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What is immune exclusion?

SITC 2023

Disclosures 2023

Employee: **University Hospital Dresden, University Hospital Heidelberg**

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What is immune exclusion?

Clifton et al., JITC, 2023

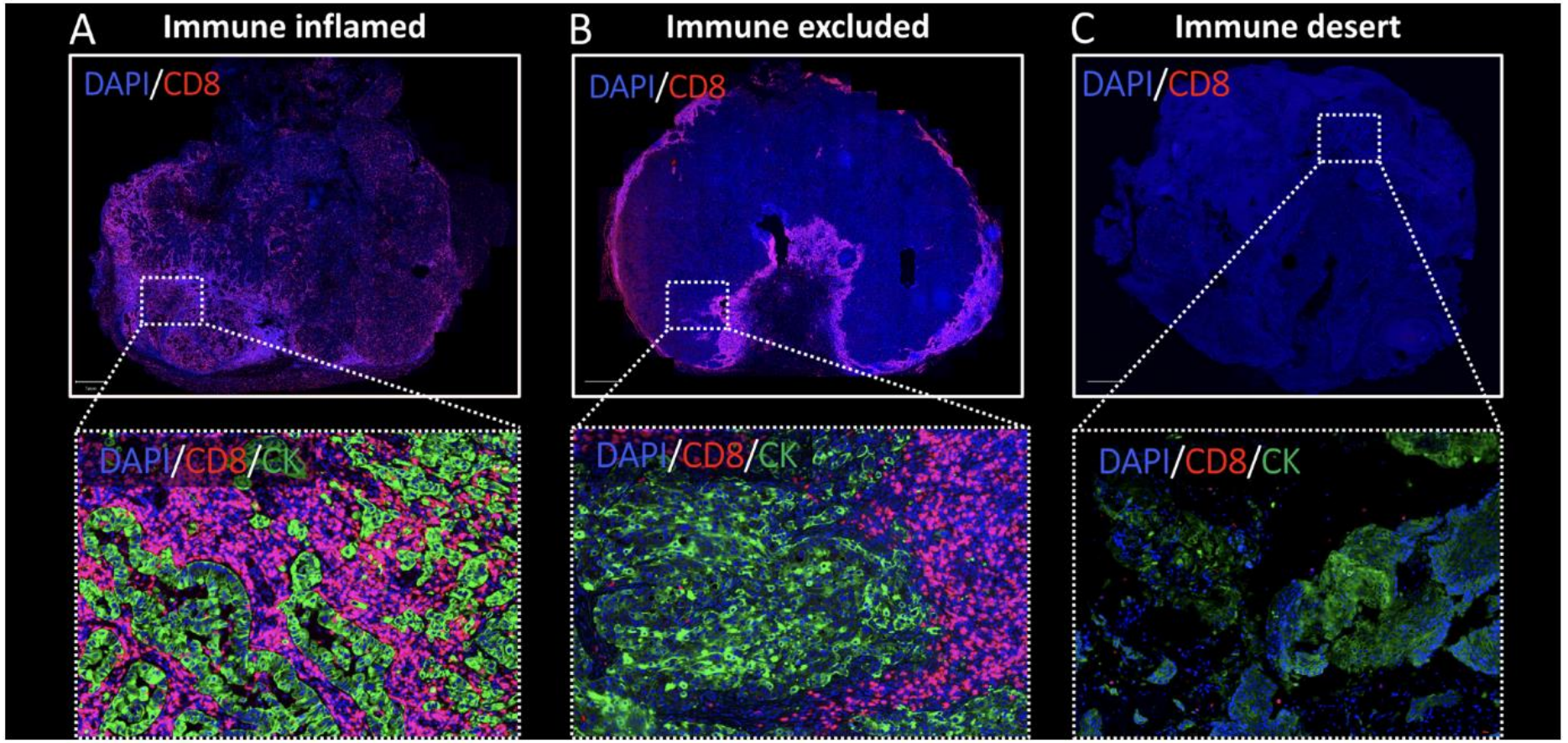
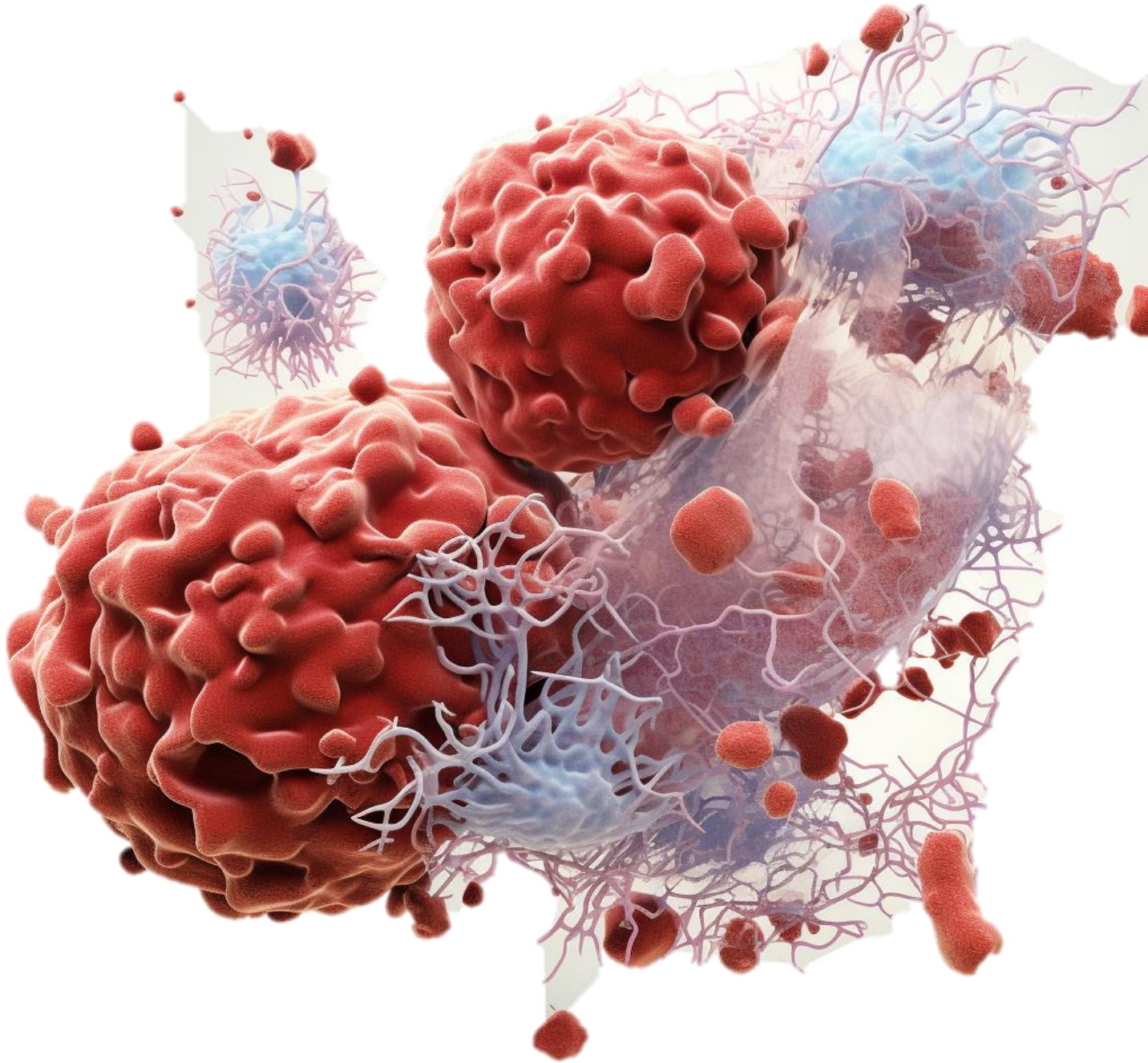


