Rigshospitalet
Diagnostisk Center

Fra glas til algoritmer: Erfaringer fra Rigshospitalet

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Afdeling for patologi, Diagnostisk Center
Rigshospitalet

ESDIP Digital Patholo...
Partner ESDIP

Map of centers that use digital pathology for primary diagnosis. You can add your Lab using the following form:
59.252 visninger
Udgivet for 7 dage siden
DEL

Computational Pathology Research Grou...

Europe Digital Pathology Map

- DigiPatICS
  - DigiPatICS - Vall d'Hebron University Hospit...
  - DigiPatICS - Bellvitge University Hospital, Ho...
  - DigiPatICS - Hospital Germans Trias i Pujol, ...
  - ... 82 mere

Asia Digital Pathology Map

- ACTREC Tata Memorial Centre, Mumbai
- The Catholic University of Korea Seoul St. M...
- King Hussein Cancer Center, Amman
- Lokman Hekim University, Faculty of Medici...

North America Digital Pathology Map

- Memorial Sloan Kettering Cancer Center, Ne...
- NYU Langone Digital Pathology - NYU Lango...



Digital patologi i Danmark

UGESKRIFT FOR LÆGER

Statusartikel

Digital patologi

Christian Beltoft Brøchner[1, 2], Elisabeth Specht Stovgaard[2, 3], Jacob Secher Ejlertsen[4], Uffe Barrientos Stolborg[5], Niels Marcussen[6], Parag Deepak Dabir[7], Mie Emilie Kristensen[8], Sine Huus Pedersen[9], Kristi Bøgh Anderson[9] & Gro Linno Willemoe[1]

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Ugeskr Læger 2026;188:V10250871. doi: 10.61409/V10250871

Rigshospitalet
Diagnostisk Center

Digital patologi i Danmark

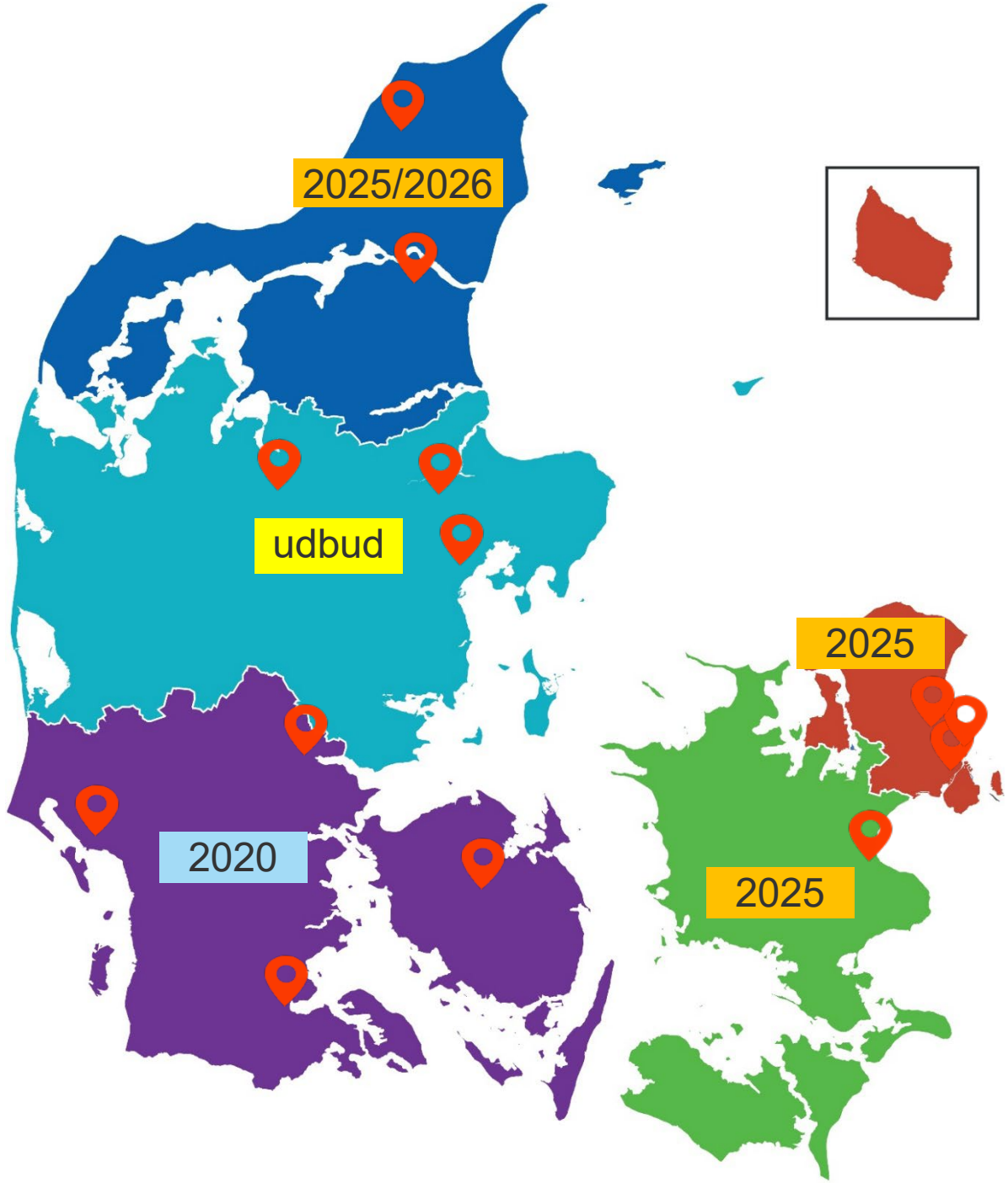
Region Hovedstaden
IMS: Tribune Health/CaloPix
Scanners: Hamamatsu

