midt
Central Denmark Region

Fremtidige perspektiver på digital patologi

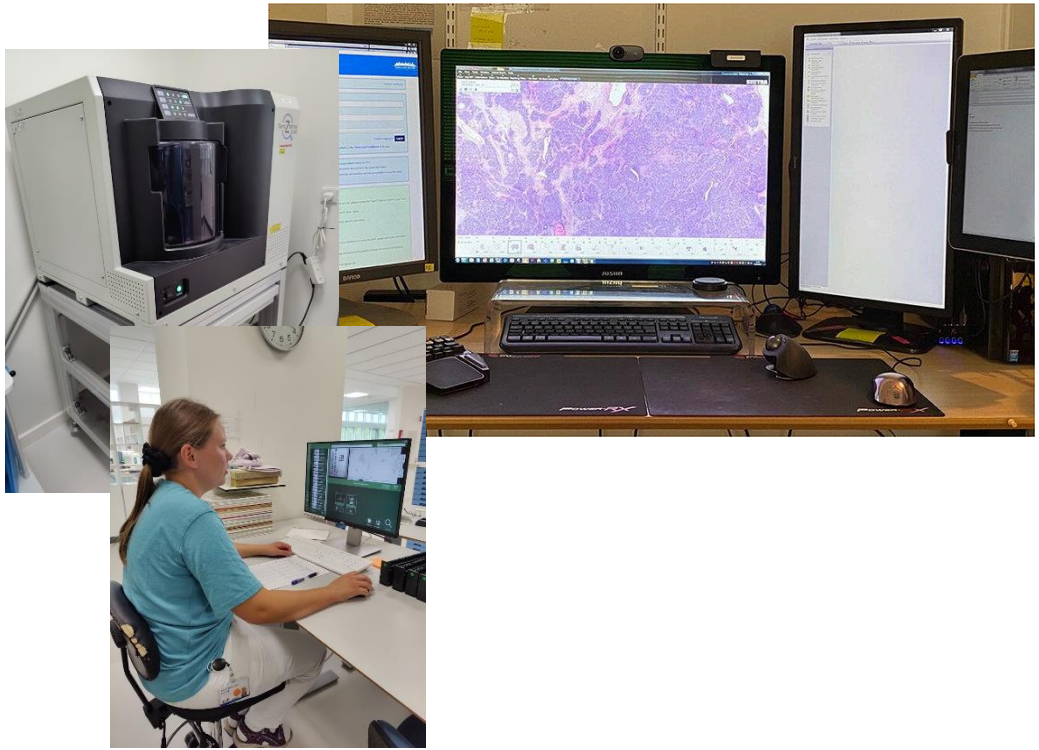
28-04-2022

Bioanalytiker

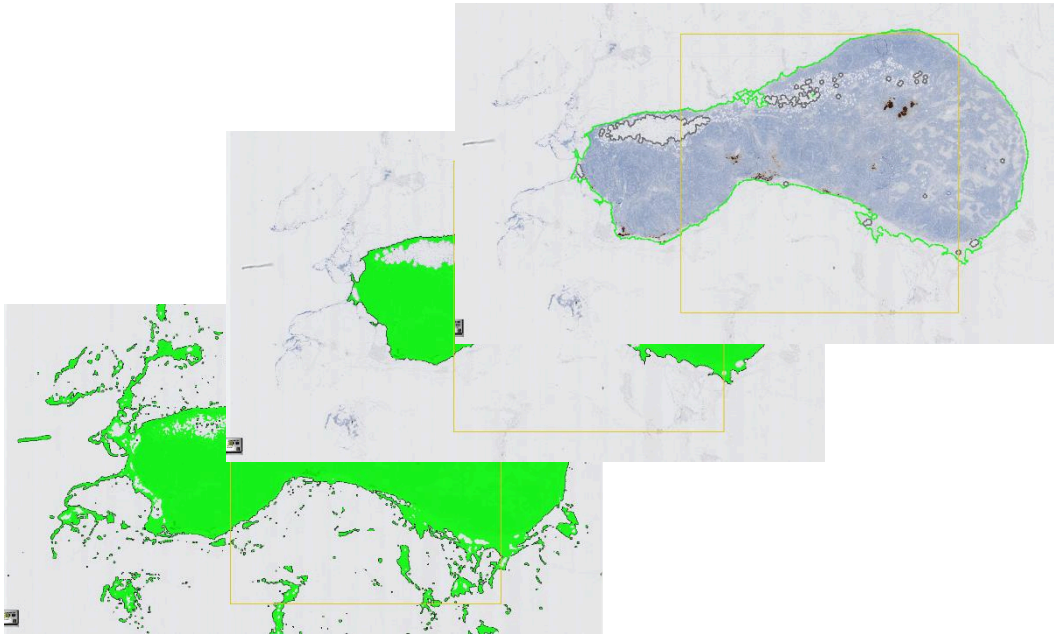
Kristina Lystlund Lauridsen

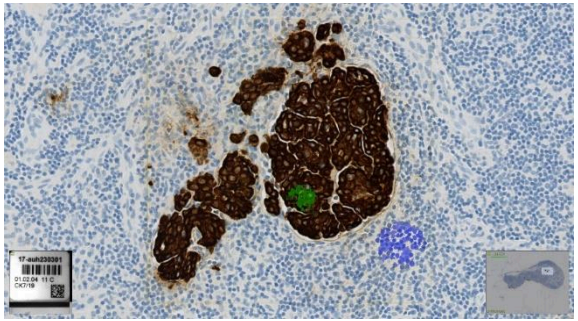
Patologi, Aarhus Universitetshospital

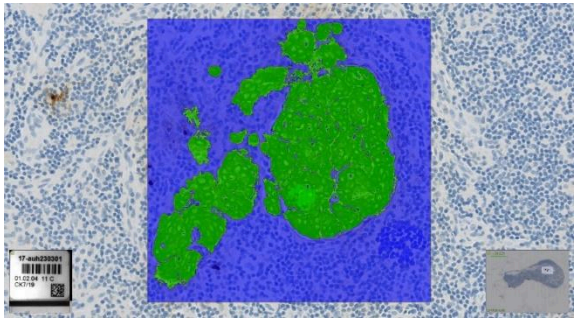
Digital patologi



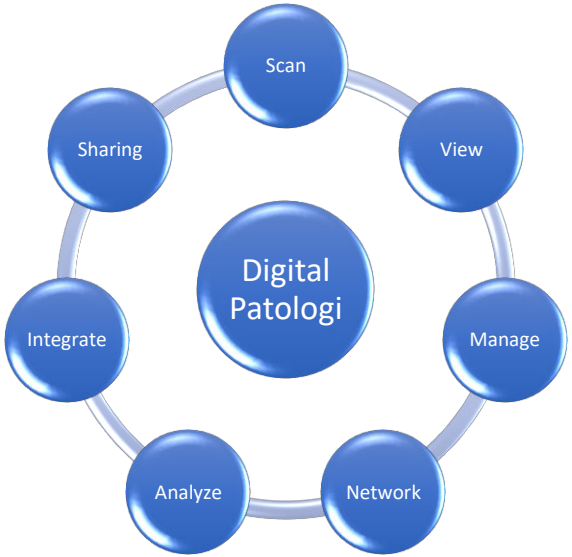
Digital billedanalyse







Samlet definition for digital patologi



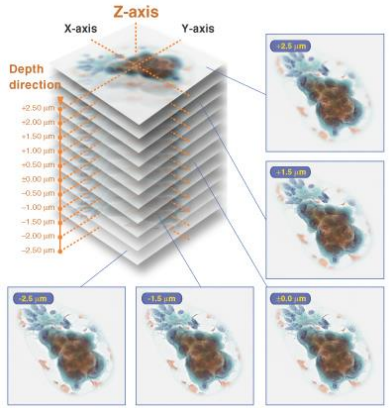
Den brede definition af digital patologi:

Alt det vi allerede gør og hvorfor det er vigtigt at huske

Skanneren

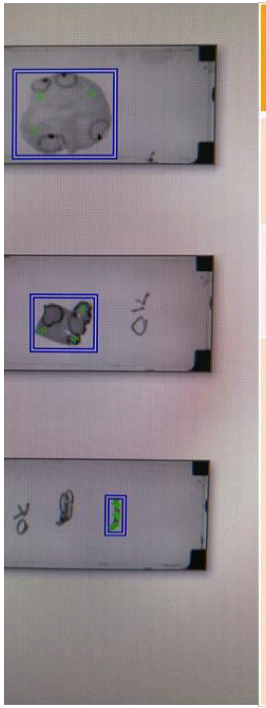
Skannertyper

- Line- og tile-skannere
- Z-stacking



Nogle overvejelser ved køb og anvendelse

- Hastighed
  - Husk at se på total skantid
  - Hvor let er den at fylde?
    - Rack eller holder
    - Tab af glas
  - Kontinuert loading
- Kvalitet
  - Fejlrate
  - Farvegengivelse
- Opløsning/forstørrelse