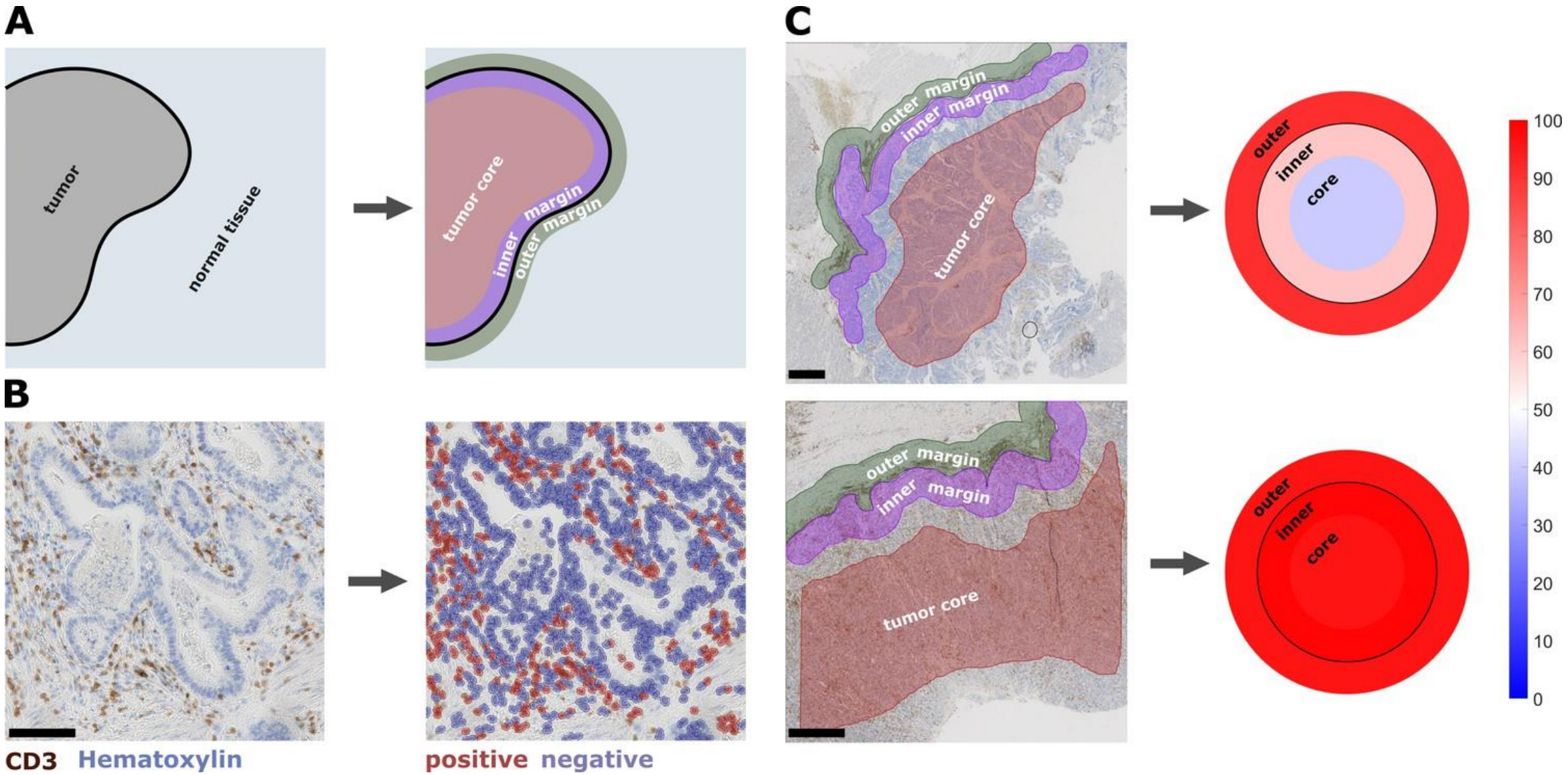
Figure 1 T-cell infiltration patterns in resected human non-small cell lung carcinomas (NSCLCs). (A–C) Representative multicolor immunofluorescence microphotographs of NSCLC sections stained with DAPI for all cells/nuclei (blue), CD8 for cytotoxic T-cells (red) and cytokeratin for tumor epithelial cells (CK, green). The tumor infiltrating lymphocyte patterns represent the extremes of a continuum. Figure was contributed by coauthor Dr Kurt Schalper from Yale University. The multiplexed immunofluorescence staining protocols, including tumor and tumor infiltrating lymphocyte markers, was adapted part of a previously studied retrospective cohort.[26] Bar=1 mm.

Can we use computer-based image analysis?



