



AI and Radiology

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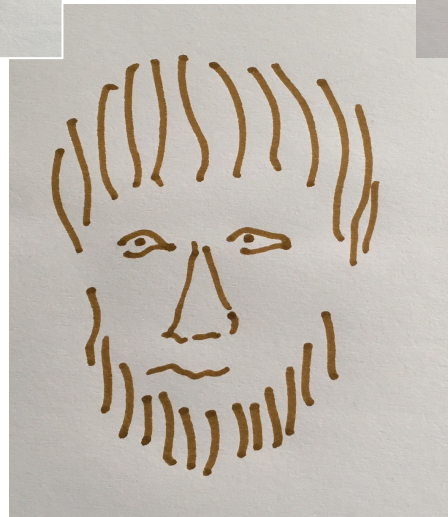
Founder AI Pioneer Centre, Biomediq A/S, Cerebriu A/S

Reasoning



Induction

Deduction



Aristoteles 384-322 BC

Deep Blue deduction

Deep Blue vs. Kasparov chess



Deep Blue
IBM chess computer



Garry Kasparov
World Chess Champion

Positions per round

Start	1
1	400
2	72,084
3	$> 9 \times 10^6$
4	$> 2.8 \times 10^{11}$

Games $\sim 10^{120}$

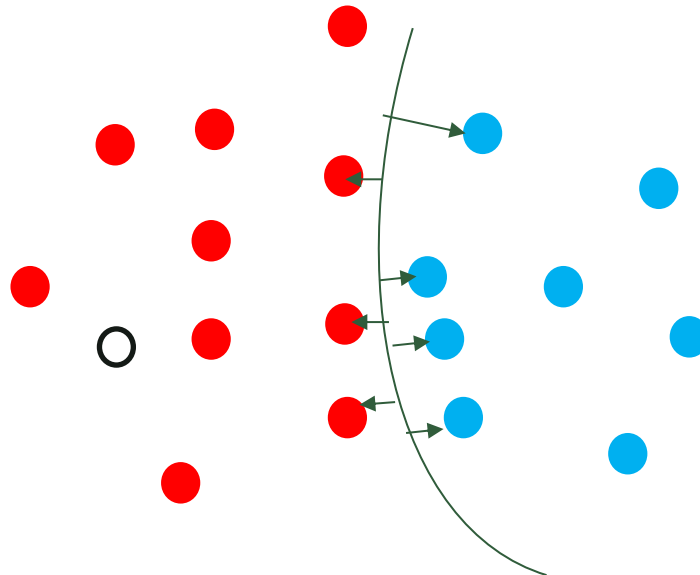


AlphaGo: March 9 2016

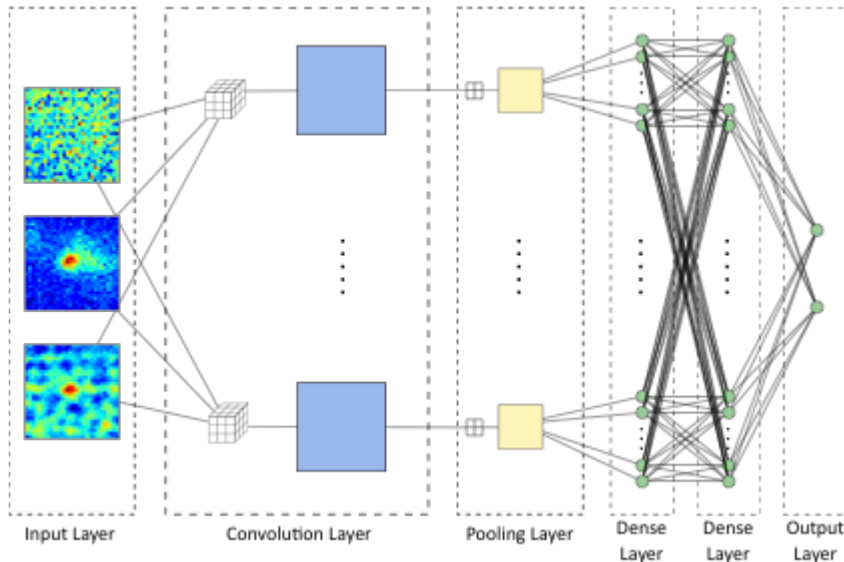




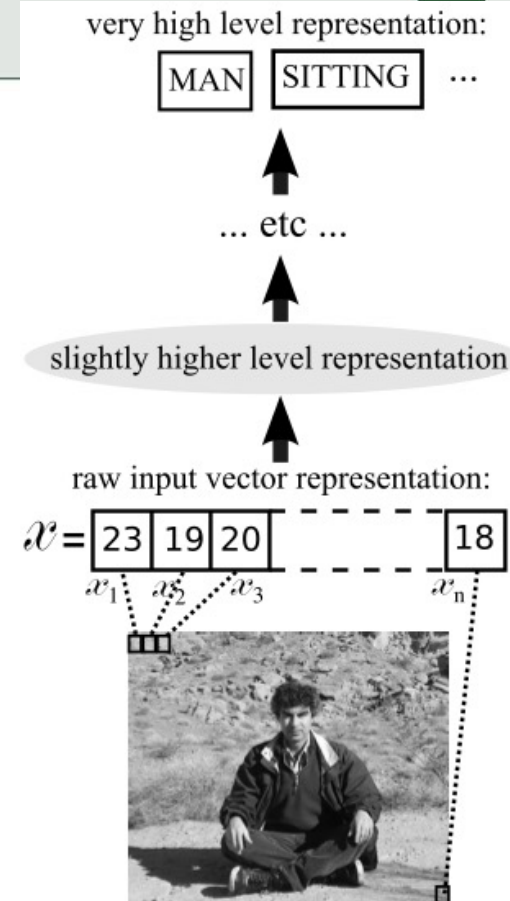
PAC Learning



Deep neural networks

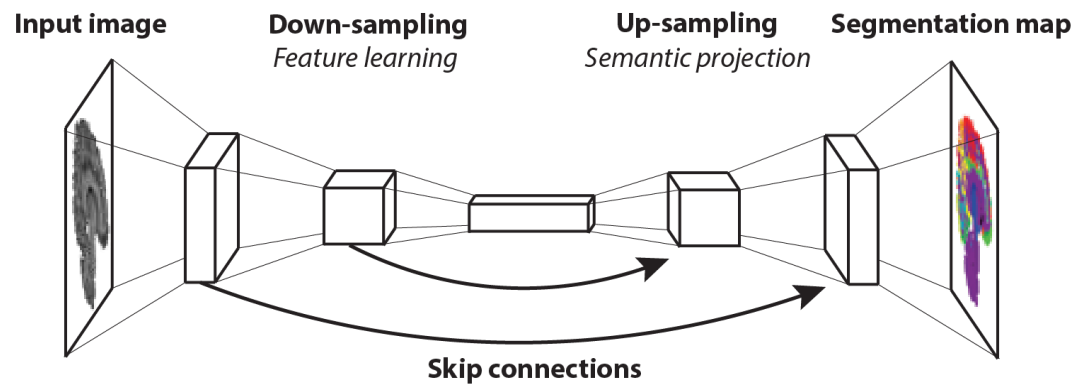


Gieseke et al. Convolutional Neural Networks for Transient Candidate Vetting in Large-Scale Surveys. *Monthly Notices of the Royal Astronomical Society*, 2017