Region Østdanmark (2027)
IMS: Sectra

Region Syddanmark
IMS: Sectra
Scanners: Hamamatsu

Region Midtjylland
IMS: Udbud
Scanners: Hamamatsu

Region Nordjylland
IMS: Tribune Health/CaloPix
Scanners: Leica





Institutional profile & regional scale

Rigshospitalet

45 consultants

Herlev and Gentofte

33 consultants

Hvidovre

18 consultants

Combined regional volume: ~ 250,000 referrals/year. ~ 1,850,000 slides/year 96 total consultants

Implementation roadmap (2022-2025)

2022 | 2023 | 2024 | 2025

Preparatory phase (2022)

- Governance and funding
- Project charter
- Regional steering committee

Technical requirements (2023)

- Scanner & slide quality
- High-throughput slide cassette
- Vendor-agnostic interoperability
- Open data exchange
- IMS to LIS integration

Pathologist training & pilot testing

- Pathologist training
- Pilot slide review

Phased go-live (Jan-May 2025)

Jan | Mar | May

100% digital diagnosis from day 1

Clinical impact & AI outlook

Observed benefits

- Broader accessibility
- Interdepartmental consultations Sharing digital slide
- Workflow flexibility Mobile location and routine

Persisting challenges

- Turnaround time (initial adaptation) Learning curve
- Storage demands Massive WSI data
- Workforce Team change-management

