PARIS MASH MEETING

10th edition

Organized by

Arun Sanyal & Lawrence Serfaty

September 5 & 6 2024

Institut Pasteur, Paris

PARIS MASH MEETING

10th edition

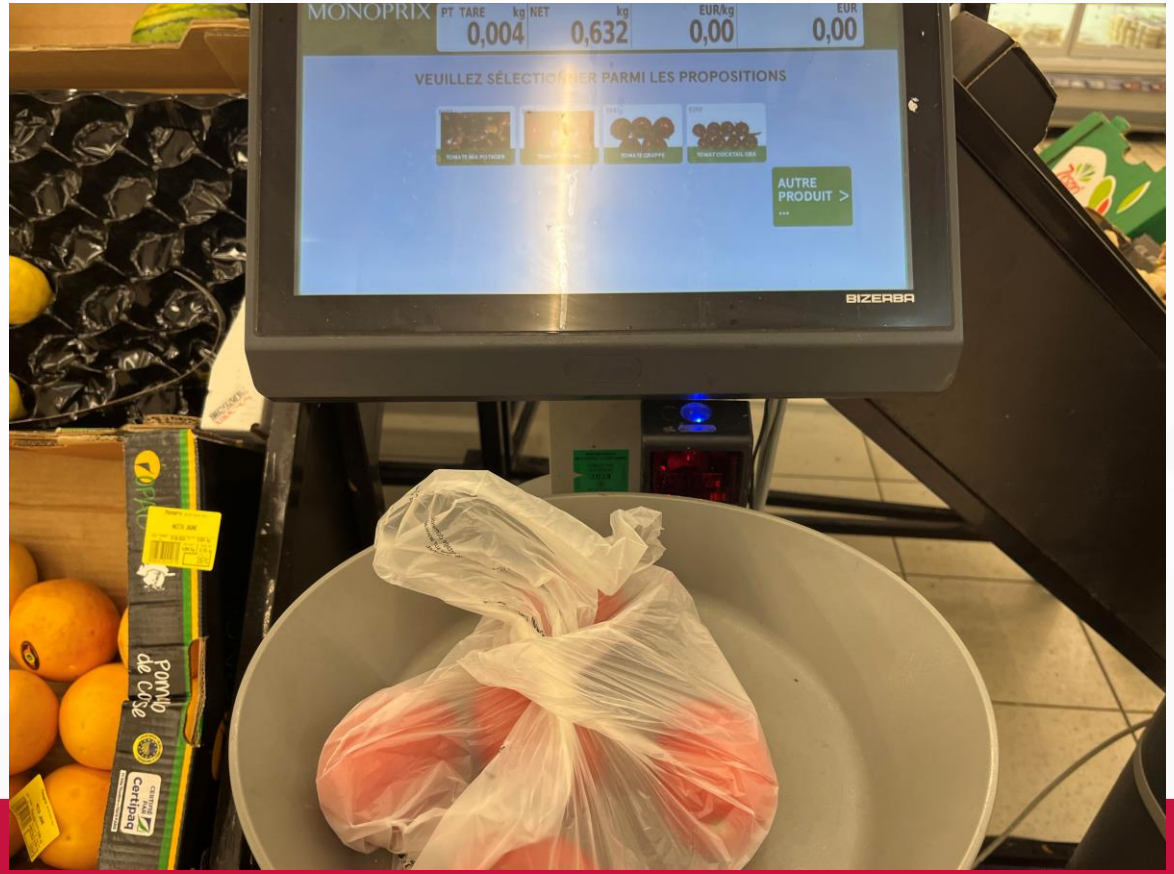
September 5 & 6 2024
Institut Pasteur, Paris

MINT-Hep
Mondor Integrative Hepatology

AP-HP.
Hôpitaux universitaires Henri-Mondor

Use of AI to optimize care delivery

AI is everywhere



APPLICATIONS

-DIAGNOSTICS

-PROGNOSIS PREDICTION/GRADING

-BIOMARKER

DIAGNOSTICS

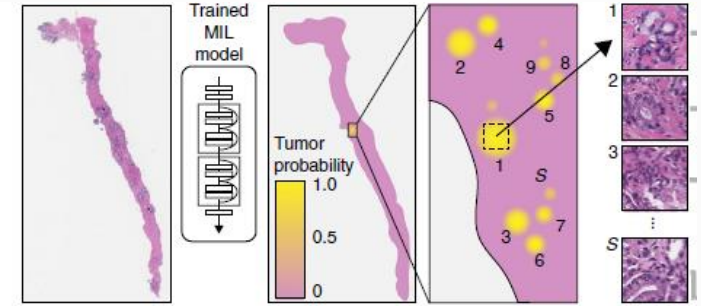
nature medicine

ARTICLES

https://doi.org/10.1038/s41591-019-0508-1

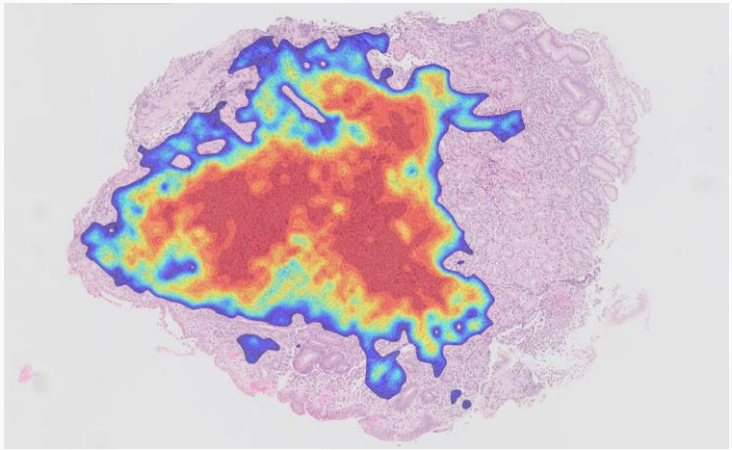
Clinical-grade computational pathology using weakly supervised deep learning on whole slide images

Gabriele Campanella[1,2], Matthew G. Hanna[1], Luke Geneslaw[1], Allen Miraflor[1], Vitor Werneck Krauss Silva[1], Klaus J. Busam[1], Edi Brogi[1], Victor E. Reuter[1], David S. Klimstra[1] and Thomas J. Fuchs[1,2*]



Ibex Obtains CE Mark for Galen Gastric, the World's First AI-powered Solution for Gastric Cancer Detection

IBEX



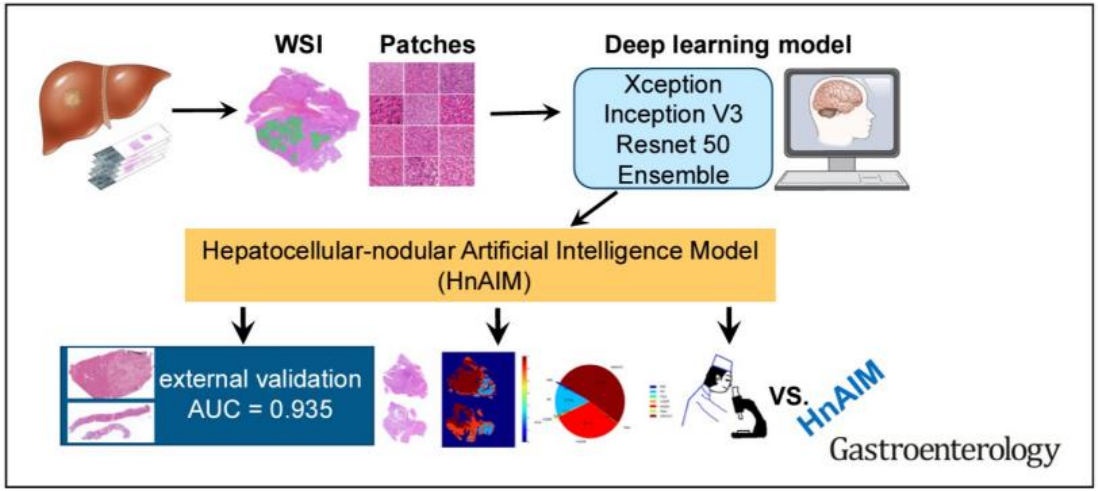
DIAGNOSTICS IN LIVER DISEASE

Gastroenterology 2022;162:1948–1961

CLINICAL—LIVER

Deep Learning-Based Classification of Hepatocellular Nodular Lesions on Whole-Slide Histopathologic Images

