The British Association of Gynaecological Pathologists

SYNAPSE Pathology

Update on Digital and AI in Gynae Pathology

The British Association of Gynaecological Pathologists

SYNAPSE Pathology

A big thank you to

FUJIFILM
Value from Innovation

for your continued support of the BAGP and it's aim of promoting the health of women through education, research and clinical guidance

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Lecturer – Dr Nirav Gandhi

Nirav is a consultant cellular pathologist at University Hospitals of Derby and Burton with a specialist interest in Gynaecological Pathology. He is treasurer of the BAGP and sits on the RCPath Working Group for Cancer Services and Core Management Group for PathLake Plus.

He is currently clinical co-lead for Digital Pathology implementation at UHDB and has presented topic covering Digital Pathology and AI at several national meetings over the past 18 months.

Nirav received an MBA from London Business School and worked for several financial institutions, including Credit Suisse and Citigroup between 2005-2010.



The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Speaker disclosures

- ❑ I have no financial conflicts of interest to disclose

The British Association of Gynaecological Pathologists

SYNAPSE Pathology

Evaluating the benefits of digital pathology implementation: time savings in laboratory logistics



Alexi Baidoshvili [1], Anca Bucur [2], Jasper van Leeuwen [2], Jeroen van der Laak [3], Philip Kluin [4], Paul J van Diest [5]

Affiliations + expand

PMID: 29924891 DOI: 10.1111/his.13691

‘On average, >19 working hours were saved on a typical day by working digitally, with the highest savings in routine diagnosis and multidisciplinary meeting workflows.’

Journal of Pathology Informatics 17 (2025) 100439

Contents lists available at ScienceDirect

Journal of Pathology Informatics

journal homepage: www.elsevier.com/locate/jpi



Comparison of the efficiency of digital pathology with the conventional methodology for the diagnosis of biopsies in an anatomical pathology laboratory in Spain

J.I. Echeveste [a,*], L. Alvarez-Gigli [a], D. Carcedo [b], Y. Soto-Serrano [b], M.D. Lozano [a]

[a] Clínica Universidad de Navarra (CUN), Pamplona, Spain
[b] Hygeia Consulting, Madrid, Spain

‘1,922 cases were analyzed: 5,836 and 6,086 diagnosed with CM and DP methodologies, respectively. Mean TaT for CM-diagnosed cases was 10.58 (standard deviation [SD] 7.10) days, compared to 6.86 (SD 5.10) days for DP-diagnosed cases, reflecting a reduction of 3.72 days ($P < 0.001$).’

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Introduction of additional steps

- Wiping slides
- Loading onto scanner
- Scanning
- Loading from scanner
- QC checking of images

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Efficiency Gains

- **Multiple publications showing efficiency gains with introduction of digital pathology**

- **Dependencies**
  - **Pre-existing efficiency**
  - **Ability to reconfigure lab processes according to Lean principles**
  - **Central Hub processing laboratory with multiple spokes**
  - **Ergonomics of the pathologist workstation**
  - **Case assignment process – Push vs Pull**

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Risk of failure in technology

- Failure of scanner
- Failure of IMS
- Failure in communication between LIMS and IMS

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Some Labs realising benefits

- Improved quality of slides produced
- Introduction of a tracking system offering improved lab management data
- Elimination of transport from central hub lab to spokes
- Greater diagnostic speed and confidence
- Obtaining 2nd/expert opinions.

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Improve ability for off site working

- Greater productivity from controlled environment
- Improved ability to attract new recruits
- Easier to outsource reporting for increased capacity
- Reduction in days lost through illness/personal commitments

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

AI – The game changer?

- **Biggest gains inaccuracy, speed, supporting personal medicine and patient safety through the introduction of AI tools**

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Most common paradigm

- AI as a tool to help pathologists report cases
- Applications are much wider

1

- Identify most urgent cases
- Screen out negative cases

2

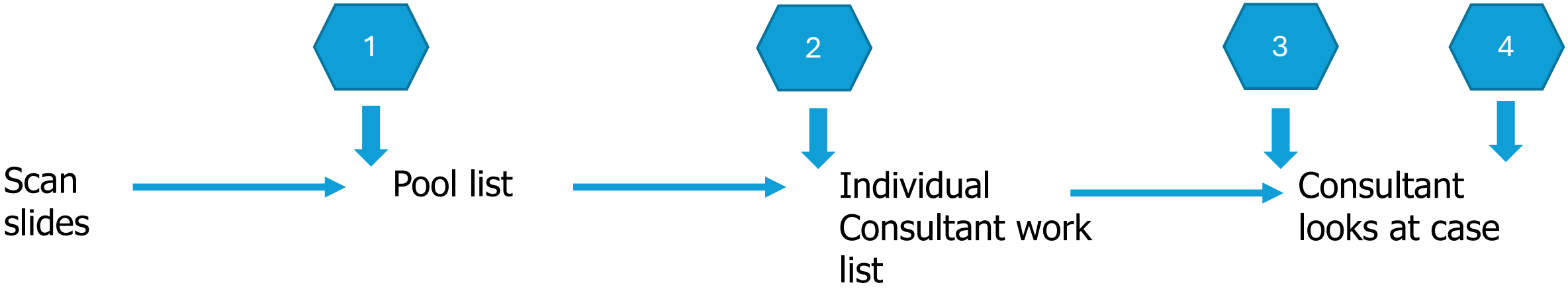
- Identify most urgent cases for that session
- Other cases still reviewed in timely fashion

3

- No prioritisation but diagnostic adjunct
- Speeds up review of individual cases