AI as diagnostic aid



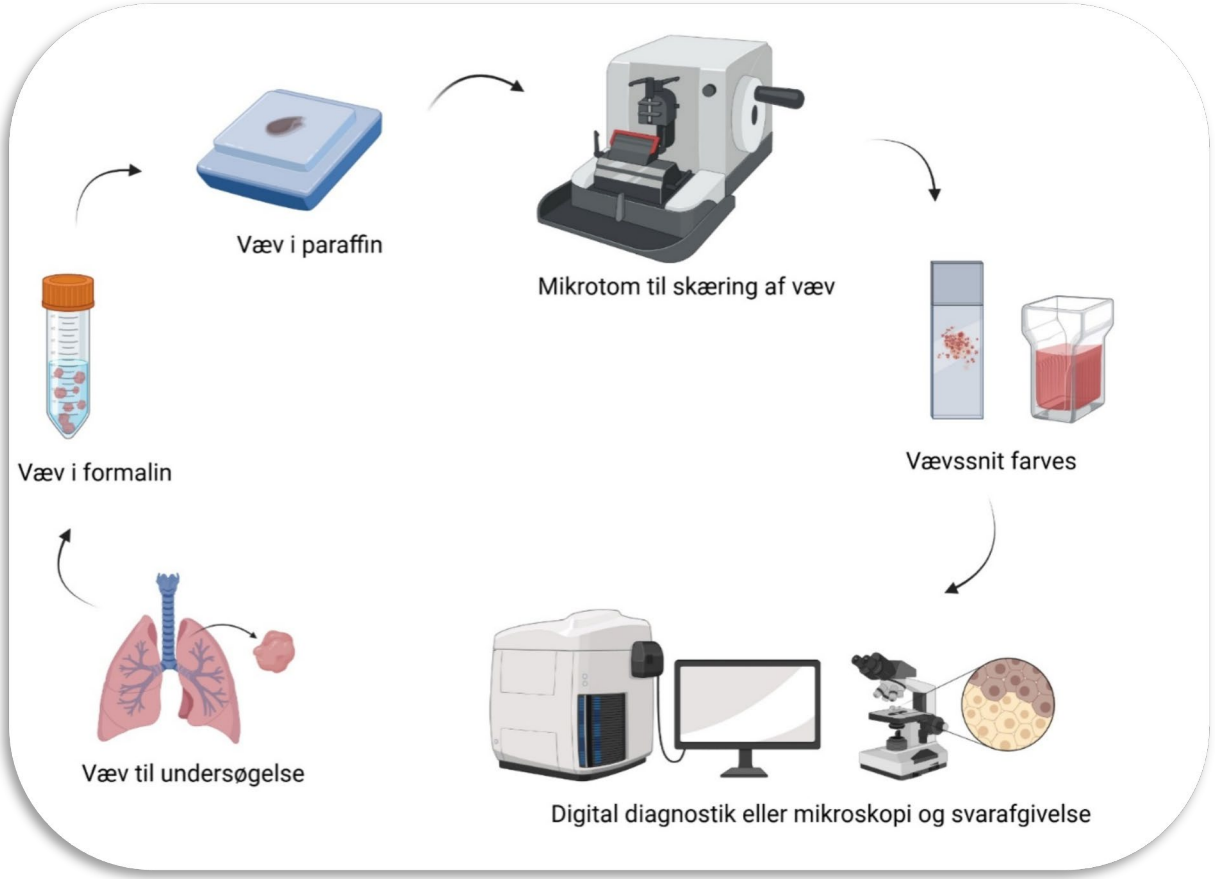


Figure created with BioRender.com

200 medarbejdere

100.000 rekvisitioner/år

> 700.000 histologi glas/år

> 70.000 cytologi glas/år

Afdeling for Patologi, Rigshospitalet

700 forskellige rekvirenter

400 patienter i venteværelset hver dag

Digital patologi i Danmark

Hvor er vi på vej hen? Hvad er fremtiden? Kan vi halvere behovet for patologer? Bliver vi arbejdsløse?



Formål og succeskritierier

Sikre optimal brug af ressourcer – og af patologer

Hurtigere, lettere tilgang til supervision, konferrering, konsultationer og revisioner på tværs af afdelinger (indenfor regionen…)

Udveksle og hjælpe hinanden på tværs af afdelinger

Digital patologi er en forudsætning for anvendelse af AI

HHS Public Access
Author manuscript
Nat Rev Clin Oncol. Author manuscript; available in PMC 2019 November 27.

Published in final edited form as:
Nat Rev Clin Oncol. 2019 November ; 16(11): 703–715. doi:10.1038/s41571-019-0252-y.

Artificial intelligence in digital pathology — new tools for diagnosis and precision oncology

Kaustav Bera[1], **Kurt A. Schalper**[2], **David L. Rimm**[2], **Vamsidhar Velcheti**[3], **Anant Madabhushi**[1,4,*]

[1]...tment of Biomedical Engineering, Case Western Reserve University, Cleveland, OH, USA.
...sity School of Medicine, New Haven, CT, USA.
...University, New York, NY, USA.

Shafi and Parwani *Diagnostic Pathology* (2023) 18:109
https://doi.org/10.1186/s13000-023-01375-z

Diagnostic Pathology

REVIEW

Open Access

Artificial intelligence in diagnostic pathology

Saba Shafi[1] and Anil V. Parwani[1*]

Abstract
Digital pathology (DP) is being increasingly employed in cancer diagnostics, providing additional tools for faster, higher-quality, accurate diagnosis. The practice of diagnostic pathology has gone through a staggering

Histopathology
Histopathology 2024, **84**, 924–934. DOI: 10.1111/his.15153

REVIEW

Pros and cons of artificial intelligence implementation in diagnostic pathology

Paul J van Diest,[1,*] Rachel N Flach,[1,2,*] Carmen van D...
Gerben E Breimer,[1] Nikolas Stathonikos,[1] Paul Bl...
[1]*Department of Pathology,* [2]*Department of Oncological H...*
Center Utrecht, Utrecht and [4]*Department of Bio...*
the Netherlands

HHS Public Access
Author manuscript
Nat Med. Author manuscript; available in PMC 2020 August 11.

...ished in final edited form as:
...at Med. 2019 August ; 25(8): 1301–1309. doi: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], **Thomas J. Fuchs**[1,2,*]