Na Cheng,[1] Yong Ren,[2,3] Jing Zhou,[1] Yiwang Zhang,[1] Deyu Wang,[1] Xiaofang Zhang,[1] Bing Chen,[4] Fang Liu,[5] Jin Lv,[5] Qinghua Cao,[6] Sijin Chen,[1] Hong Du,[7] Dayang Hui,[1] Zijin Weng,[1] Qiong Liang,[1] Bojin Su,[1] Luying Tang,[8] Lanqing Han,[3] Jianning Chen,[1] and Chunkui Shao[1]

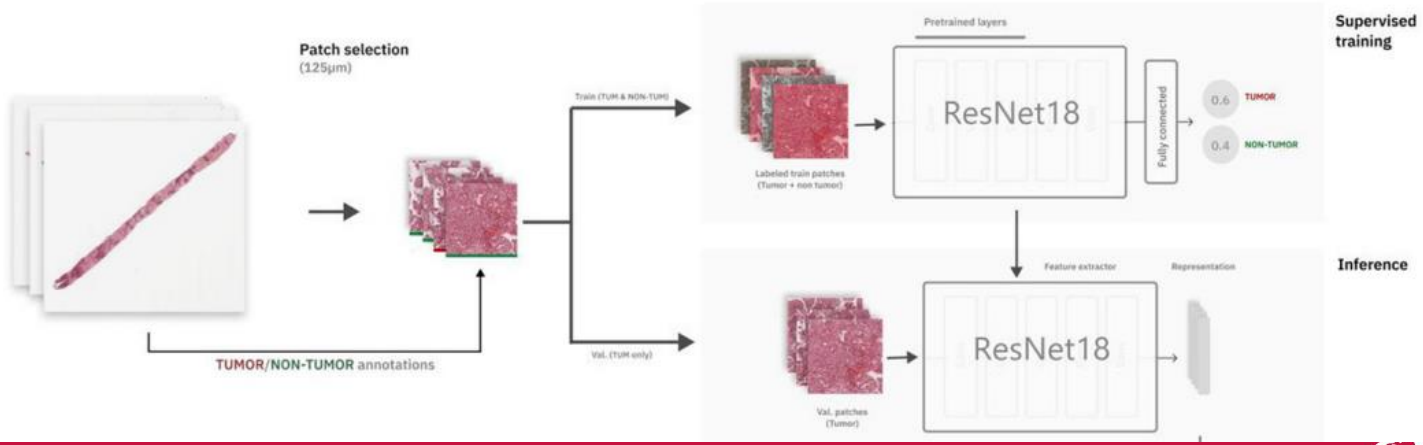


DIAGNOSTICS IN LIVER DISEASE

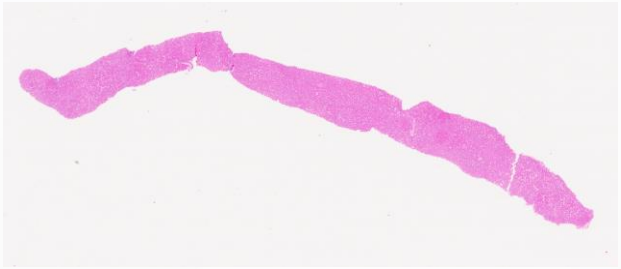
JHEP Reports Innovation in Hepatology | EASL

Primary liver cancer classification from routine tumour biopsy using weakly supervised deep learning

Aurélie Beaufrère • Nora Ouzir • Paul Emile Zafar • ... Kévin Mondet • Jean-Christophe Pesquet • Valérie Paradis • Show all authors • Show footnotes



DIAGNOSTICS: CHALLENGING FOR THE LIVER



- *Auto-immune*
- *MASH*
- *Alcohol*
- *Virus*
- *Primary sclerosing cholangitis*
- *Primary biliary cholangitis*

>50 differential diagnoses

GRADING

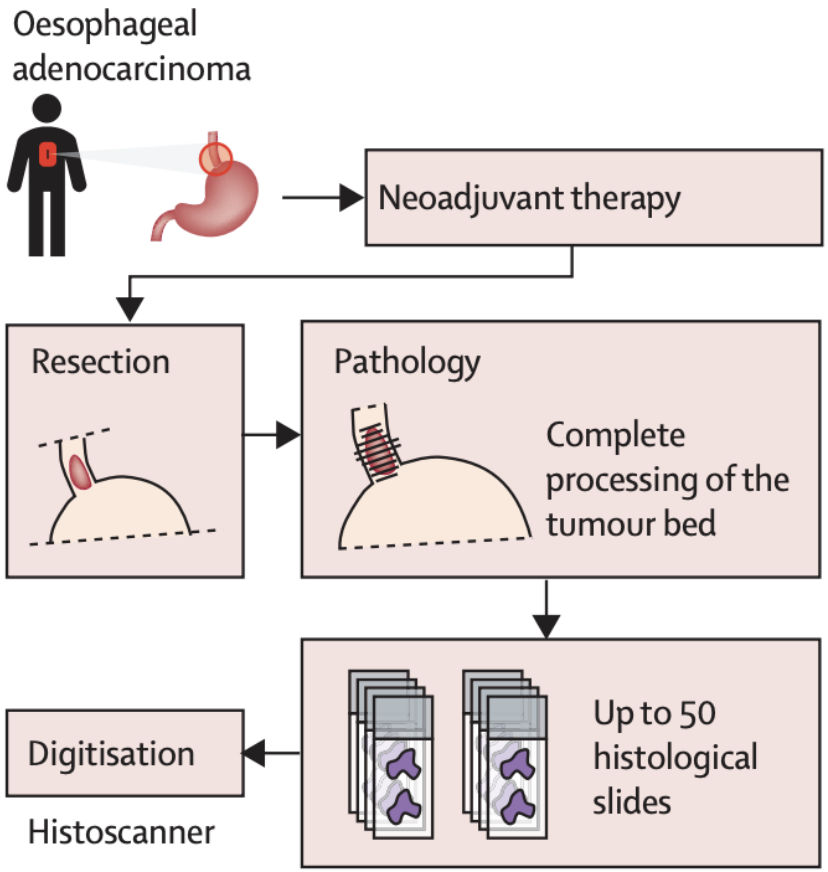
THE LANCET
Digital Health

ARTICLES | VOLUME 5, ISSUE 5, E265-E275, MAY 2023

Artificial intelligence for tumour tissue detection and histological regression grading in oesophageal adenocarcinomas: a retrospective algorithm development and validation study

Yuri Tolkach, MD † • Lisa Marie Wolgast † • Alexander Damanakis, MD • Alexey Pryalukhin, MD • Simon Schallenberg, MD • Wolfgang Hulla, MD • et al. Show all authors • Show footnotes