4

- Supports diagnostic accuracy and could still increase speed of individual case review
- Does not create bias



The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Applications of AI in Pathology

- ❑ Making a diagnosis
- ❑ Pathologist Adjunct – speed and confidence
- ❑ Histological Classification
- ❑ Molecular classification
- ❑ Treatment eligibility/efficacy
- ❑ Prediction of prognosis
- ❑ Triage of cases in lab workflow

Vulva/Vagina

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Vulval/vaginal

- Least amount of development of AI tools in gynae tract
- Examples of diagnostic tools in oral and cervical pathology for the diagnosis of squamous cell carcinoma and melanoma
- Need to translate these and validate them for use in vulval and vaginal samples

The British Association of Gynaecological Pathologists

SYNAPSE Pathology

Vulva / Vagina

- ❑ Diagnosis of SCCs
- ❑ Diagnosis of melanoma
- ❑ Identification of lymph node metastasis

The British Association of Gynaecological Pathologists

SYNAPSE Pathology

Vulva / Vagina

- ❑ Diagnosis of SCCs
- ❑ Diagnosis of melanoma
- ❑ Identification of lymph node metastasis

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Visiopharm - Metastasis Detection APP

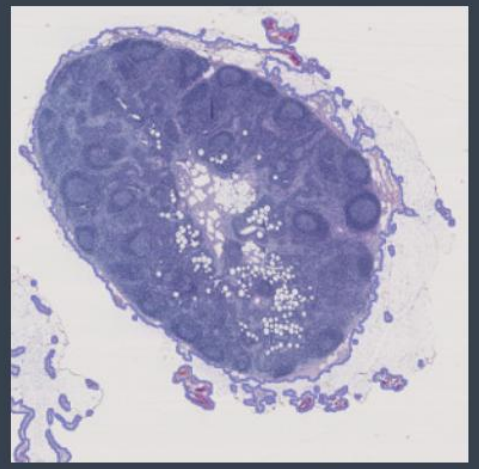


Figure 1

All relevant lymph node tissue is automatically outlined (in purple) for further analysis.

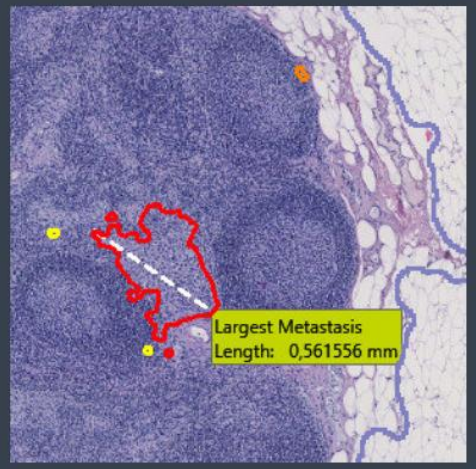


Figure 2

Metastases are identified as High Probability (red), Medium Probability (orange), Low Probability (yellow) and the largest is highlighted and measured.

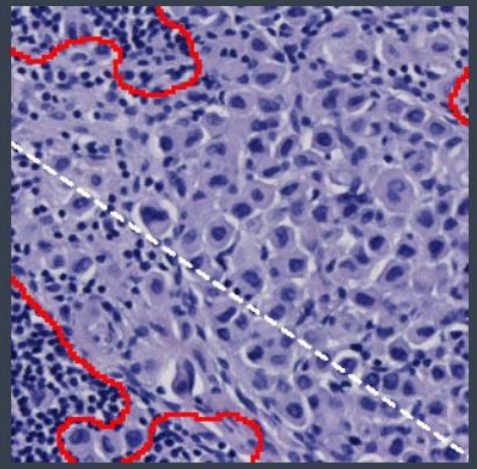


Figure 3

Zooming in, the largest metastasis is reviewed in detail.

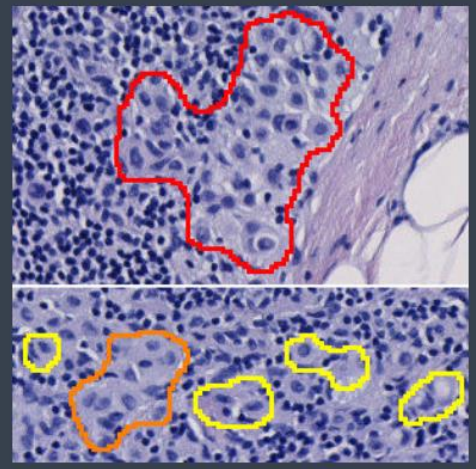


Figure 4

The remaining metastases in the image are reviewed as necessary, showing High Probability (red), Medium Probability (orange) and Low Probability (yellow).

Cervix

Cervix

- ❑ Making a diagnosis
- ❑ Identification of LN metastasis
- ❑ Cytology – Cervical cancer screening programme

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Gynae Cytology

Comparison of the Hologic Genius Digital Diagnostics System with the ThinPrep Imaging System—A retrospective assessment

Hans Ikenberg MD, PhD[1] | Sabrina Lieder[2] | André Ahr MD, PhD[1,3] | Manfred Wilhelm PhD[4] | Christiane Schön MSc[5] | Arjola Xhaja MD[1]

Cancer Cytopathol. 2023;131(7): 424-432. doi:10.1002/cncy.22695

ThinPrep LBC slides (Hologic), which were previously analyzed in using ThinPrep Imaging System (TIS) with CAS in routine cotesting for cytology/human papillomavirus, were reviewed in a blinded mode using the Genius Digital Diagnostics System (Hologic).

AI algorithms used to present a gallery of six tiles each (containing objects of interest) in five categories.

