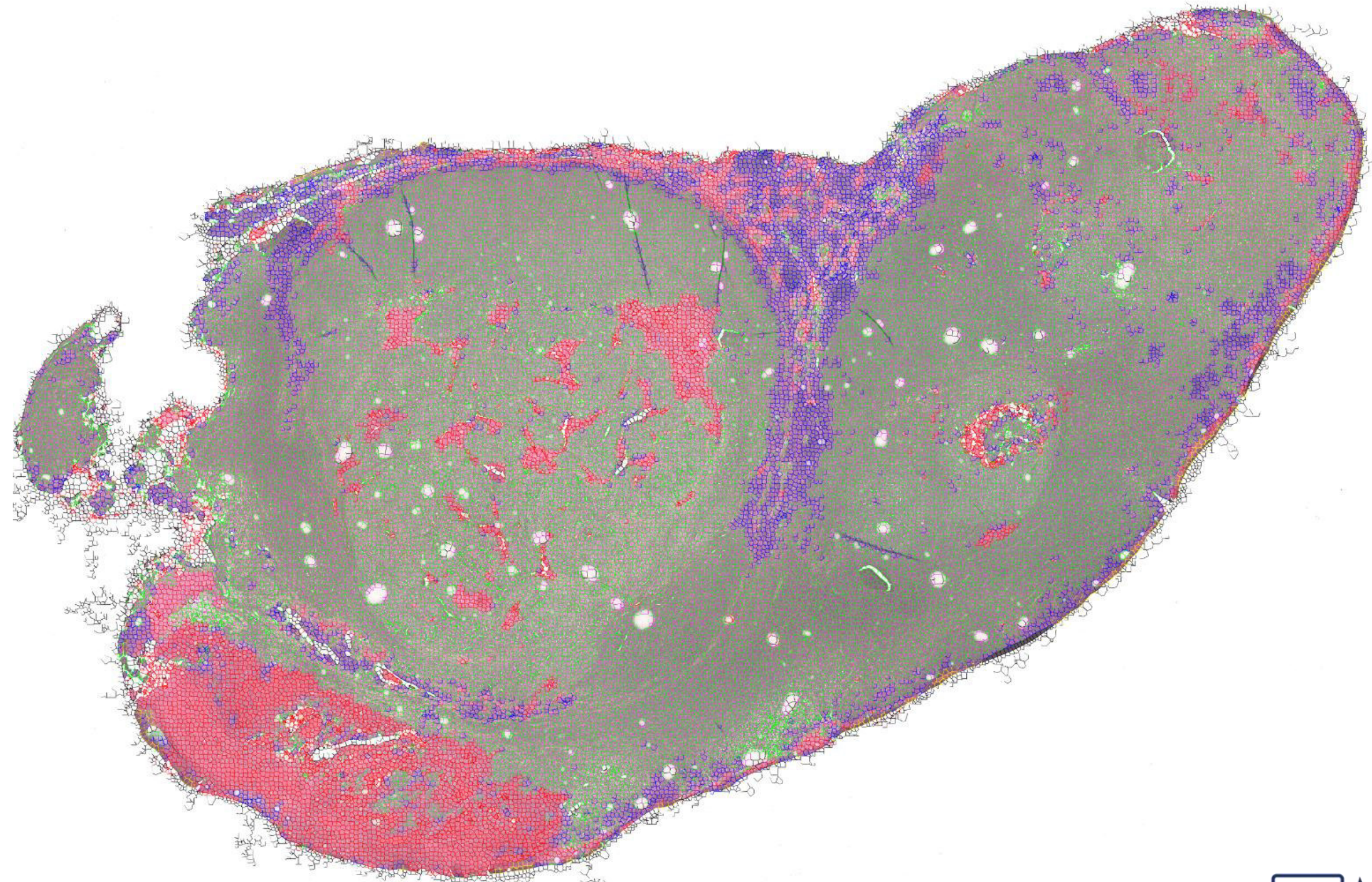
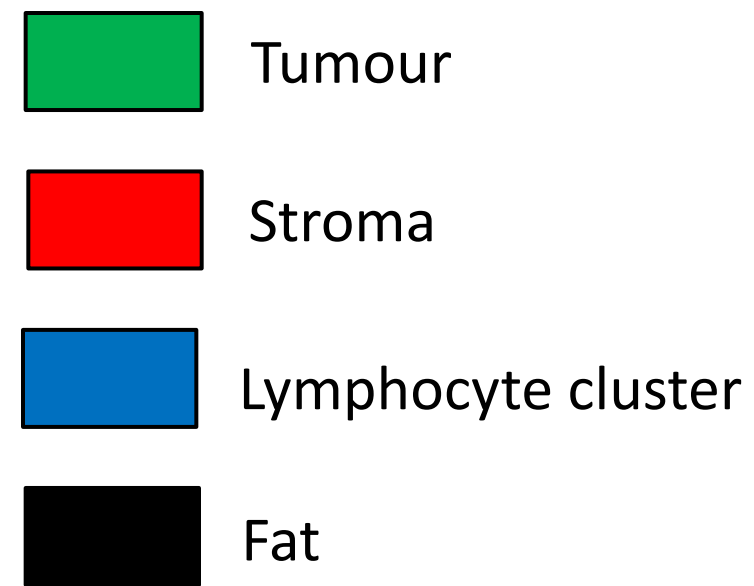
-  Tumour
-  Cell death
-  Differentiation
-  Blood
-  Lymphocyte cluster
-  Muscle
-  Other



K. Zormpas-Petridis et al, Front. In Oncol. (2021)

Computational Pathology – Phenotypic characterisation

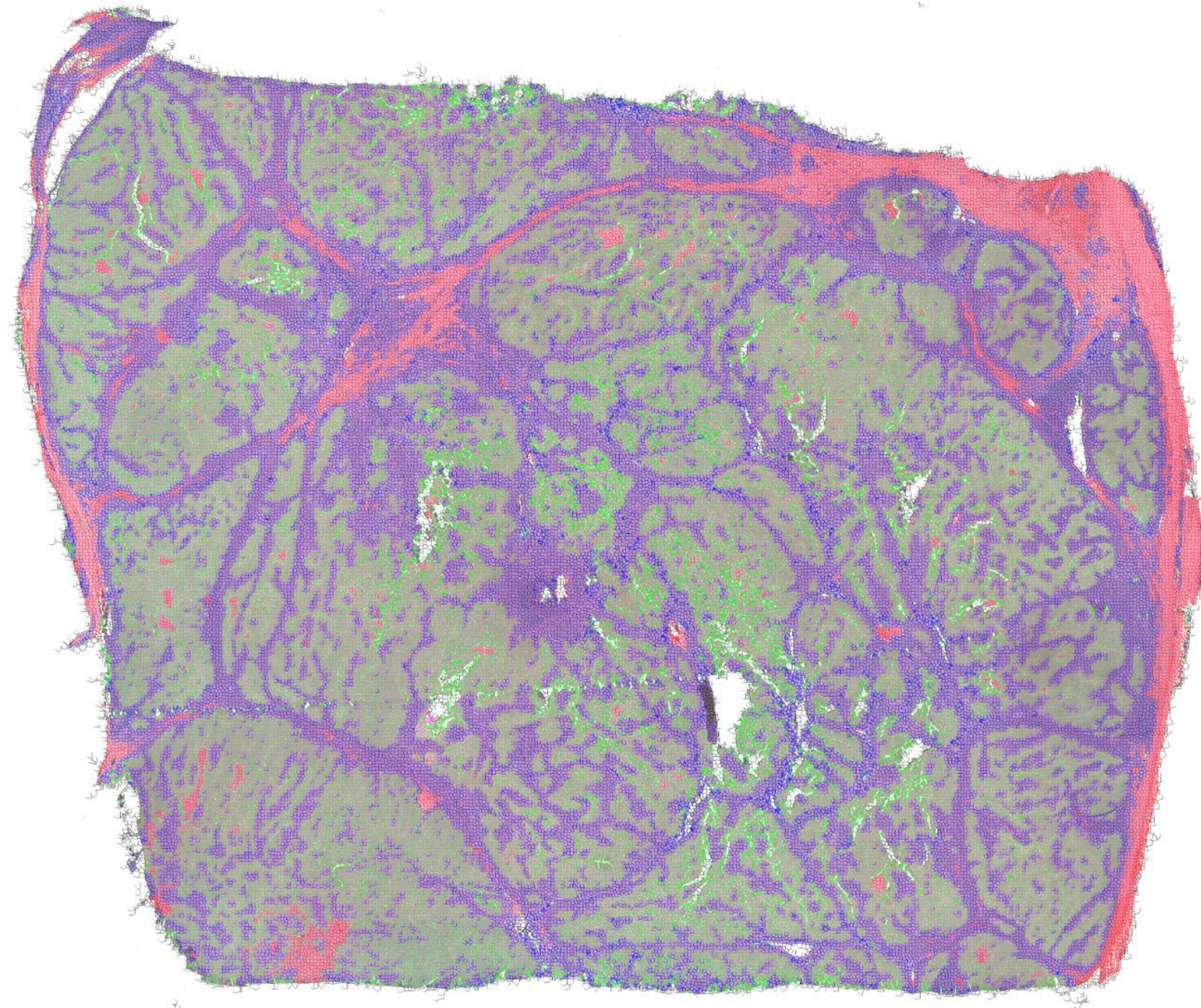
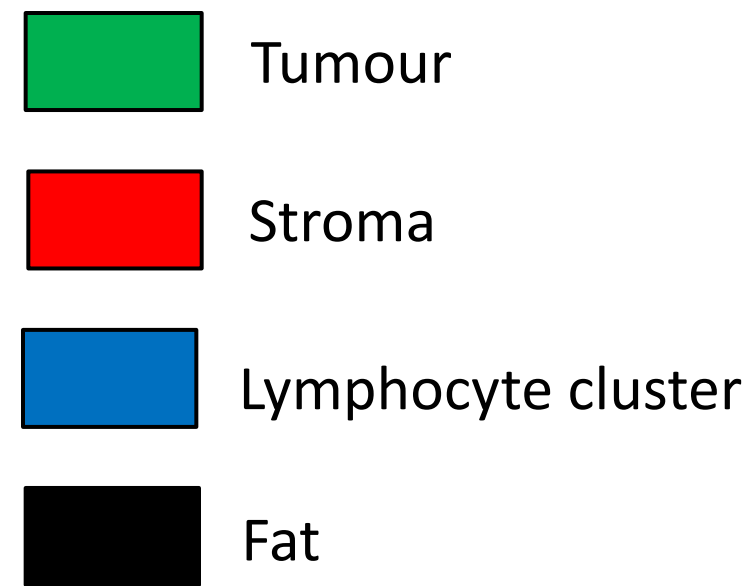
Immune exclusion