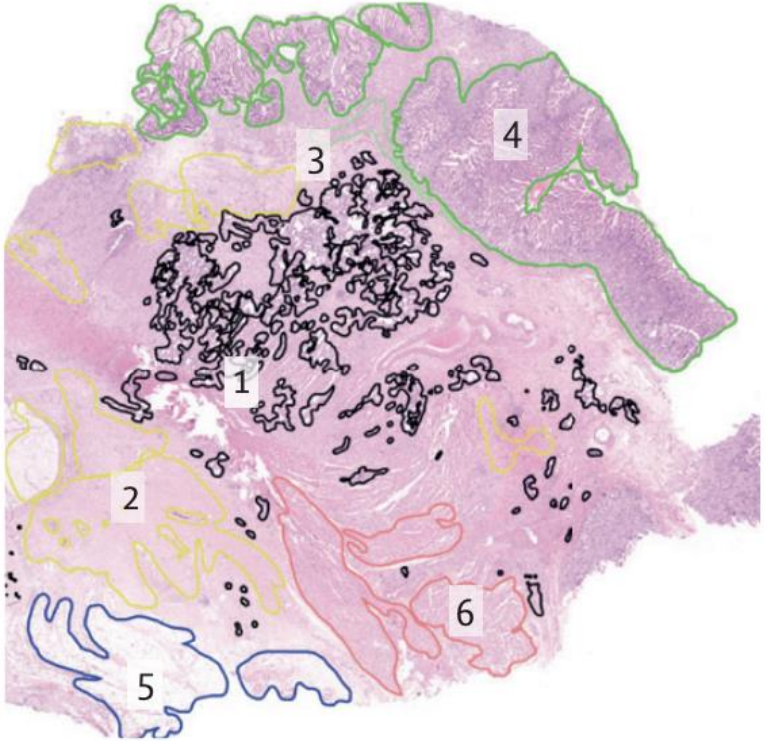
A



B

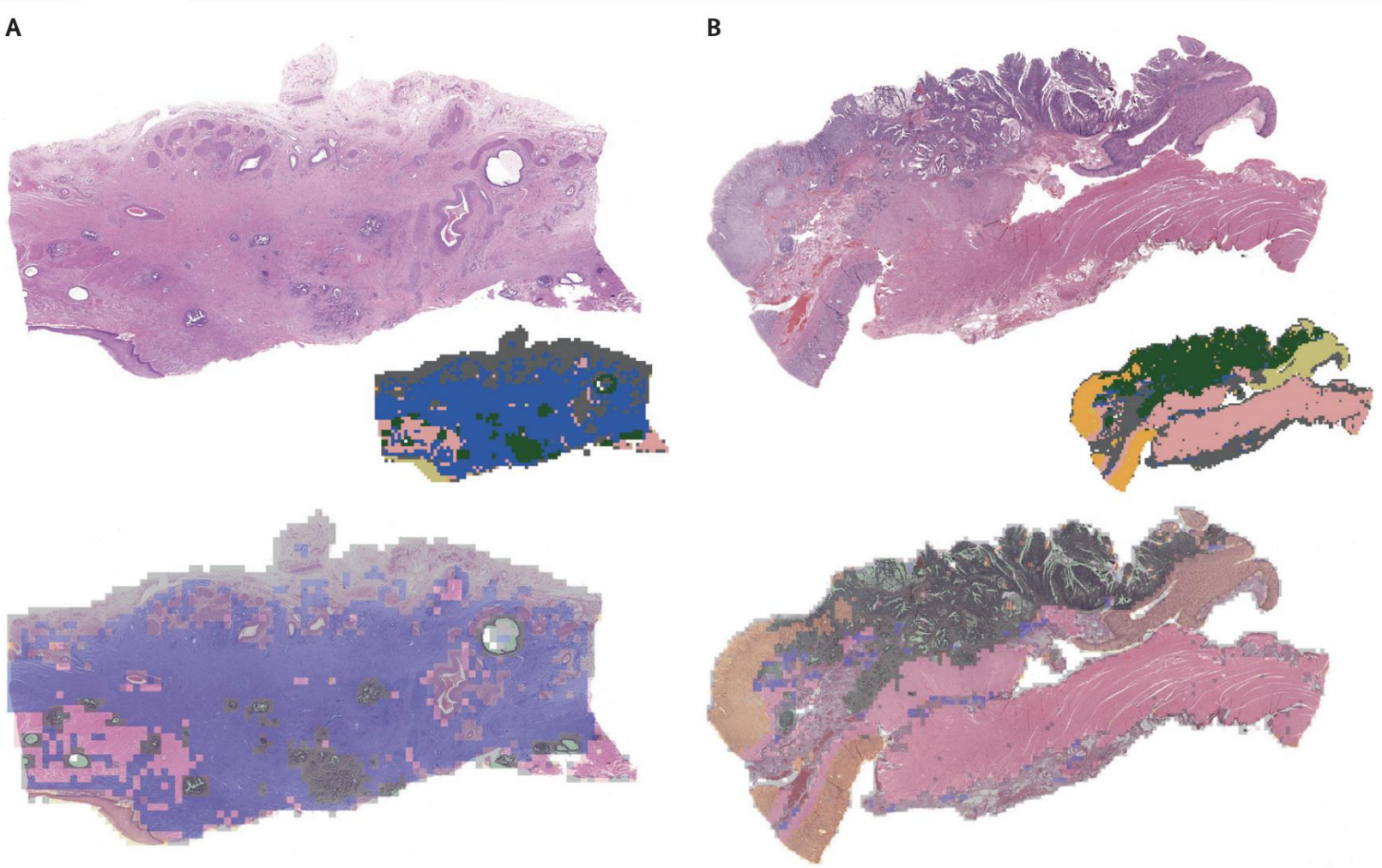
Study cohorts		Patients	Slides
UKK1	Training	98	193
UKK1	Test 1	20	22
Wiener Neustadt	Test 1	15	62
Charité Berlin	Test 1	69	214
TCGA	Test 1	22	22
UKK2	Test 2	95	1407

C Principles of annotations



Tissue classes

Tumour[1]	Mucosa, oesophagus	Barrett's mucosa, no dysplasia
Regression tissue[2]	Mucosa, gastric[4]	Barrett's mucosa, dysplasia
Muscularis mucosae[3]	Adventitia[5]	Submucosal glands
Submucosa	Muscularis propria[6]	Lamina propria mucosae
Necrosis	Ulceration	Lymph node tissue


A
B
Tumour tissue
Regression tissue
Muscular tissue
Oesophageal mucosa
Gastric mucosa plus Barrett's mucosa
Stromal, other

GRADING

HEPATOLOGY

A Machine Learning Approach Enables Quantitative Measurement of Liver Histology and Disease Monitoring in NASH

SCIENTIFIC REPORTS
nature research

Deep learning enables pathologist-like scoring of NASH models

Fabian Heinemann*, Gerald Birk & Birgit Stierstorfer

HEPATOLOGY AASLD

ORIGINAL | Full Access

A Machine Learning Approach to Liver Histological Evaluation Predicts Clinically Significant Portal Hypertension in NASH Cirrhosis

Jaime Bosch, Chuhan Chung, Oscar M. Carrasco-Zevallos, Stephen A. Harrison, Manal F. Abdelmalek, Mitchell L. Shiffman, Don C. Rockey, Zahil Shanis, Dinkar Juyal, Harsha Pokkalla, Quang Huy Le, Murray Resnick, Michael Montalto, Andrew H. Beck, Ilan Wapinski, Ling Han, Catherine Jia, Zachary Goodman, Nezam Afdhal, Robert P. Myers, Arun J. Sanyal ... See fewer authors

