

Artificial Intelligence in de (nefro)pathologie

Jeroen van der Laak



Notice of financial disclosure

Philips	SAB	Honorarium
Philips	Research collab.	Remuneration
ContextVision	SAB	Honorarium
Sectra	Research collab.	Grant



U.S. Department of Health and Human Services



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FDA News Release

FDA allows marketing of first whole slide imaging system for digital pathology

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For Immediate Release

April 12, 2017

Release

The U.S. Food and Drug Administration today permitted marketing of the Philips IntelliSite Pathology Solution (PIPS), the first whole slide imaging (WSI) system that allows for review and interpretation of digital surgical pathology slides prepared from biopsied tissue. This is the first time the FDA has permitted the marketing of a WSI system for these purposes.

Inquiries

Media

[✉ Stephanie Caccomo](#)
[☎ 301-348-1956](#)

Consumers

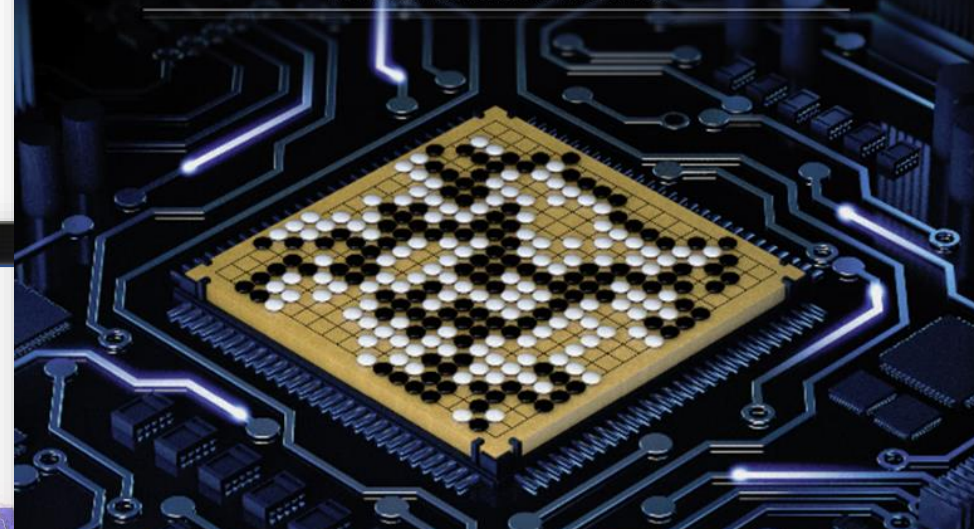
[☎ 888-INFO-FDA](#)

Related Information

- [FDA: Medical Devices](#)
- [FDA: Office of In Vitro Diagnostics and Radiological](#)

nature

THE INTERNATIONAL WEEKLY JOURNAL OF SCIENCE



At last — a computer program that
can beat a champion Go player **PAGE 484**

ALL SYSTEMS GO

CONSERVATION

SONGBIRDS À LA CARTE

Illegal harvest of millions
of Mediterranean birds

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RESEARCH ETHICS

SAFEGUARD TRANSPARENCY

Don't let openness backfire
on individuals

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POPULAR SCIENCE

WHEN GENES GOT 'SELFISH'