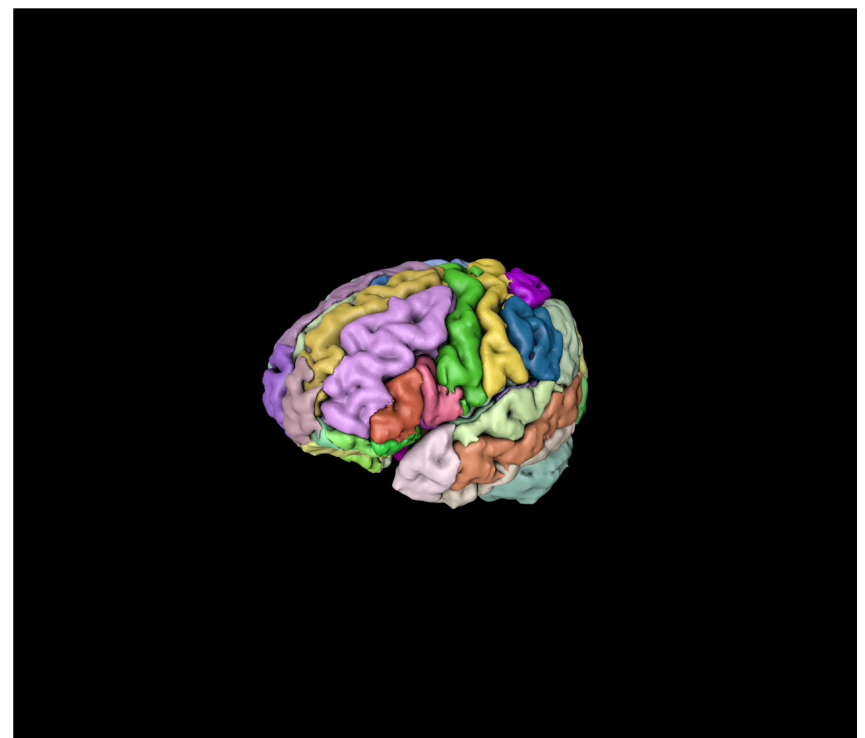
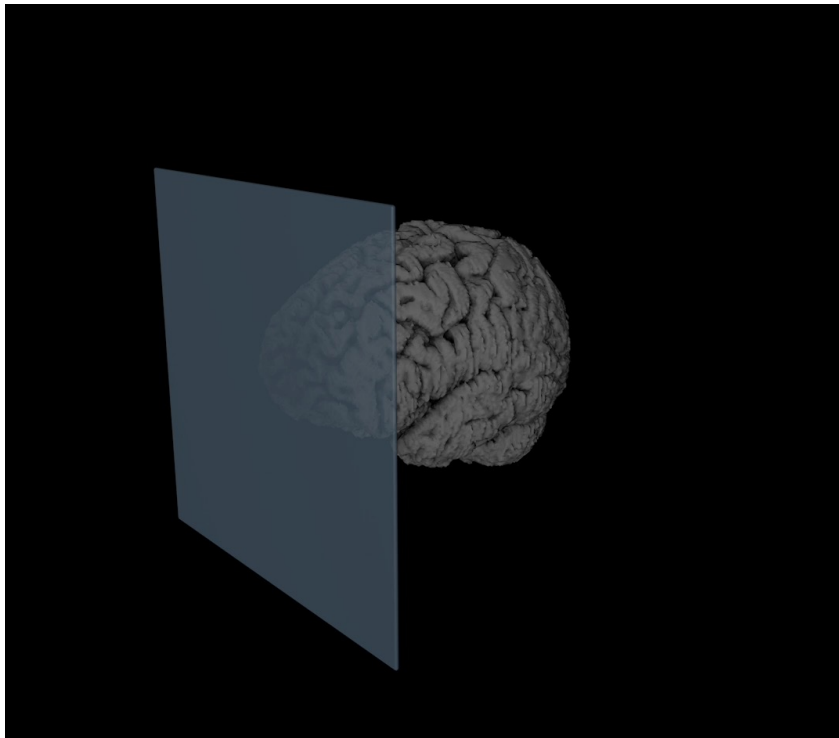
Bengio. Learning Deep Architectures for AI. *Foundations and Trends in Machine Learning*, 2009

What is where?





Medical imaging





Neurological disorders affect millions globally: WHO report

27 February 2007 | News release | Brussels | Geneva | Reading time: 2 min (469 words)

A new report from the World Health Organization (WHO) shows that neurological disorders, ranging from epilepsy to Alzheimer disease, from stroke to headache, affect up to one billion people worldwide. Neurological disorders also include brain injuries, neuroinfections, multiple sclerosis and Parkinson disease.