First published: 01 August 2021 | https://doi.org/10.1002/hep.32087

nature medicine

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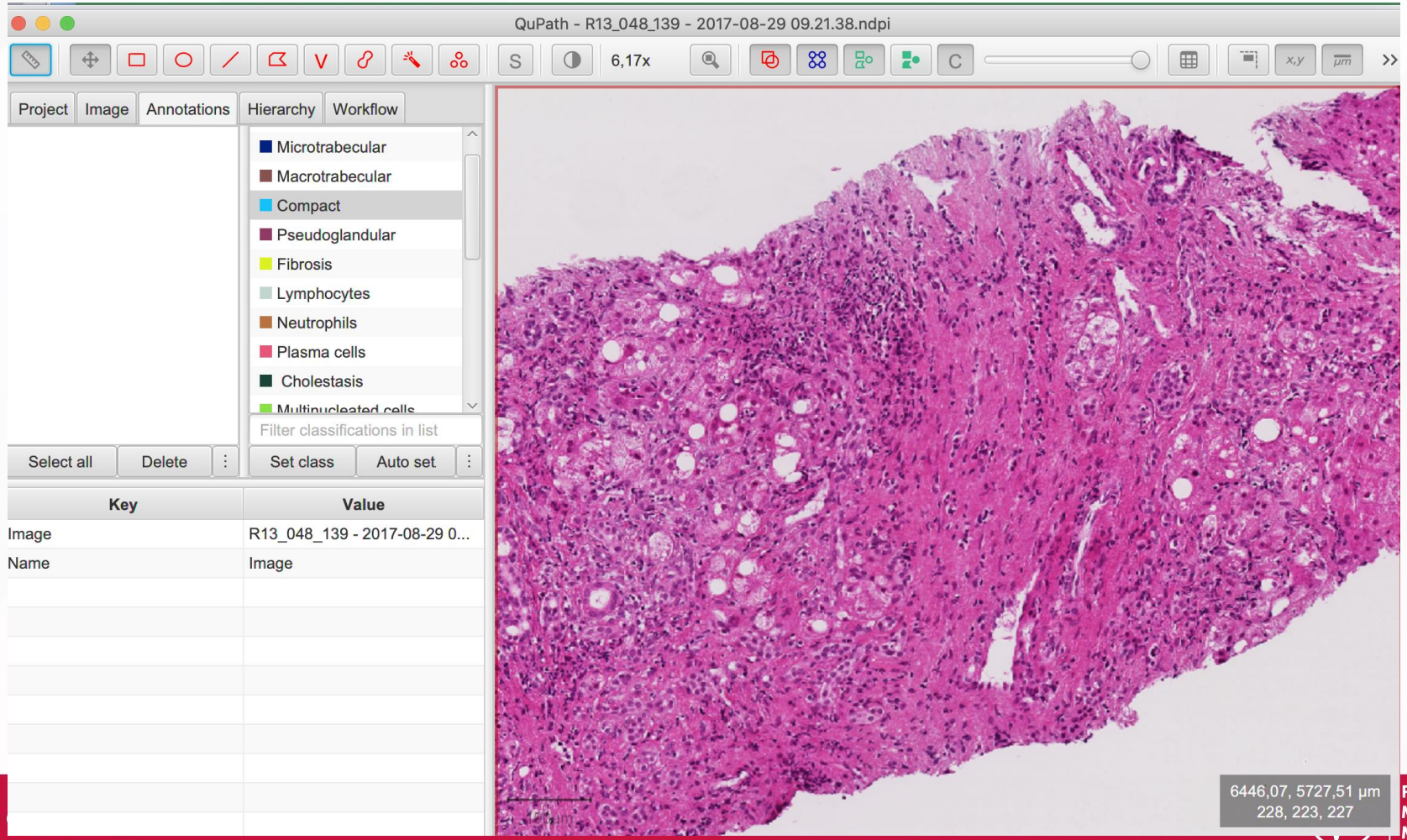
nature > nature medicine > articles > article

Article | Open access | Published: 07 August 2024

AI-based automation of enrollment criteria and endpoint assessment in clinical trials in liver diseases