Dawkins' is calling
card forty years on

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NATURE.COM/NATURE

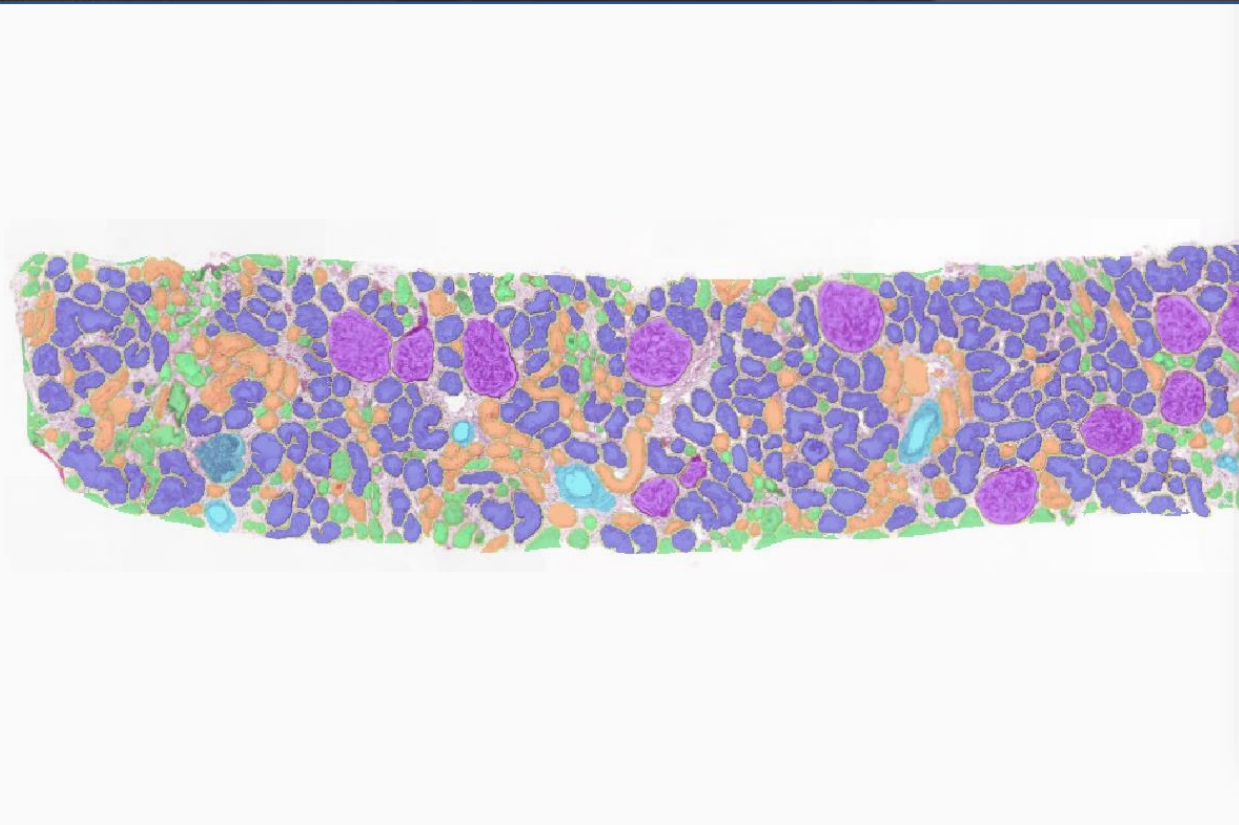
26 January 2015 £9

ISSN 0028-0836

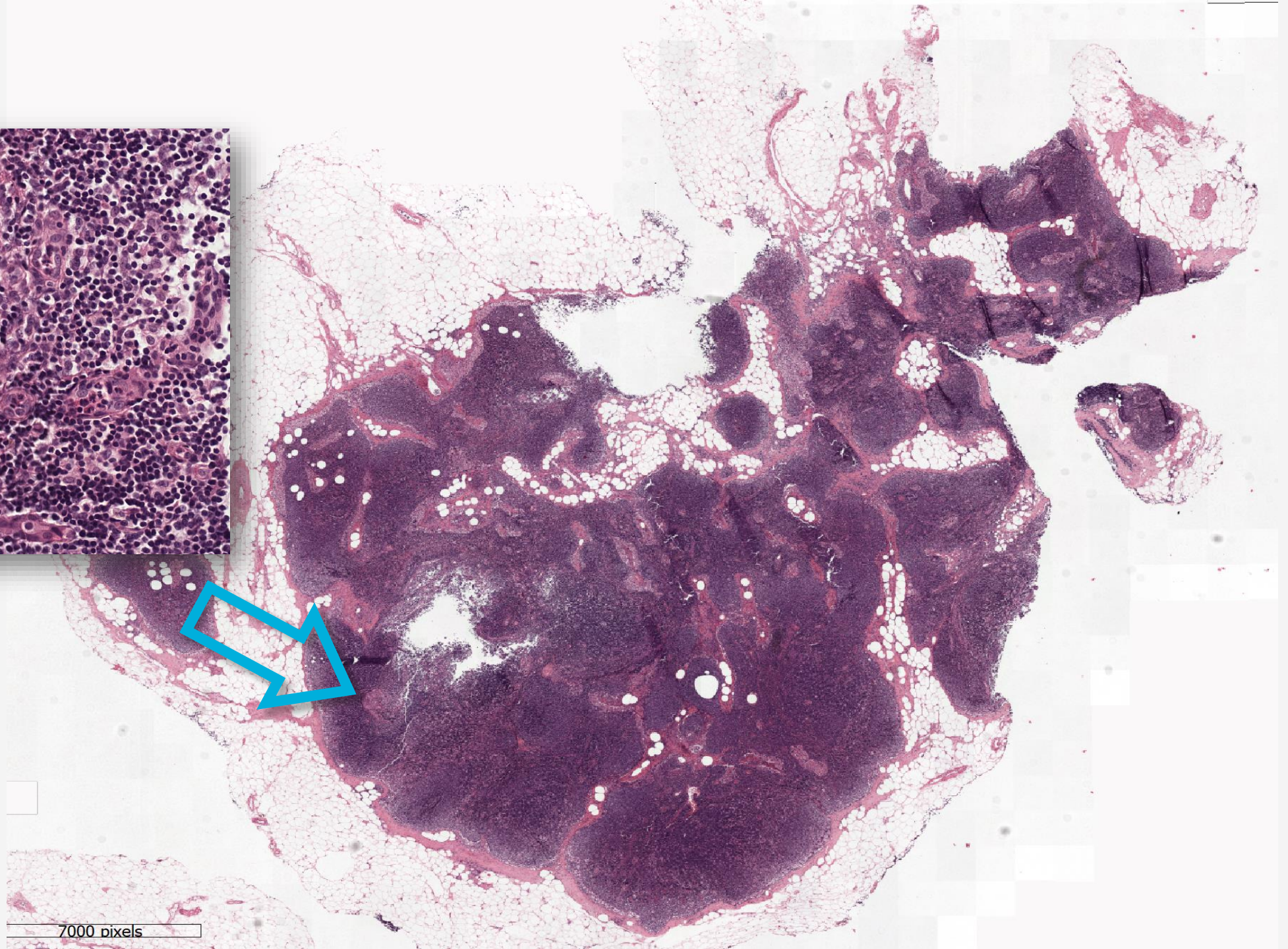
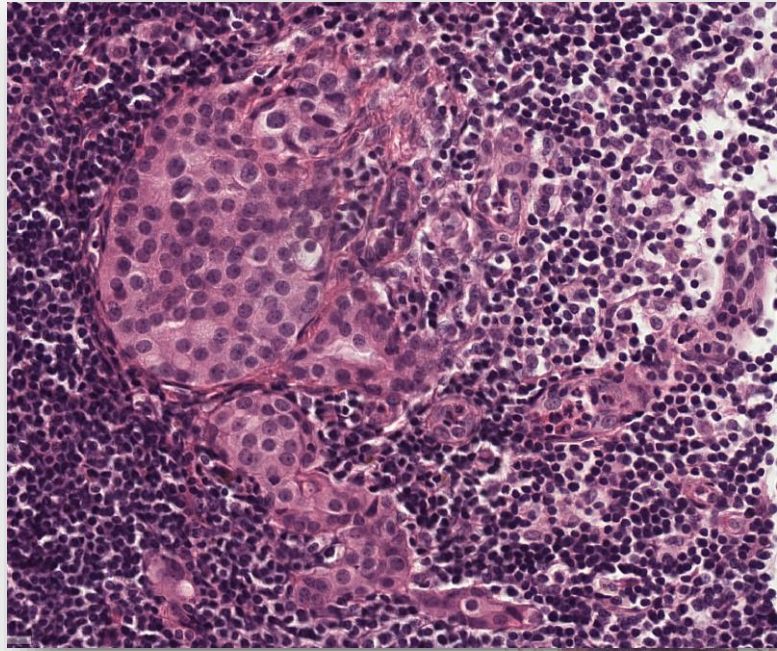


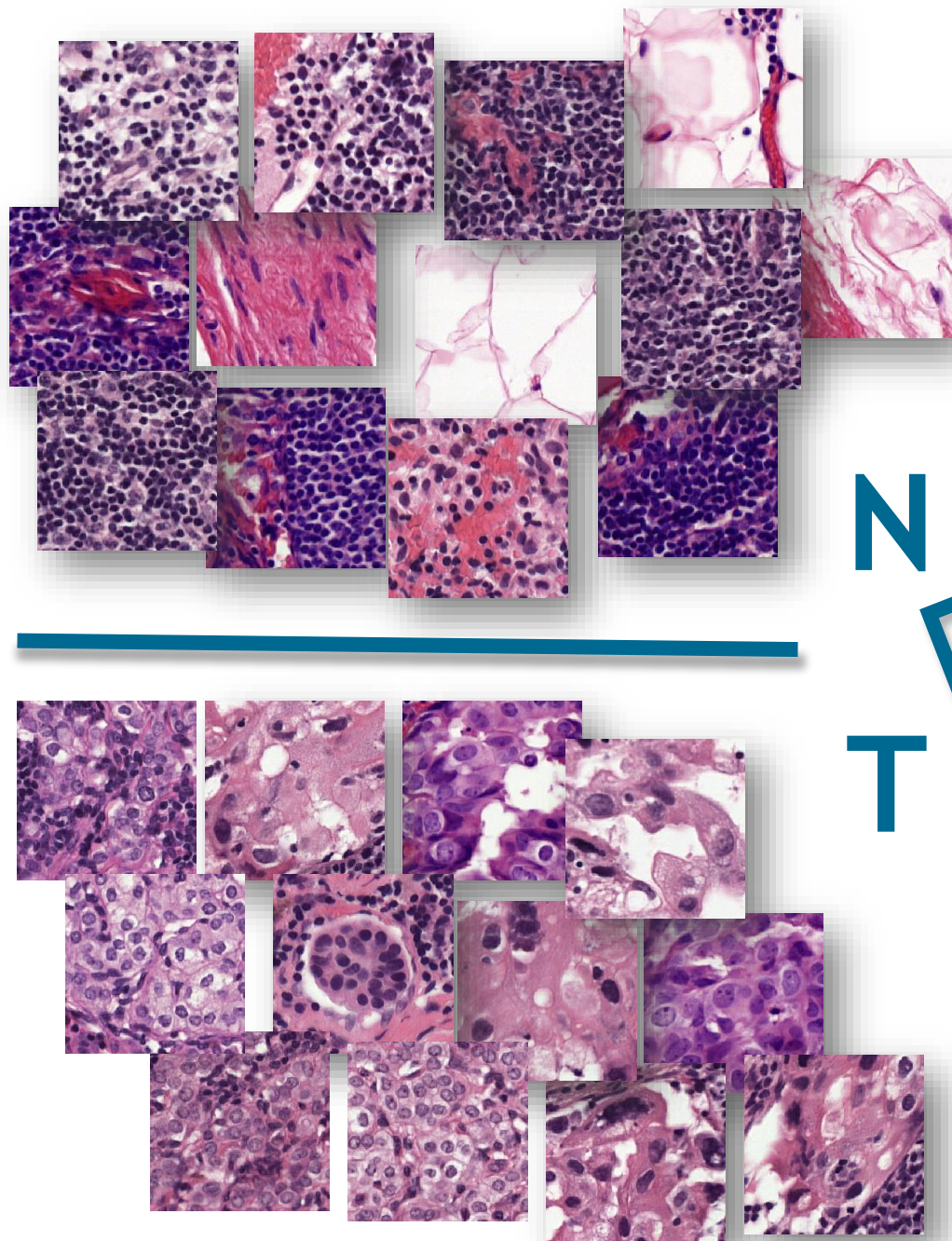
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LED monitor