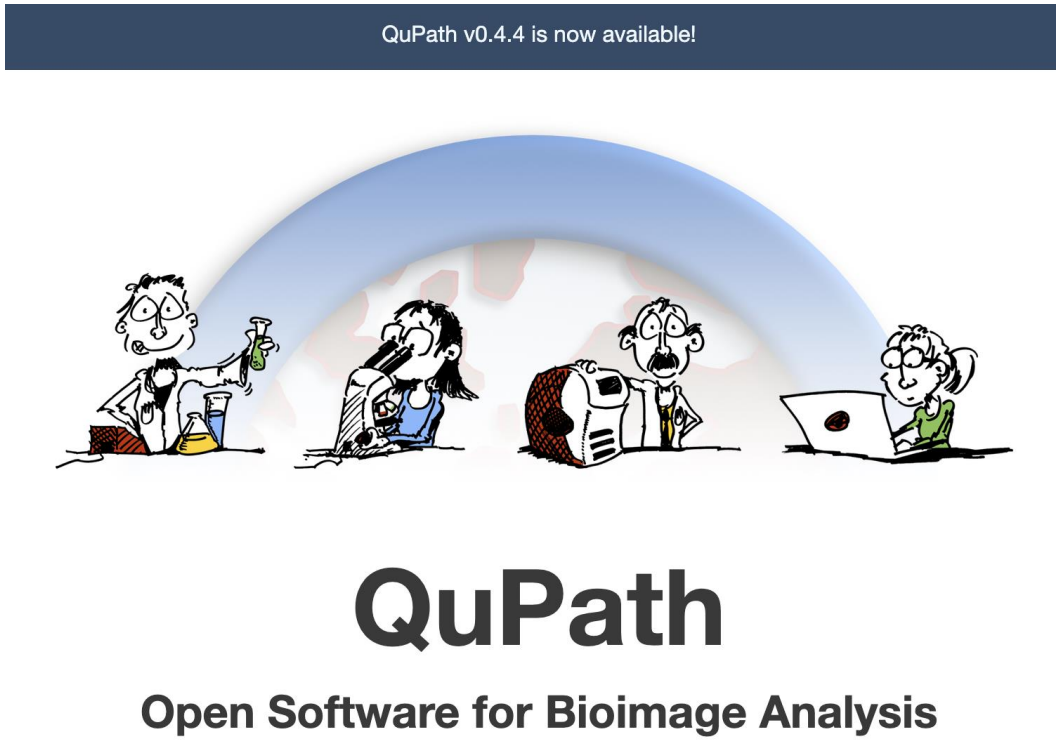
Brightfield microscopy image analysis

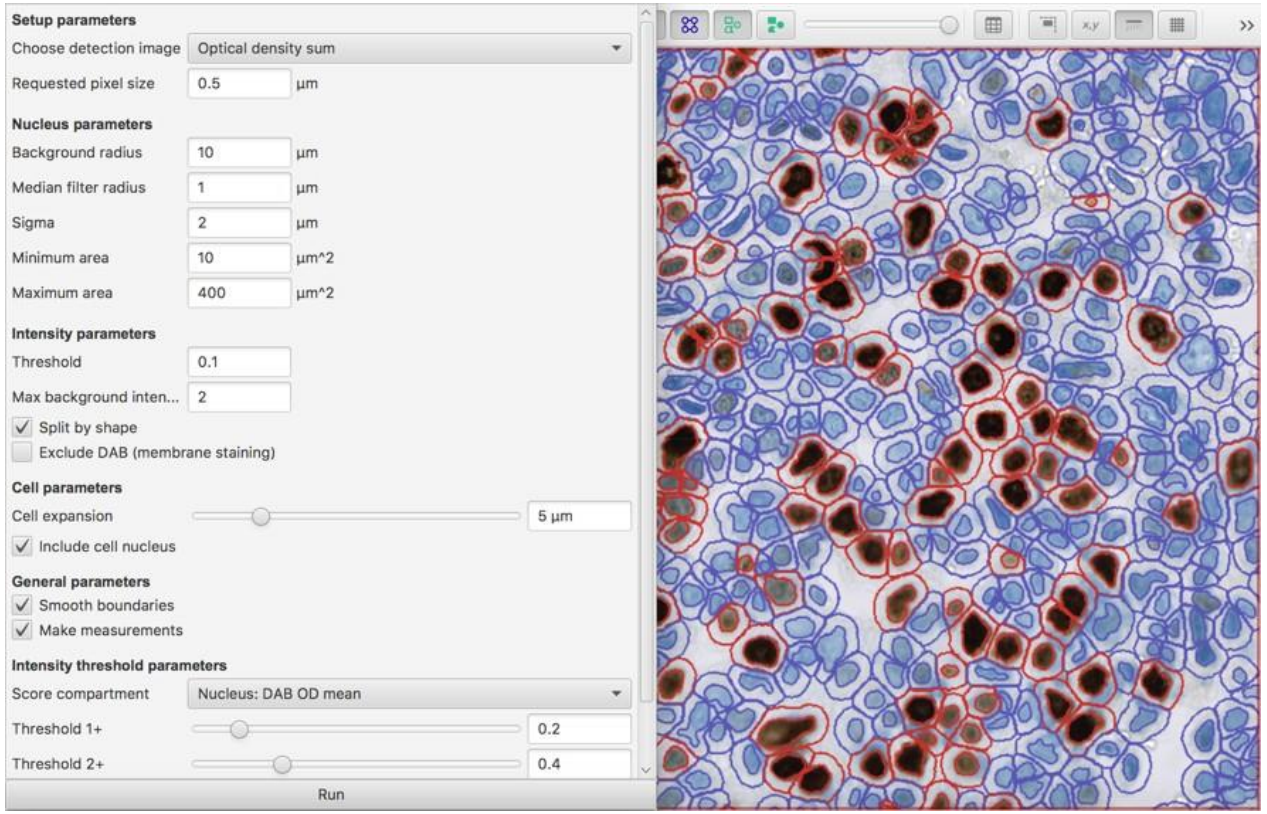
Kather et al., eLife 2018



The tool of choice: QuPath

Pete Bankhead

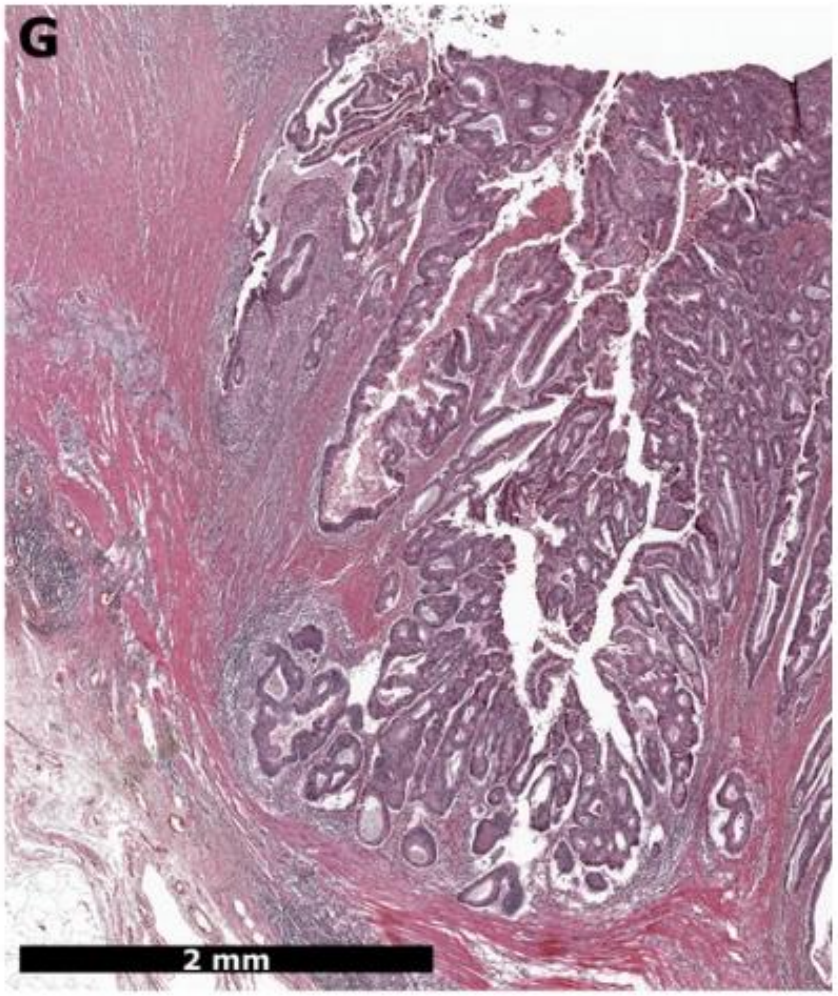


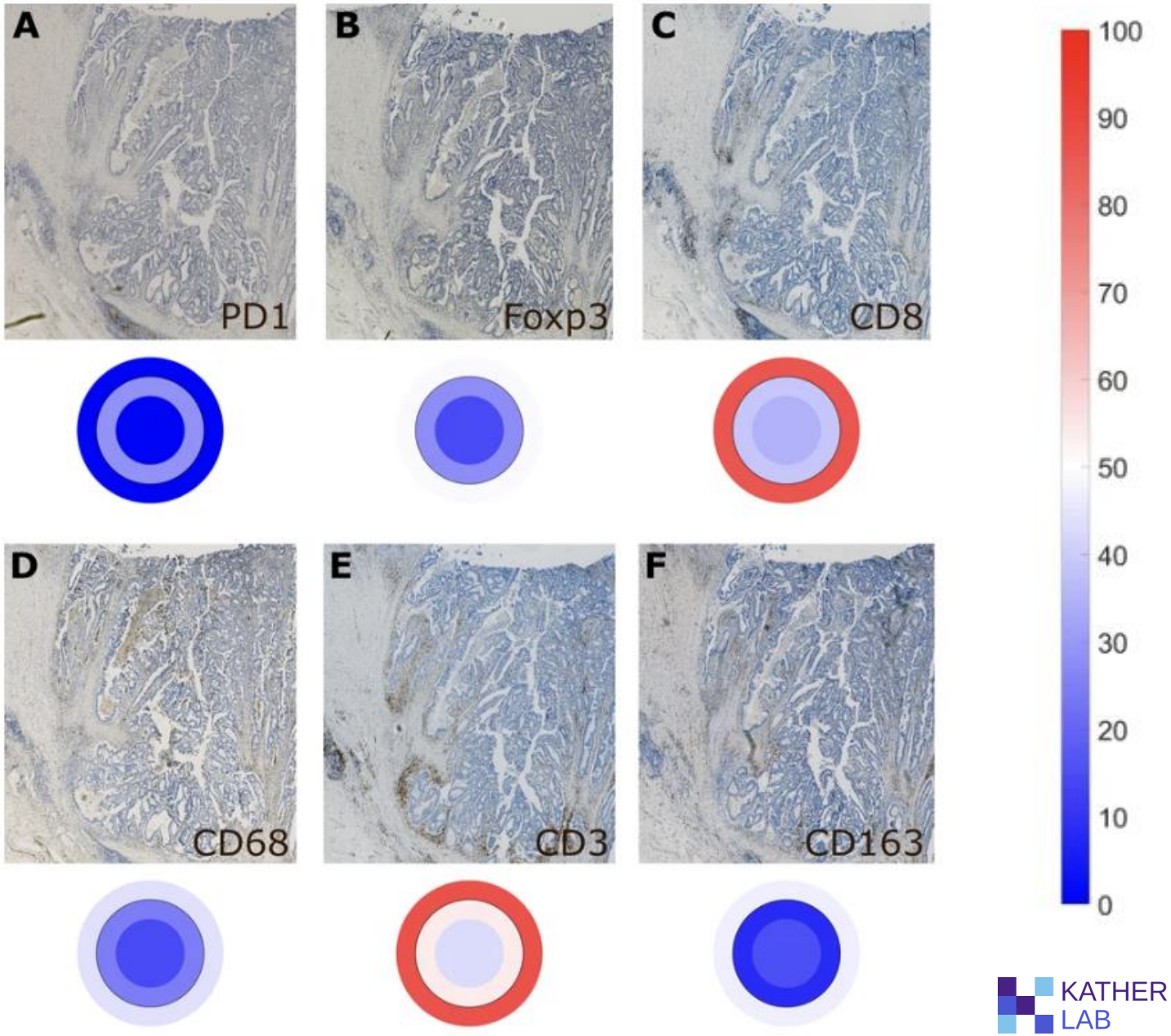


https://petebankhead.github.io/qupath/tips/2018/03/22/setting-positive.html

Different immune cells: it is complicated.