[1]Department of Pathology, Memorial Sloan Kettering Cancer Center, New York, NY, USA.
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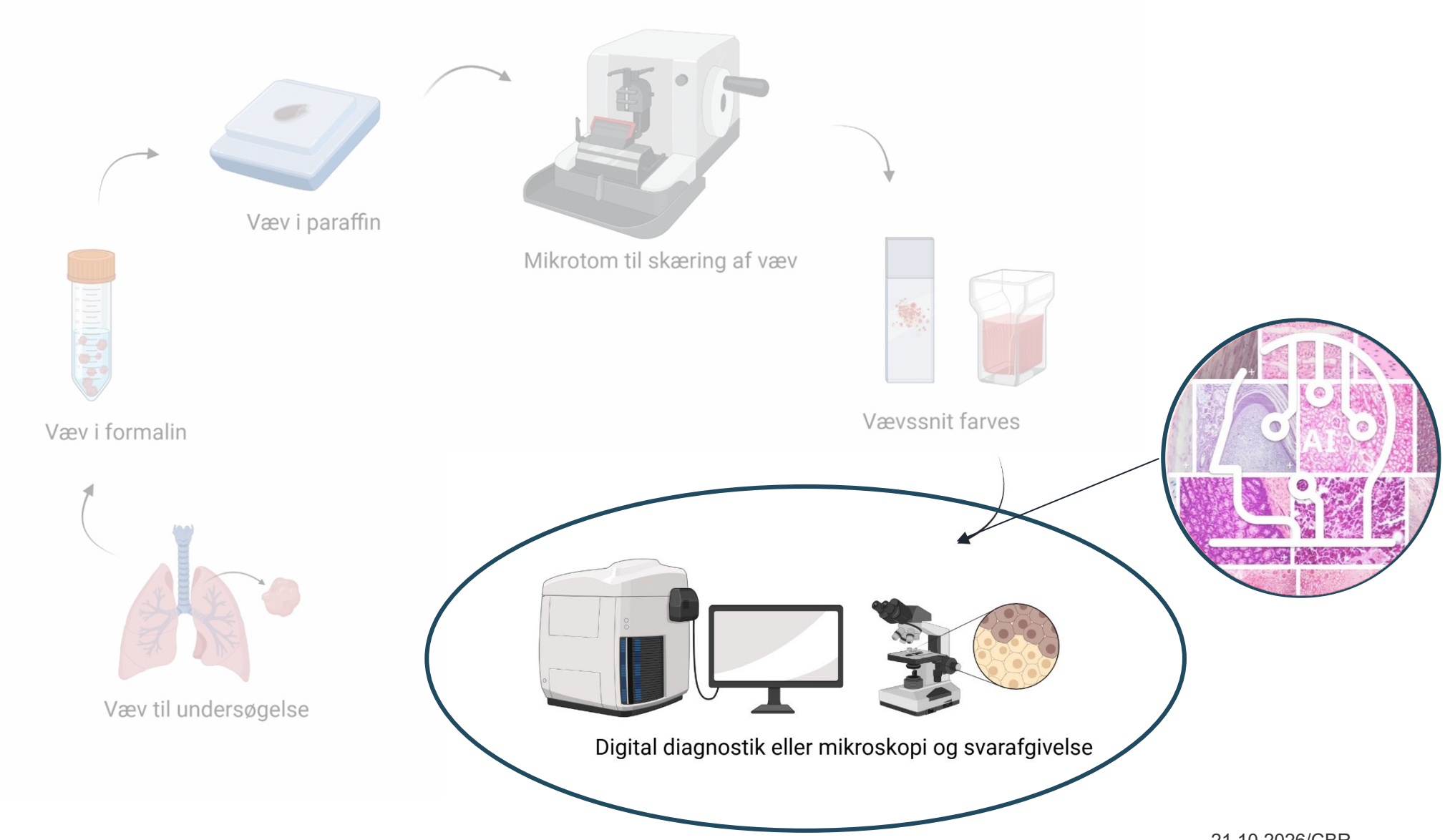
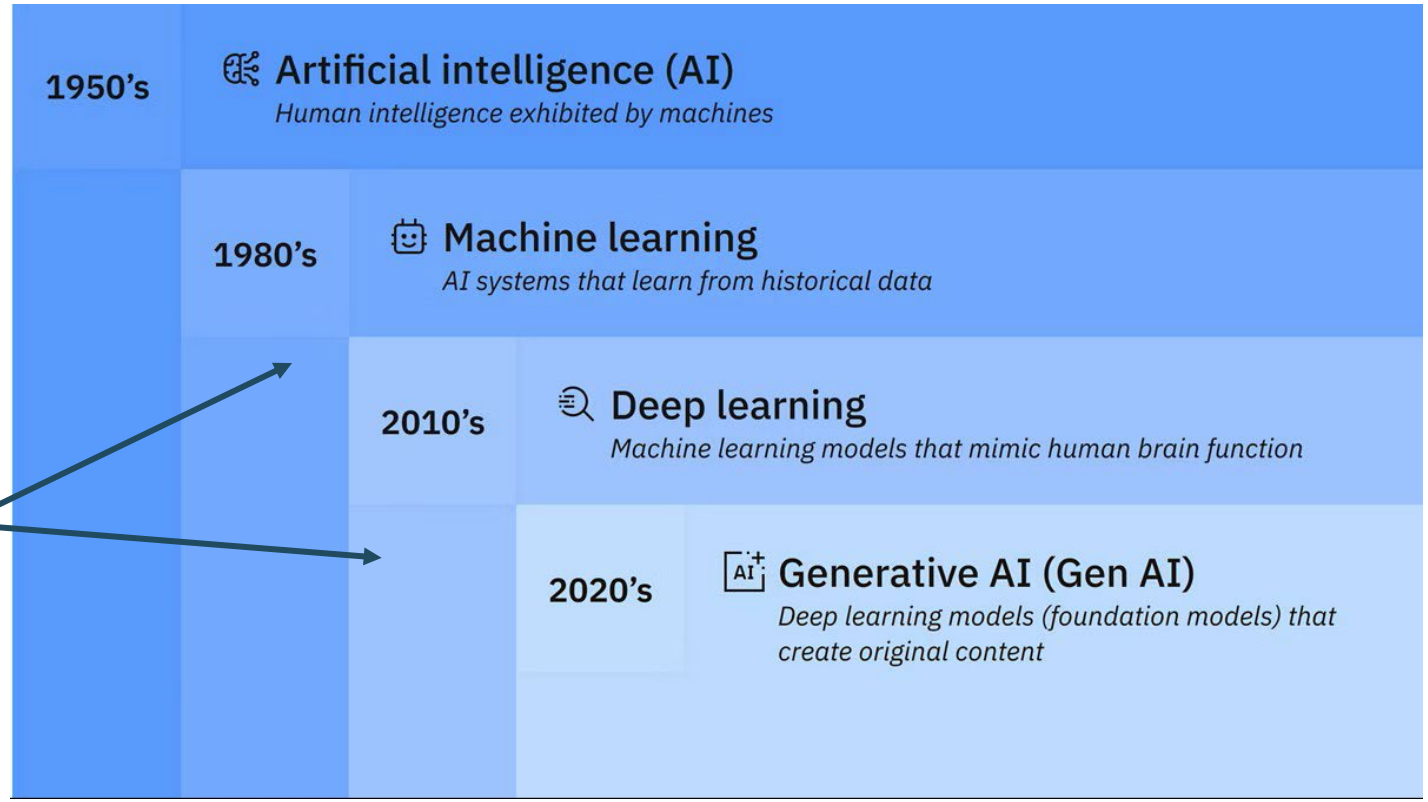