acer





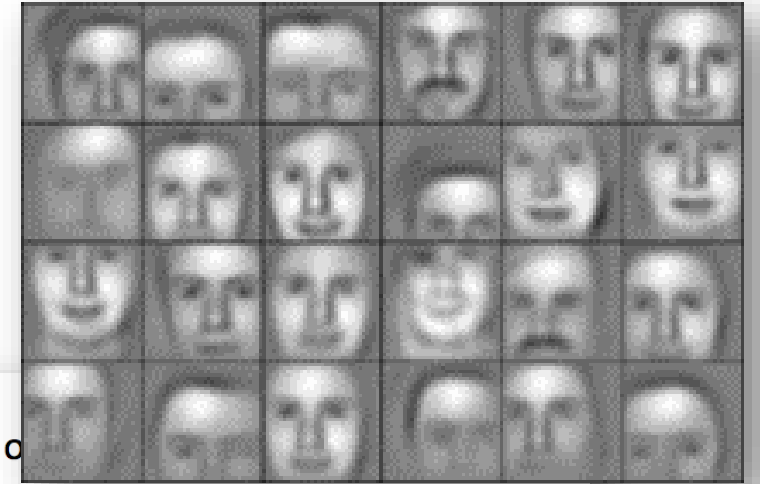
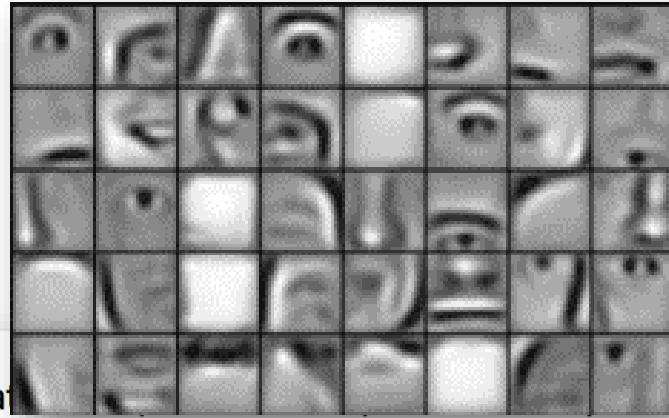
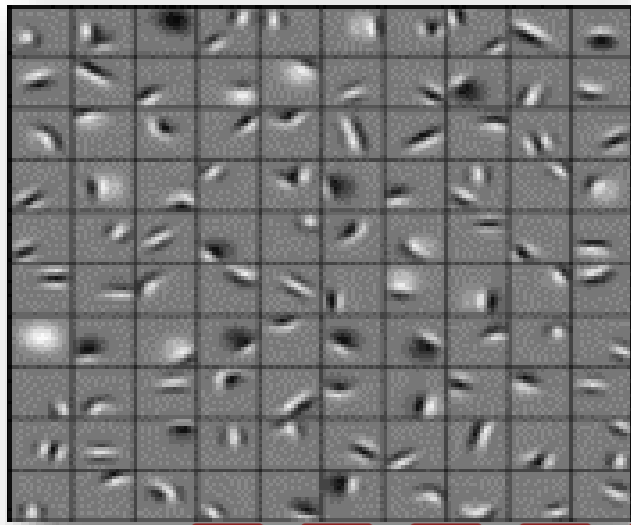
N