  - Eksempel: Hamamatsu Nanozoomer objektiv 20x/0,75NA
- Semi og/eller fuldautomatisk skanning
- Oppetid
- Antal og størrelse glas
  - OBS angående megaglas
- Fluorescens/Mega slides
- Mulighed for service og support
- Cytologi?



Vævs størrelse	20x	40x
Stor	563 MB 3,12 min	1,71 GB 5,32 min
Mellem	186 MB 1,22 min	588 MB 2,45 min
Lille	24,9 MB 0,43 min	80,2 MB 1,2 min
		HT2.0

Vævs størrelse	20x	40x
Stor	718 MB 1,02 min	2,4 GB 1,03 min
Mellem	259 MB 0,34 min	907 MB 0,34 min
Lille	33,3 MB 0,18 min	135 MB 0,18 min
		S360

Forudsætninger for god skan-kvalitet

PROBLEMER

- Artefakter
  - Flydere
  - Ridser
  - Folder
  - Montering
- Tykkelse af vævssnit
- Fedtvæv/meget svagt farvet væv
- Kalibrering/hvidbalance

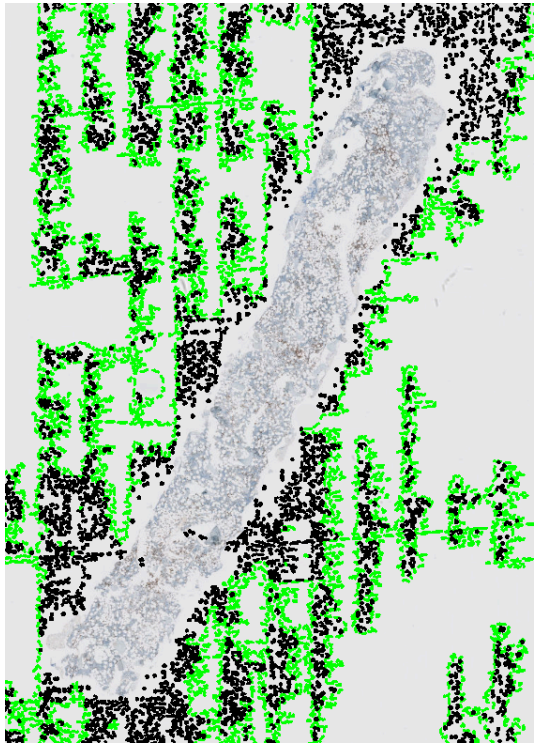
- **Hvad har i oplevet som et problem?**

HVAD KAN VI GØRE?

- Skift vandbad
- Tid til mikrotomi
- Snittykkelse
  - Mikrotomi-robotter
- Opmærksomhed på montering
- (Kvalitetskontrol indbygget i skanneren)
- Husk at kalibrere
- Hvidbalance