The British Association of
Gynaecological Pathologists

SYNAPSE® Pathology

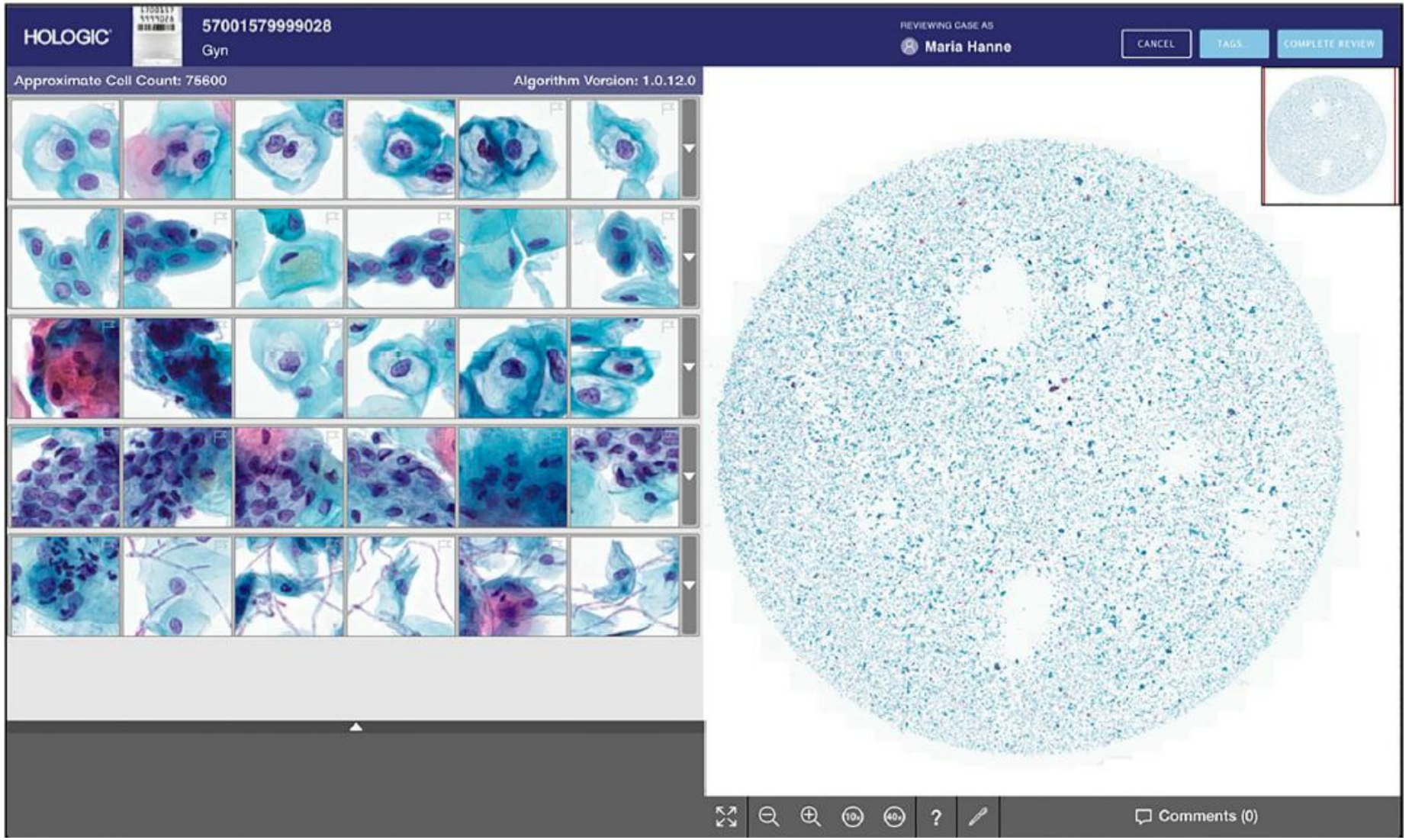


TABLE 5 Concordance analysis within cytology categories and considering the histology result.

Major discrepancies, favor TIS	Minor discrepancies, favor TIS	Match	Minor discrepancies, favor DC	Major discrepancies, favor DC
0.35%	9.28%	86.56%	3.51%	0.30%
		Concordance 90.37%		

Abbreviations: DC, digital cytology; TIS, the ThinPrep Imaging System.

TABLE 6 Concordance analysis within cytology categories and considering the histology result, follow-up cytology, and/or a retrospective review.

Major discrepancies, favor TIS	Minor discrepancies, favor TIS	Match	Minor discrepancies, favor DC	Major discrepancies, favor DC
0.00%	2.66%	86.56%	10.13%	0.65%
		Concordance 97.34%		

Abbreviations: DC, digital cytology; TIS, the ThinPrep Imaging System.

'The average screening time of DC was 44.8 seconds per slide versus 89.9 seconds per slide for TIS. These differences between the two technologies are significant ($p < .0001$).'

Endometrium

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Uterus/Endometrium

- ❑ Classification of benign / malignant
- ❑ POLE, p53 and MMR mutations
- ❑ Other mutations
- ❑ Identification of lymph node metastases

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Endometrium – Classification Benign/Malignant

› Exp Biol Med (Maywood). 2022 Nov;247(22):2025-2037. doi: 10.1177/15353702221126560. Epub 2022 Oct 25.