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Neural
network

Error

T / N



5x5
convolution

2x2
subsampling

5x5
convolution

2x2
subsampling

feature extraction

fully
connected

classification

14 x 14

10 x 10

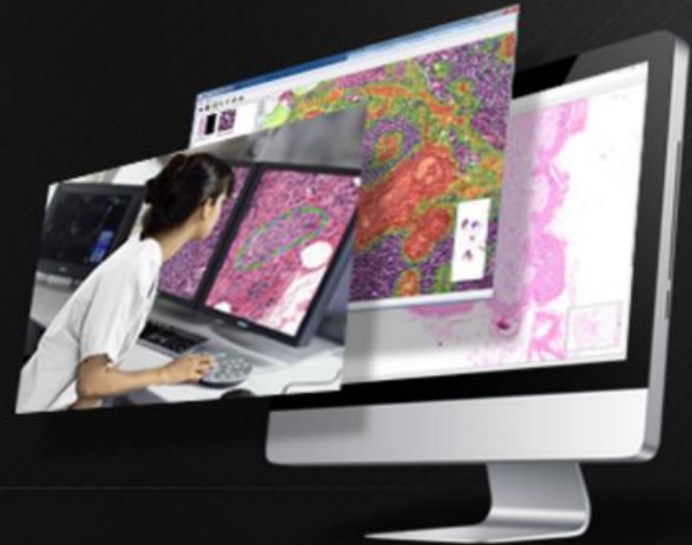
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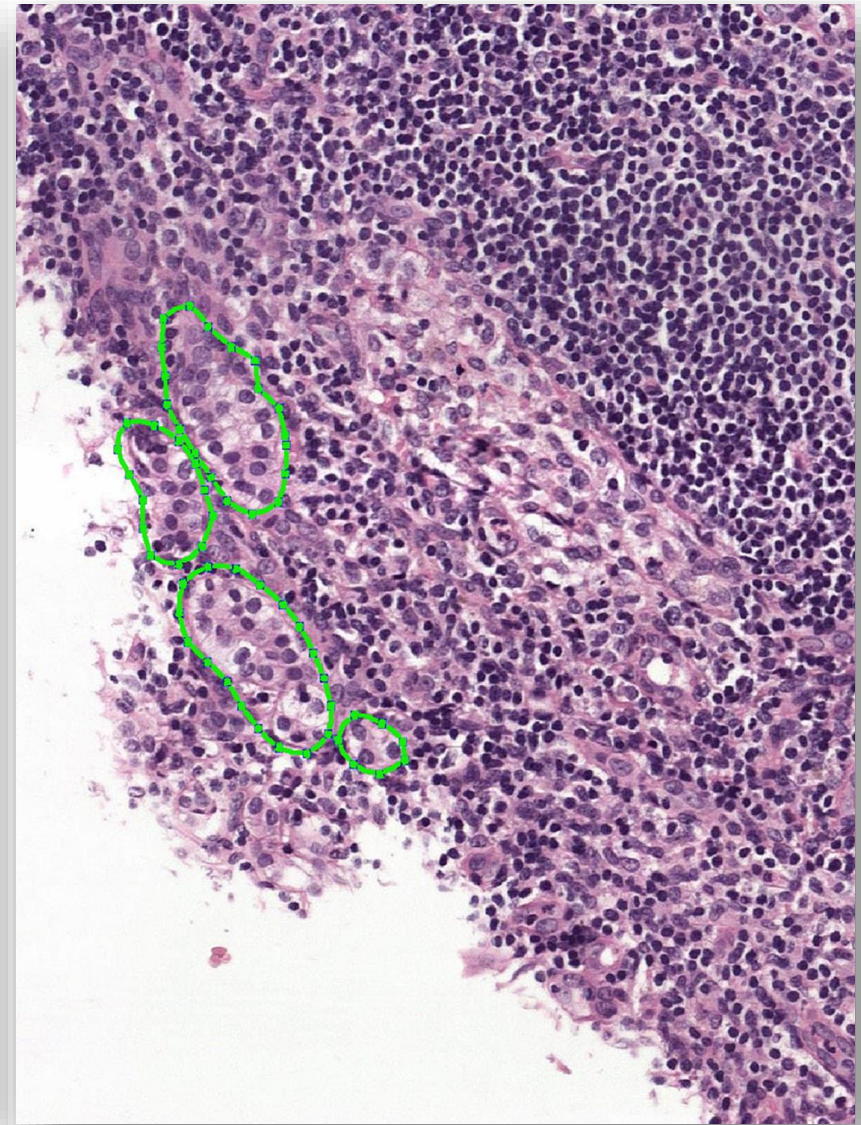
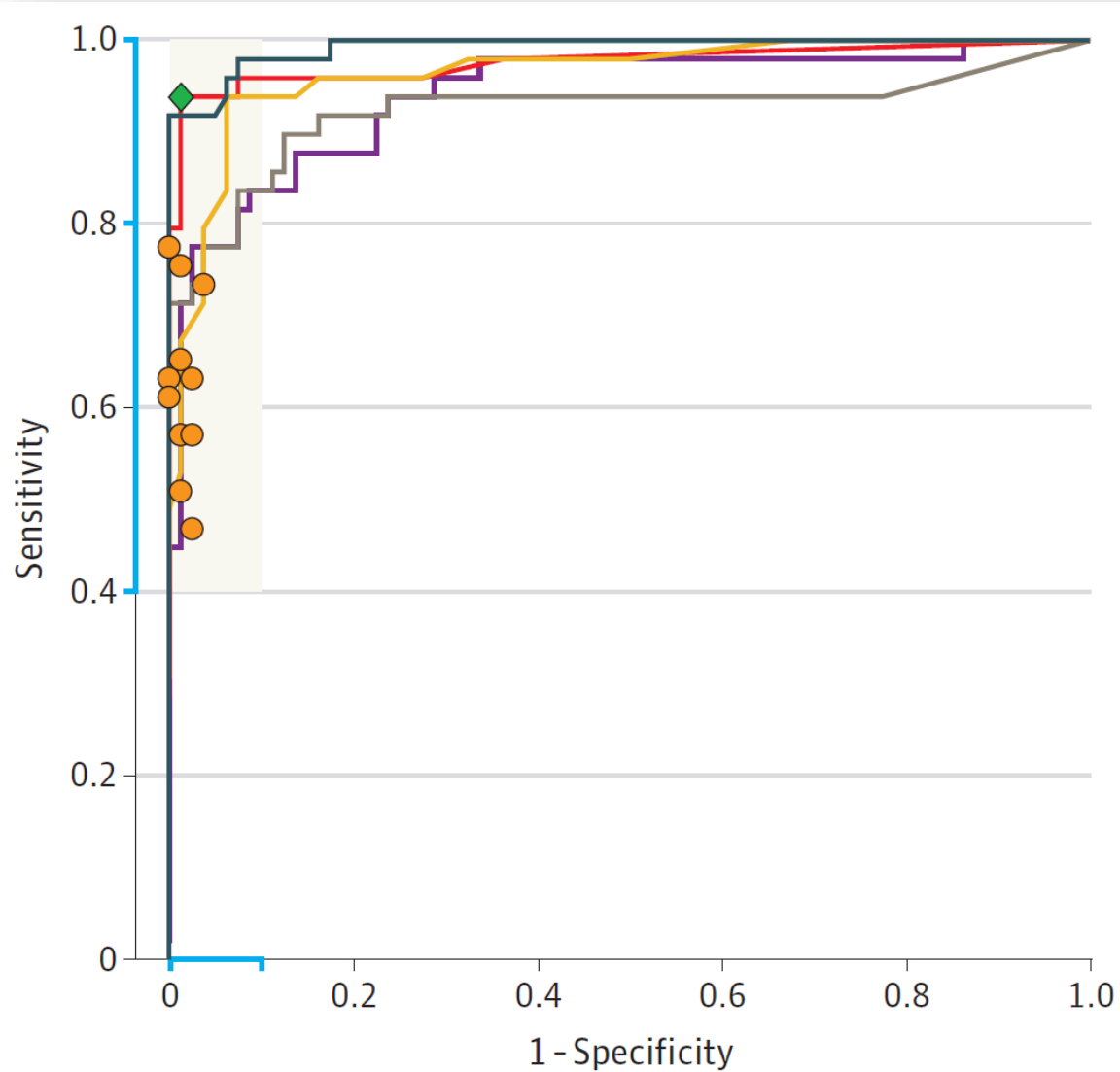