Figure created with BioRender.com

Hvad er kunstig intelligens (AI)?

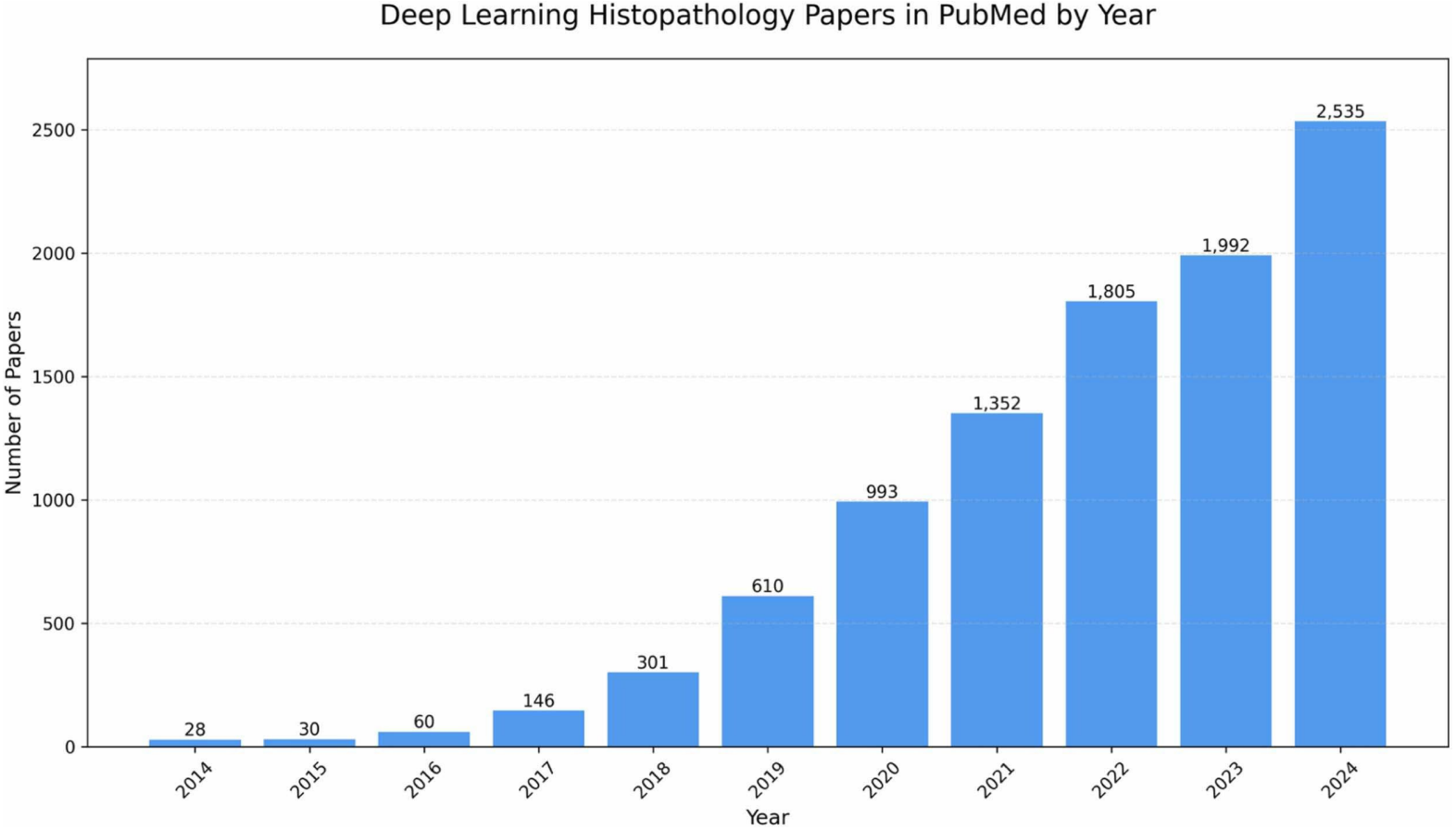
"Kunstig intelligens (AI) er teknologi, der gør det muligt for computere og maskiner at simulere menneskelig læring, forståelse, problemløsning, beslutningstagning, kreativitet og autonomi."
– oversat fra IBM, 2024