Janani S. Iyer, Dinkar Juyal, Quang Le, Zahil Shanis, Harsha Pokkalla, Maryam Pouryahya, Aryan Pedawi, S. Adam Stanford-Moore, Charles Biddle-Snead, Oscar Carrasco-Zevallos, Mary Lin, Robert Egger, Sara Hoffman, Hunter Elliott, Kenneth Leidal, Robert P. Myers, Chuhan Chung, Andrew N. Billin, Timothy R. Watkins, Scott D. Patterson, Murray Resnick, Katy Wack, Jon Glickman, Alastair D. Burt, ... Andrew H. Beck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6,17x
Project
Image
Annotations
Hierarchy
Workflow
Microtrabecular
Macrotrabecular
Compact
Pseudoglandular
Fibrosis
Lymphocytes
Neutrophils
Plasma cells
Cholestasis
Filter classifications in list
Select all
Delete
Set class
Auto set
Key
Value
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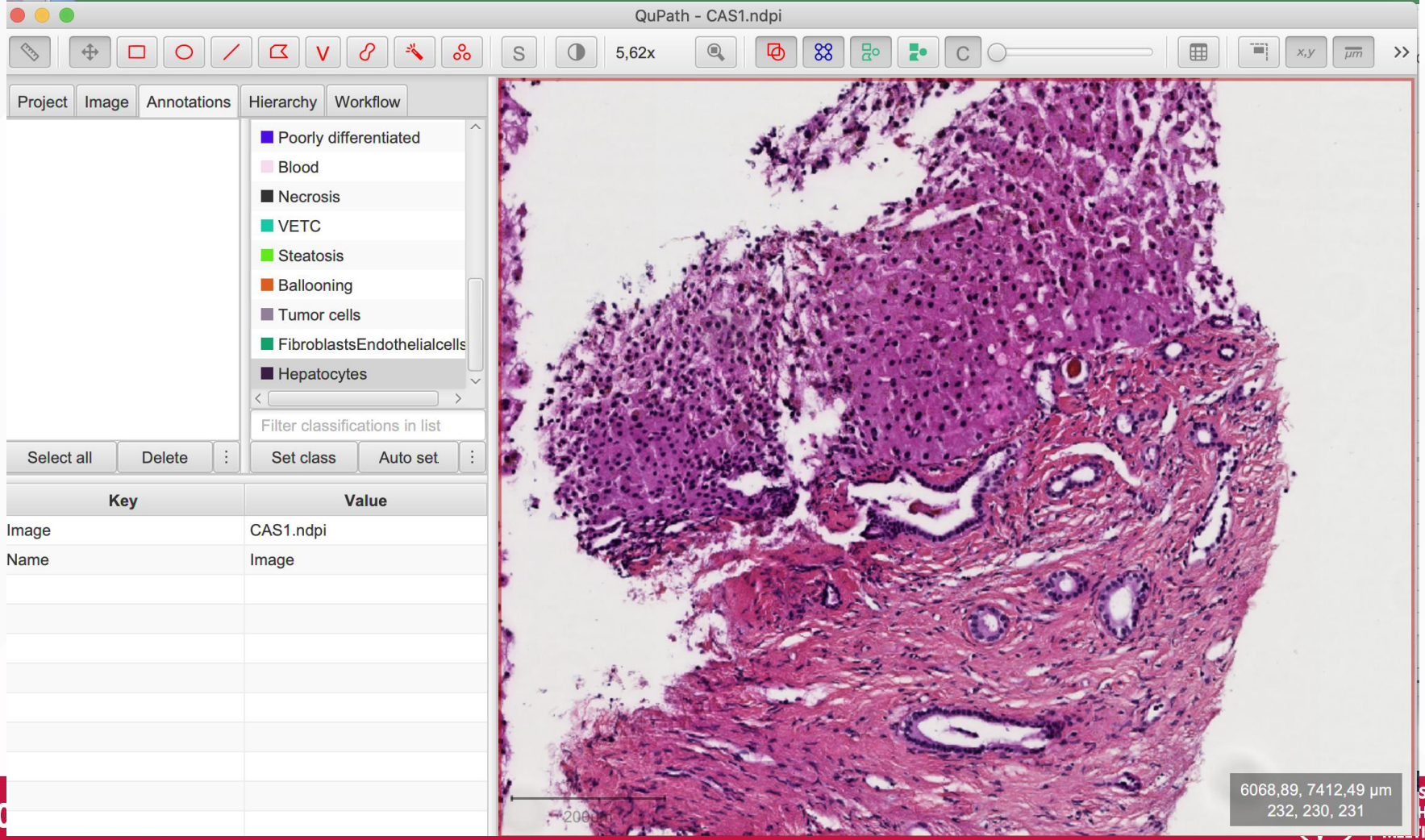
Name
Image
6446,07, 5727,51 µm
228, 223, 227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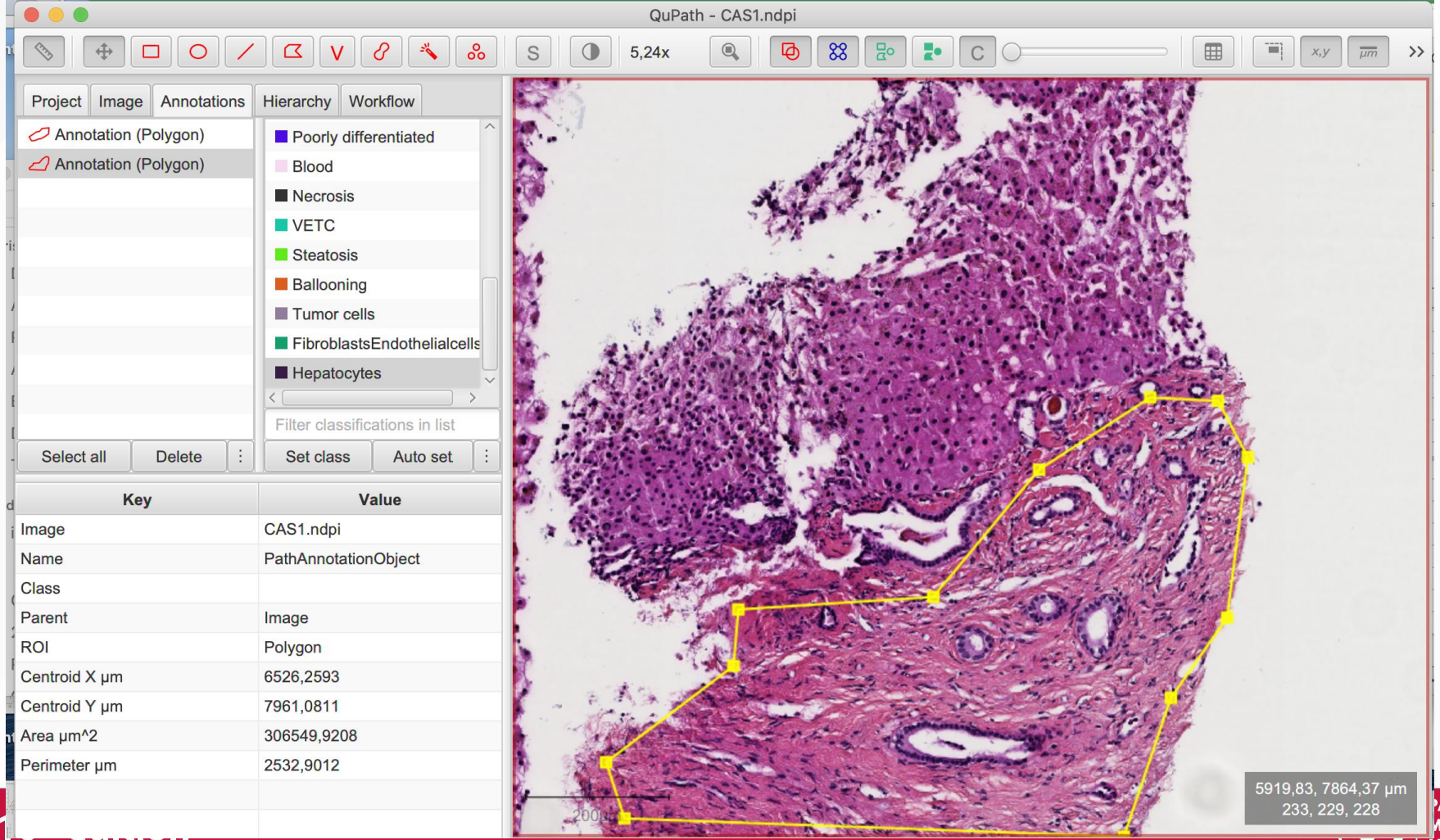
Project
Image
Annotations
Hierarchy
Workflow
Poorly differentiated
Blood
Necrosis
VETC
Steatosis
Ballooning
Tumor cells
FibroblastsEndothelialcells
Hepatocytes
Filter classifications in list
Select all
Delete
Set class
Auto set
Key
Value
Image
CAS1.ndpi
Name
Image
6068,89, 7412,49 µm
232, 230, 231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Annotations
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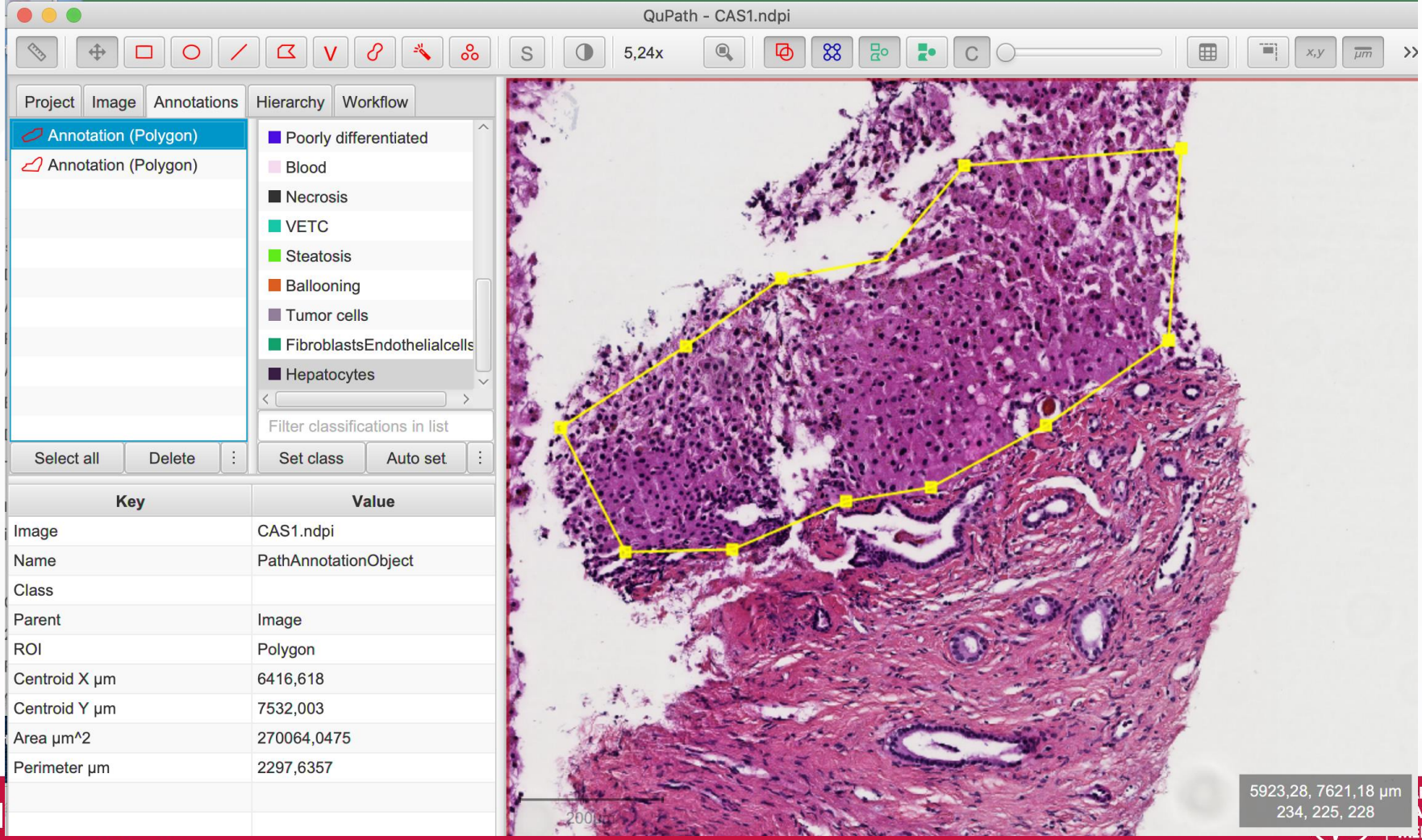
Workflow
Annotation (Polygon)
Annotation (Polygon)
Poorly differentiated
Blood
Necrosis
VETC
Steatosis
Ballooning
Tumor cells
FibroblastsEndothelialcells
Hepatocytes
Filter classifications in list
Select all
Delete
Set class
Auto set
Key
Value
Image
CAS1.ndpi
Name
PathAnnotationObject
Class
Parent
Image
ROI
Polygon
Centroid X µm
6526,2593
Centroid Y µm
7961,0811
Area µm^2
306549,9208
Perimeter µm
2532,9012
5919,83, 7864,37 µm
233, 229, 228
200µm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Workflow
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Annotation (Polygon)
Poorly differentiated
Blood
Necrosis
VETC
Steatosis
Ballooning
Tumor cells
FibroblastsEndothelialcells
Hepatocytes
Filter classifications in list
Select all
Delete
Set class
Auto set
Key
Value
Image
CAS1.ndpi
Name
PathAnnotationObject
Class
Parent
Image
ROI
Polygon
Centroid X µm
6416,618
Centroid Y µm
7532,003
Area µm^2
270064,0475
Perimeter µm
2297,6357
200µm
5923,28, 7621,18 µm
234, 225, 228