K. Zormpas-Petridis et al, Front. In Oncol. (2021)

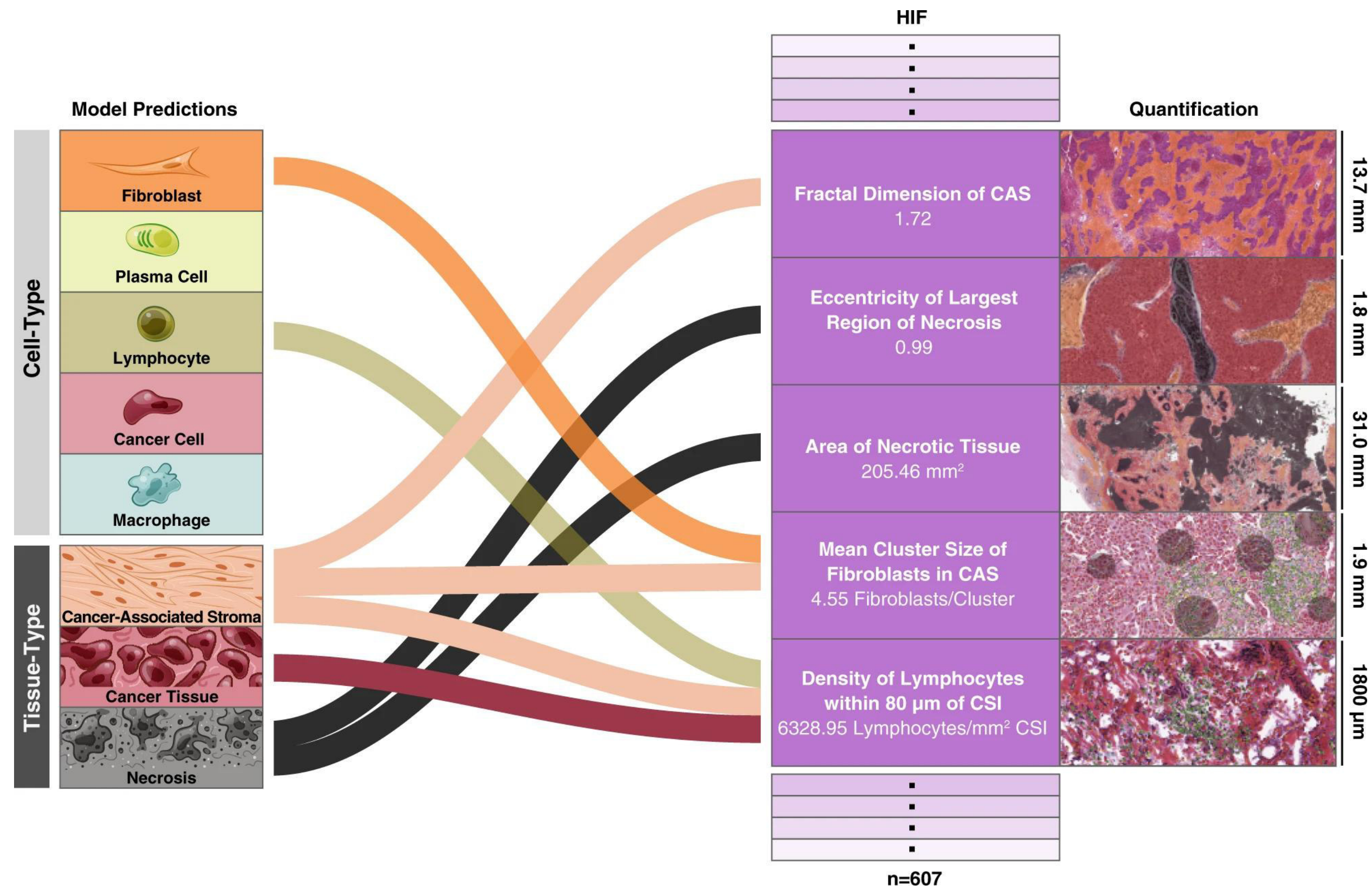
Computational Pathology – Phenotypic characterisation