PAHO



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World Radiography Day: Two-Thirds of the World's Population has no Access to Diagnostic Imaging

Between 70% and 80% of diagnostic problems can be resolved through basic use of X-rays and/or ultrasound examinations; PAHO/WHO works with countries to strengthen radiological services in the Region



BRAIN MRI WORKFLOW EFFICIENCY BARRIERS



**NO
ABNORMAL
FINDINGS**

60%



**EXTENSIVE
SCANS**

30-60 MIN



**EXTENSIVE
CONTRAST**

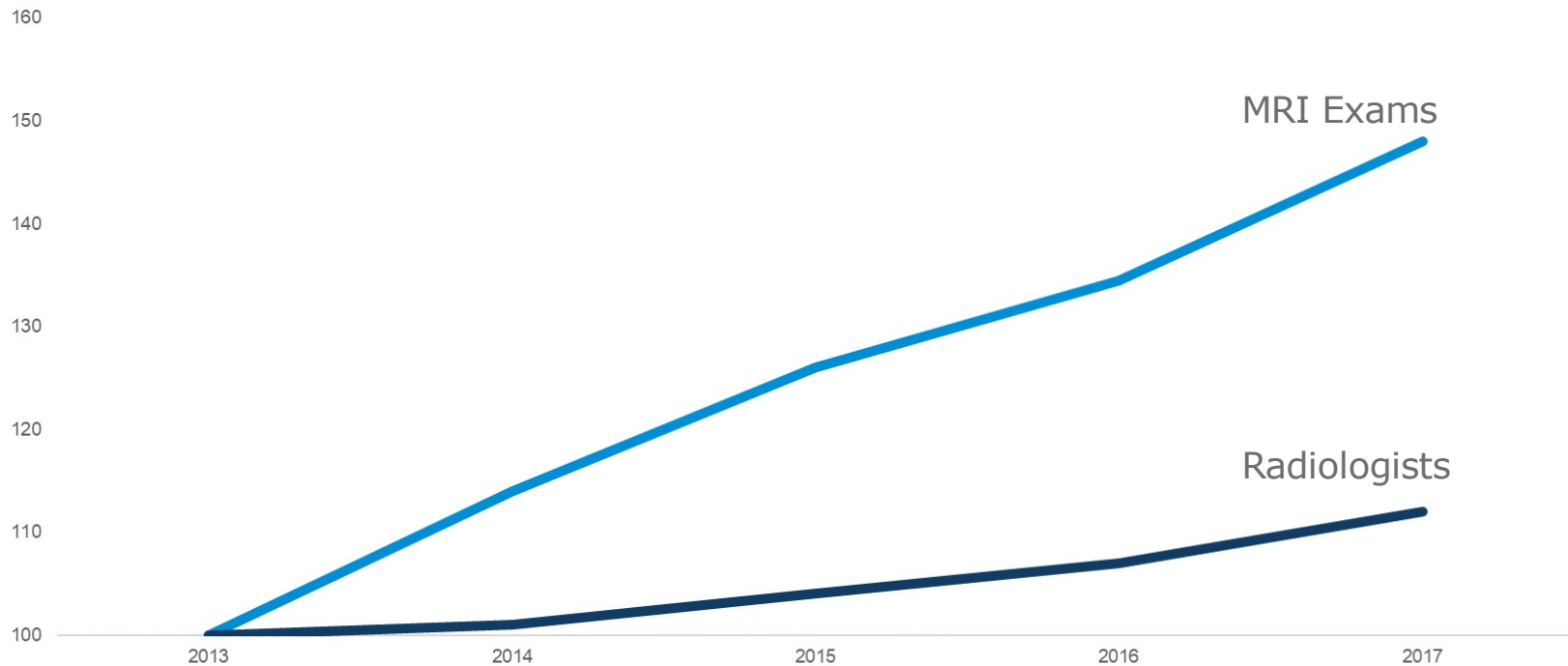
20-80%



**STRESS
BURNOUT**

60%

TREND: 9% YEARLY GAP



Source: The Royal College of Radiologists (2017): UK workforce census 2016 report.



SMART PROTOCOL™

INCREASED THROUGHPUT

Smart Protocol, UK patent application no. 1909212.1



On Prem | Cloud | Platform | Embedded

- STROKE
 - Hemorrhagic stroke
 - Ischemic stroke
- BRAIN TUMOR
- ICH

Triage

Classify

Localize

Smart Protocol

OVERVIEW AND FLOW

REAL-TIME
DECISION
SUPPORT

Number of studies in study list: 7

Patient Name	Patient ID	Study Date/Time	Modality	Scanner	Study Summary	Triage	Disclaimer
Rebecca M. Lund	291298-1110	08/04/2020 20:54	MR	MR Scanner 1	Indications of infarct	Medium	NOT FOR CLINICAL USE
Marius N. Hansen	070554-1825	20/02/2020 17:27	MR	MR Scanner 1	Indications of infarct	Medium	NOT FOR CLINICAL USE
Nicklas S. Lorenzen	300153-1025	30/01/2020 22:17	MR	MR Scanner 1	Indications of infarct	Medium	NOT FOR CLINICAL USE
Amanda A. Olesen	250476-0920	29/01/2020 10:30	MR	MR Scanner 2	Indications of infarct	Medium	NOT FOR CLINICAL USE
Katrine B. Juhl	020885-2604	31/01/2020 14:31	MR	MR Scanner 2	Indications of tumor	Medium	NOT FOR CLINICAL USE
Frederik P. Gregersen	230756-3633	10/02/2020 20:11	MR	MR Scanner 1	No indication	Normal	NOT FOR CLINICAL USE
Naja N. Paulsen	110170-2320	05/02/2020 20:51	MR	MR Scanner 2	No indication	Normal	NOT FOR CLINICAL USE

Classify

Triage

Introducing Smart Protocol (pat. pending) technology into our MR clinical application on the Cerebriu Apollo (CE) platform. Investigational use in US. Not for commercial use in US.

Corona giver store forsinkelser i svar på brystkræftscreening

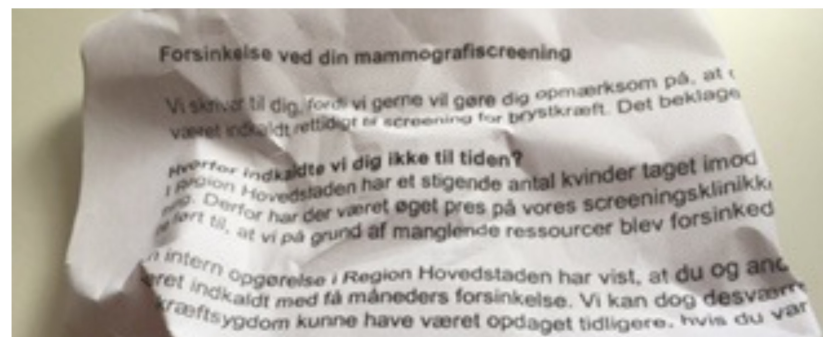
25-02-2021

Kvinder, der deltager i brystkræftscreening i Region Hovedstaden, har i løbet af de seneste måneder måttet vente helt op til 58 dage på at få svar på undersøgelsen. Det er urimeligt lange ventetider og kan have alvorlige konsekvenser, advarer Kræftens Bekæmpelse.