Kather et al., eLife 2018





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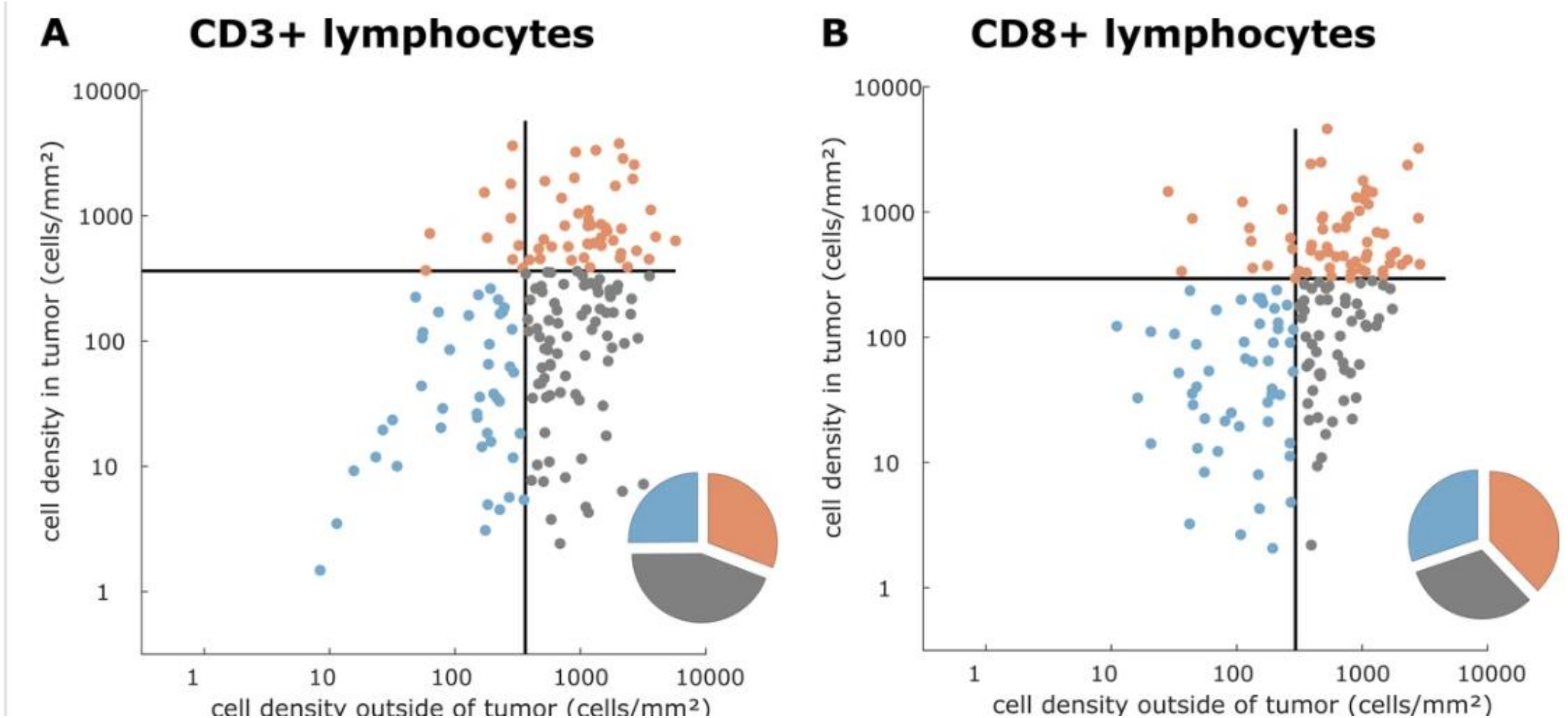
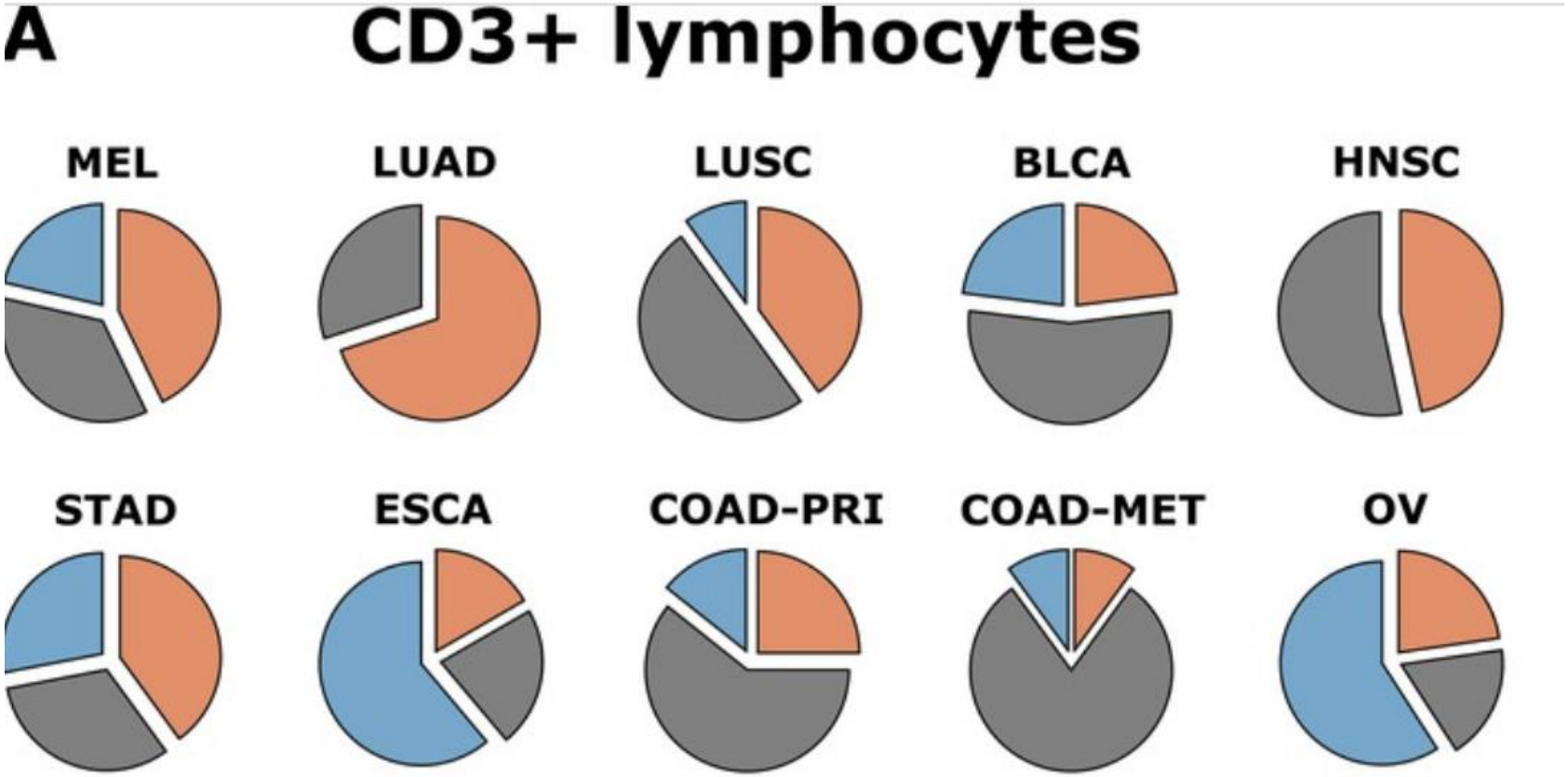
Is immune exclusion a continuum?

Kather et al., eLife 2018



It depends on the tumor type!