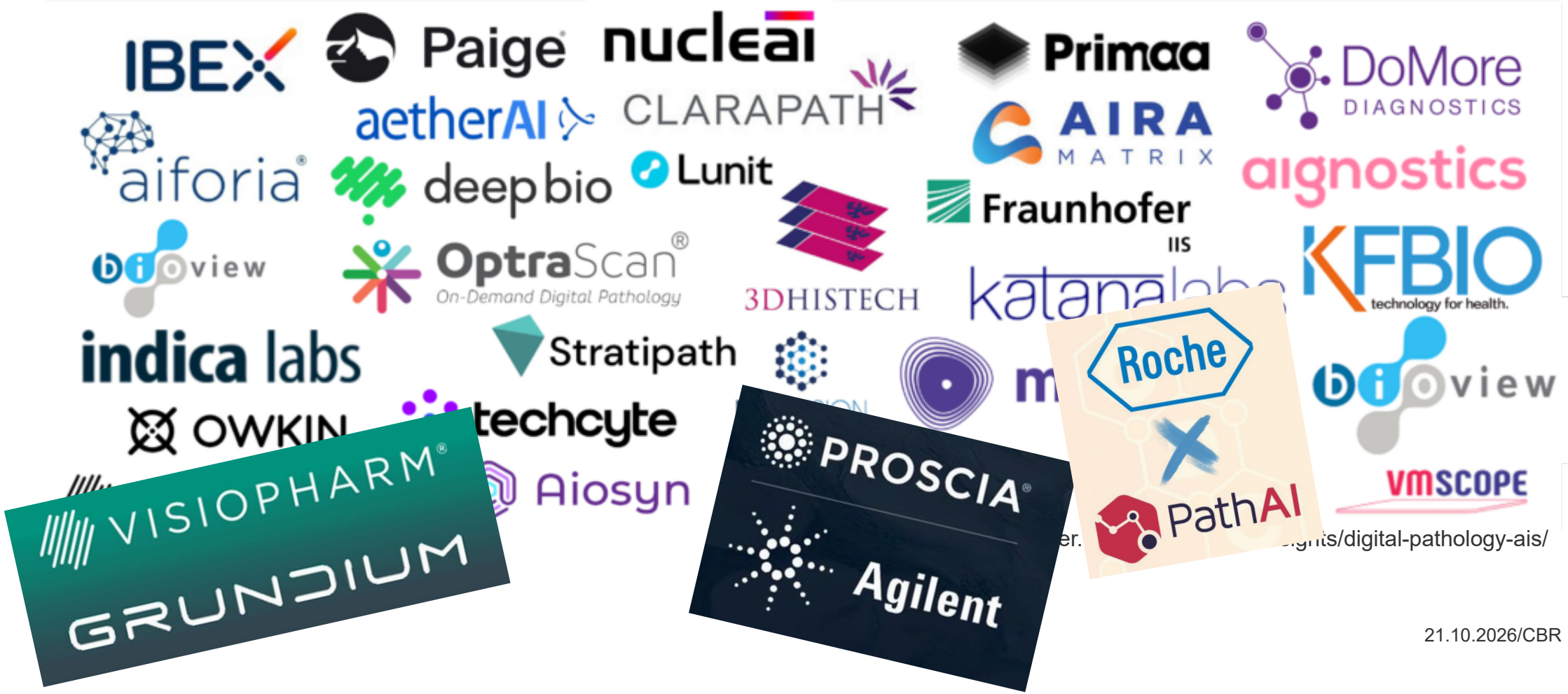
https://www.ibm.com/think/topics/artificial-intelligence

Antal publikationer om deep learning og digital patologi er steget fra 301 i 2018 til 2535 i 2024, dvs. en mere end 8-dobling på 6 år.