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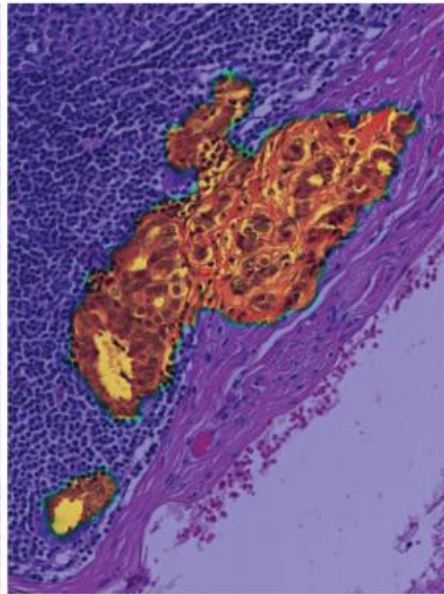
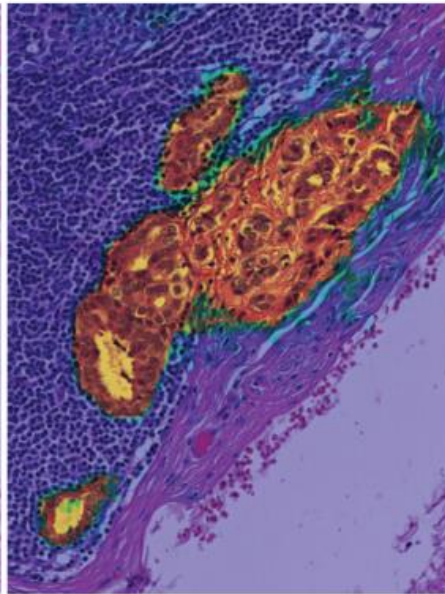
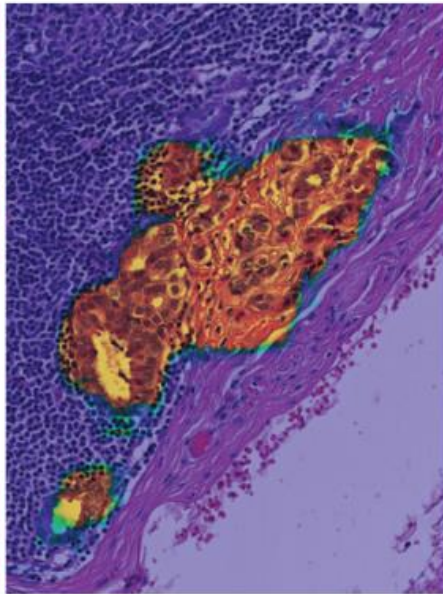
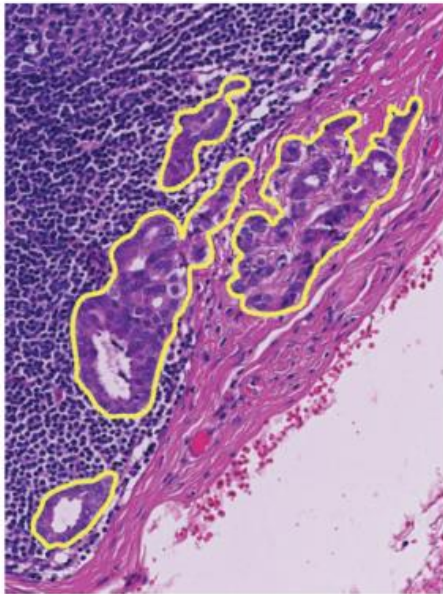
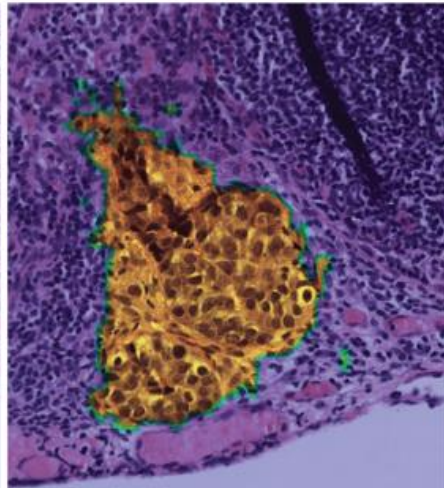
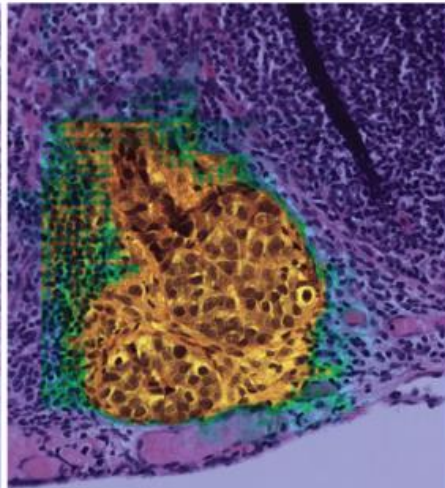
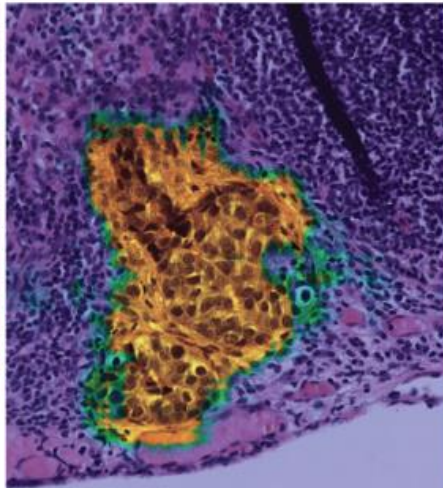
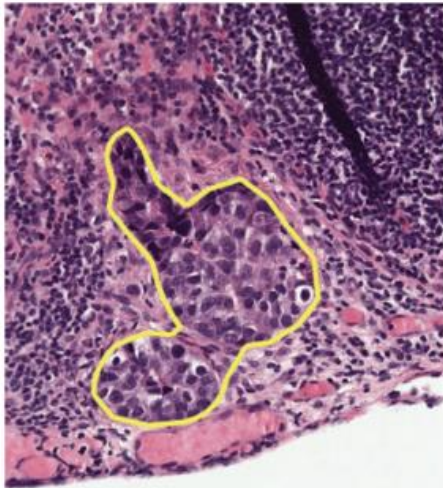