Immune hot

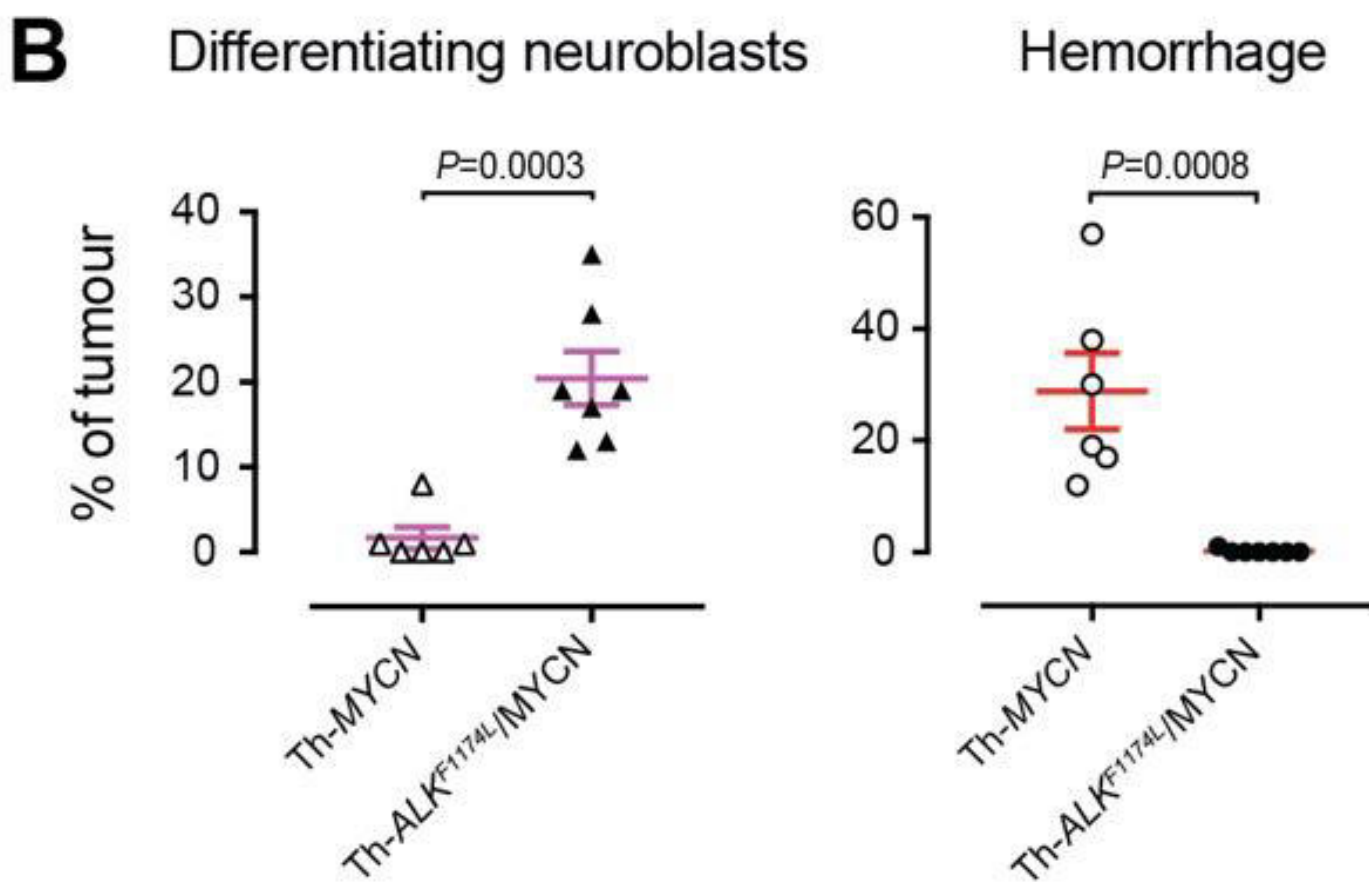
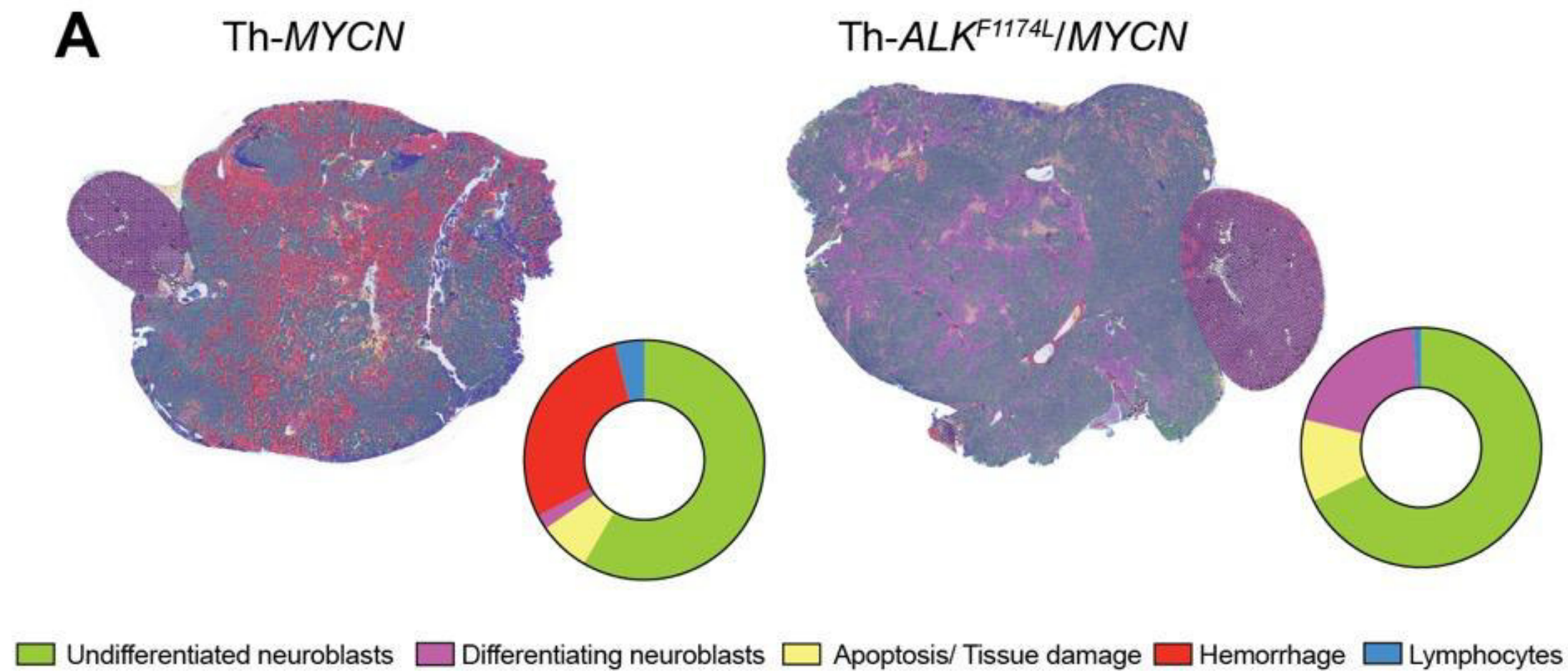