Kather et al., eLife 2018



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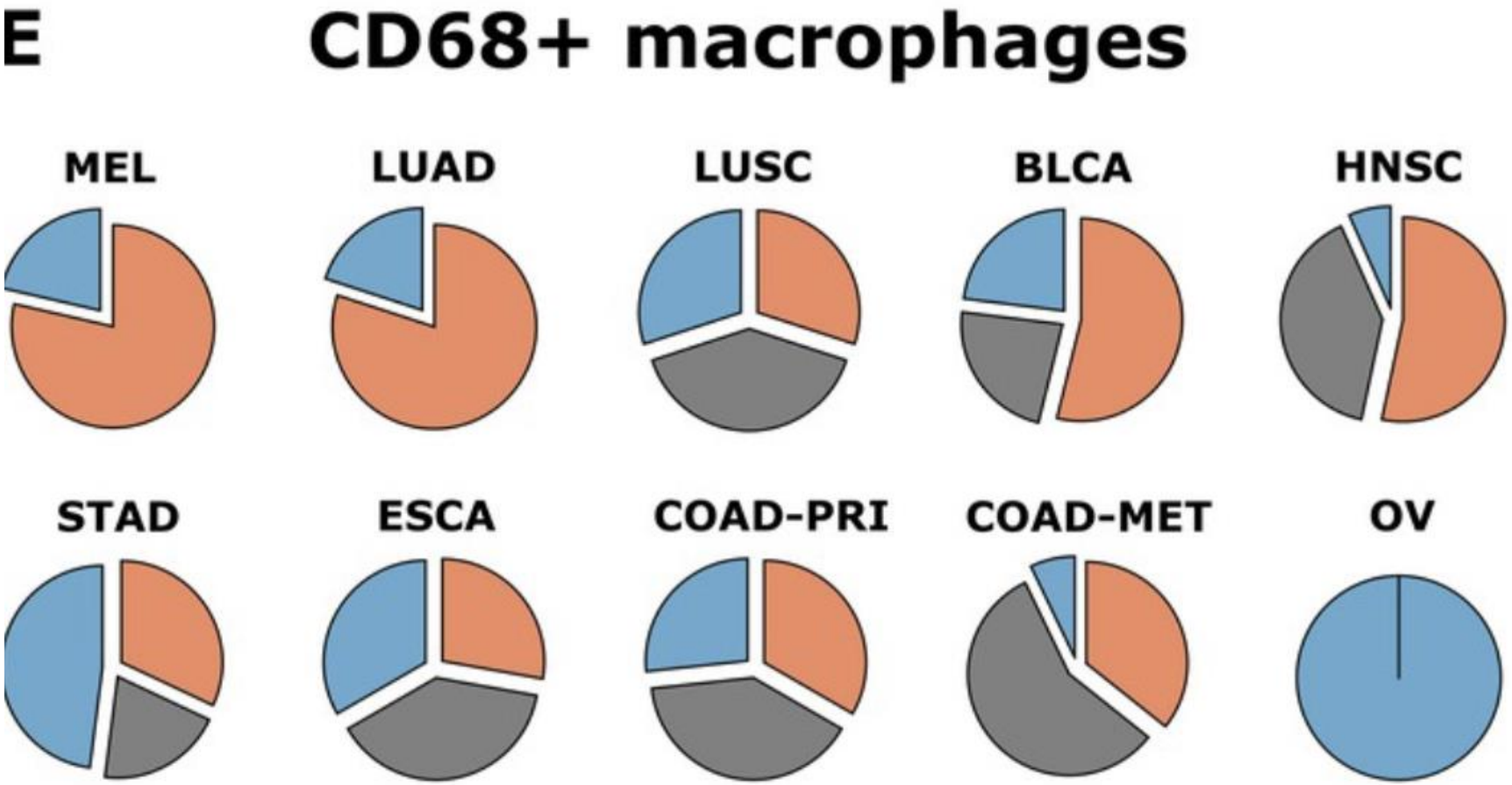
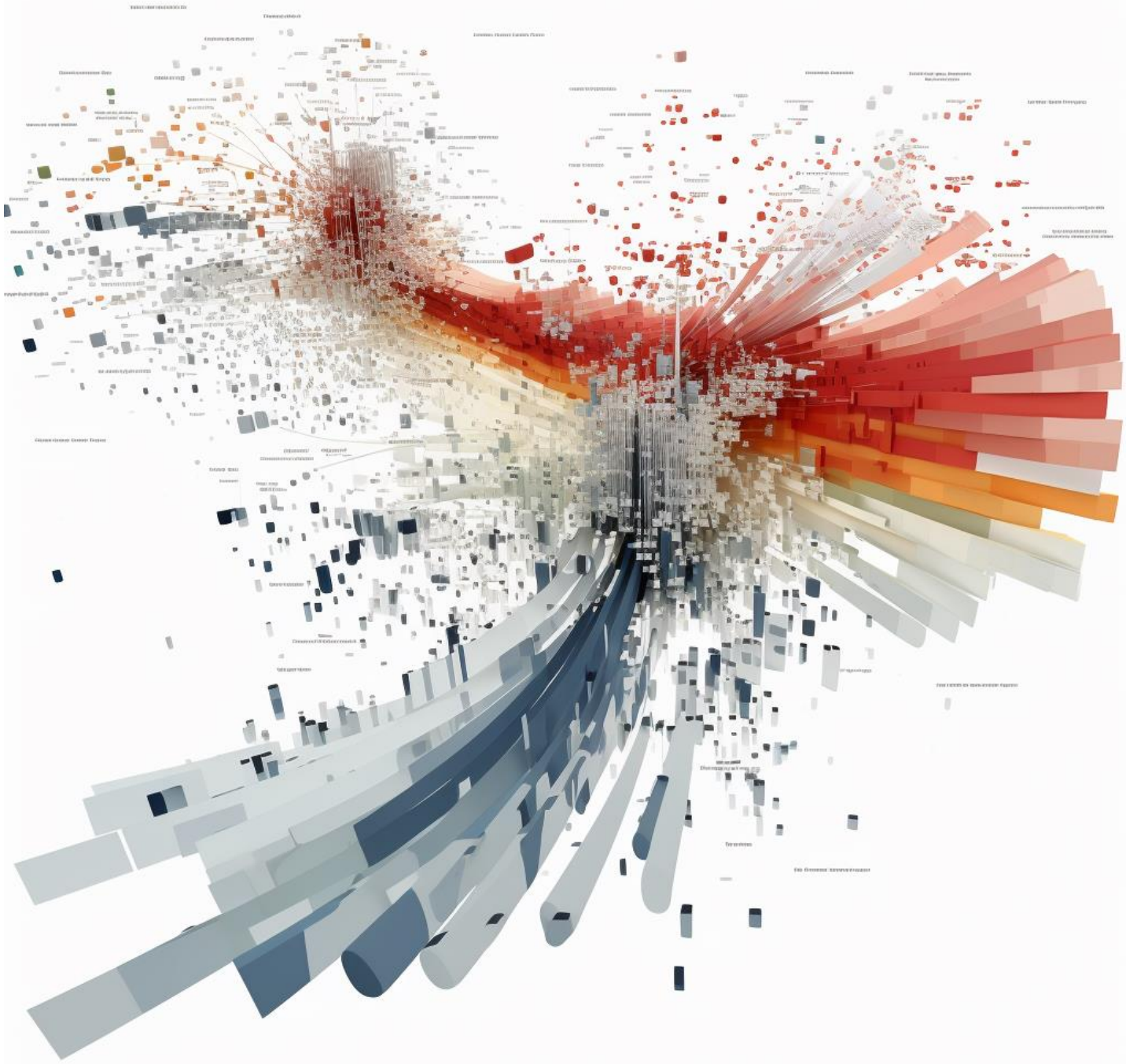
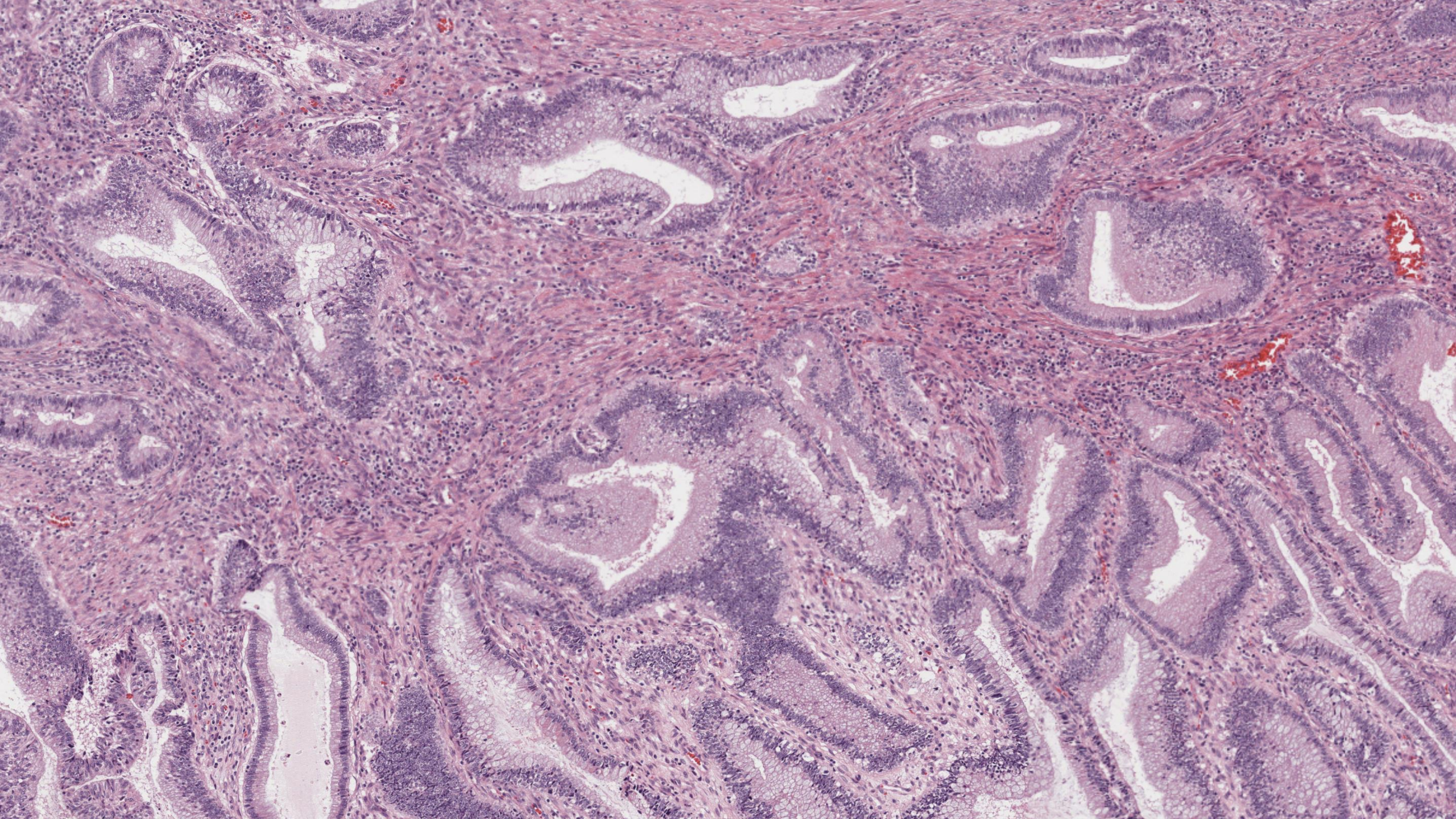
Kather et al., eLife 2018