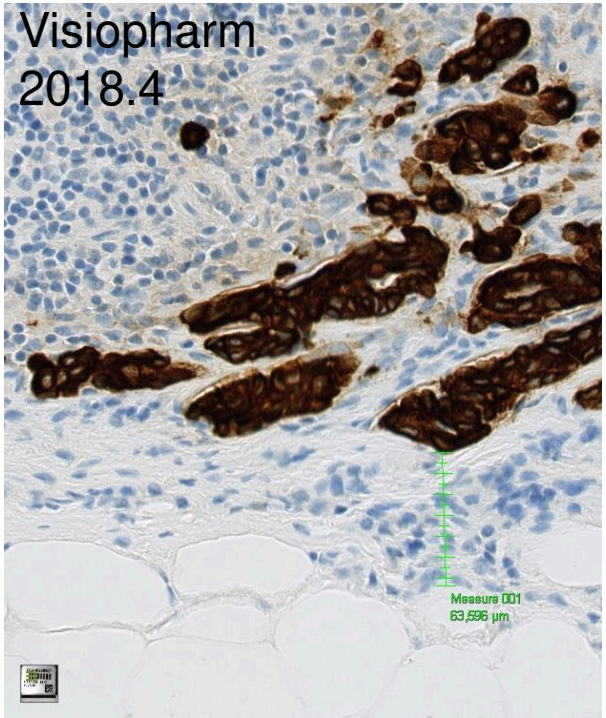
- **Har i andre løsninger?**

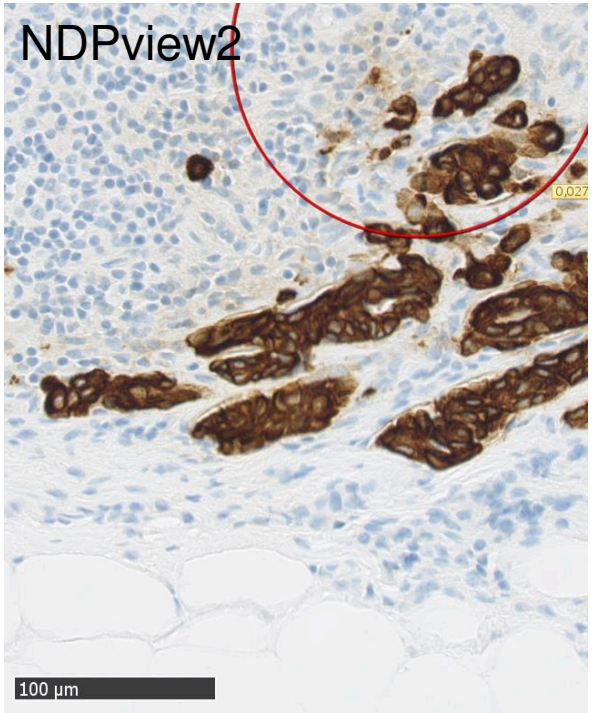
Skanner



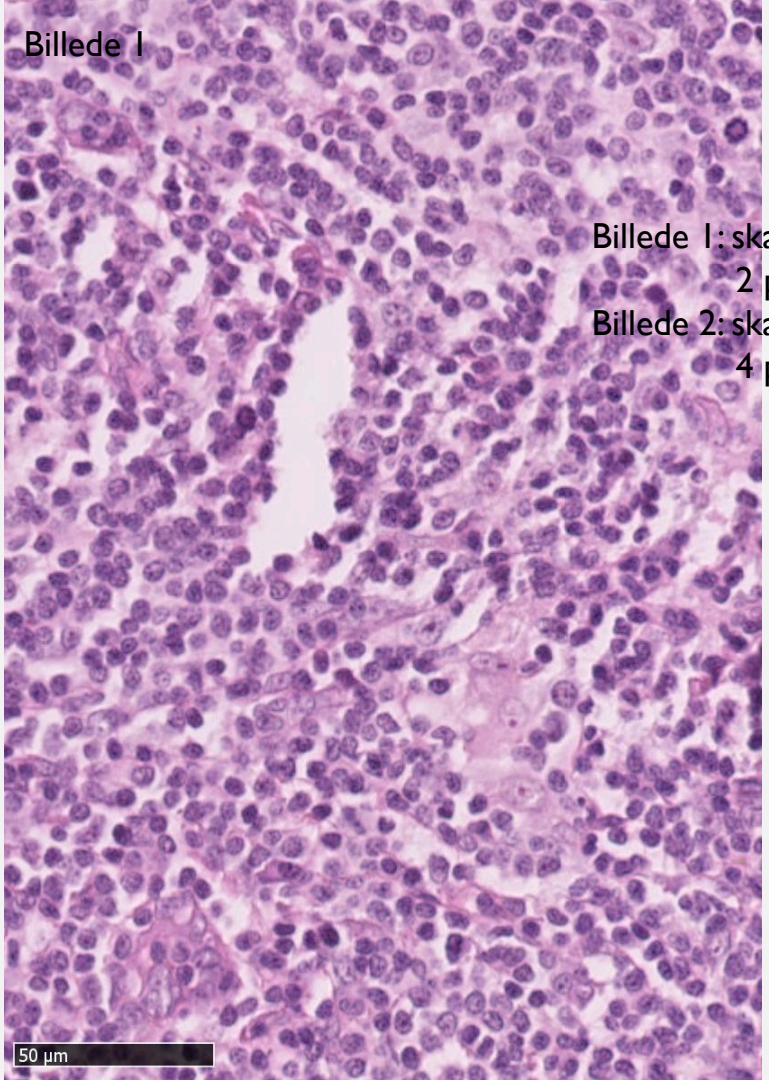
Viewer

Viewer



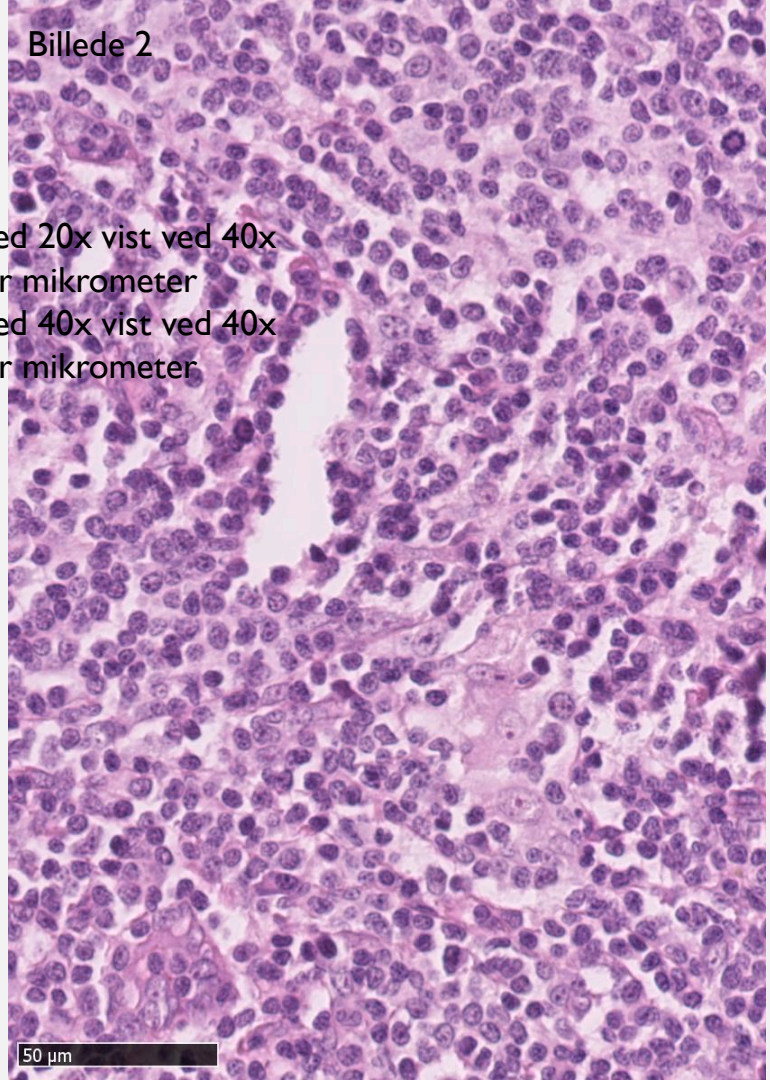