K. Zormpas-Petridis et al, Front. In Oncol. (2021)

Computational Pathology – Spatial statistics / Biological features extraction

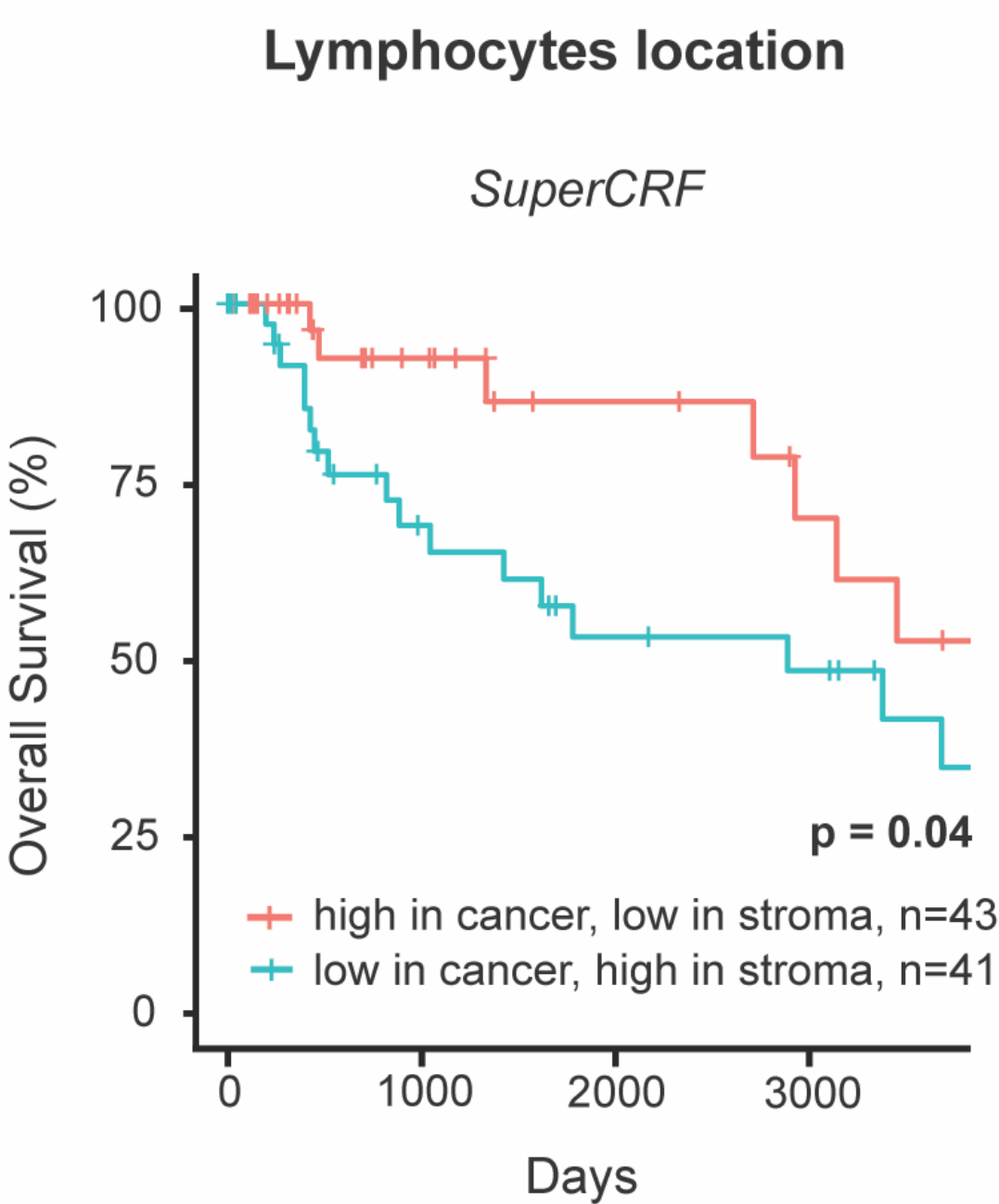
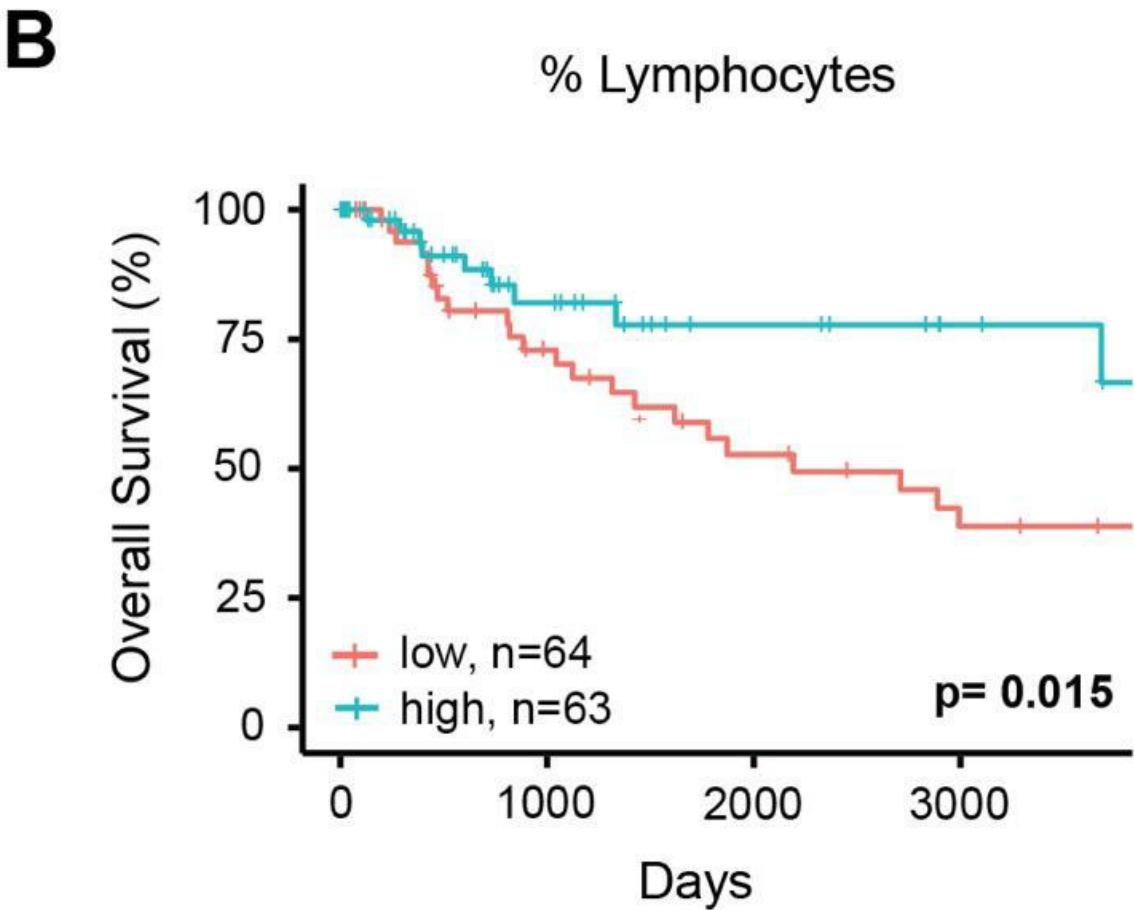
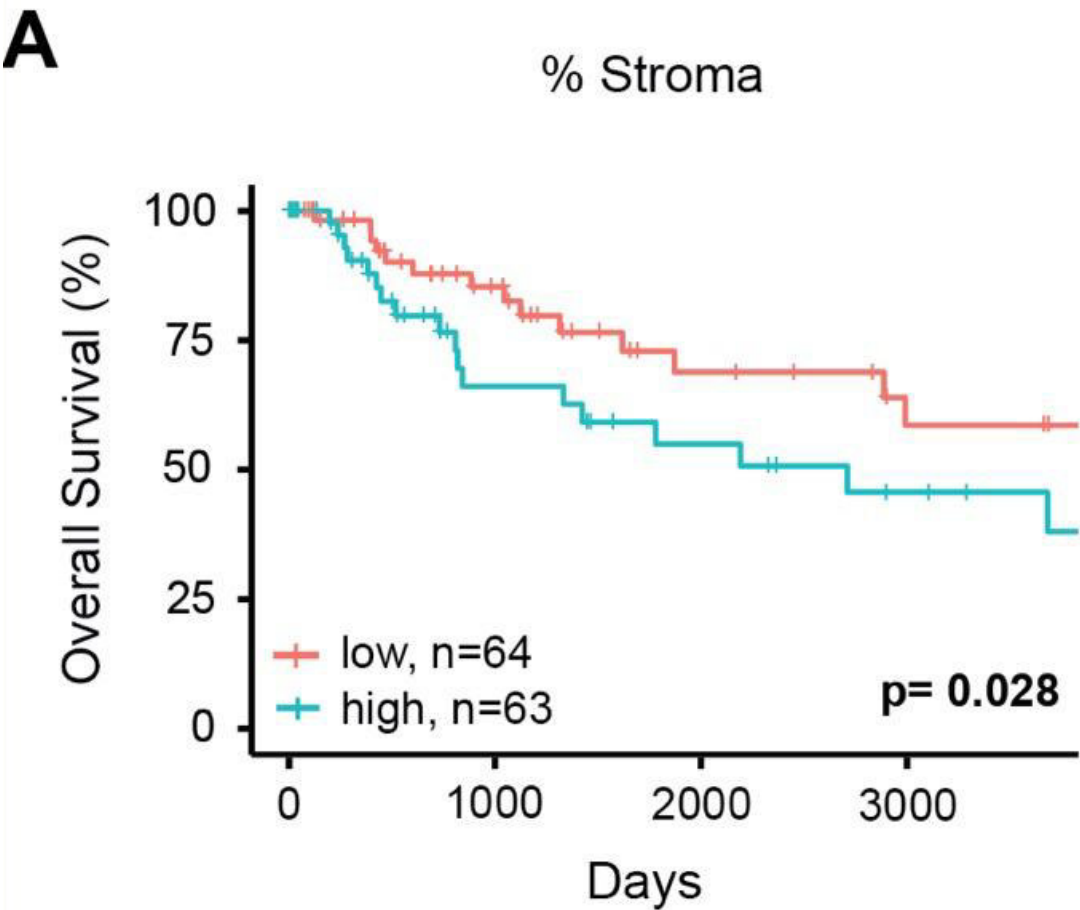