Komura et. al,. Machine learning methods for histopathological image analysis: Updates in 2024. Computational and Structural Biotechnology Journal, Vol27, 2025, pp. 383-400

Mange firmaer med AI løsninger til patologi



er. ights/digital-pathology-ais/

Mange firmaer med AI løsninger til patologi

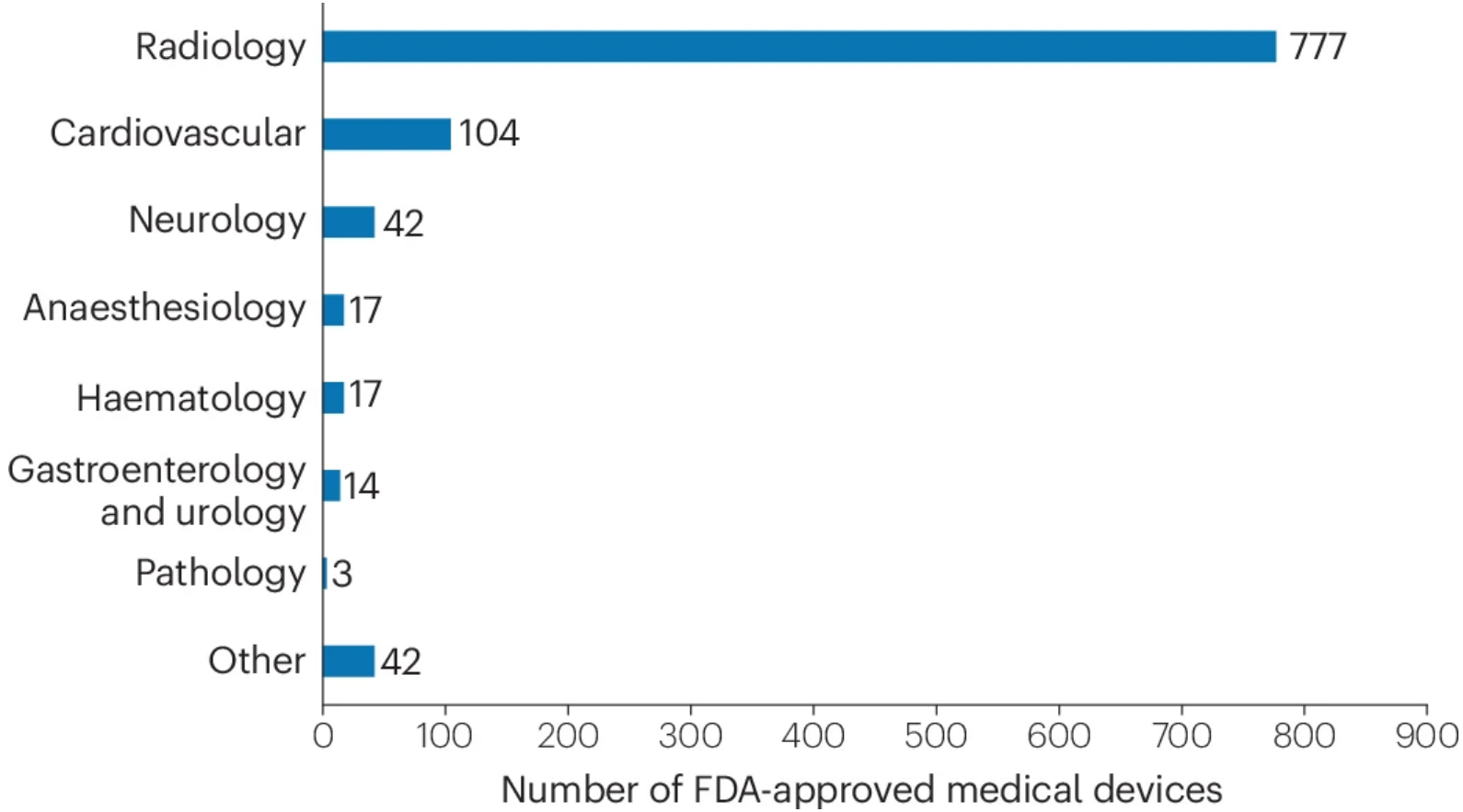
Biomarkør vurdering	Diagnostisk	Andet
Ki-67	Prostatakræft	Stratificering af patienter
ER/HER2	Brystkræft	Triagering af cases
PD-L1	Lymfeknuder - metastaser	Molekylære aberrationer?
Mitosetælling	Cervix cytology	Arbejdsflow & kvalitet
…mere	…mere	…mere

Hvad gør en algoritme brugbar/god?

Vigtige egenskaber

- Løse et (klinisk) behov: Mere sensitiv, mere reproducerbar, hurtigere
- Trænet og valideret: Lignende patientpopulation? Hvordan valideret?
- Certificeret: CE-IVD / IVDR godkendt (FDA i USA). In-house?
- Implementer-/integrerbar: Server? Integrerbar i IMS (Sectra)? Automatisk kørsel?
- Visning af resultater: Direkte i IMS? Strukturerede data? Annotationer?

FDA-godkendte AI-baserede løsninger/devices – dec. 2024



Aggarwal, A., Bharadwaj, S., Corredor, G. *et al.* Artificial intelligence in digital pathology — time for a reality check. *Nat Rev Clin Oncol* **22**, 283–291 (2025).

Hvad gør vi lokalt?