Weakly supervised learning and interpretability for endometrial whole slide image diagnosis



Mahnaz Mohammadi [1], Jessica Cooper [1], Ognjen Arandelović [1], Christina Fell [1], David Morrison [1], Sheeba Syed [2], Prakash Konanahalli [2], Sarah Bell [2], Gareth Bryson [2], David J Harrison [3], David Harris-Birtill [1]

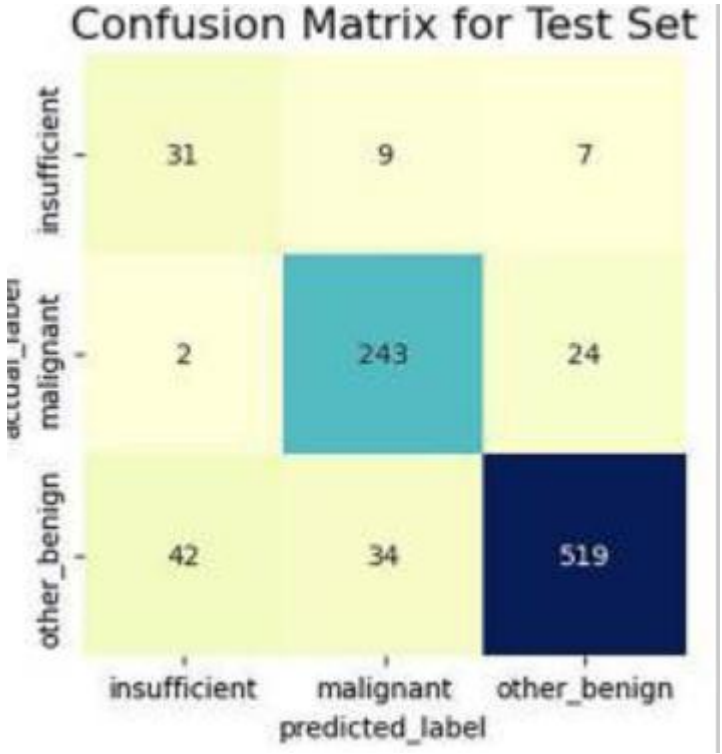
Affiliations + expand

PMID: 36281799 PMCID: PMC9791308 DOI: 10.1177/15353702221126560

The British Association of Gynaecological Pathologists

SYNAPSE Pathology

Endometrium – Classification Benign/Malignant



Performance evaluation of the CLAM and MIL models on validation and test sets.

Model	Valid set		Test set	
	Accuracy (ACC) (%)	Area under the ROC curve (AUC) (%)	ACC (%)	AUC (%)
CLAM	85.57	95.19	87.04	95.06
MIL	81.16	90.13	82.21	90.54

1

- Identify most urgent cases
- Screen out negative cases

2

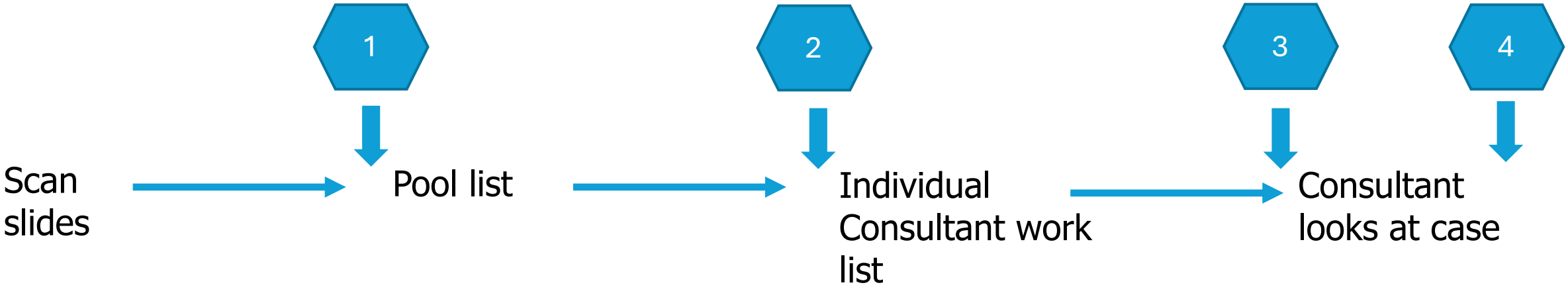
- Identify most urgent cases for that session
- Other cases still reviewed in timely fashion

3

- No prioritisation but diagnostic adjunct
- Speeds up review of individual cases

4

- Supports diagnostic accuracy and could still increase speed of individual case review
- Does not create bias