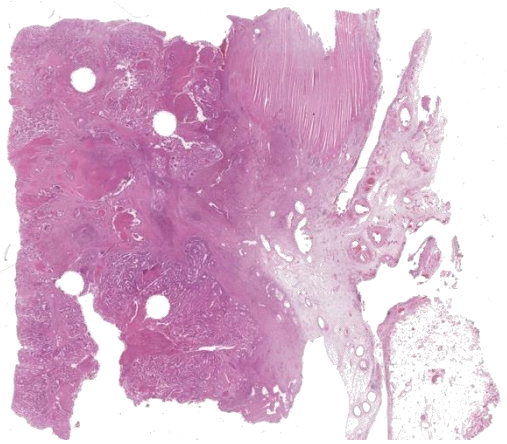
How can computational pathology help?



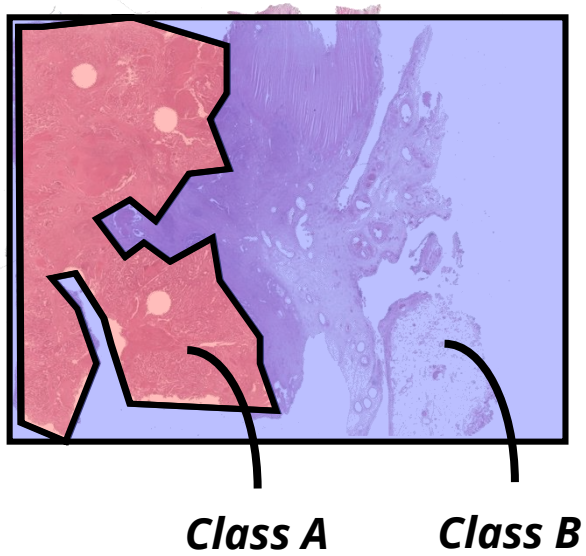


Strong supervision

original image



strong labels



Weak supervision

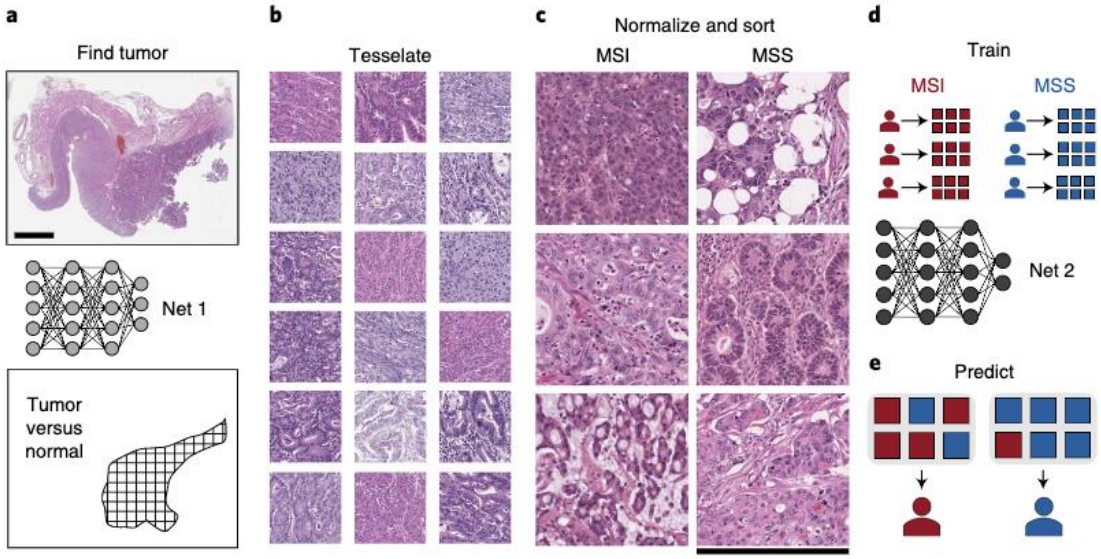
weak labels

Deep Learning yields surprisingly good results when trained on weakly labeled data

nature medicine

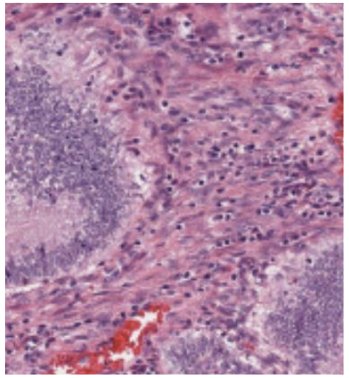
Deep learning can predict microsatellite instability directly from histology in gastrointestinal cancer

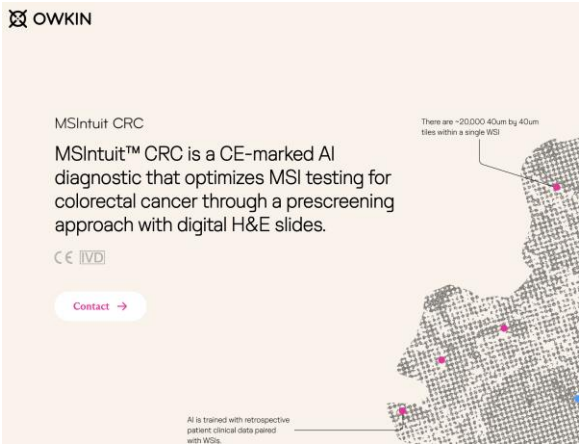
Jakob Nikolas Kather[1,2,3,4,5*], Alexander T. Pearson[4], Niels Halama[2,5,6], Dirk Jäger[2,3,5], Jeremias Krause[1], Sven H. Loosen[1], Alexander Marx[7], Peter Boor[8], Frank Tacke[9], Ulf Peter Neumann[10], Heike I. Grabsch[11,12], Takaki Yoshikawa[13,14], Hermann Brenner[2,15,16], Jenny Chang-Claude[17,18], Michael Hoffmeister[15], Christian Trautwein[1] and Tom Luedde[1*]