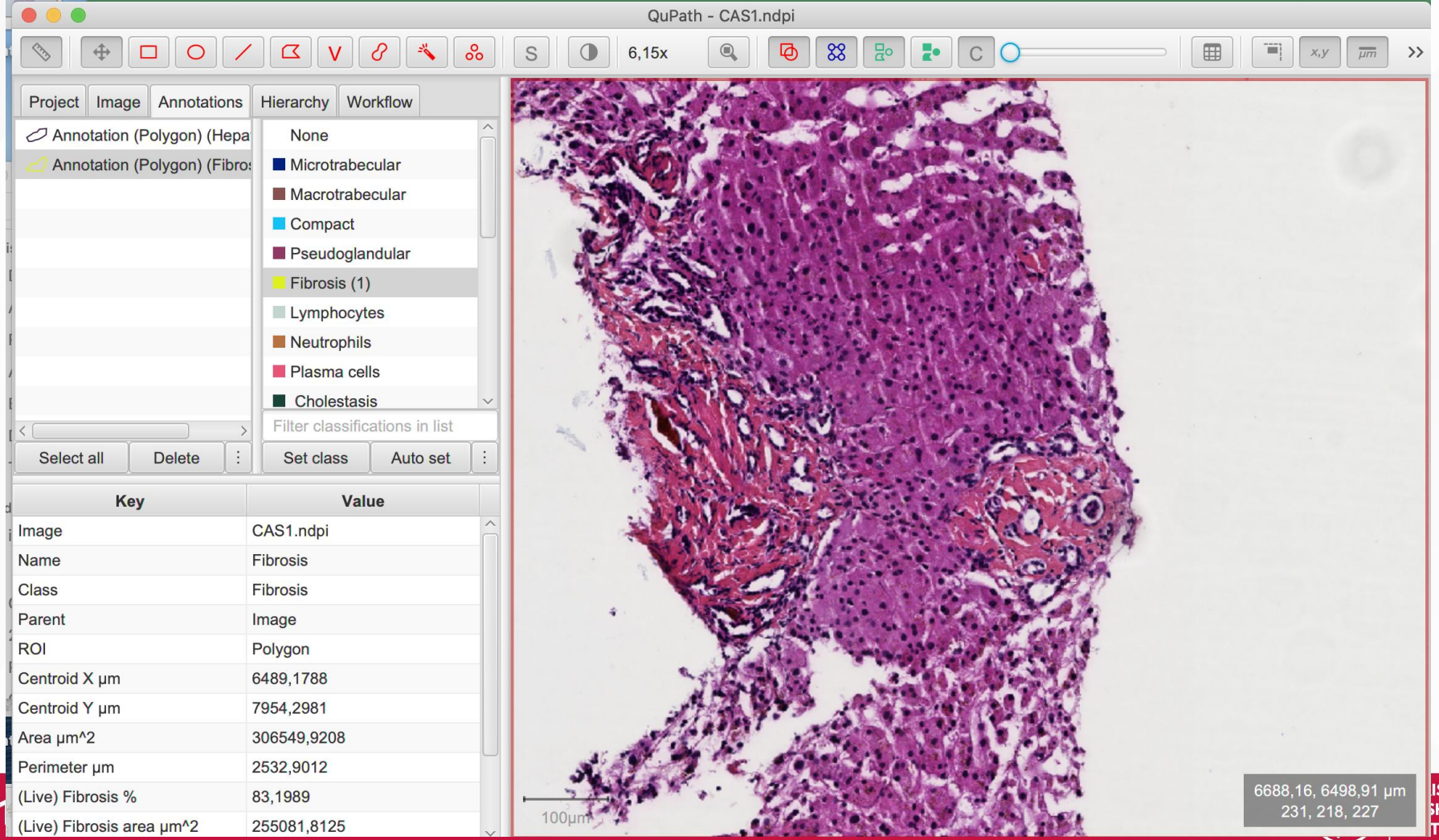
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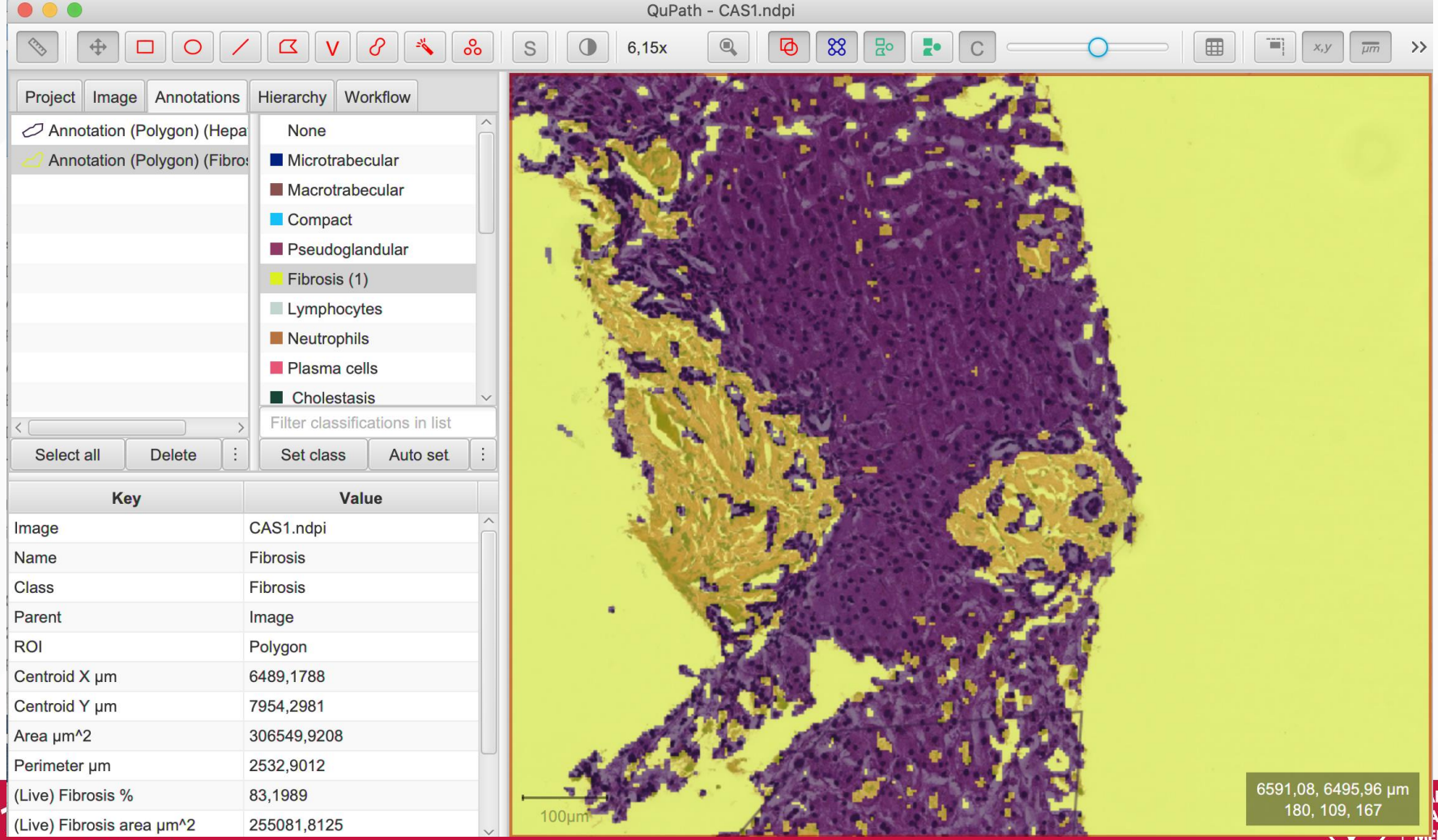
Image
Annotations
Hierarchy
Workflow
Annotation (Polygon) (Hepa
Annotation (Polygon) (Fibros
None
Microtrabecular
Macrotrabecular
Compact
Pseudoglandular
Fibrosis (1)
Lymphocytes
Neutrophils
Plasma cells
Cholestasis
Filter classifications in list
Select all
Delete
Set class
Auto set
Key
Value
Image
CAS1.ndpi
Name
Fibrosis
Class
Fibrosis
Parent
Image
ROI
Polygon
Centroid X µm
6489,1788
Centroid Y µm
7954,2981
Area µm^2
306549,9208
Perimeter µm
2532,9012
(Live) Fibrosis %
83,1989
(Live) Fibrosis area µm^2
255081,8125
100µm
6688,16, 6498,91 µm
231, 218, 227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Hierarchy
Workflow
Annotation (Polygon) (Hepa
Annotation (Polygon) (Fibros
None
Microtrabecular
Macrotrabecular
Compact
Pseudoglandular
Fibrosis (1)
Lymphocytes
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Filter classifications in list
Select all
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Set class
Auto set
Key
Value
Image
CAS1.ndpi
Name
Fibrosis
Class
Fibrosis
Parent
Image
ROI
Polygon
Centroid X µm
6489,1788
Centroid Y µm
7954,2981
Area µm^2
306549,9208
Perimeter µm
2532,9012
(Live) Fibrosis %
83,1989
(Live) Fibrosis area µm^2
255081,8125
100µm
6591,08, 6495,96 µm
180, 109, 167