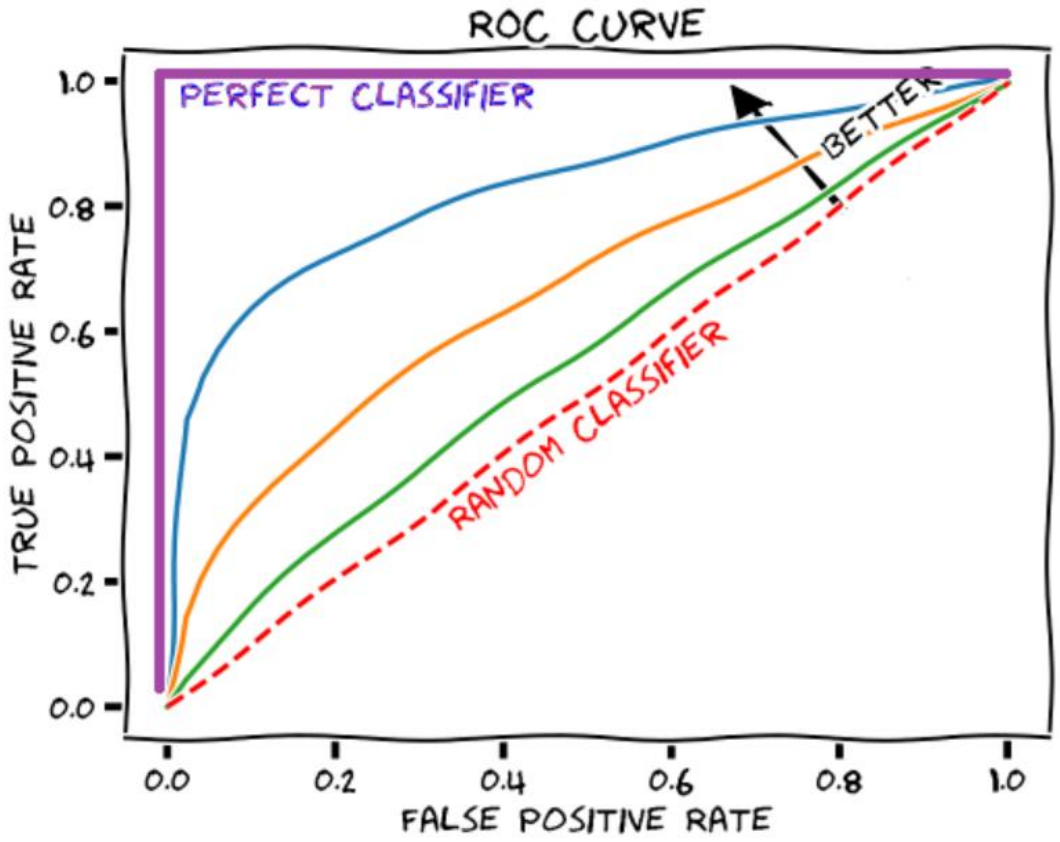


The British Association of Gynaecological Pathologists

SYNAPSE Pathology

https://glassboxmedicine.com/2019/02/23/measuring-performance-auc-auroc/

Measuring Performance: AUC (AUROC)



	Best architecture	Per-patient AUROC	Per-tile AUROC
Histology	Panoptes2	**0.969 (0.905—1)**	**0.870 (0.866–0.874)**
CNV-H from endometrioid	Panoptes1	**0.958 (0.886—1)**	**0.864 (0.859–0.870)**
CNV-H	Panoptes4	**0.934 (0.851–1)**	0.731 (0.728–0.734)
POLE	Multi-model system	**0.890 (0.821–0.960)**	0.691 (0.683–0.700)
CNV-L	Panoptes1	**0.889 (0.755–1)**	0.710 (0.705–0.716)
TP53	Panoptes2	**0.873 (0.768–0.977)**	0.713 (0.709–0.717)
FAT1	Panoptes2 with clinical	**0.835 (0.666–1)**	0.639 (0.635–0.642)
MSI-high	InceptionResnetV1	**0.827 (0.705–0.948)**	0.638 (0.635–0.641)

The British Association of Gynaecological Pathologists

SYNAPSE Pathology

nature communications

Article

https://doi.org/10.1038/s41467-023-42453-6

Validation of MSIntuit as an AI-based pre-screening tool for MSI detection from colorectal cancer histology slides

Received: 28 March 2023

Accepted: 11 October 2023

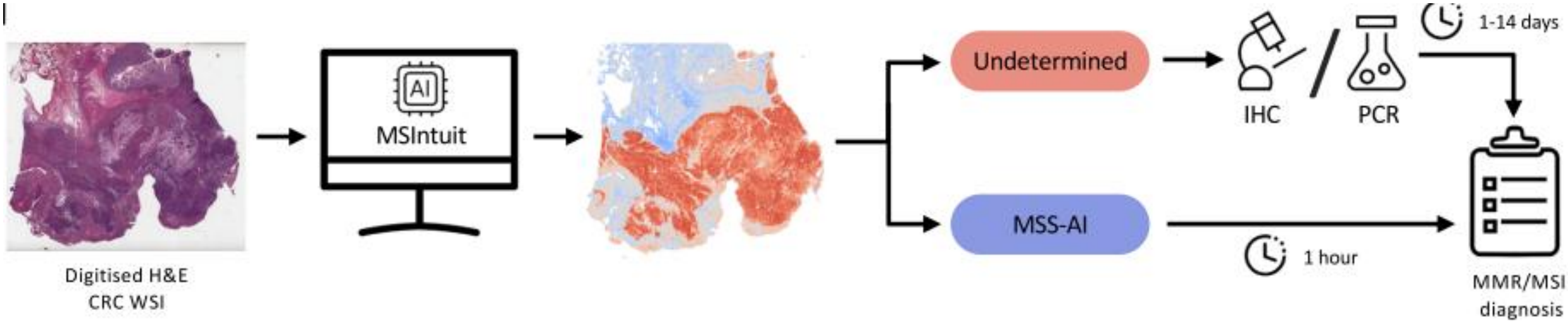
Published online: 06 November 2023

Check for updates

Charlie Saillard[1], Rémy Dubois[1], Oussama Tchita[1], Nicolas Loiseau[1], Thierry Garcia[2], Aurélie Adriansen[2], Séverine Carpentier[2], Joelle Reyre[2], Diana Enea[3], Katharina von Loga[1], Aurélie Kamoun[1], Stéphane Rossat[2], Corentin Wiscart[1], Meriem Sefta[1], Michaël Auffret[1], Lionel Guillou[1], Arnaud Fouillet[1], Jakob Nikolas Kather[4,5,6] & Magali Svrcek[3,6]