Overordnet fokus på udvikling indenfor digitalisering og AI

Følger aktivt udviklingen regionalt, nationalt og internationalt

DAAK
Digitalisering, Automatisering og AI af Kerneopgaven

Lokale løsninger

Quan10: In-house udviklet AI-software i test indenfor flere organområder
Forskning / udvikling mhp. implementering i diagnostikken
Arbejder på certificering

Contents lists available at ScienceDirect

Journal of Pathology Informatics

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

Technical note: Impact of tissue section thickness on accuracy of cell classification with a deep learning network

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[b] Faculty of Health and Medical Sciences, University of Copenhagen, Copenhagen, Denmark

ORIGINAL ARTICLE OPEN ACCESS

Deep Learning-Based Tumor Cell Classification in Lung Adenocarcinoma With a Case-by-Case Human-in-the-Loop Approach

Martin Stampe[1,2] | Pia Klausen[1] | Ida Skovgaard Christiansen[1] | Charlotte Vestrup Rift[1] | Peter Rindom Koffeldt[1] | Rasmus Hartvig[1] | Eric Santoni-Rugiu[1,2] | Thomas H. L. Jensen[1,2,3]

[1]Department of Pathology, Rigshospitalet, Copenhagen, Denmark | [2]Department of Clinical Medicine, University of Copenhagen, Copenhagen, Denmark | [3]BRIC—Biotech Research & Innovation Centre, University of Copenhagen, Copenhagen, Denmark

ORIGINAL ARTICLE OPEN ACCESS

PMI Focus Issue 2026 – Artificial Intelligence in Diagnostic, Clinical and Forensic Pathology

Quantitative Histological Insights Into Sudden Arrhythmic Death Syndrome: Findings From a Forensic Autopsy Cohort

Pernille Heimdal Holm[1,2] | Thomas Hartvig Lindkær Jensen[3] | Joseph Westaby[4] | Mary Sheppard[4] | Stine Bøttcher Jacobsen[2,5] | Mikkel Eriksen Dupont[2,5] | Jeppe Dyrberg Andersen[5] | Bo Gregers Winkel[2] | Jacob Tfelt-Hansen[2,5] | Jytte Banner[1] | Kristine Boisen Olsen[1]

Received: 12 July 2024 | Revised: 28 August 2024 | Accepted: 5 September 2024

DOI: 10.1002/alr.23454

RESEARCH NOTE

Quantitative characterization of eosinophilia in nasal polyps with AI-based single cell classification

Martin Stampe MD[1] | Ida Skovgaard Christiansen MD, PhD[1] | Vibeke Backer MD[2] | Kasper Aanæs MD, PhD[2] | Anne-Sophie Homøe MD[2] | Jens Tidemandsen MD[2] | Emilie Neumann Nielsen MSc[1,3] | Sigrid Louise Hjorth Rasmussen MSc[1,3] | Rasmus Hartvig MSc[1] | Katalin Kiss MD[1] | Thomas Hartvig Lindkær Jensen MD, PhD[1,4]

Hvad gør vi lokalt?

Triagering af prøver

Primaa CleoSkin

Slides Priorization

Cleo Skin automatically prioritizes the most critical cases thanks to a first-read analysis and gives you access to a smart work list.

Molekylære forandringer

Waiv

MSIntuit® Suite

Optimize MSI testing

Rule-out MSS cases from the diagnostic workflow by screening with AI for digital pathology

Hvad gør vi regionalt?

[illegible]isk følgegruppe for AI (alle 3 patologiafdelinger + CIMT)
[illegible]25 mhp. afdække behov og

Juli 2026
Pauseret på ubestemt tid

Hvor kan der høste[illegible]
Hvad er de tekniske krav og udfor[illegible]
Juridiske?

Erfaringer fra andre regioner (Region Syddanmark)?

Tænke nationalt når vi kan!



Hvad gør vi nationalt?

DPAS
DANSK PATOLOGISELSKAB

Udvalg for Digital Patologi (Dansk patologiselskab)

Følger udviklingen af digital patologi på landsplan

Akkreditering ifbm. digitalisering – f.eks. skærme og andet udstyr?

Kommende: hvad med EUs AI-forordning?
Kan de regionale begrænsninger løsnes?

Interessegruppe for AI (Dansk patologiselskab)

Deler erfaring og ideer om AI på nationalt plan

Forskning / test / implementering / diagnostik

Hvad kunne vi gøre?









National strategi for AI i patologien
Etablere regionsuafhængigt AI-testcenter?
Struktureret deling af erfaringer mellem regioner og afdelinger

Eksempler på udfordringer

Økonomiske:	Algoritmer koster penge – licens, software, implementering og pris-pr-case – Afd. budget? Rekvirent? Region?
Tekniske:	Krav til IT – og træning i IT?
Juridiske:	Ensartet jura mellem regioner? Flow gennem det juridiske?
Personale:	Mangel på patologer



Tak for opmærksomheden

Kwon D. How artificial intelligence is transforming pathology. *Nature* **641**, 1342-1344 (2025)
Picture credit: Getty