Computational Pathology – Applications: Mutation prediction



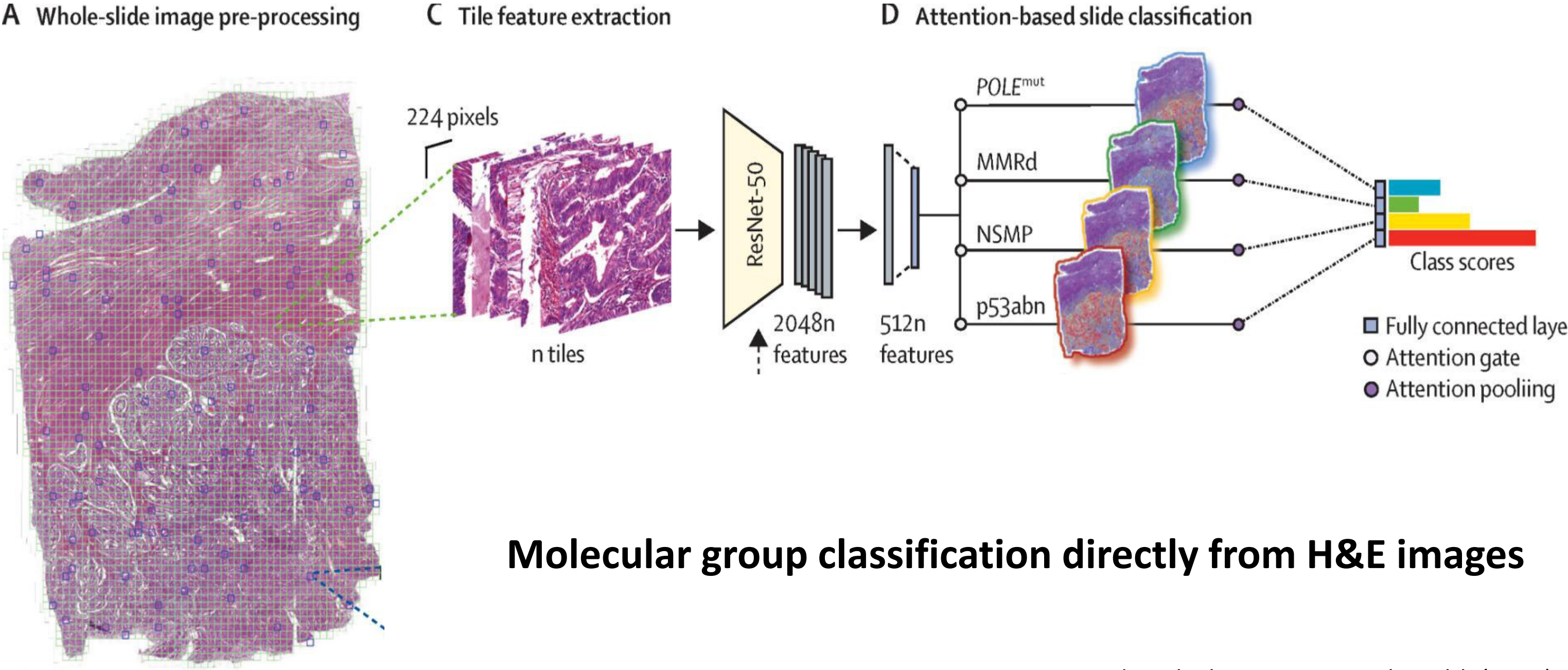
K. Zormpas-Petridis et al, Front. In Oncol. (2021)

Computational Pathology – Applications: Survival prediction



K. Zormpas-Petridis et al, *Front. In Oncol.* (2019)
K. Zormpas-Petridis et al, *COMPAY MICCAI* (2018)

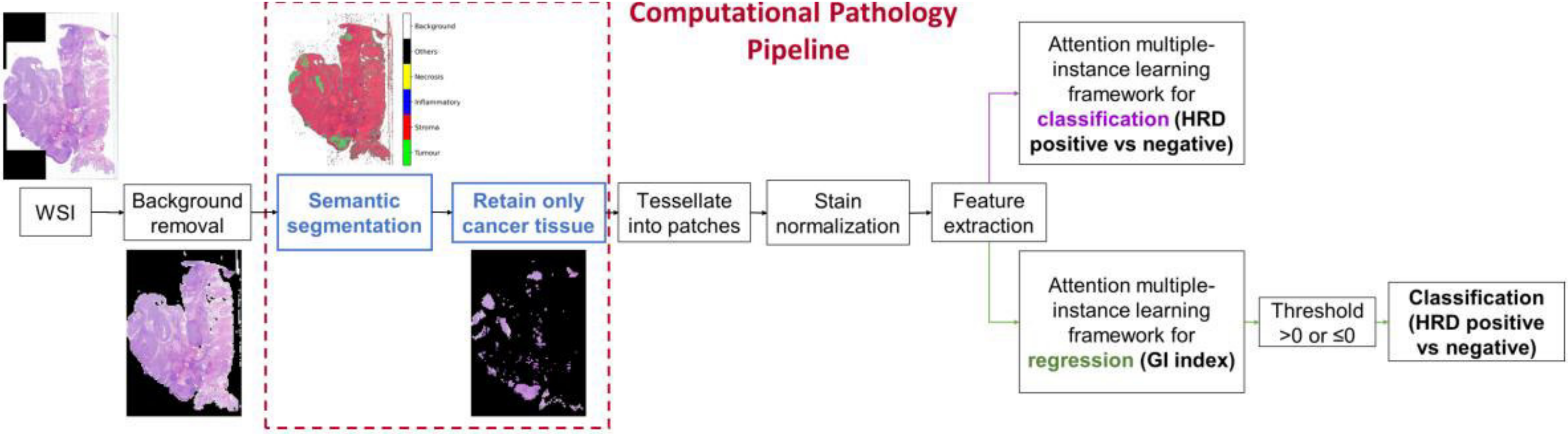
Computational Pathology – Foundation models



Molecular group classification directly from H&E images

Fremond et al, The Lancet Digital Health (2022)

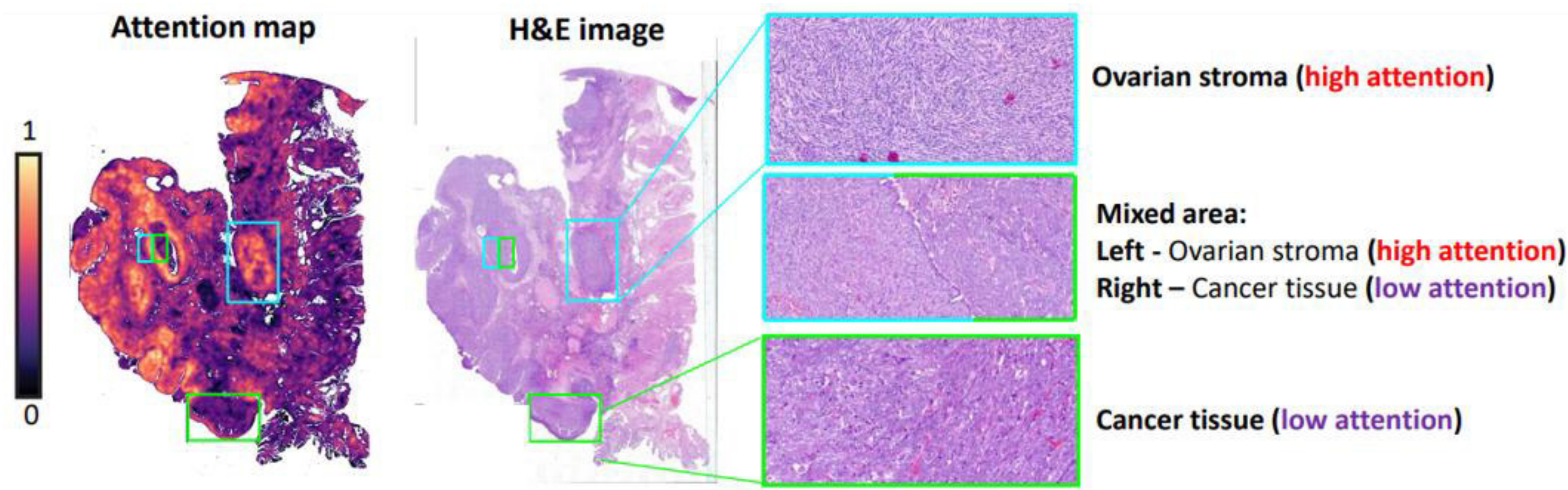
Predicting HRD from H&E images in ovarian cancer