Målet er at kvinder skal have svar på brystkræftscreening inden for 14 dage. Det mål er langt fra overholdt de seneste måneder, og det er ikke godt nok, mener Kræftens Bekæmpelse. Foto: Tomas Bertelsen

De har gamblet med mit liv – Region H beklager den forsinkede screening



MAMMOGRAPHY AUGMENTATION



ScreenPoint

[Home](#)

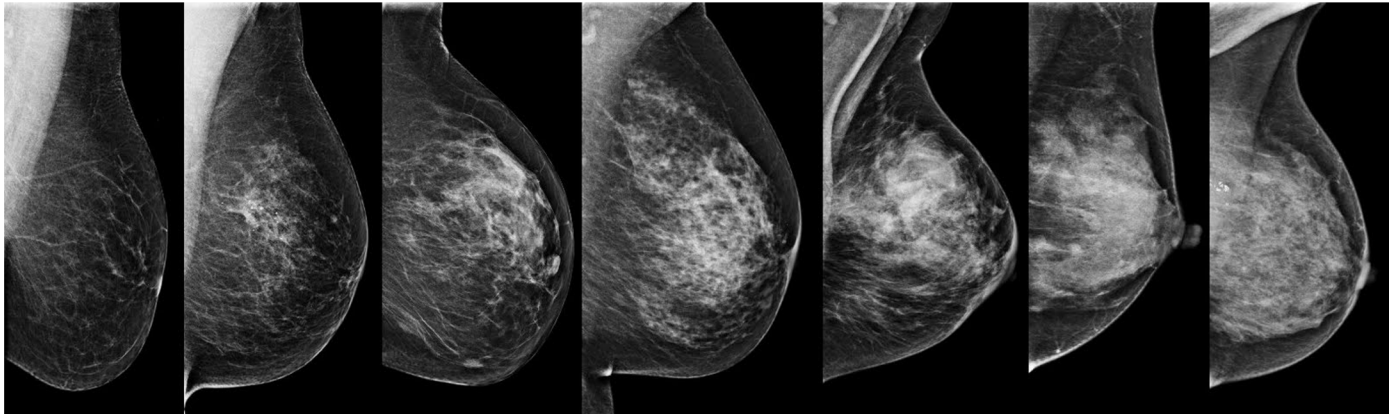
[About](#)



ADD, Dansk Erhverv, ATV

Mads Nielsen

Mammographic Breast Density



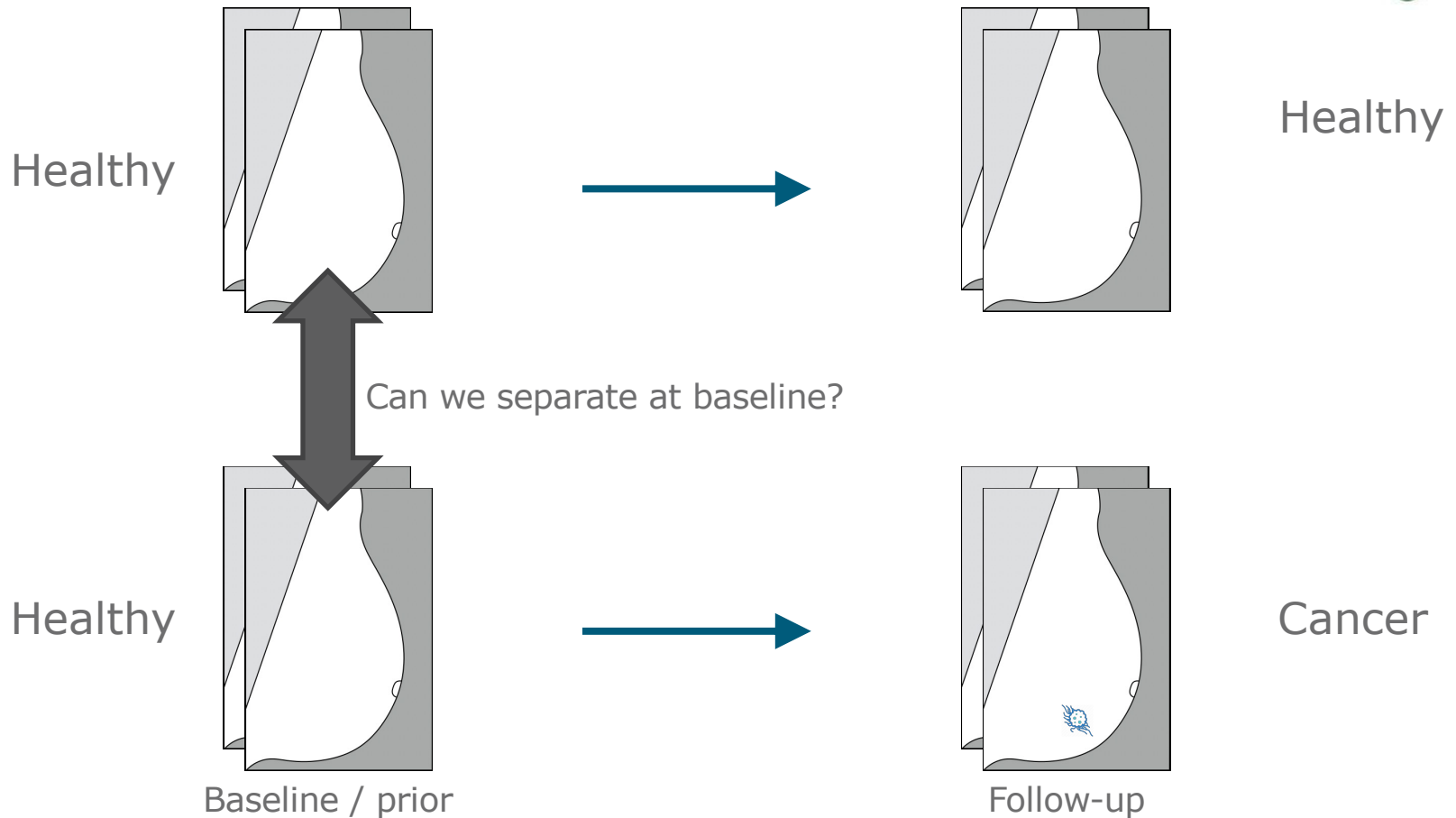
→ Breast cancer risk [1,2]
→ Masking risk [3]

[1] V. A. Mc Cormack et al., *Cancer Epidemiol Biomarkers Prev*, 15-6, 1159-69, 2006