ISBI challenge on cancer metastasis detection in lymph node





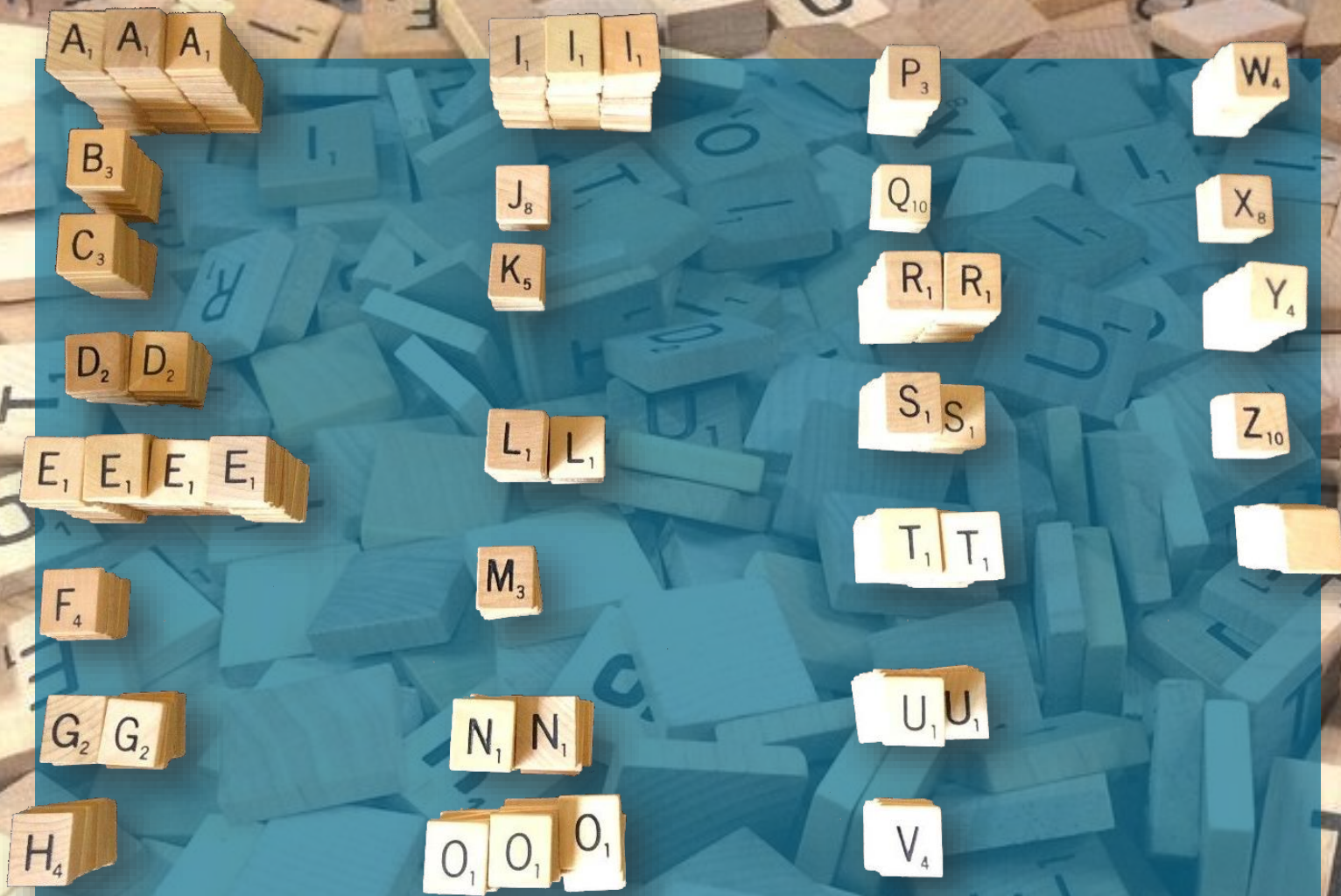
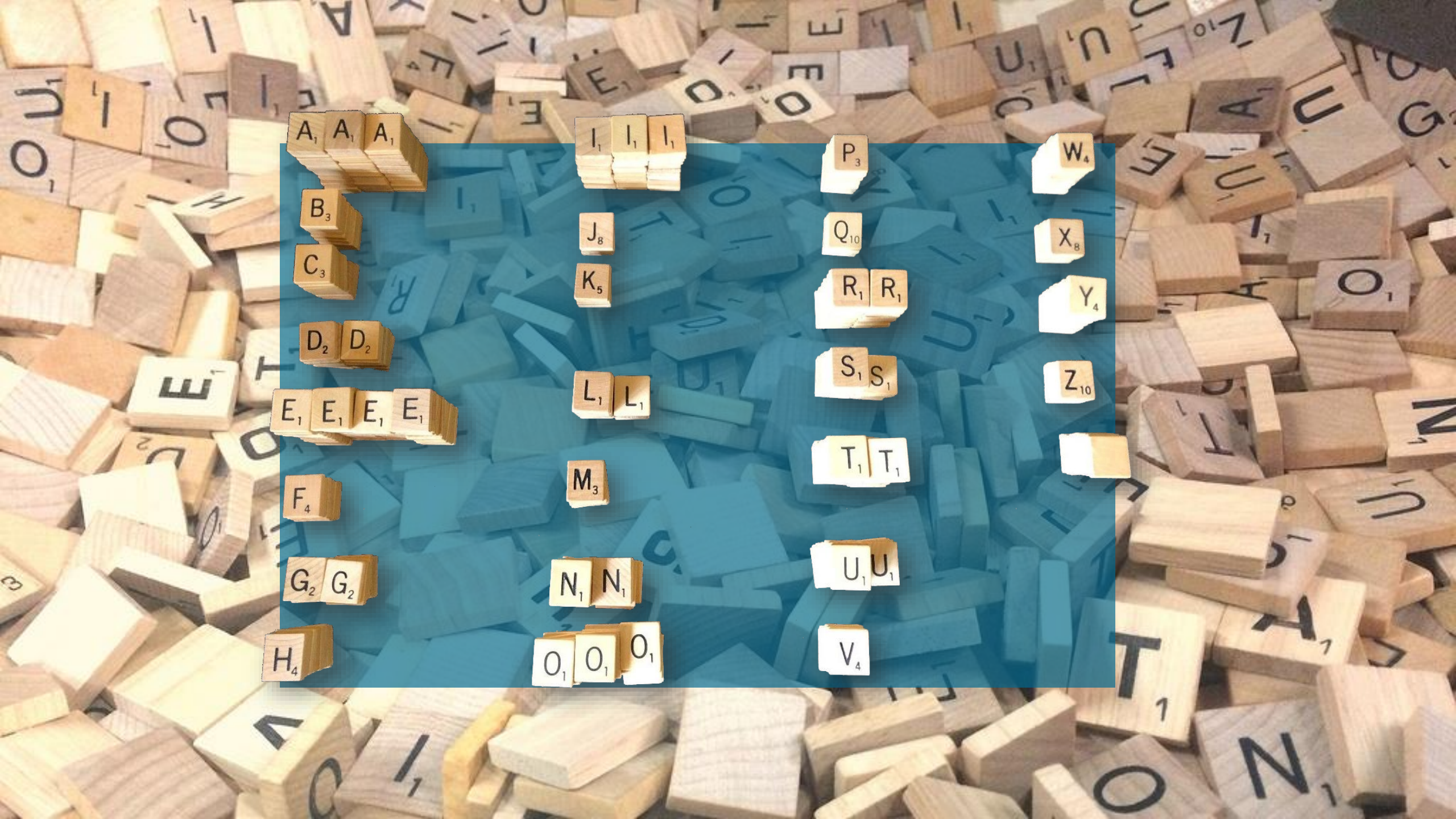
Ehteshami Bejnordi B, et al. Diagnostic assessment of deep learning algorithms for detection of lymph node metastases in women with breast cancer. *JAMA* 318: 2199-2210, 2017.