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology



The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

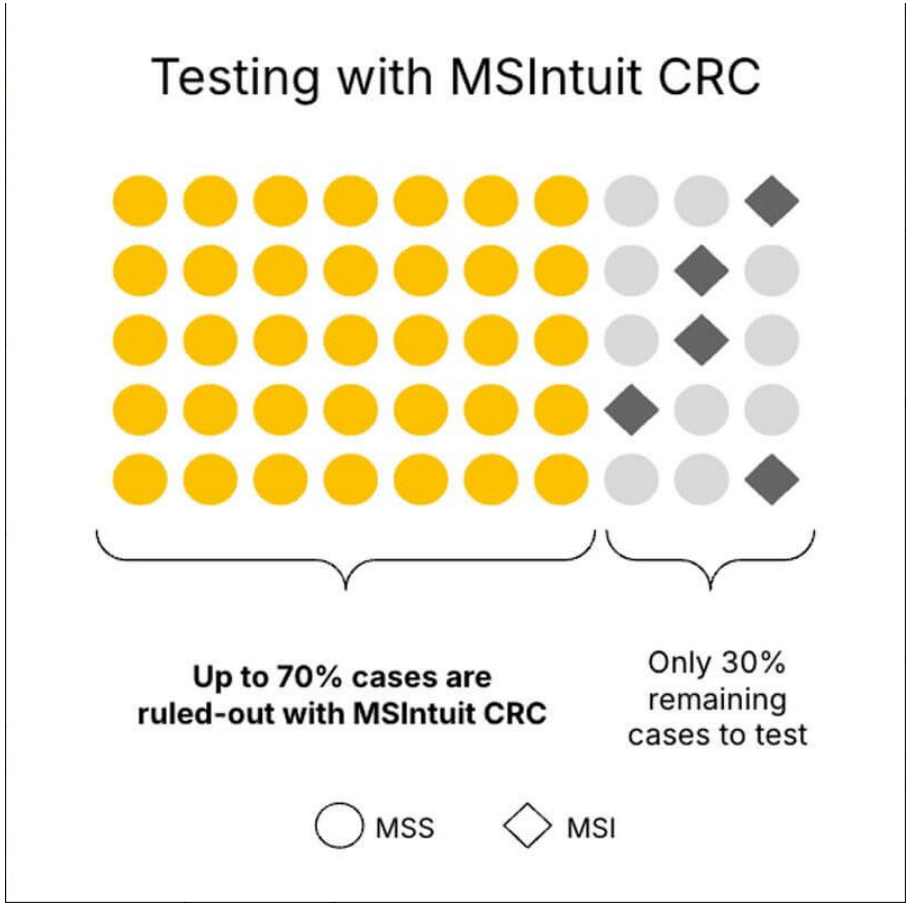
Table 1 | Confusion matrix of MSIntuit on MPATH-DP200 cohort

	MSS-AI	Undetermined
non-MSI	208	246
MSI	2	81

Table 2 | Confusion matrix of MSIntuit on MPATH-UFS cohort

	MSS-AI	Undetermined
non-MSI	218	250
MSI	4	82

- MSIntuit, an AI-based tool that can be used in clinical practice for MSI pre-screening from routine H&E slides of CRC patients. Used as a prescreening tool, MSIntuit can rule out almost half of the non-MSI population while correctly classifying more than 96% of dMMR/MSI patients, on par with current gold standard methods (92–95%)



https://www.owkin.com/blogs-case-studies/case-study-msintuit-r-crc

Ovary

Ovary – Prediction of treatment response

- Bevacizumab is an extensively studied targeted therapeutic agent used in the treatment of recurrent EOC

- Expensive cost, related toxic adverse events, such as hypertension, proteinuria, bleeding, thromboembolic events, poor wound healing, and gastrointestinal perforation

The British Association of Gynaecological Pathologists

SYNAPSE Pathology

Discover Oncology

Analysis

Benchmarking histopathology foundation models for ovarian cancer bevacizumab treatment response prediction from whole slide images

Mayur Mallya[1] · Ali Khajegili Mirabadi[1] · David Farnell[3,4] · Hossein Farahani[2] · Ali Bashashati[2,3]

Received: 30 July 2024 / Accepted: 11 February 2025
Published online: 17 February 2025
© The Author(s) 2025 OPEN

- Histopathology foundation models trained on large-scale whole slide image (WSI) datasets to extract ovarian tumour tissue features for predicting bevacizumab response from WSIs.
- Demonstrate the capability of these large models in predicting bevacizumab response in ovarian cancer patients with the best models achieving a patient-level balanced accuracy score close to 70%