[2] C. M. Vachon et al., *Breast Cancer Res*, 9-6, 217, 2007

[3] P.A. Carney et al., *Ann Intern Med*, 138, 168-175, 2003

Training design – mammographic cancer risk

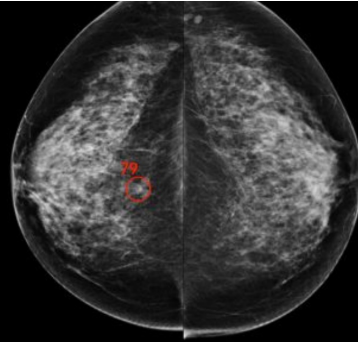


INTERACTIVE LEASION SCORING



10

Exam Score

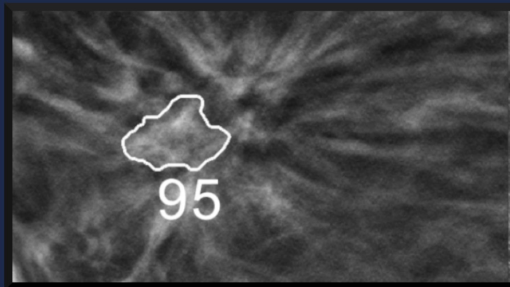


Measuring short and long-term breast cancer risk by combining mammographic texture models, an AI-based CAD system, and established risk factors

Lauritzen A D, Rodriguez-Ruiz A, von Euler-Chelpin M C, Lynge E, Vejborg I, Nielsen M, Karssemeijer N, Lillholm M
ECR2021

Aim and Objective

To investigate the combined effect of mammographic texture and the exam score of an AI-based CAD system in terms of quantifying short- and long-term breast cancer risk.



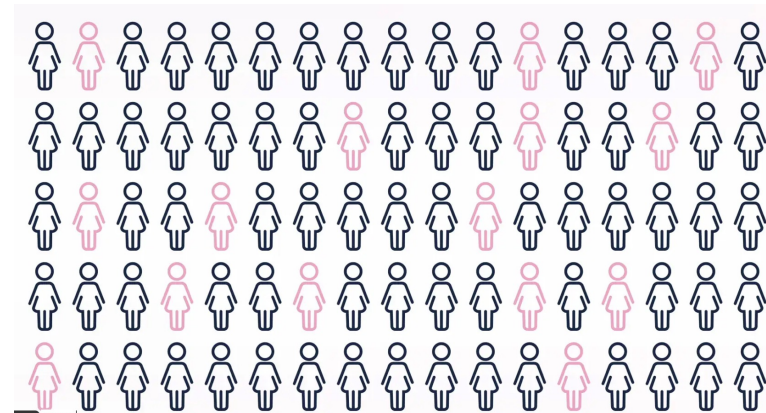
Detection Aid

A second pair of eyes to support radiologists



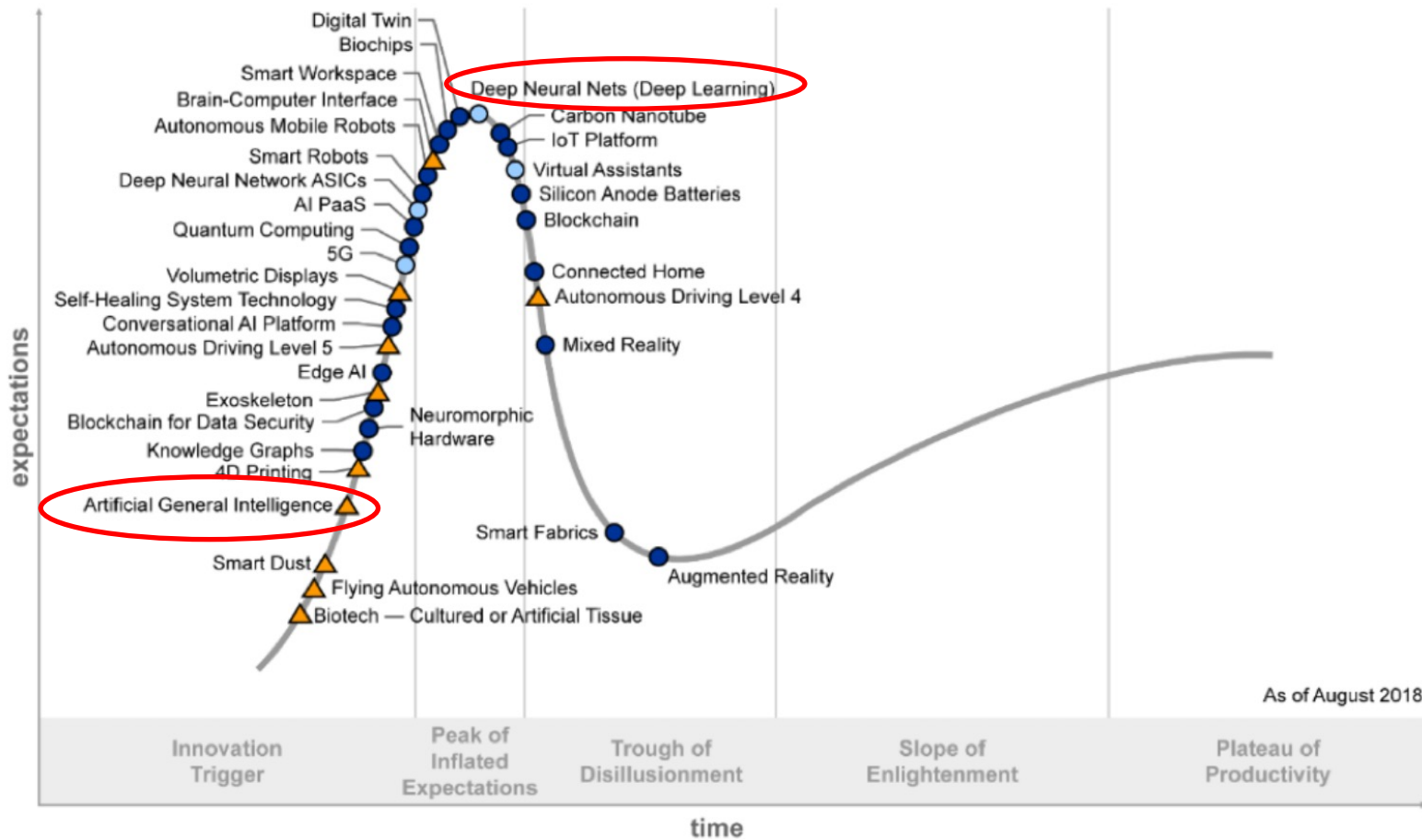
Region Analysis

Transpara findings are graded between 1-100





Gartner Hype, August 2018



Plateau will be reached:

- less than 2 years
- 2 to 5 years
- 5 to 10 years
- ▲ more than 10 years
- ⊗ obsolete before plateau



AI Performance

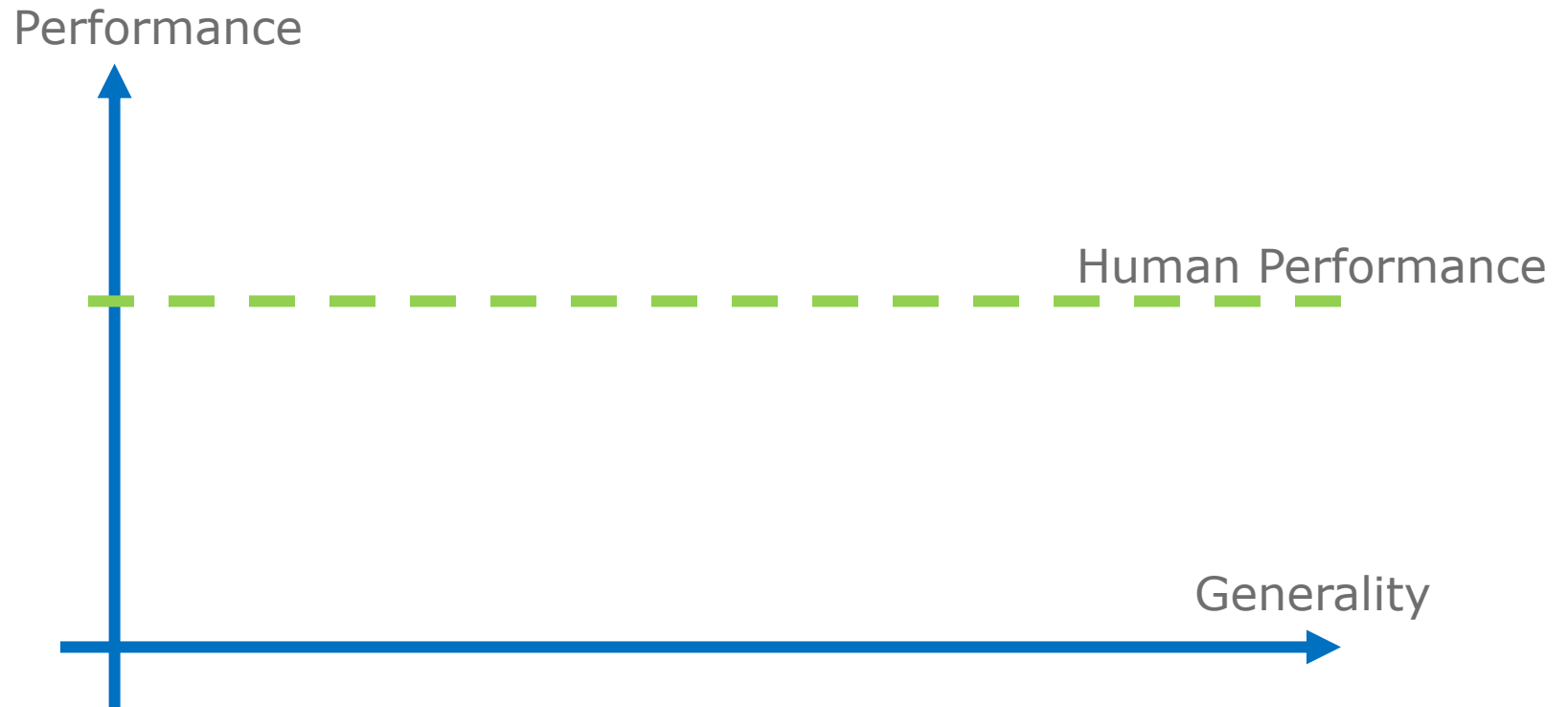