Billede 1

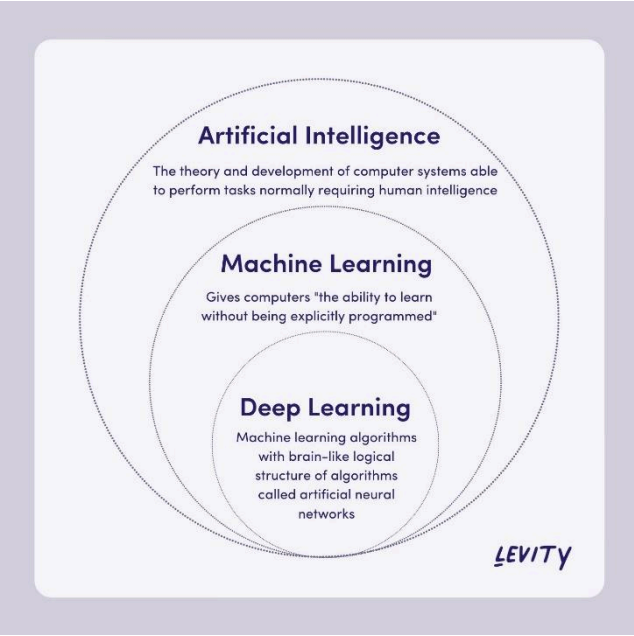


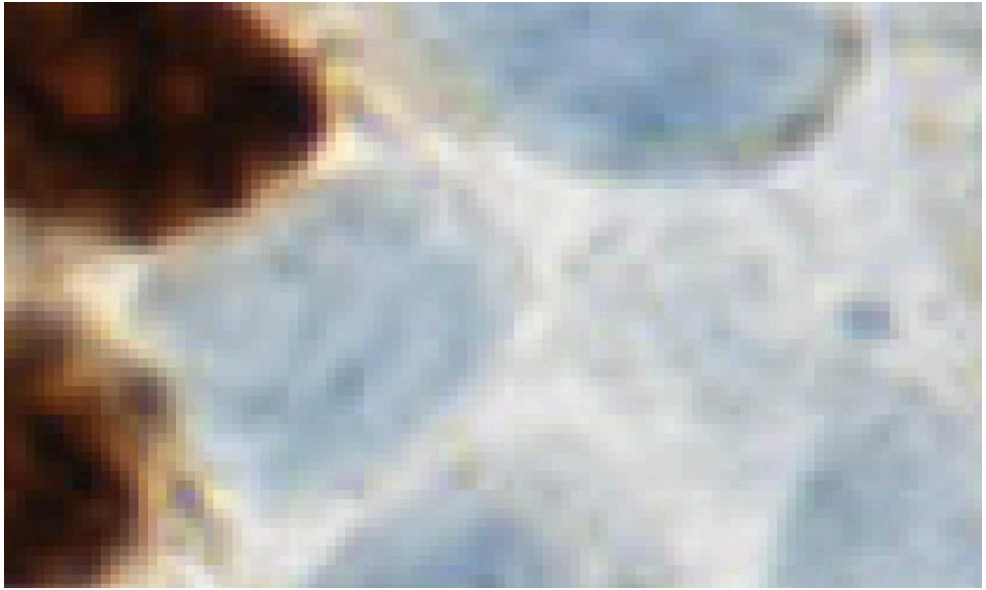
Billede 1: skannet ved 20x vist ved 40x
2 pixels pr mikrometer
Billede 2: skannet ved 40x vist ved 40x
4 pixels pr mikrometer