Genotype determines the phenotype

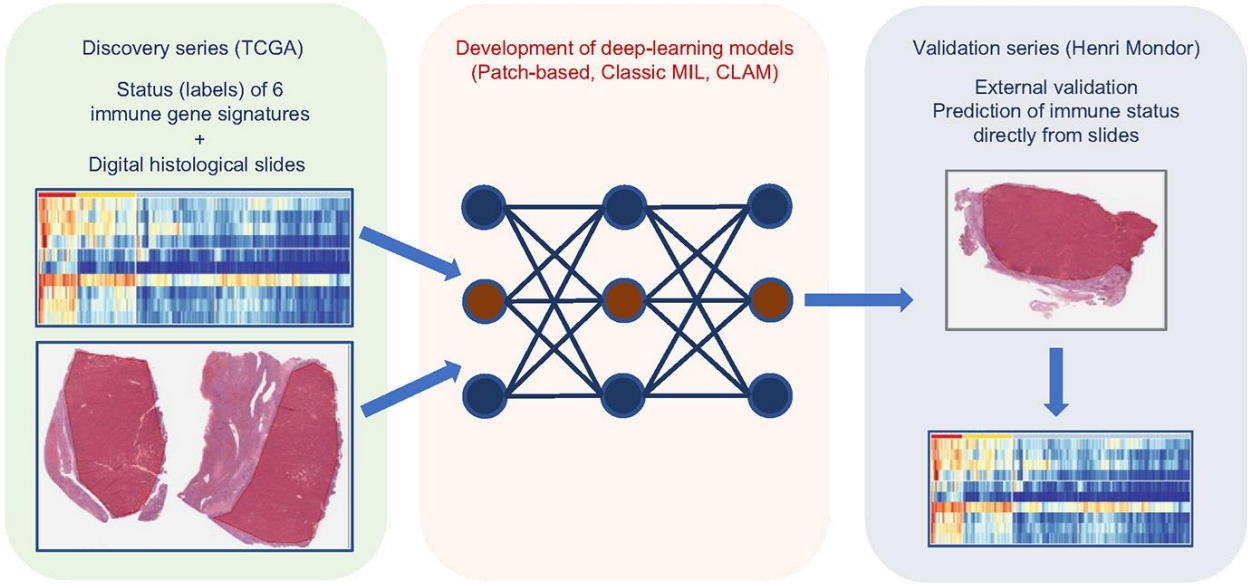
Deep Learning predicts genotype

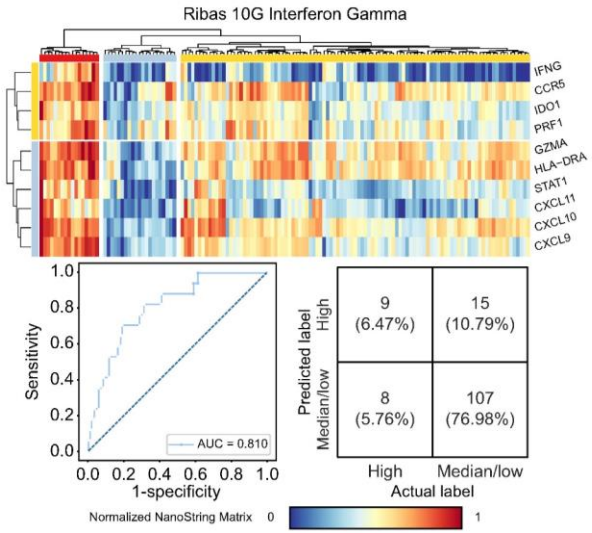


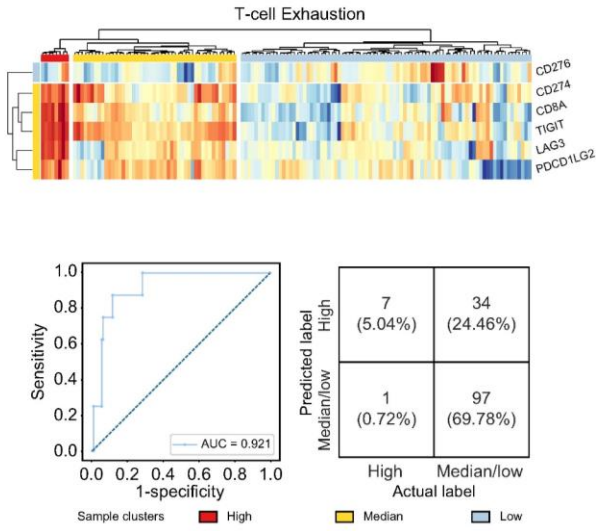


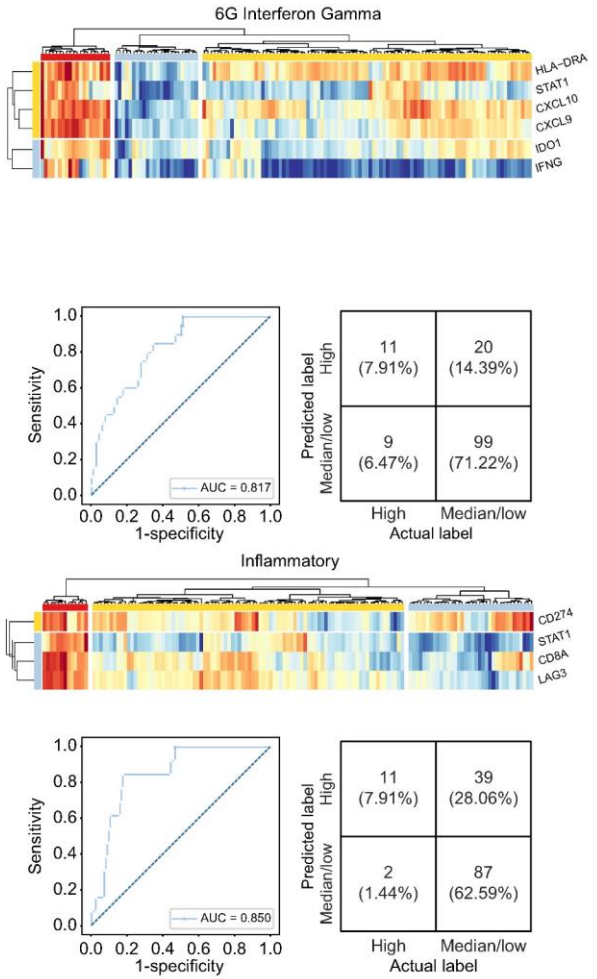
now available as a product for clinical use in the EU

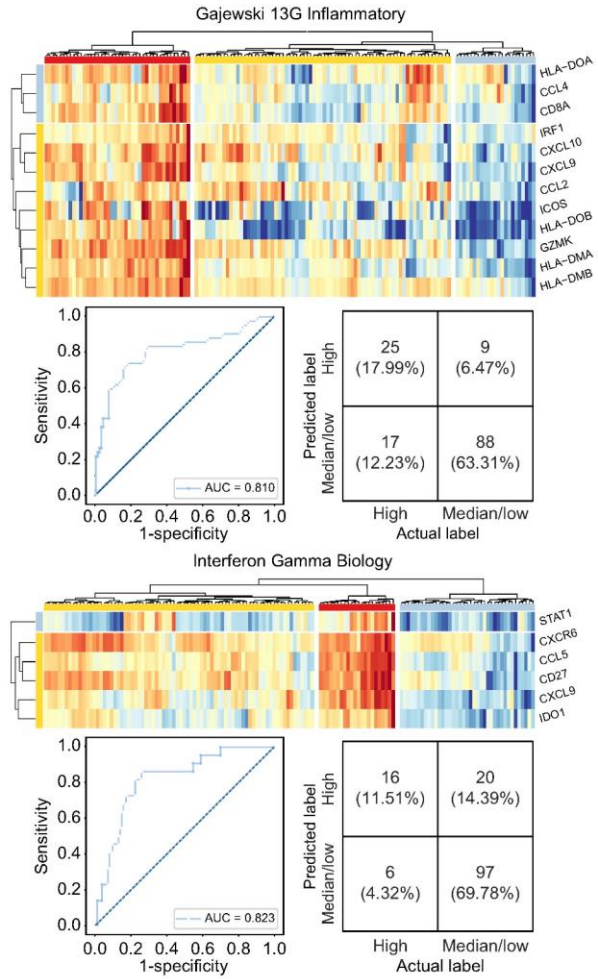
Immunotherapy response prediction from pathology (in HCC)











Artificial intelligence predicts immune and inflammatory gene signatures directly from hepatocellular carcinoma histology, Zeng et al., Journal of Hepatology, 2022

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AI-immunoscore with multimodal models

Foersch et al., Nature Medicine, 2023

nature medicine

Article

https://doi.org/10.1038/s41591-022-02134-1

Multistain deep learning for prediction of prognosis and therapy response in colorectal cancer