Performance



Generality

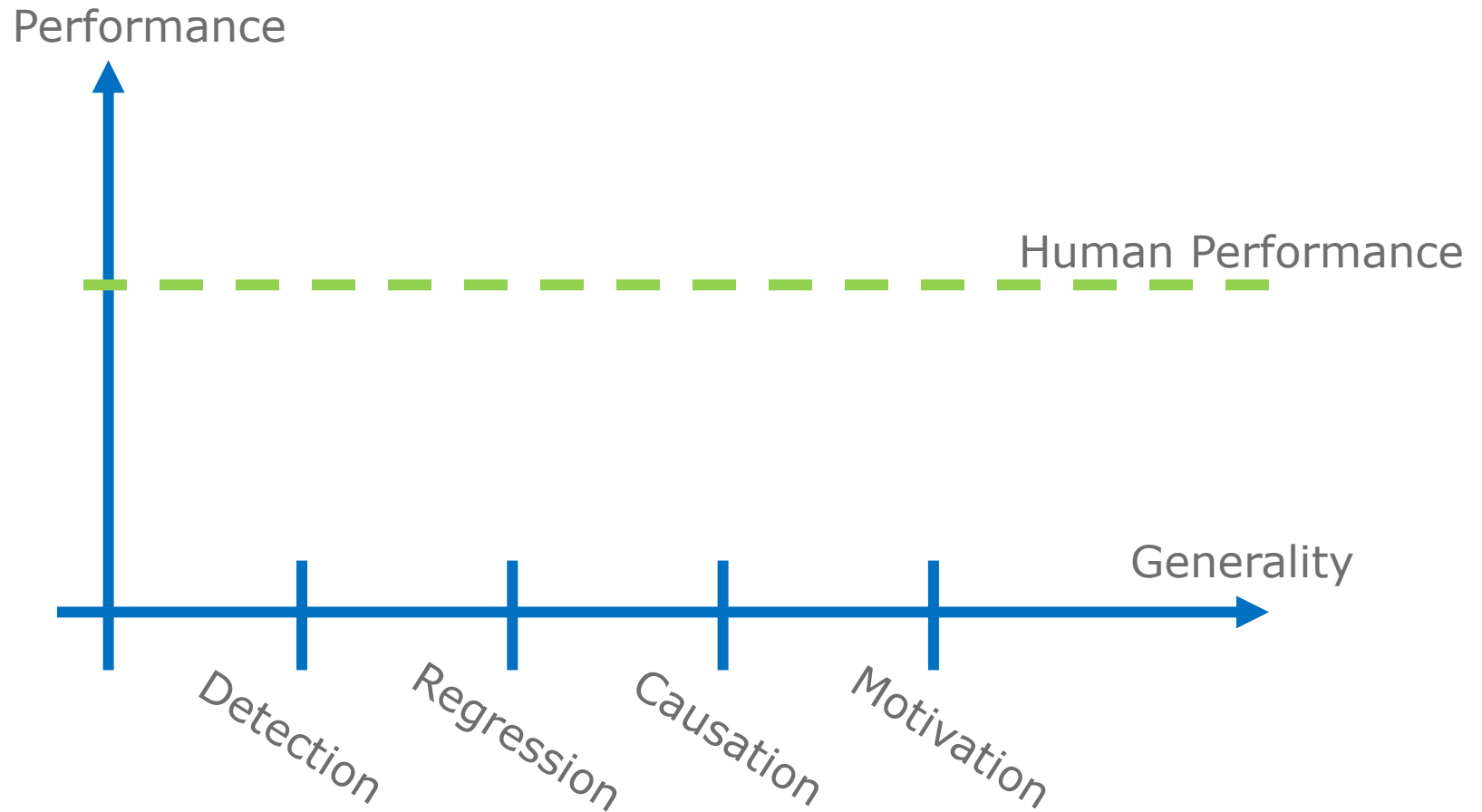


AI Performance



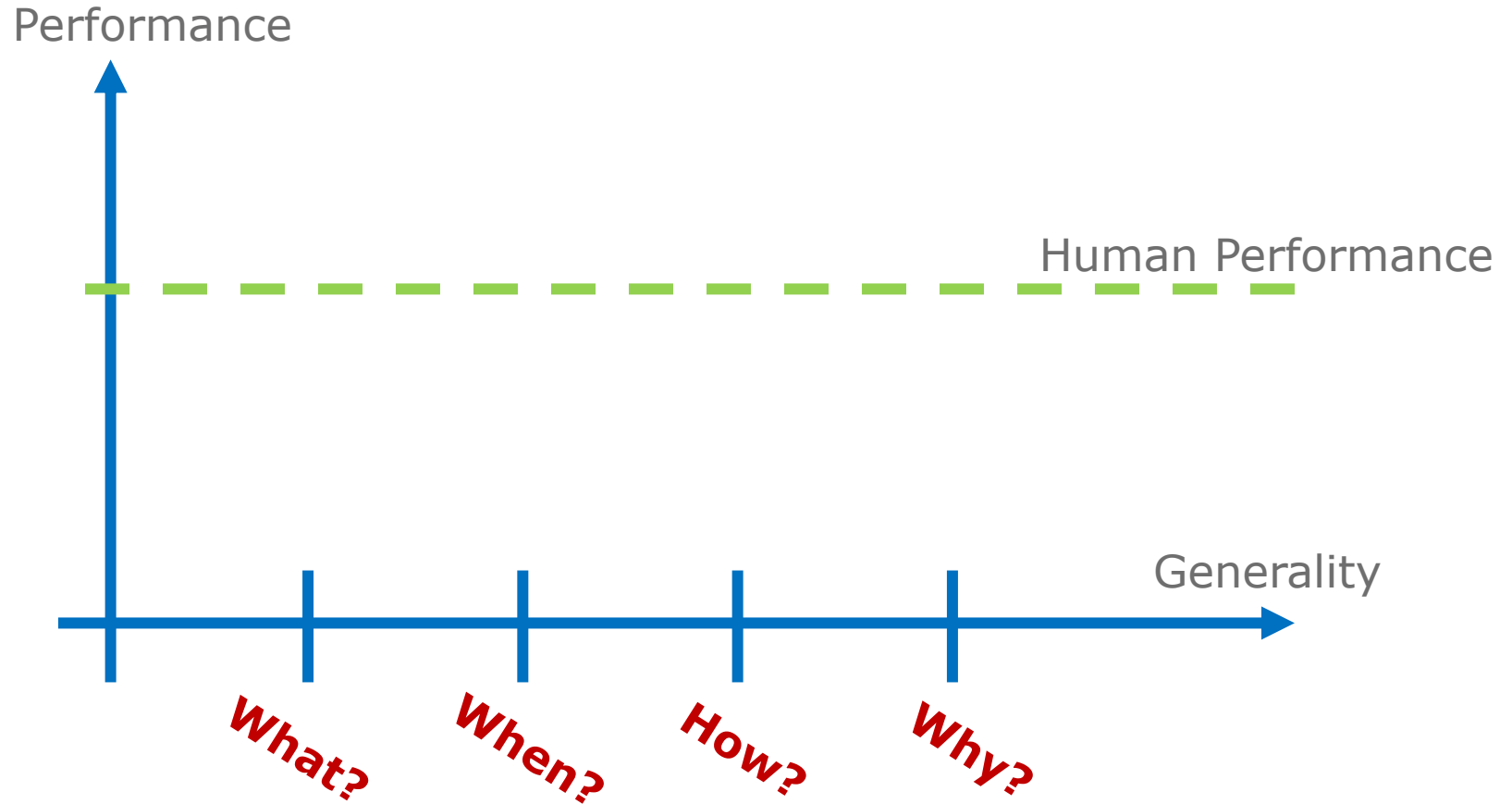