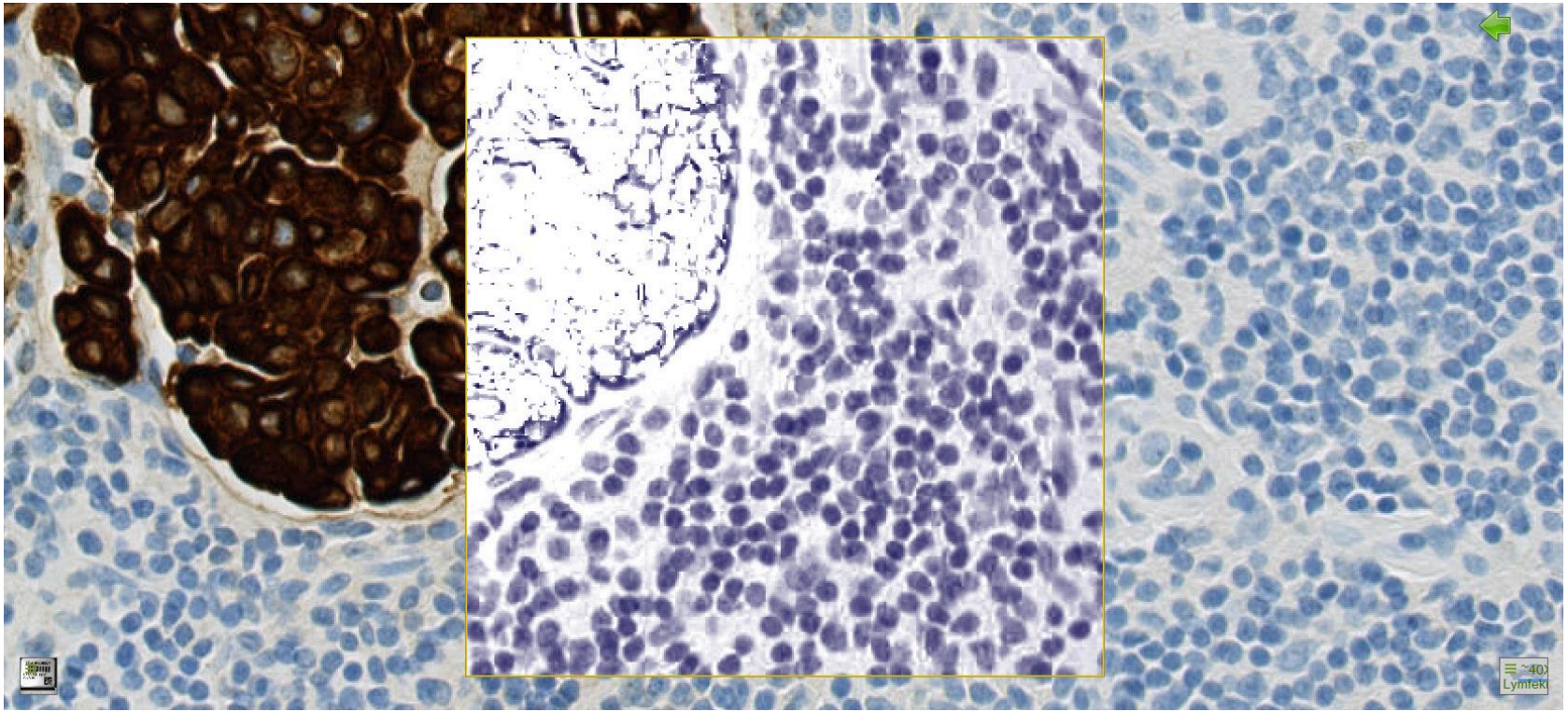
Billede 2

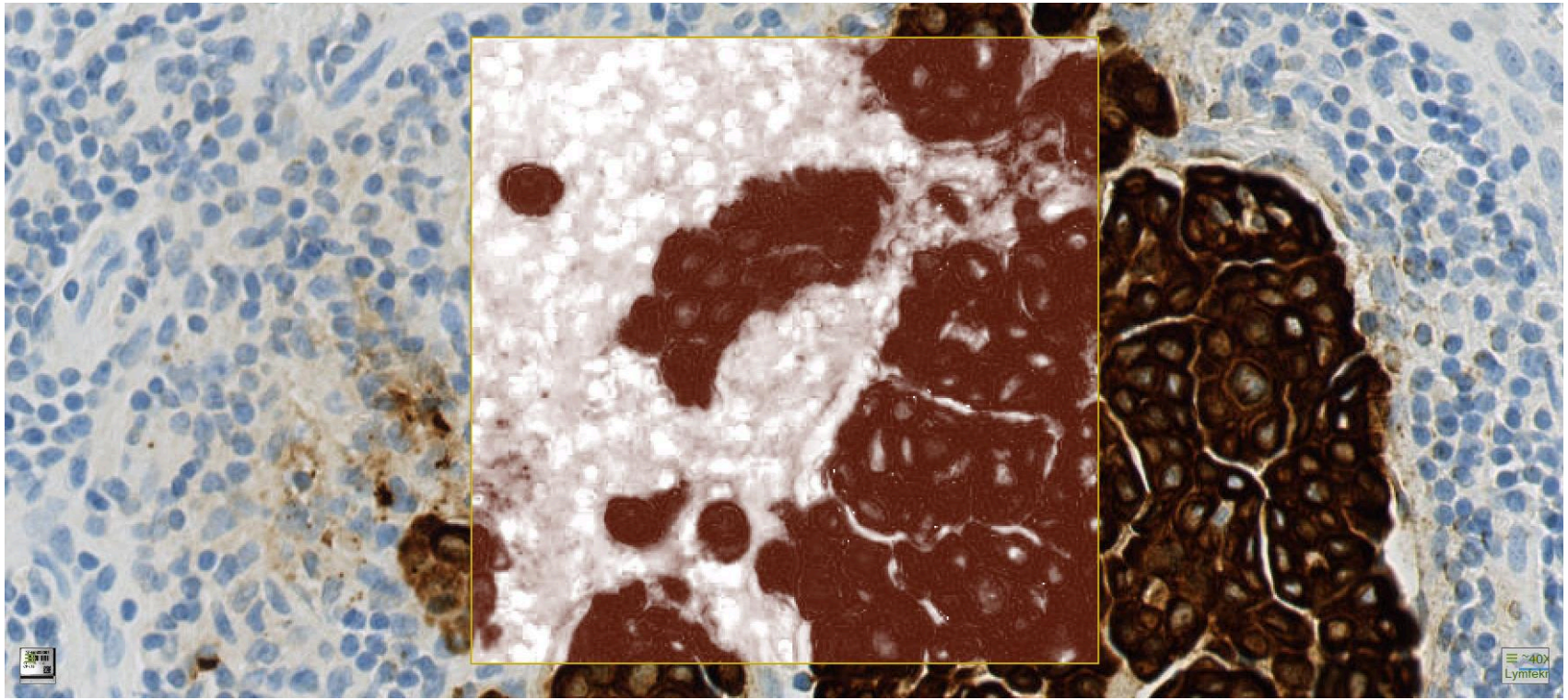


Ikke for dybt

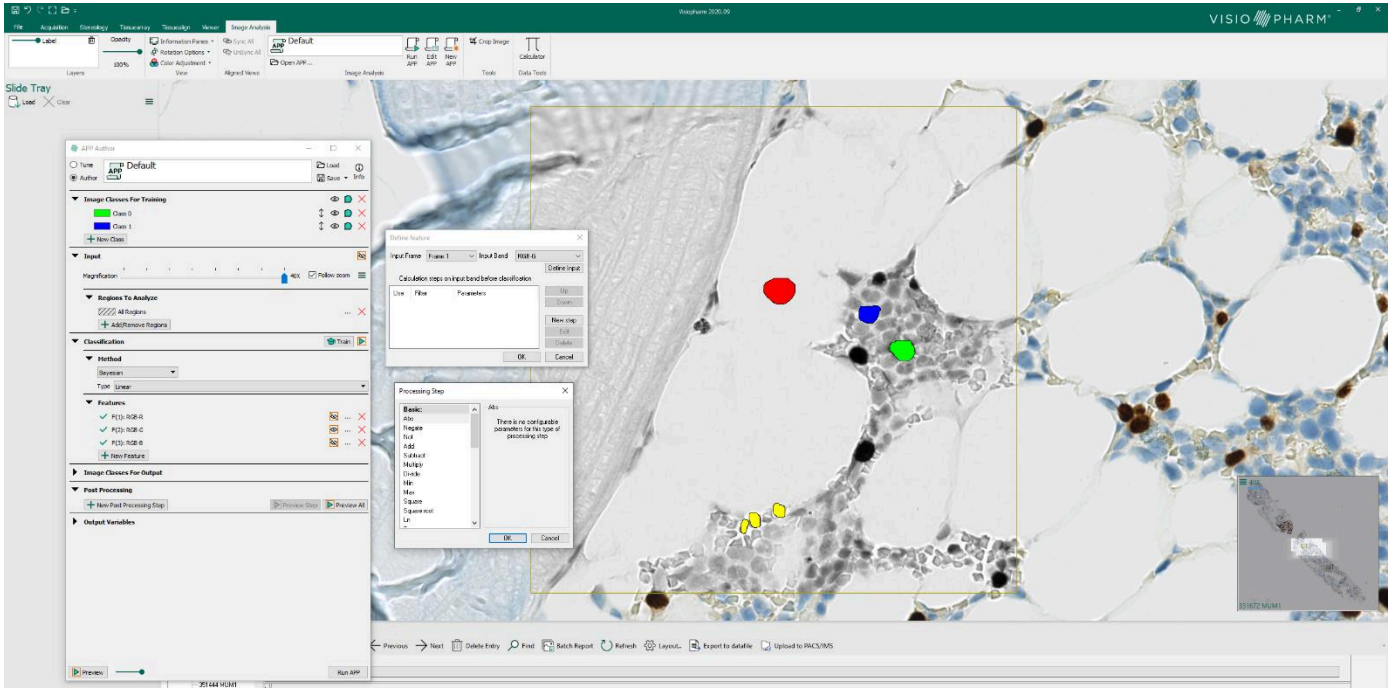








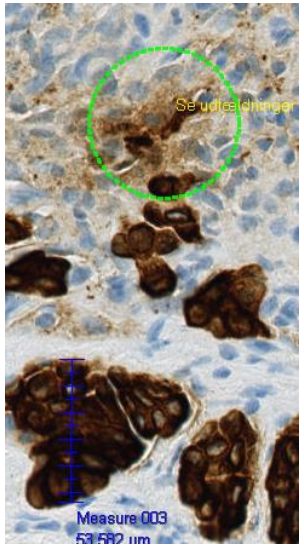
Træning af en billedanalyseprotokol (Machine learning)