Vagni et al., ESGO 2025

Predicting HRD from H&E images in ovarian cancer

Model explainability

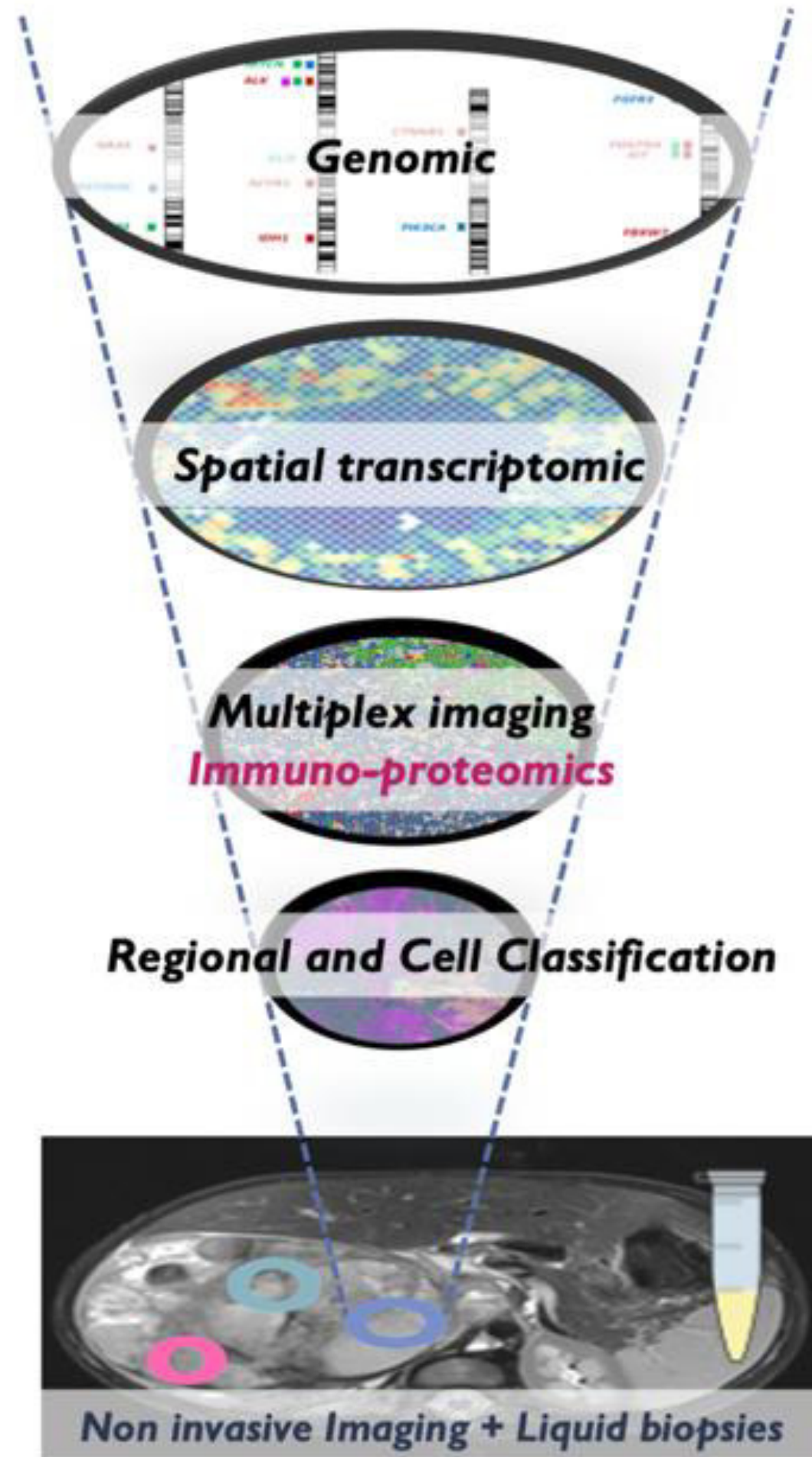


Vagni et al., ESGO 2025

Multi-omics integration

Types of medical data

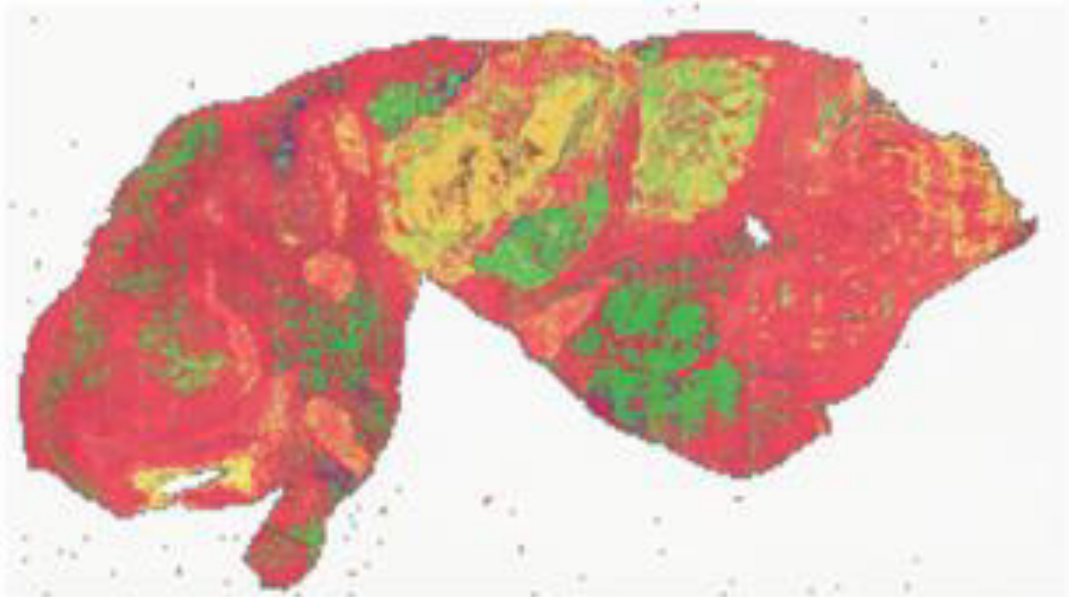
- Genomic
- Transcriptomic
- Proteomics
- Histopathology
- Medical imaging



A map for radiotherapy targeting?