BIOMARKER

nature medicine

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nature › nature medicine › brief communications › article

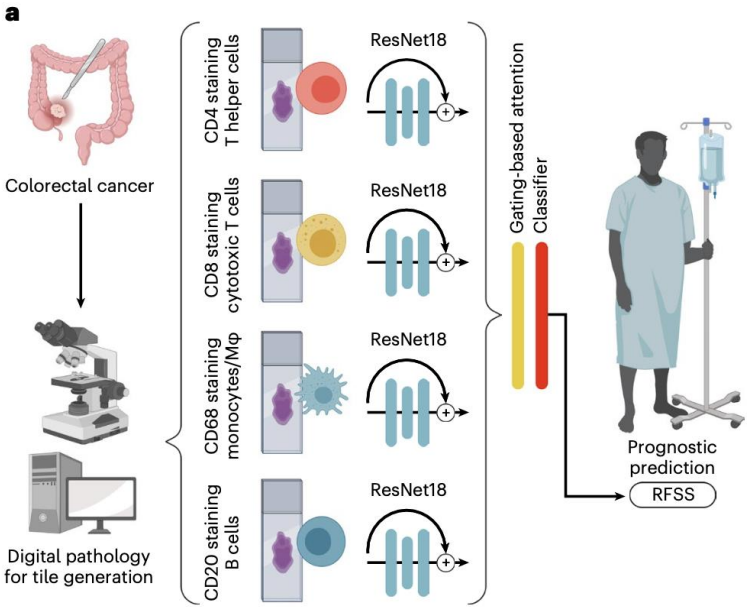
Brief Communication | Published: 03 June 2019

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

Jakob Nikolas Kather ✉, Alexander T. Pearson, Niels Halama, Dirk Jäger, Jeremias Krause, Sven H. Loosen, Alexander Marx, Peter Boor, Frank Tacke, Ulf Peter Neumann, Heike I. Grabsch, Takaki Yoshikawa, Hermann Brenner, Jenny Chang-Claude, Michael Hoffmeister, Christian Trautwein & Tom Luedde ✉

nature medicine

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



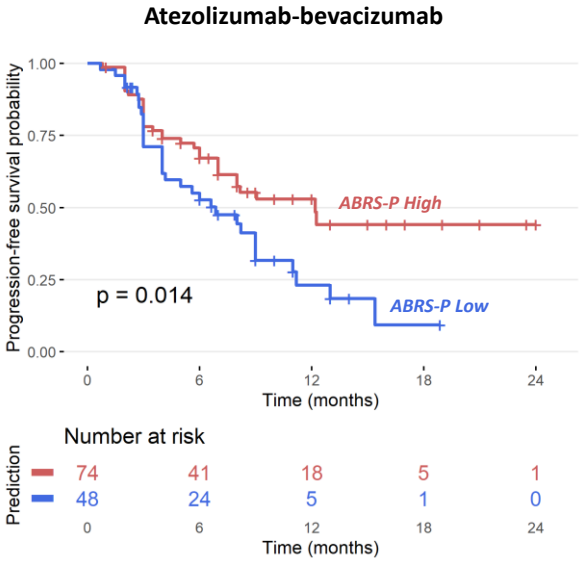
Foersch et al, Nat Med, 2022

BIOMARKER

THE LANCET
Oncology

Artificial intelligence-based pathology as a biomarker of sensitivity to atezolizumab–bevacizumab in patients with hepatocellular carcinoma: a multicentre retrospective study