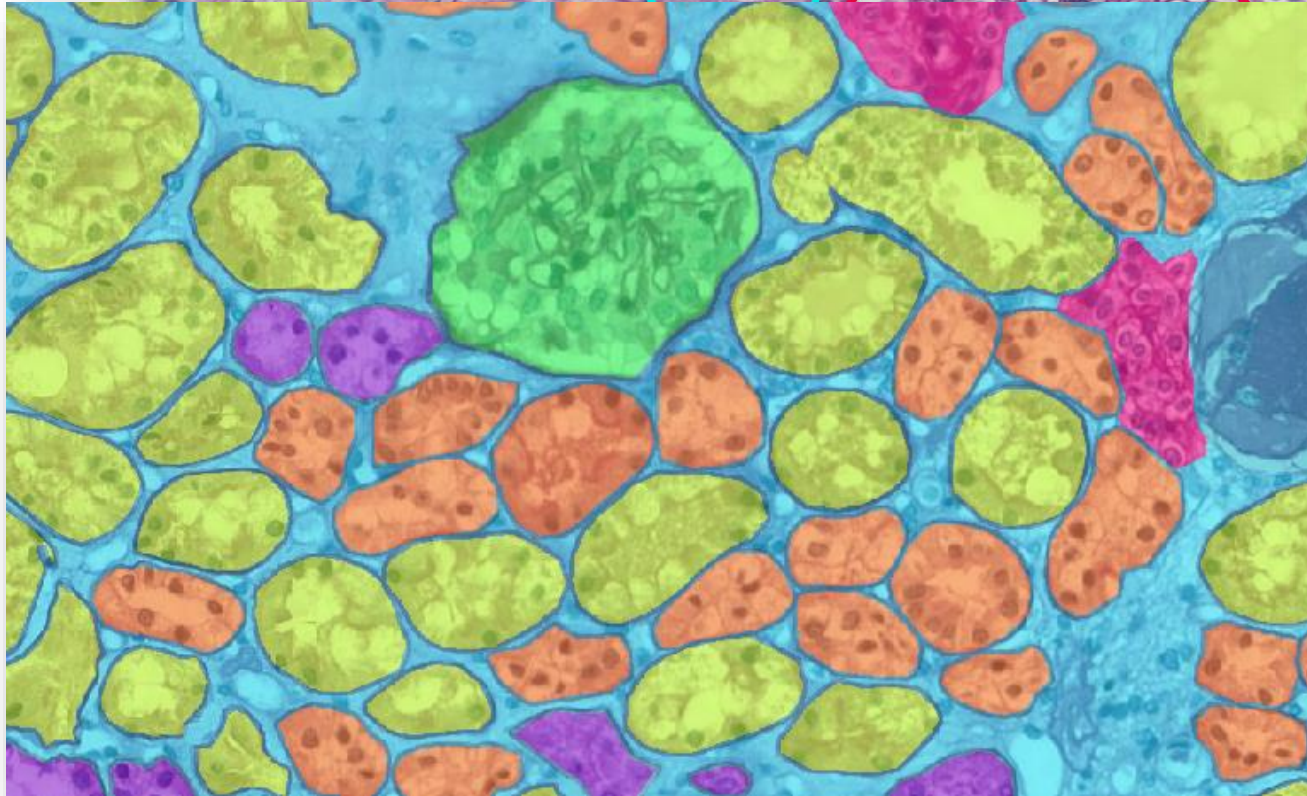
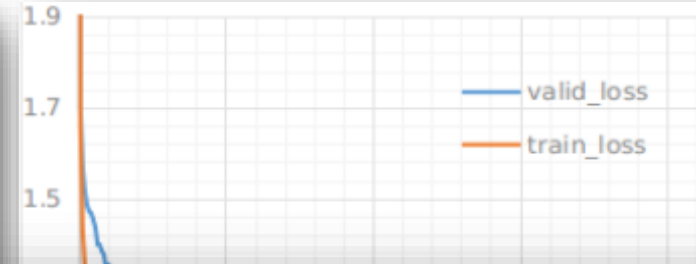
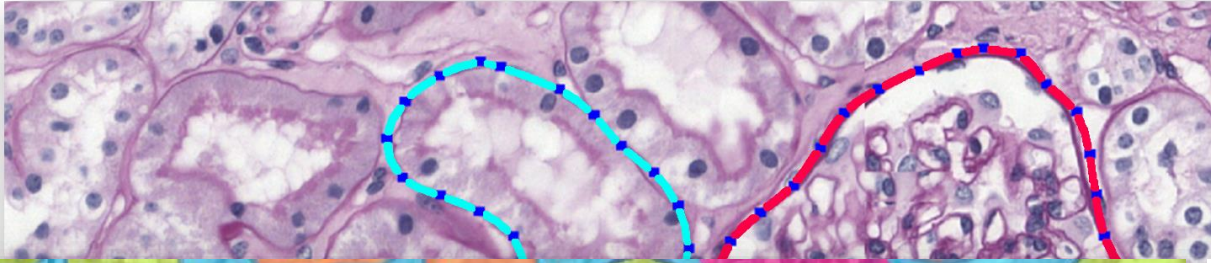