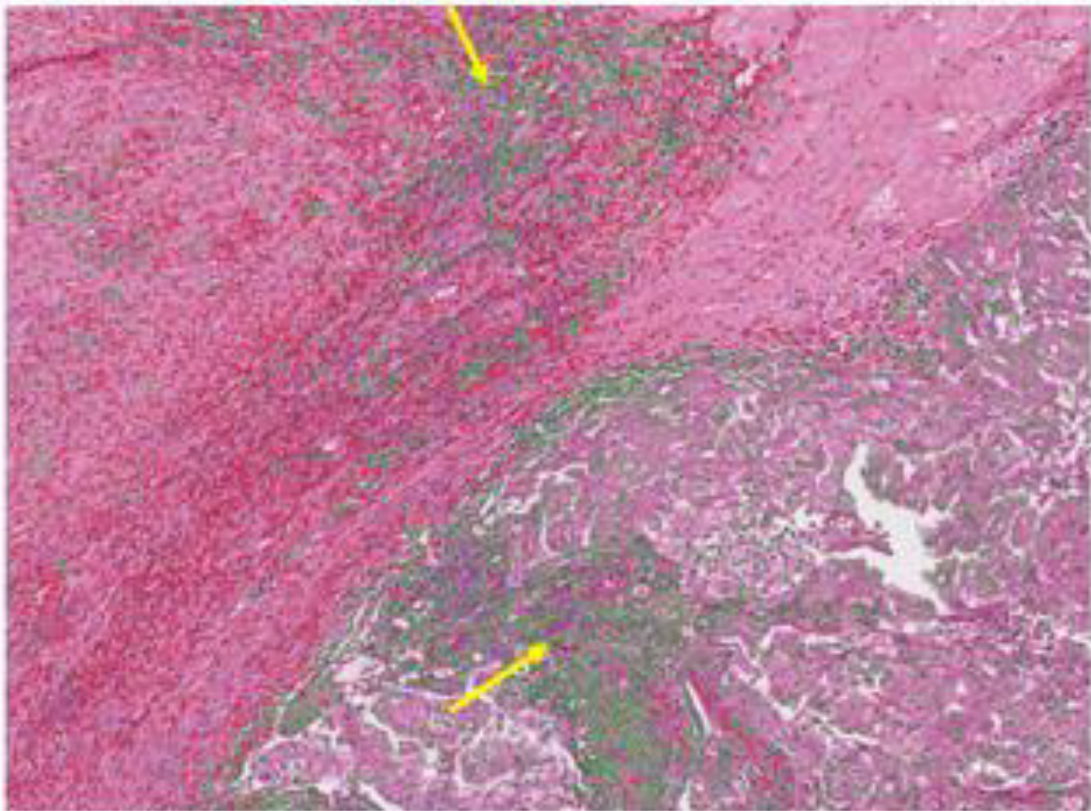
Semantic segmentation



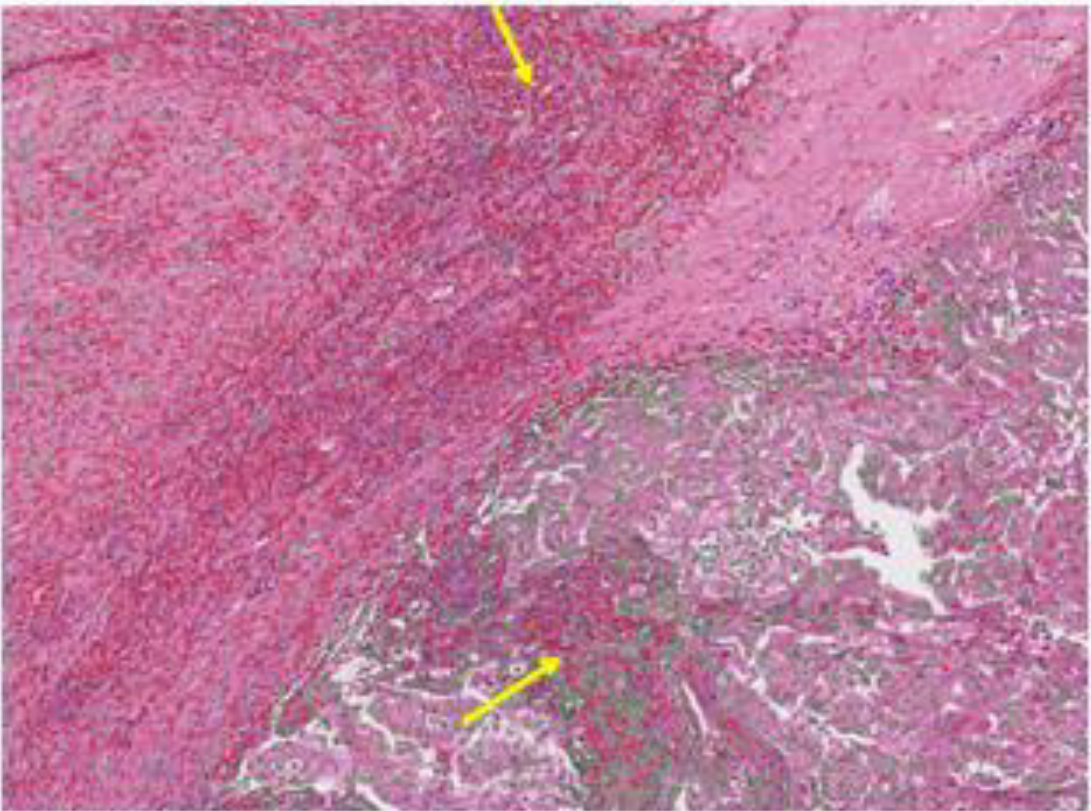
- Background
- Others
- Necrosis
- Inflammatory
- Stroma
- Tumour

Cell detection

Original



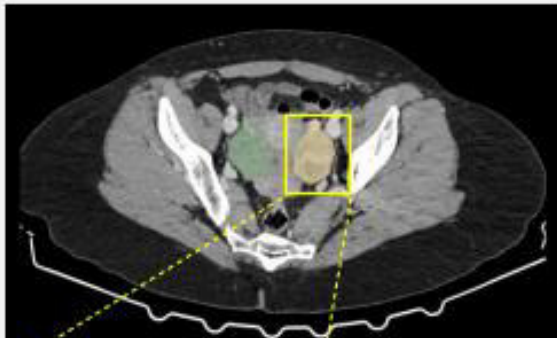
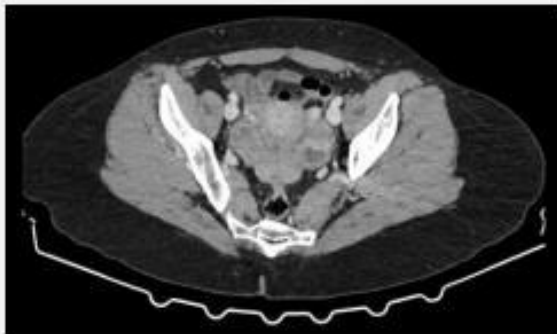
Retrained



Radiology - Histology registration through 3D-printed patient- specific moulds



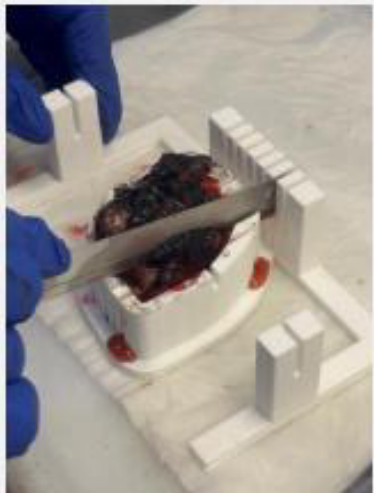
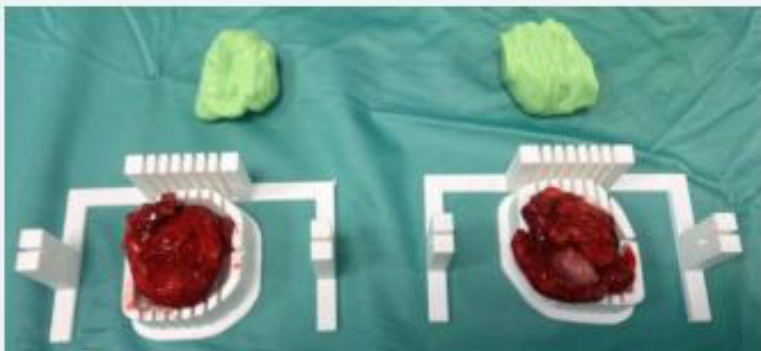
Radiology