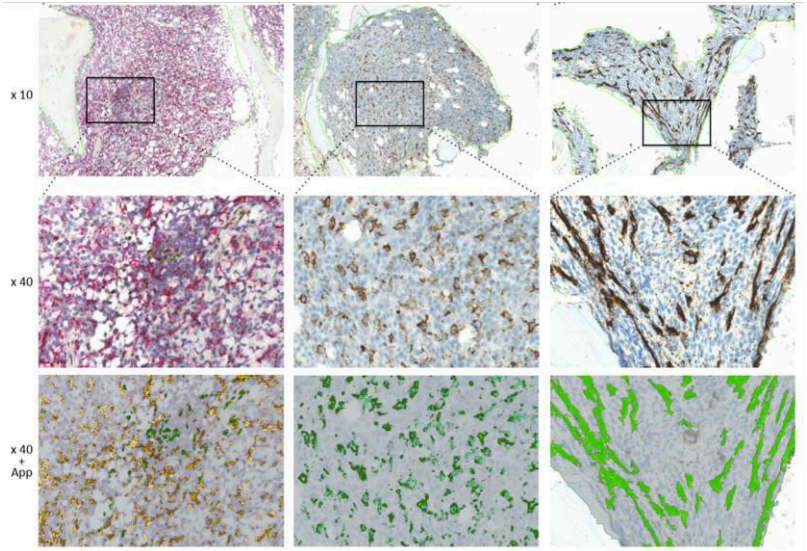


Hvorfor er digital billedanalyse en del af fremtiden?

Hvorfor vil vi anvende digital patologi?

- Dokumentation
- Reproducerbarhed
- Objektivitet

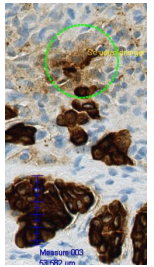


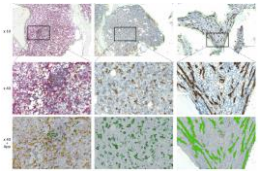


Hvorfor vil vi anvende digital patologi?

- Dokumentation
- Reproducerbarhed
- Objektivitet

- Lad os udfordre det:
  - Data mængder
  - Hvad vil og skal vi gemme?
  - Men hvad hvis billedanalyse protokollen ændres?
    - Cloud-løsninger
    - Deep-learning – livslang læring
  - Hvad er det der er objektivt?
    - At bygge en billedanalyseprotokol

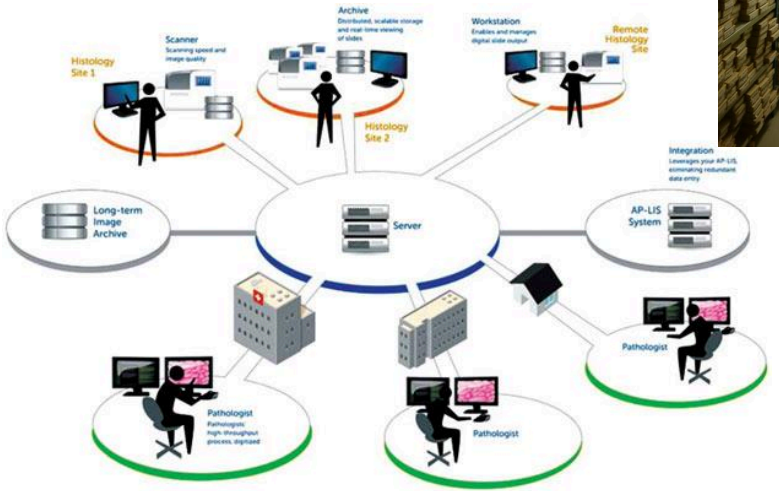




Hvorfor vil vi anvende digital patologi?

- Dokumentation
- Reproducerbarhed
- Objektivitet

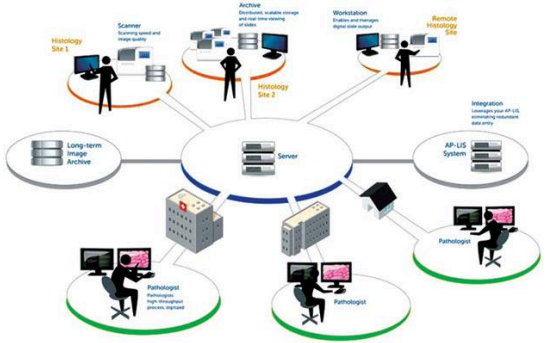
- Multidiciplinære konferencer/arkivering
- Samarbejde nationalt og internationalt
  - Telepatologi
  - Undervisning



Hvorfor vil vi anvende digital patologi?

- Multidiciplinære konferencer/arkivering
- Samarbejde nationalt og internationalt
  - Telepatologi
  - Undervisning