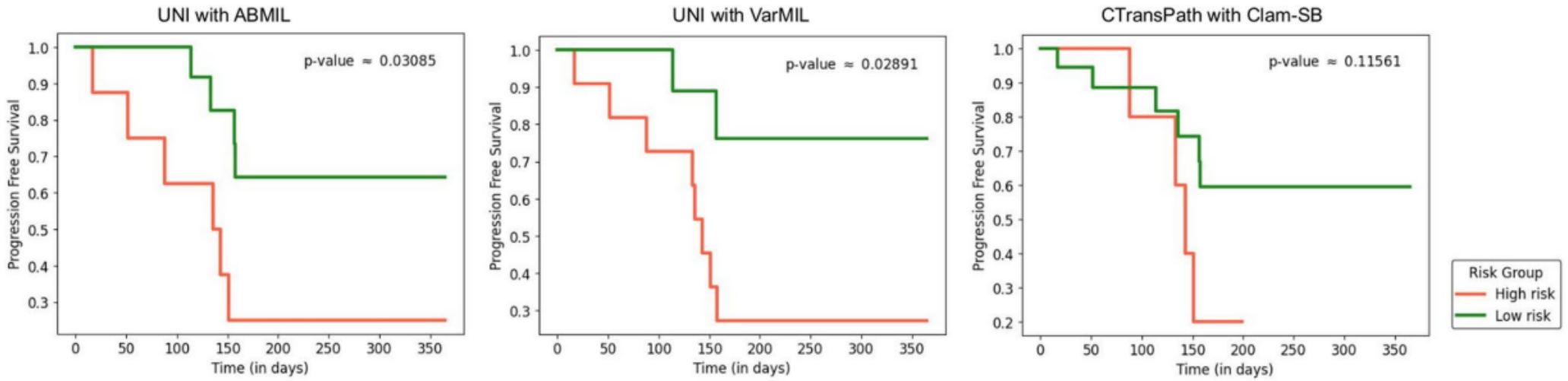


Fig. 4 Kaplan–Meier plots stratifying the high- and low-risk patients (includes all subtypes). The selected models are the top 3 best-performing models from Table 3 showing the patient-level classification performances

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Applications of AI in Pathology

- ❑ Making a diagnosis
- ❑ Pathologist Adjunct – speed and confidence
- ❑ Histological Classification
- ❑ Molecular classification
- ❑ Treatment eligibility/efficacy
- ❑ Prediction of prognosis
- ❑ Triage of cases in lab workflow

The British Association of Gynaecological Pathologists

SYNAPSE Pathology

Cervical Cancer - Prognostication

Cancer Medicine

Open Access

RESEARCH ARTICLE | Open Access

The pathological risk score: A new deep learning-based signature for predicting survival in cervical cancer

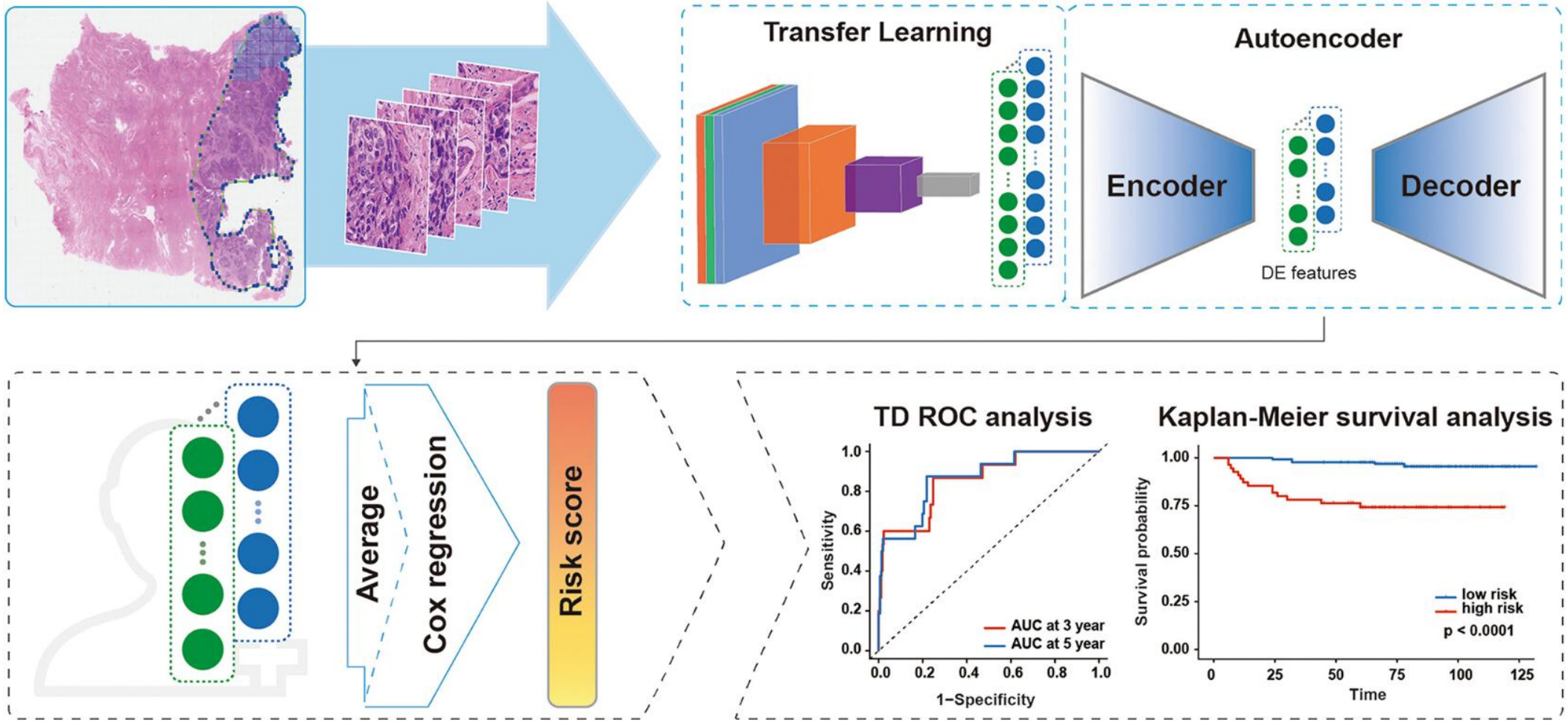
Chi Chen, Yuye Cao, Weili Li, Zhenyu Liu, Ping Liu, Xin Tian, Caixia Sun, Wuliang Wang, Han Gao, Shan Kang, Shaoguang Wang, Jingying Jiang, Chunlin Chen, Jie Tian