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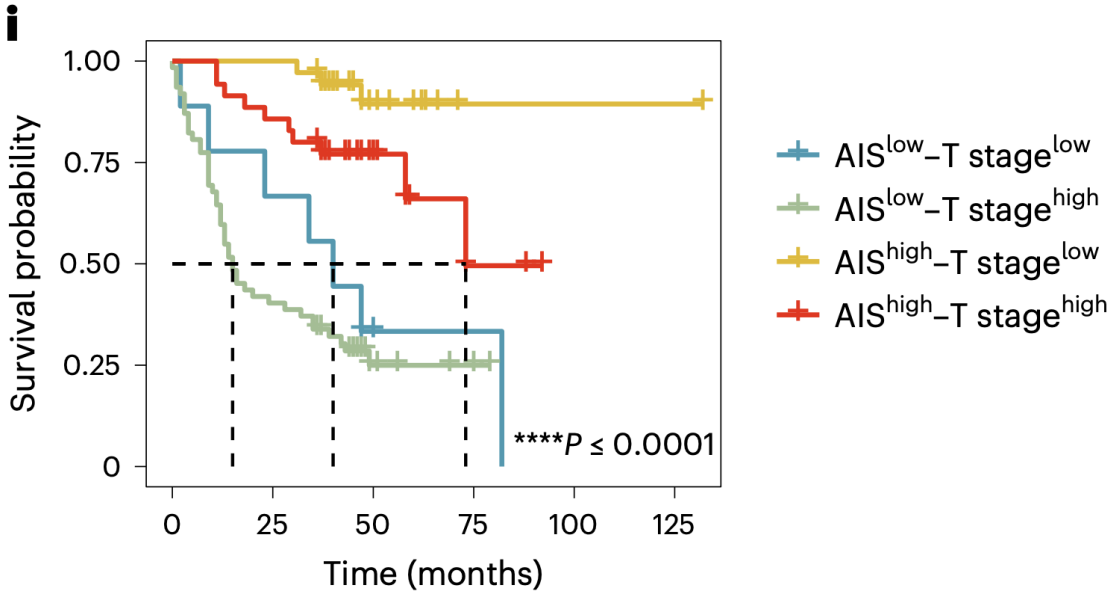
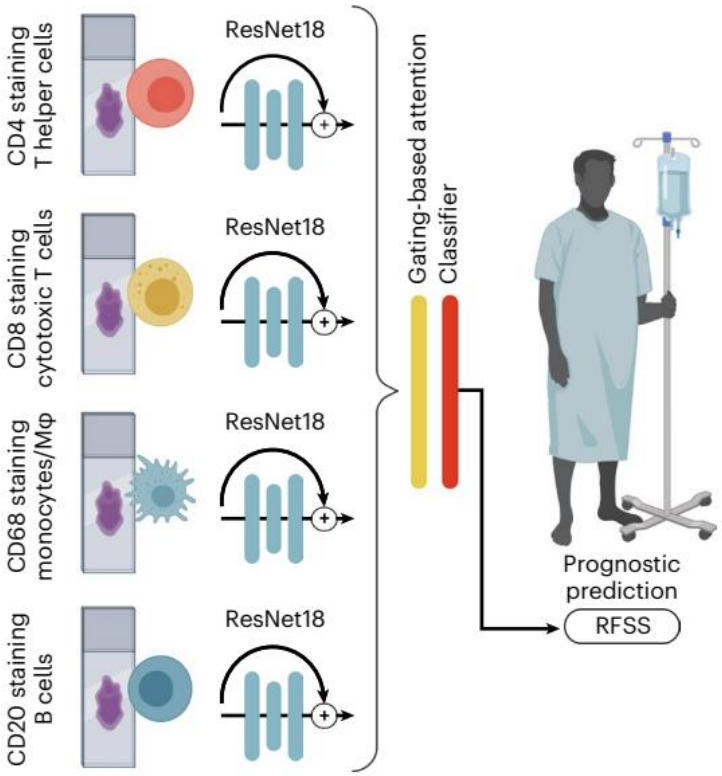
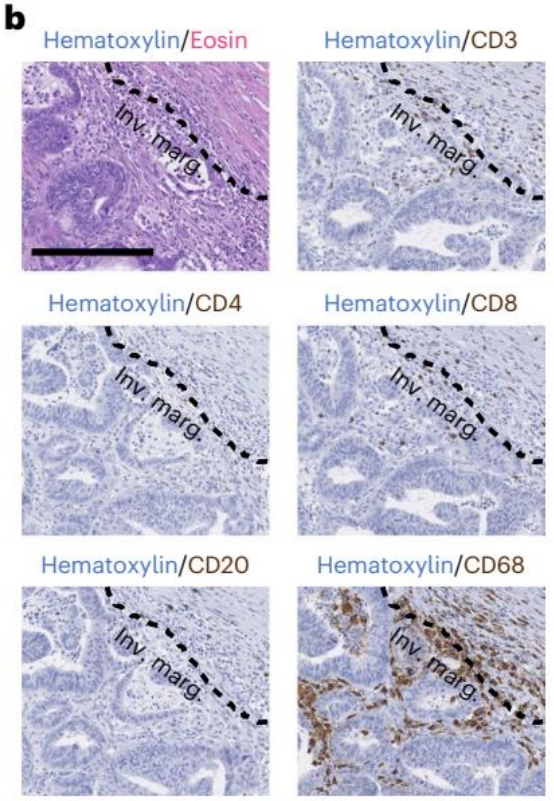
Check for updates

Sebastian Foersch[1], Christina Glasner[1], Ann-Christin Woerl[1,2], Markus Eckstein[3], Daniel-Christoph Wagner[1], Stefan Schulz[1], Franziska Kellers[1,4], Aurélie Fernandez[1], Konstantina Tserea[1], Michael Kloth[1], Arndt Hartmann[3], Achim Heintz[5], Wilko Weichert[6], Wilfried Roth[1], Carol Geppert[3], Jakob Nikolas Kather[7,8,9] & Moritz Jesinghaus[6,10]







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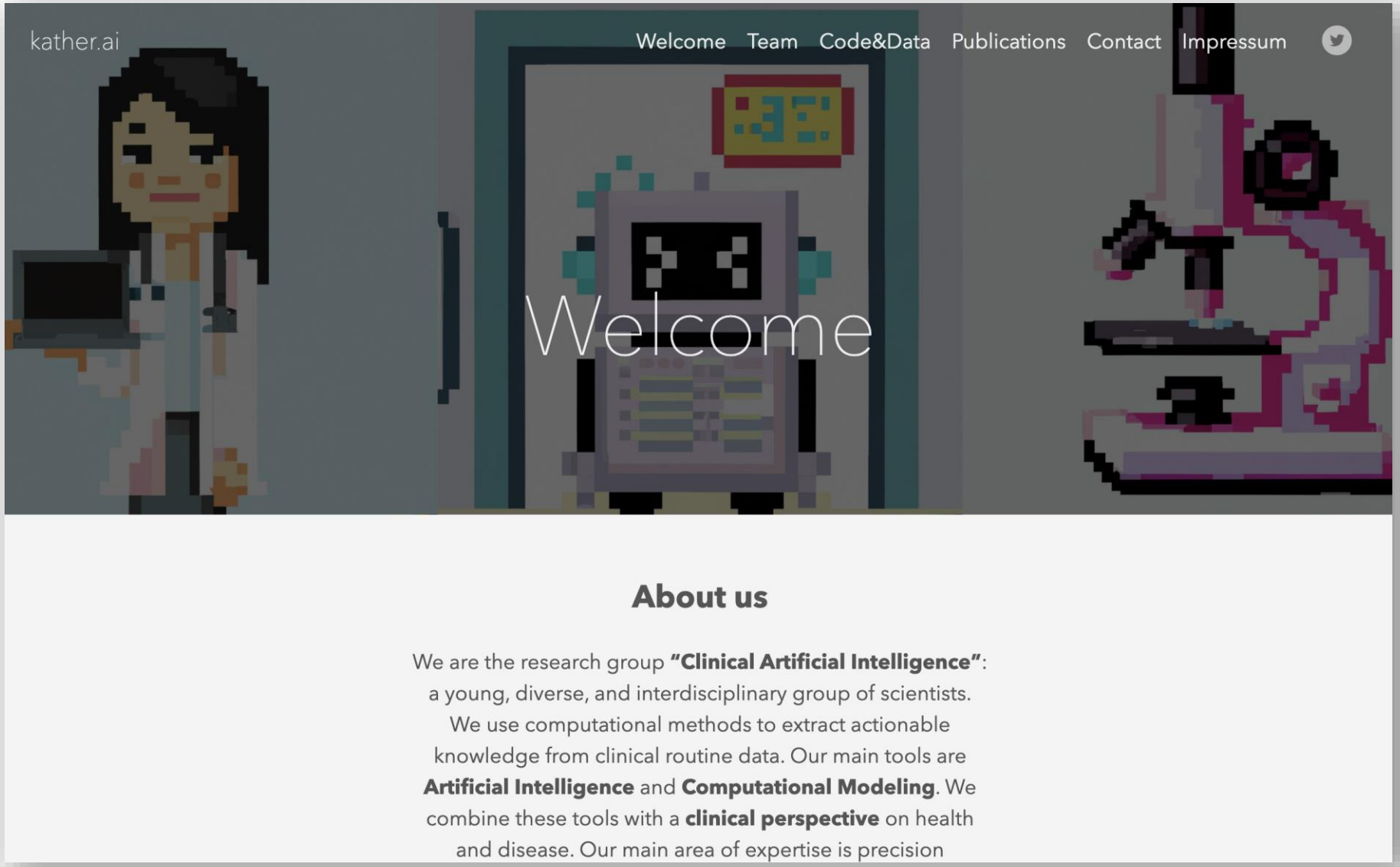

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