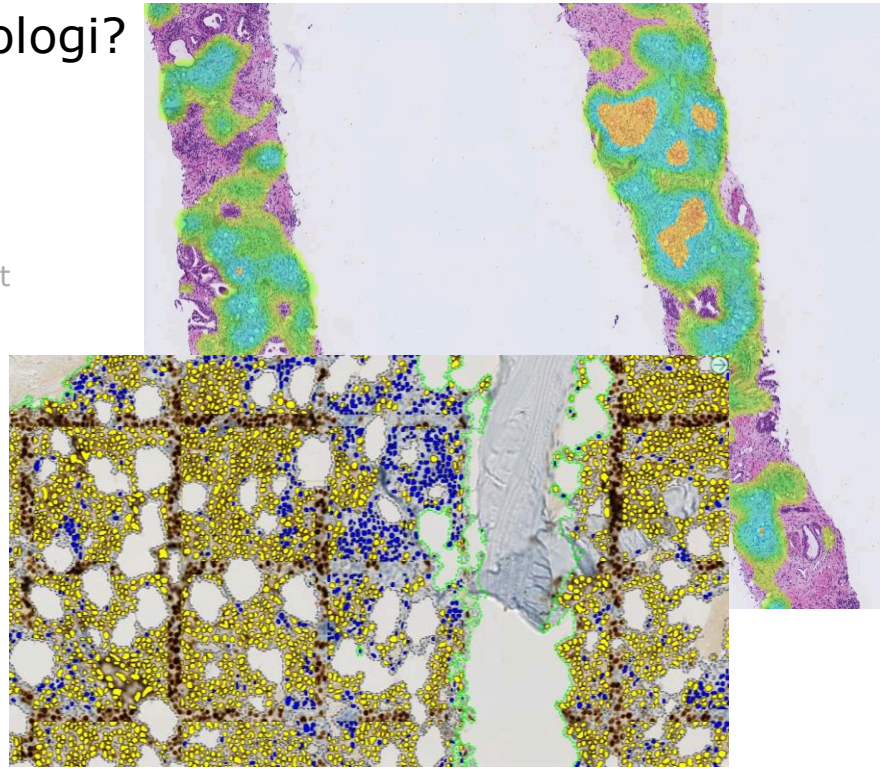
- Lad os udfordre det:
  - Arkivplads
  - Vieweren
  - Forskellige skannere
  - Billedanalyseprotokollen



Hvorfor vil vi anvende digital patologi?

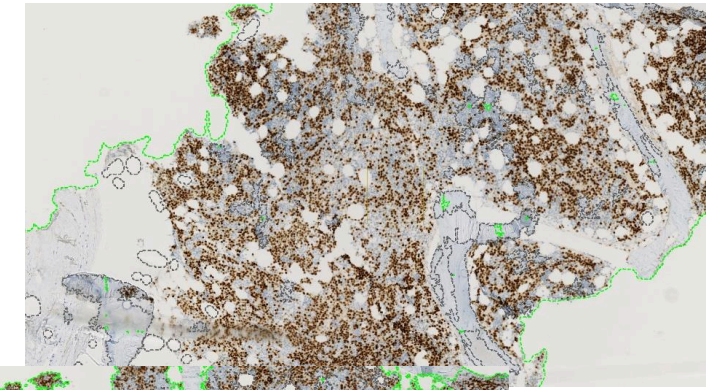
- Dokumentation
- Reproducerbarhed
- Objektivitet
- Multidiciplinære konferencer/arkivering
- Fordele arbejdsopgaver hensigtsmæssigt nationalt og internationalt
  - Telepatologi
  - Undervisning

- Opgaveglidning
- Tidsbesparende - triagering
- Kvalitetssikring
- Behandlingsbestemmende, prognostiske
- og diagnostiske analyser

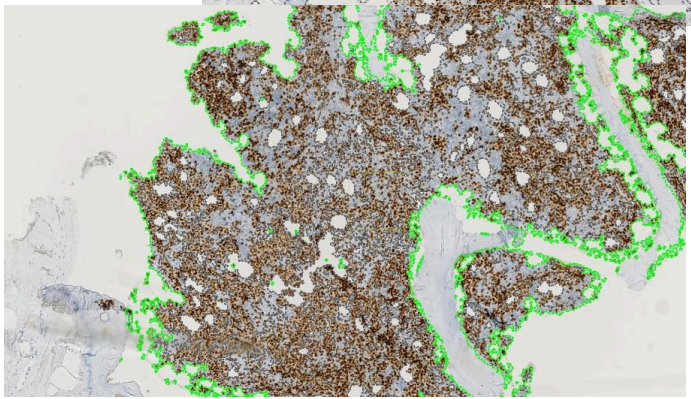


Hvorfor vil vi anvende digital patologi?

- Opgaveglidning
- Tidsbesparende - triagering
- Kvalitetssikring
- Behandlingsbestemmende, prognostiske og diagnostiske analyser



- Lad os udfordre det:
  - Region of Interest
  - Tidsbesparende?
  - Vi skal være kritiske – diagnostisk?
  - Hvordan passer det ind i flow i vores laboratorier



Hvorfor vil vi anvende digital patologi?

- Dokumentation
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- Objektivitet
- Multidiciplinære konferencer/arkivering
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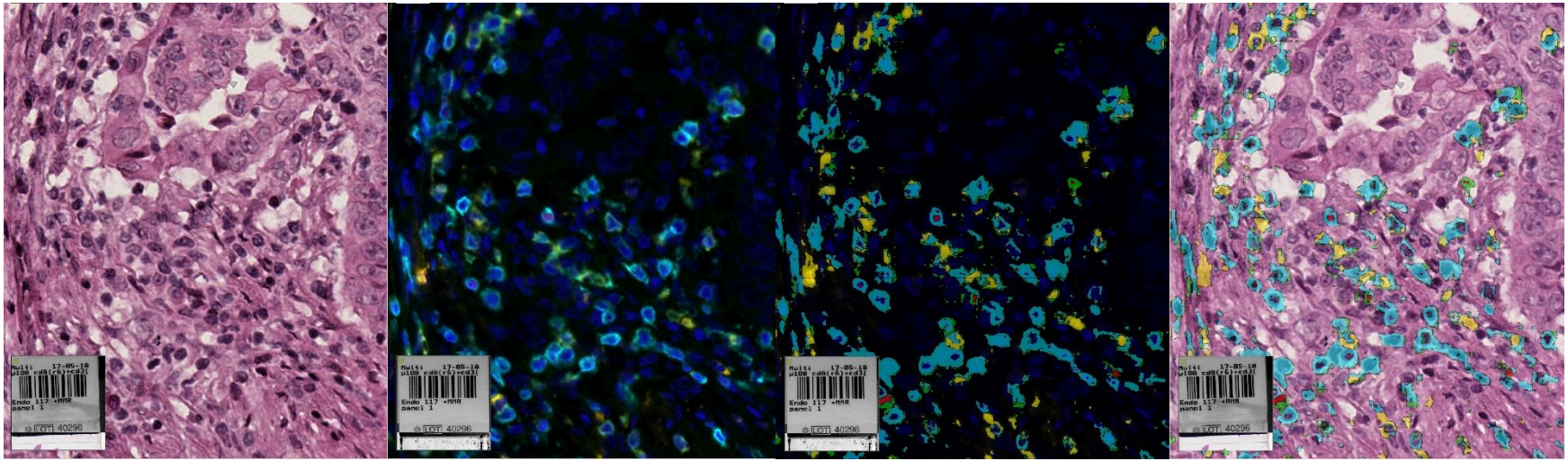
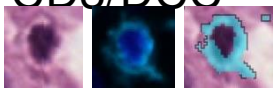
  - Telepatologi
  - Undervisning
- Opgaveglidning
- Behandlingsbestemmende, prognostiske og diagnostiske analyser

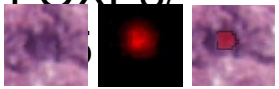
- Fluorescens og multiple kromogener
- Forskning



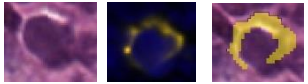
CD3/DCC



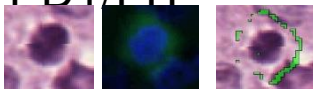
FOXP3/



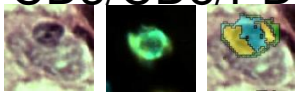
CD8/Rhodamin6



PD1/FIT



CD3/CD8/PD1



Hvorfor vil vi anvende digital patologi?