First published: 28 June 2022 | https://doi.org/10.1002/cam4.4953 | Citations: 4

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

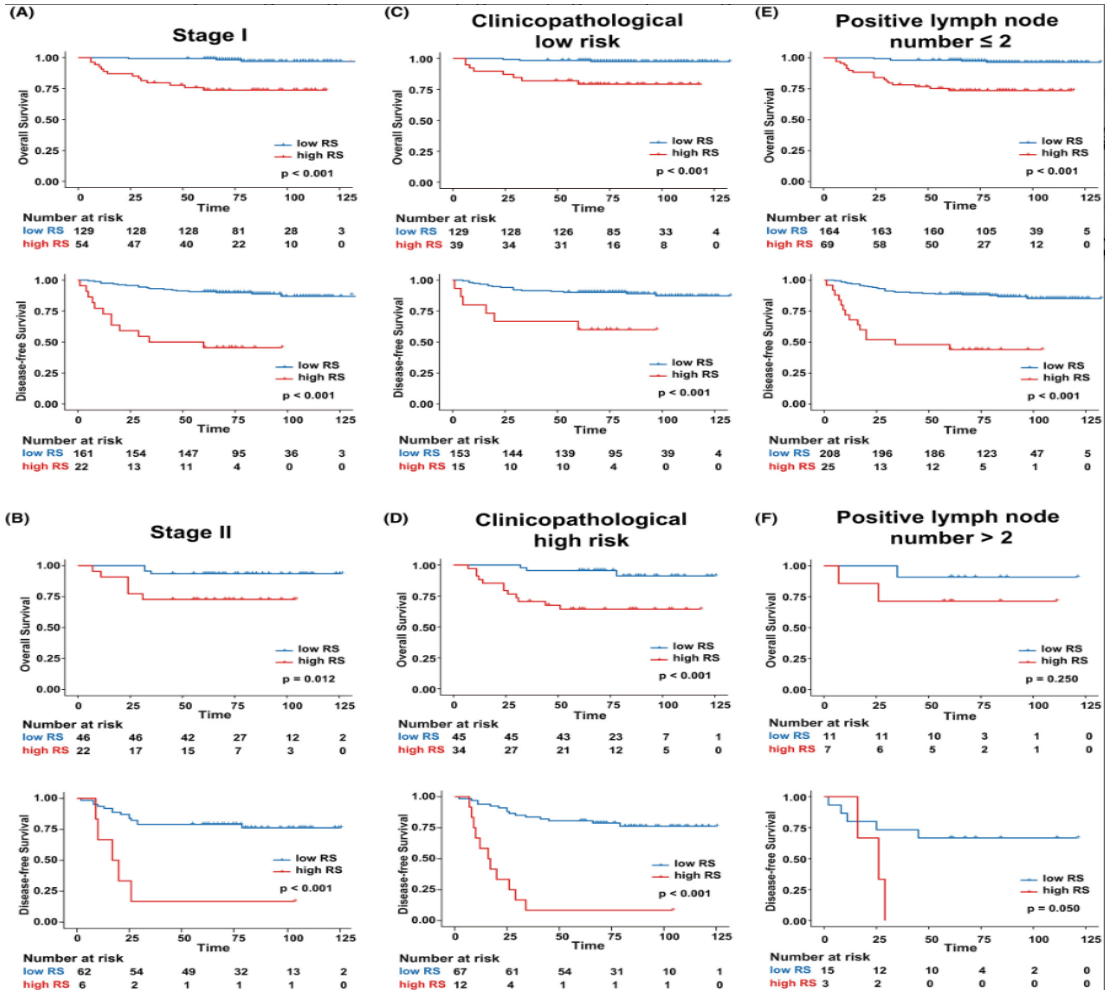
Cervical Cancer - Prognostication



The British Association of Gynaecological Pathologists

SYNAPSE Pathology

Cervical Cancer - Prognostication



The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

AI-enabled identification prediction of homologous recombination deficiency (HRD) from histopathology images.

Authors: Gowhar Shafi, Shivamurthy P.M., Anand Ulle, Krithika Srinivasan, Aravindan Vasudevan, Vikas Jadhav, Dr Sujit Joshi, Nirmal Vivek Raut, Jayant Khandare, Mohan Uttarwar, and Kenneth Joel Bloom | AUTHORS INFO & AFFILIATIONS

Publication: Journal of Clinical Oncology • Volume 40, Number 16_suppl • https://doi.org/10.1200/JCO.2022.40.16_suppl.3019

iPREDICT-HRD AI engine trained on 120 H&E slides that were used to identify tumour prior to manual microdissection for HRD assessment by NGS. Histopathological features were extracted, followed by feature mapping to predict HRD status based on the results of NGS testing.

Using single blinded clinical samples, iPREDICT-HRD tool detected HRD + ve samples with 99.3% accuracy with 100% sensitivity and 99% specificity in the test set.

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Challenges

- Validity across wider populations with genetic diversity

- Financial
  - Cost of each use case
  - Value for money
  - IT integration
  - Accreditation

- Reconfiguration of digital workflow
- User experience of using multiple tools

The British Association of Gynaecological Pathologists

SYNAPSE® Pathology

Applications of AI in Pathology

- ❑ Making a diagnosis
- ❑ Pathologist Adjunct – speed and confidence
- ❑ Histological Classification
- ❑ Molecular classification
- ❑ Treatment eligibility/efficacy
- ❑ Prediction of prognosis
- ❑ Triage of cases in lab workflow