Qinghe Zeng, Christophe Klein, Stefano Caruso, Pascale Maille, Daniela S Allende, Beatriz Mínguez, Massimo Iavarone, Massih Ningarhari, Andrea Casadei-Gardini, Federica Pedica, Margherita Rimini, Riccardo Perbellini, Camille Boulagnon-Rombi, Alexandra Heurgué, Marco Maggioni, Mohamed Rela, Mukul Vij, Sylvain Baulande, Patricia Legoix, Sonia Lameiras, the HCC-AI study group, Léa Bruges, Viviane Gnemmi, Jean-Charles Nault, Claudia Campani, Hyungjin Rhee, Young Nyun Park, Mercedes Iñarrairaegui, Guillermo Garcia-Porrero, Josepmaria Argemi, Bruno Sangro, Antonio D'Alessio, Bernhard Scheiner, David James Pinato, Matthias Pinter, Valérie Paradis, Aurélie Beaufrère, Simon Peter, Lorenza Rimassa, Luca Di Tommaso, Arndt Vogel, Sophie Michalak, Jérôme Boursier, Nicolas Loménie, Marianne Ziol, Julien Calderaro*



LIMITATIONS

-Digitalization of pathology labs

-Availability of (high-quality) data, in particular for multimodal AI

-AI models need to be rigorously assessed

-Explainability

DIGITALIZATION

-Costly/ Massive storage capacities

-ROI?

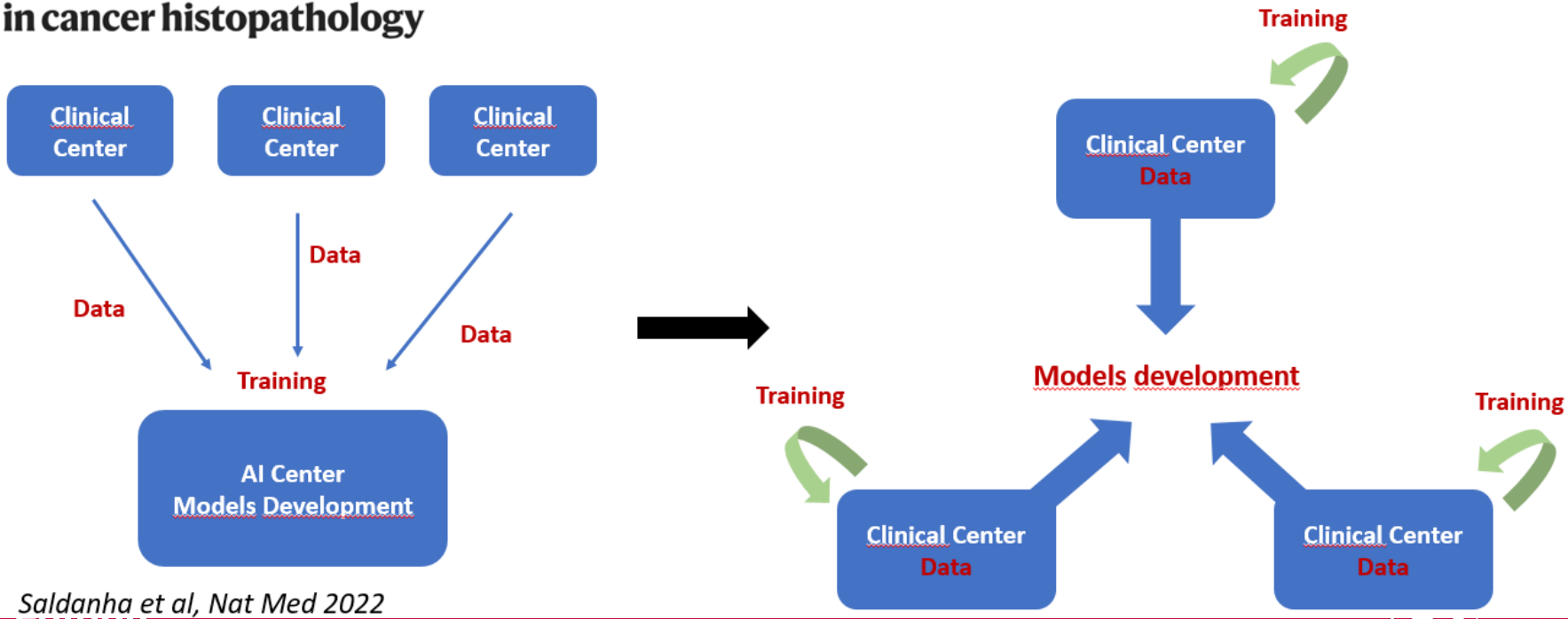
-Digital is now the new standard

AVAILABILITY OF DATA

nature medicine

Article | Open Access | Published: 25 April 2022

Swarm learning for decentralized artificial intelligence in cancer histopathology



Saldanha et al, Nat Med 2022

ASSESSMENT

Health informatics
Protocol

Developing a reporting guideline for artificial intelligence-centred diagnostic test accuracy studies: the STARD-AI protocol

Viknesh Sounderajah [1, 2], Hutan Ashrafian [1, 2], Robert M Golub [3], Shravya Shetty [4], Jeffrey De Fauw [5], Lotty Hooft [6, 7], Karel Moons [6, 7], Gary Collins [8], David Moher [9], Patrick M Bossuyt [10], Ara Darzi [1, 2], Alan Karthikesalingam [11], Alastair K Denniston [12, 13, 14, 15], Bilal Akhter Mateen [16], Daniel Ting [17], Darren Treanor [18], Dominic King [19], Felix Greaves [20], Jonathan Godwin [5], Jonathan Pearson-Stuttard [21], Leanne Harling [1], Matthew McInnes [22], Nader Rifai [23], Nenad Tomasev [5], Pasha Normahani [1], Penny Whiting [24], Ravi Aggarwal [1, 2], Sebastian Vollmer [16], Sheraz R Markar [1], Trishan Panch [25], Xiaoxuan Liu [12, 13, 14, 15] On behalf of the STARD-AI Steering Committee
Correspondence to Hutan Ashrafian; hutan@imperial.ac.uk

nature medicine

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nature › nature medicine › consensus statements › article

Consensus Statement | Open access | Published: 09 September 2020

Reporting guidelines for clinical trial reports for interventions involving artificial intelligence: the CONSORT-AI extension

Xiaoxuan Liu, Samantha Cruz Rivera, David Moher, Melanie J. Calvert, Alastair K. Denniston & The SPIRIT-AI and CONSORT-AI Working Group

ETHICS

protect autonomy

promote human well-being, human safety and the public interest

ensure transparency, explainability and intelligibility

ETHICS

foster responsibility and accountability

ensure inclusiveness and equity

promote artificial intelligence that is responsive and sustainable

THANK YOU

PARIS MASH MEETING

10th edition