HMS & MIT II

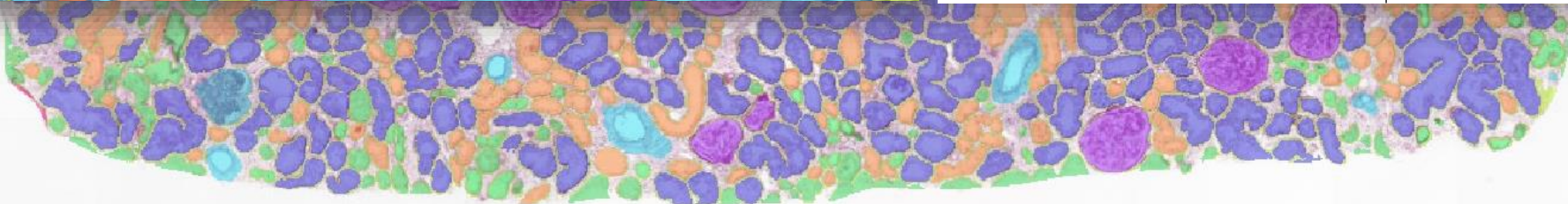
HMS & MGH III

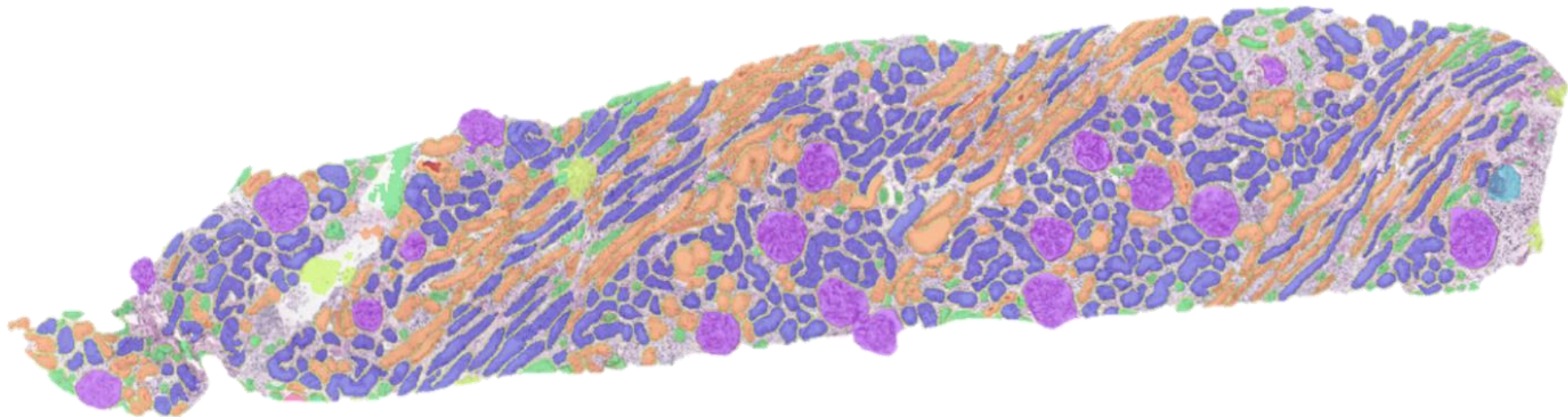
CULab



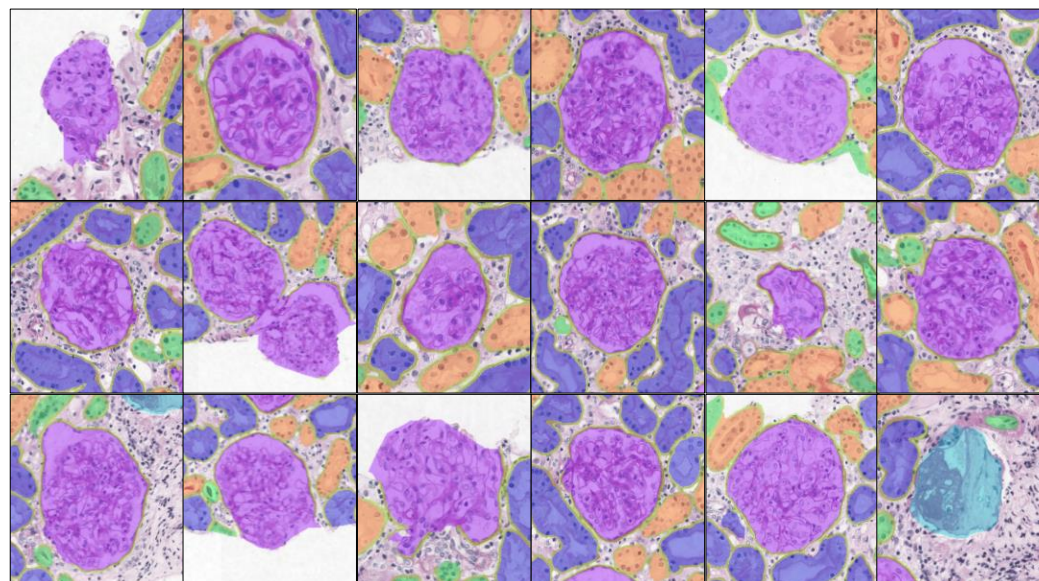


Class	DC	DC post PP
Glomeruli	0.95	0.95
Sclerotic glomeruli	0.63	0.62
Empty Bowman's capsules	0.52	0.37
Proximal tubuli	0.86	0.87
Distal tubuli	0.82	0.81
Atrophic tubuli	0.48	0.49
Undefined tubuli	0.32	0.30
Tubuli combined	0.93	0.92
Arteries	0.69	0.70
Interstitium	0.88	0.88
Capsule	0.89	0.84
Weighted average	0.80	0.80
Weighted average with tubuli as combined class	0.88	0.88





	No.
Pathologist 1	13
Pathologist 2	13
Pathologist 3	14
CNN <i>Glomeruli</i>	17
CNN <i>Sclerotic glomeruli</i>	1



Human (BANFF ct score) vs CNN (%atrophic tubuli)

Quantitative criteria for tubular atrophy: *ct* score

ct0	No tubular atrophy
ct1	Tubular atrophy involving up to 25% of the area of cortical tubules (mild tubular atrophy)
ct2	Tubular atrophy involving up to 26-50% of the area of cortical tubules (moderate tubular atrophy)
ct3	Tubular atrophy involving in >50% of the area of cortical tubules (severe tubular atrophy)

Human (BANFF ci score) VS CNN (% Interstitium)

Quantitative criteria for interstitial fibrosis: *ci* score

ci0	Interstitial fibrosis in up to 5% of cortical area
ci1	Interstitial fibrosis in 6-25% of cortical area (mild interstitial fibrosis)
ci2	Interstitial fibrosis in 25-50% of cortical area (moderate interstitial fibrosis)
ci3	Interstitial fibrosis in >50% of cortical area (severe interstitial fibrosis)

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Pathologists shortage 'delaying cancer diagnosis'

By
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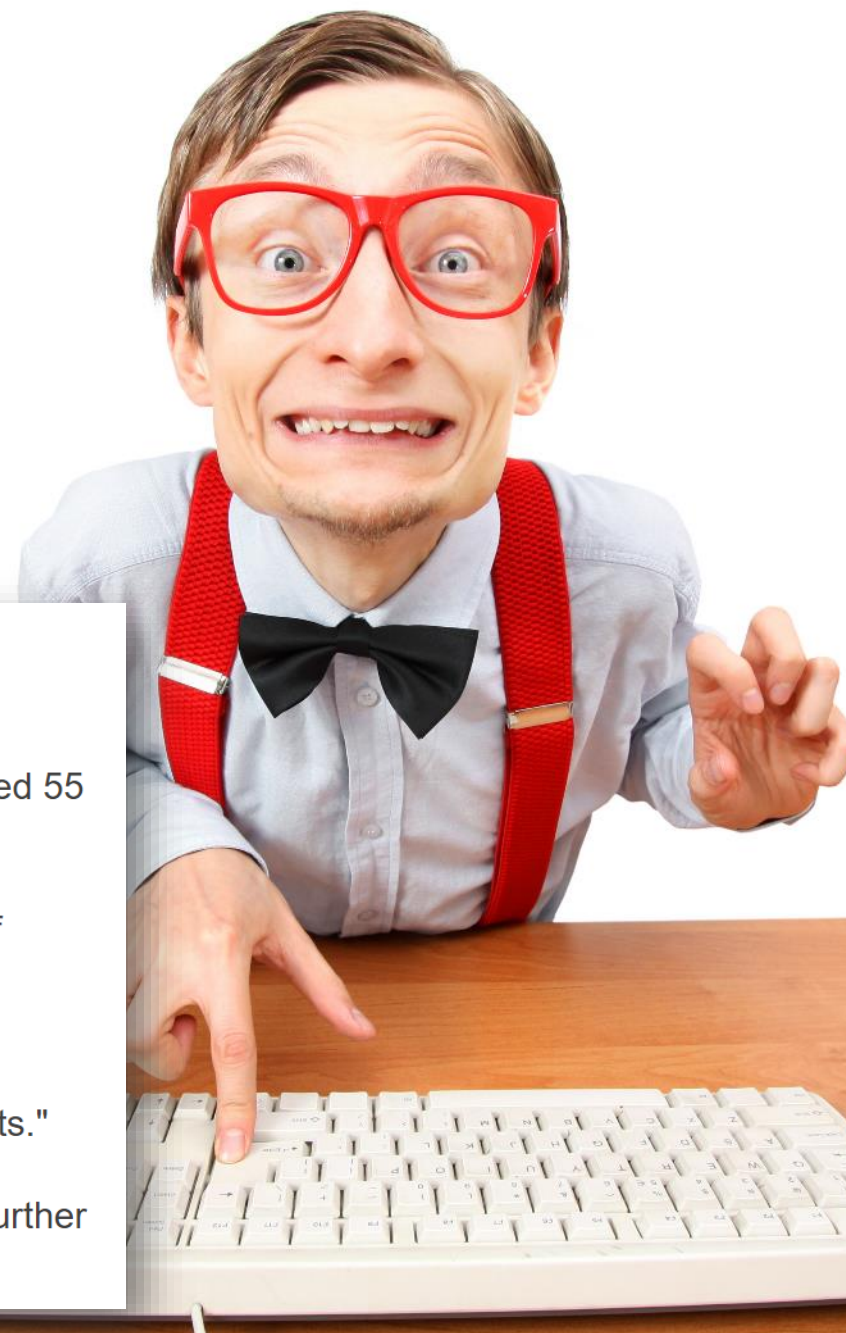
The report says histopathologists are facing intense pressure from increasing workloads due to new NHS screening programmes.

It also warns of an approaching retirement crisis - with a quarter of all staff aged 55 or over.

"If this trend continues unchecked, clinical services could be in jeopardy," Prof Martin said.

"Making sure pathology services can cope with current and future demand is essential if we are to ensure early diagnosis and improve outcomes for patients."

The college is calling for more funded training places, better IT systems and further investment in pathology services.



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