- Fluorescens og multiple kromogener
- Forskning

- Lad os udfordre det:
  - Skantider

Et eksempel på digital billedanalyse

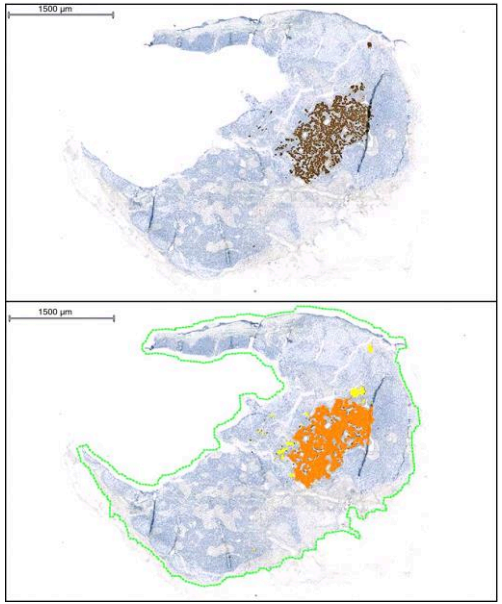
Application of automated image analysis reduces the workload of manual screening of sentinel lymph node biopsies in breast cancer

- Rigshospitalet
- Sygehus Sjælland
- Odense Universitetshospital
- Sentinel Lymph Node
- 135 pt – 900 glas
- 3 forskellige cytokeratin immunhistokemiske farvninger
- Skannet centralt – 1 algoritme tilpasset de 3 immunhistokemiske farvninger

Henrik Holten-Rossing Maj-Lis Møller Talman Anne Marie Bak Jylling
Anne-Vibeke Lænkholm Martin Kristensson Ben Vainer

Aarhus University Hospital

Application of automated image analysis reduces the workload of manual screening of sentinel lymph node biopsies in breast cancer



Skankvalitet blev undersøgt manuelt – ingen omtale af niveauet af behov for omskanning

Application of automated image analysis reduces the workload of manual screening of sentinel lymph node biopsies in breast cancer, Volume: 71, Issue: 6, Pages: 866-873,
First published: 05 July 2017, DOI: (10.1111/his.13305)

Application of automated image analysis reduces the workload of manual screening of sentinel lymph node biopsies in breast cancer

All SLN slides	DIA			
Manual assessment		**Negative**	**Positive**	**Total**
	Negative	524	237	761 (84.6%)
	Positive	0	139	139 (15.4%)
	Total	524 (58.2%)	376 (41.7%)	900
Percentage agreement				73.7%

Falsk positive

Ingen falsk negative – sensitivitet på 100%

Reduktion i arbejdsmængde ca. 60%

Ingen glas blev ekskluderet fra studiet pga. artefakter

Table 3. Agreement between manual assessment and digital image analysis (DIA); note that DIA revealed no false negatives

Application of automated image analysis reduces the workload of manual screening of sentinel lymph node biopsies in breast cancer

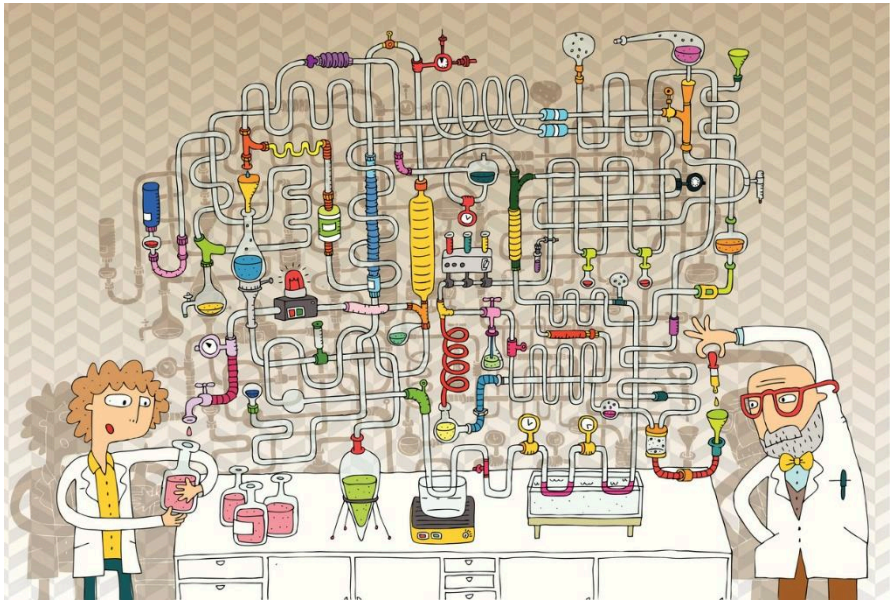
Time study, *n* = 12 (18 FFPE blocks)	Time/block
Total time spent (conventional microscopy):	76.0 min
Average time per block:	4.22 min
Average number of blocks per patient undergoing sentinel lymph node surgery	1.63
Average time spent on sentinel lymph node biopsy microscopy	6.88 min
Workload reduced to an average of:	2.88 min per patient

Rigshospitalet 2016: 580 pt med SN Eksklusion af ca. 60% af arbejdsbyrden svarende til 39 timers arbejde.

Table 4. Work required for digital image analysis versus manual assessment with a conventional microscope

Application of automated image analysis reduces the workload of manual screening of sentinel lymph node biopsies in breast cancer

Contaminating, CK-positive epithelial cells would result in a false-positive stain and, in a worst-case scenario, be misdiagnosed as positive for metastases. As such artefacts are unlikely to be excluded entirely, it is vital for the pathologist to assess the slides deemed to be positive by the digital algorithm, by using either a conventional microscope or the already scanned slides in a virtual or digital solution. Other artefacts, such as dirt, coverslip glue, hair, staining variation, and cross-reactions of the CK cocktails with endothelial cells or dendritic reticulum cells, also contributed to the large number of false-positive slides.



Tak og fortsat god dag!