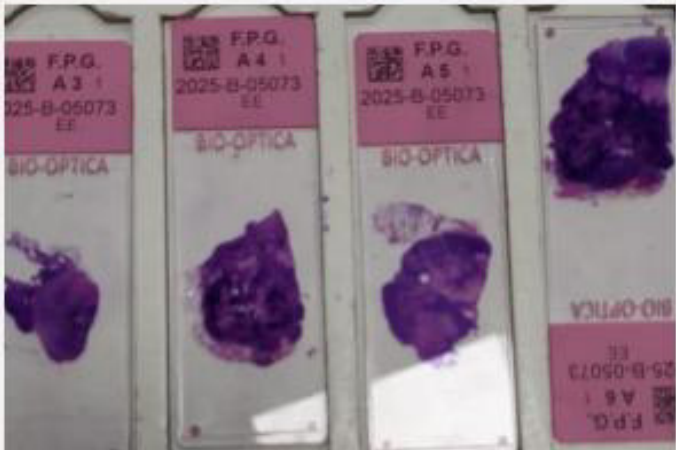
3D printing



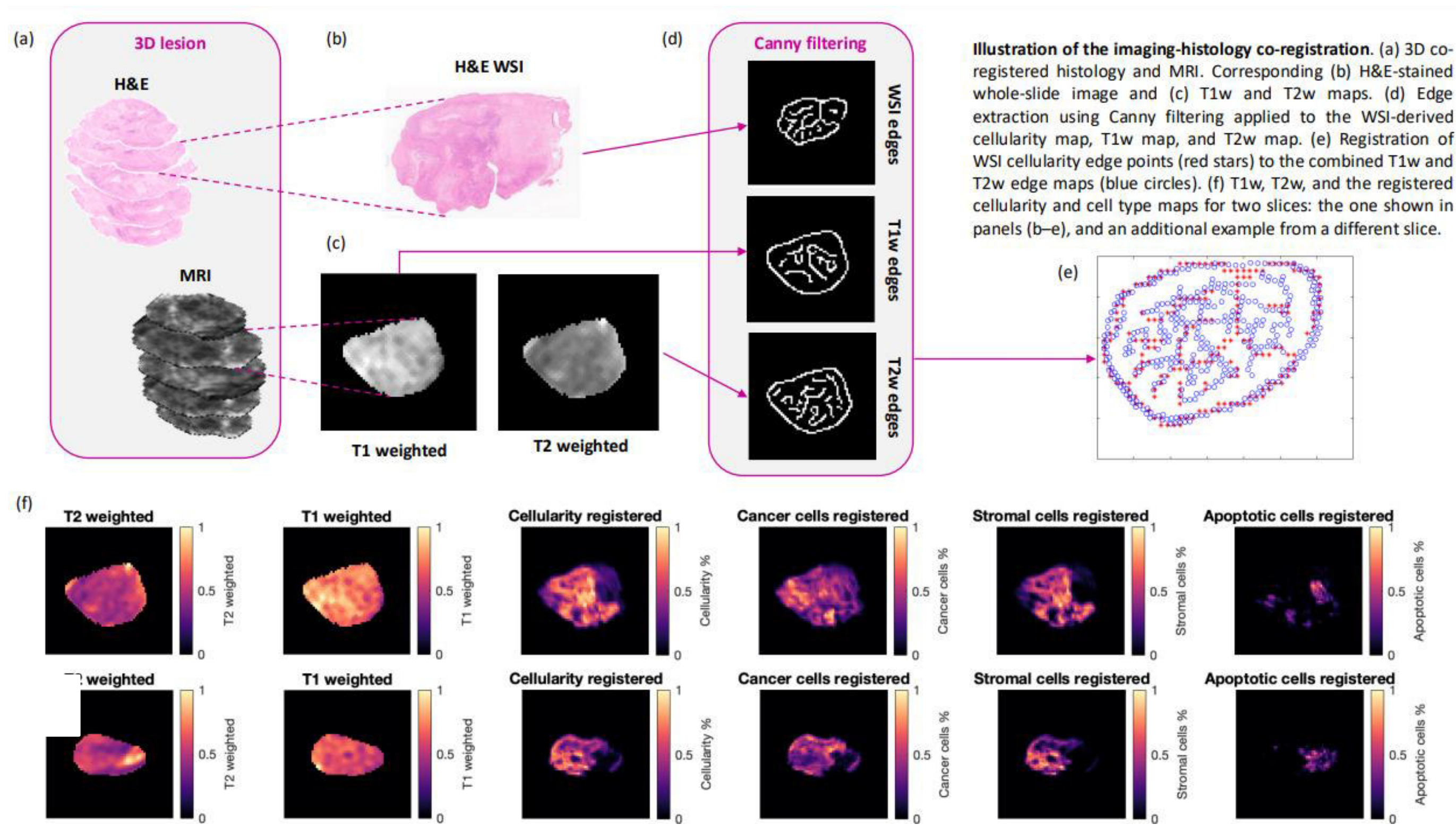
Surgery



Anatomopathology



Radio – Pathomics 3D analysis of whole ovarian cancer lesions using artificial intelligence



Clayton et al,
submitted to
RSNA 2025

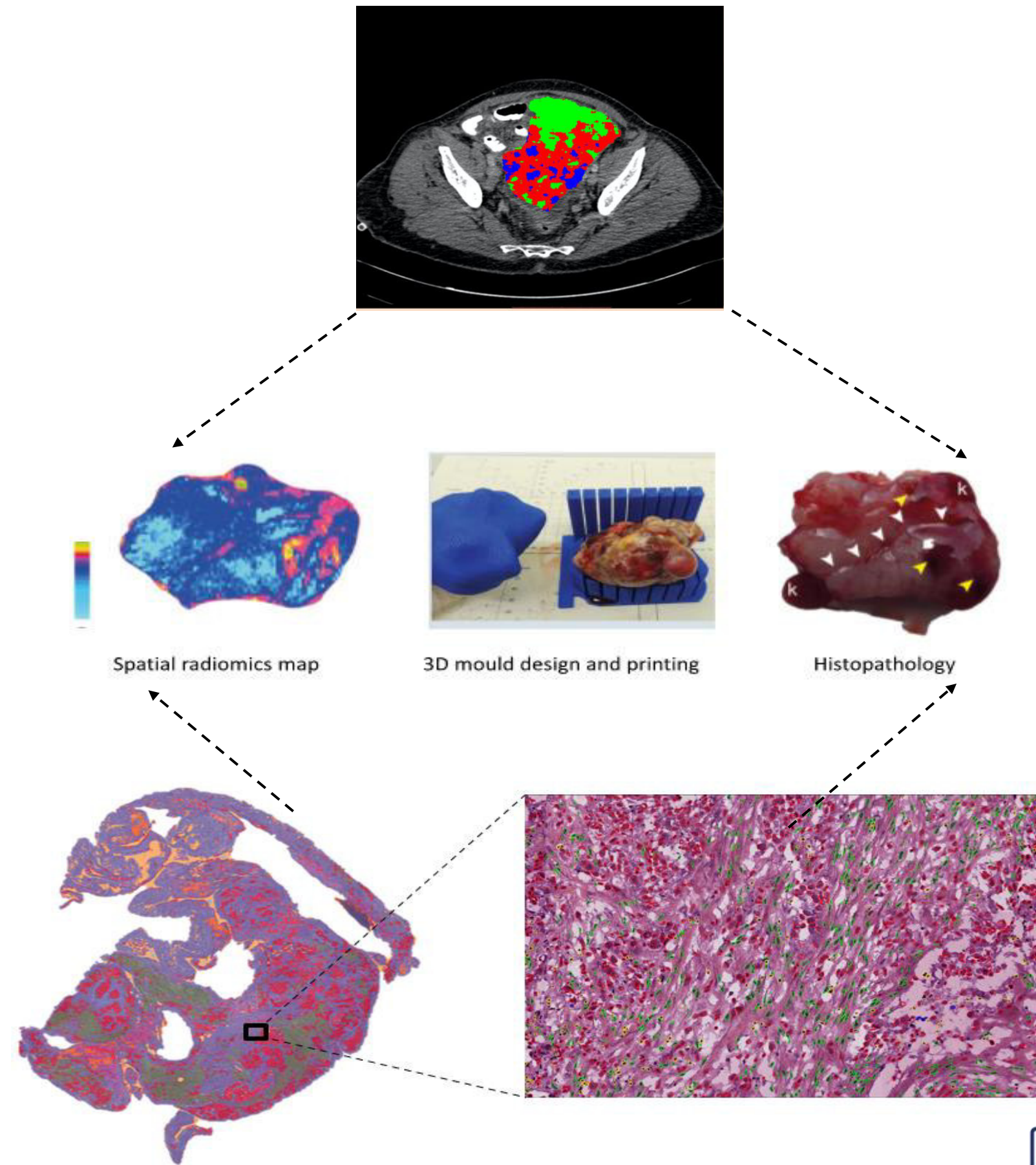
MRO.ART
MODERN RADIATION ONCOLOGY
35° RESIDENTIAL COURSE

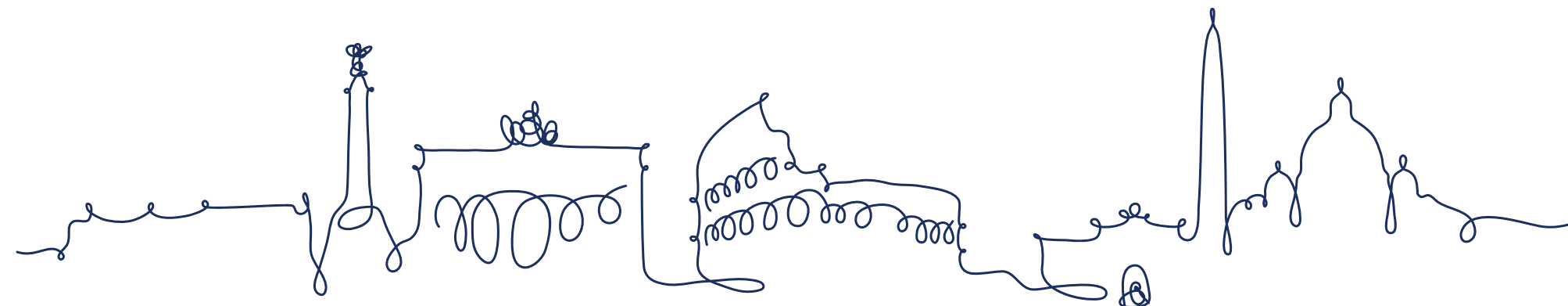
Collaboration with the University of Cambridge, UK

Do not use / share

Impact

- Better patient stratification
- Virtual biopsies
- Better response assessment
- Histologically-validated imaging biomarkers for response and relapse prediction





Grazie

- Thank you -

Ευχαριστώ

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Dr. Alberto Augello
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MRO.35: Equity and research in oncology. The subtle balance
between personalized medicine and accessibility to care

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(UK)**

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