AI Performance



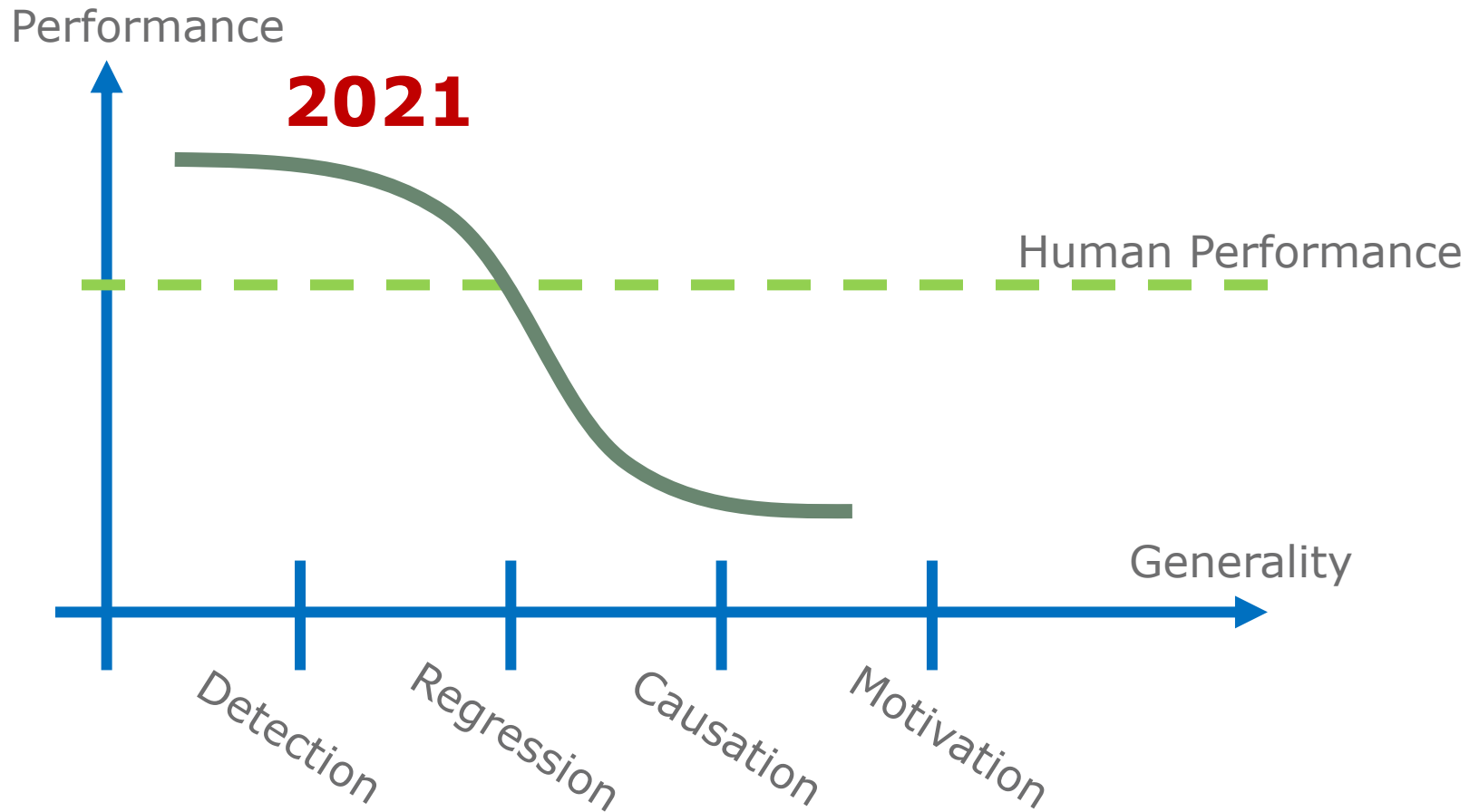


AI Performance



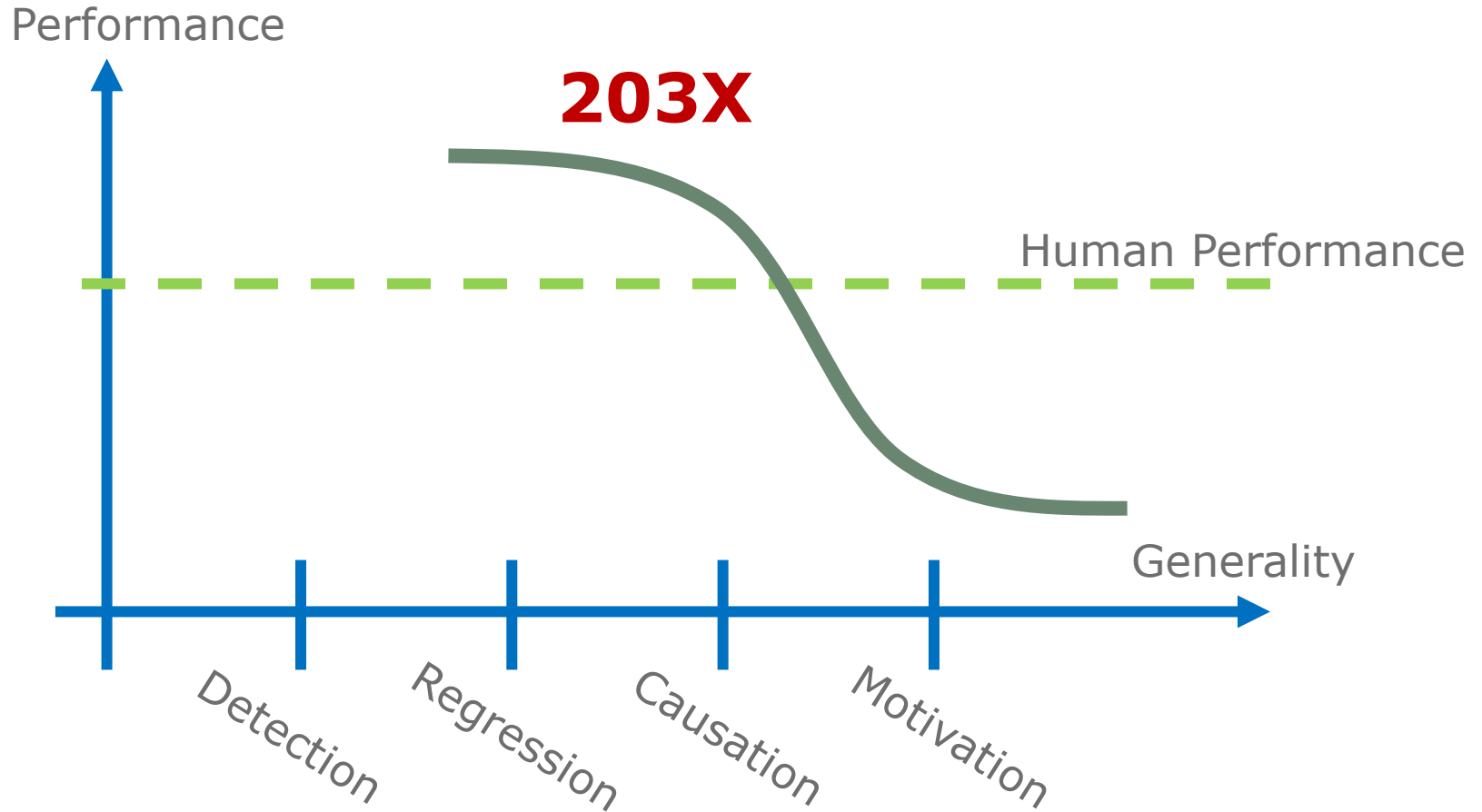


AI Performance



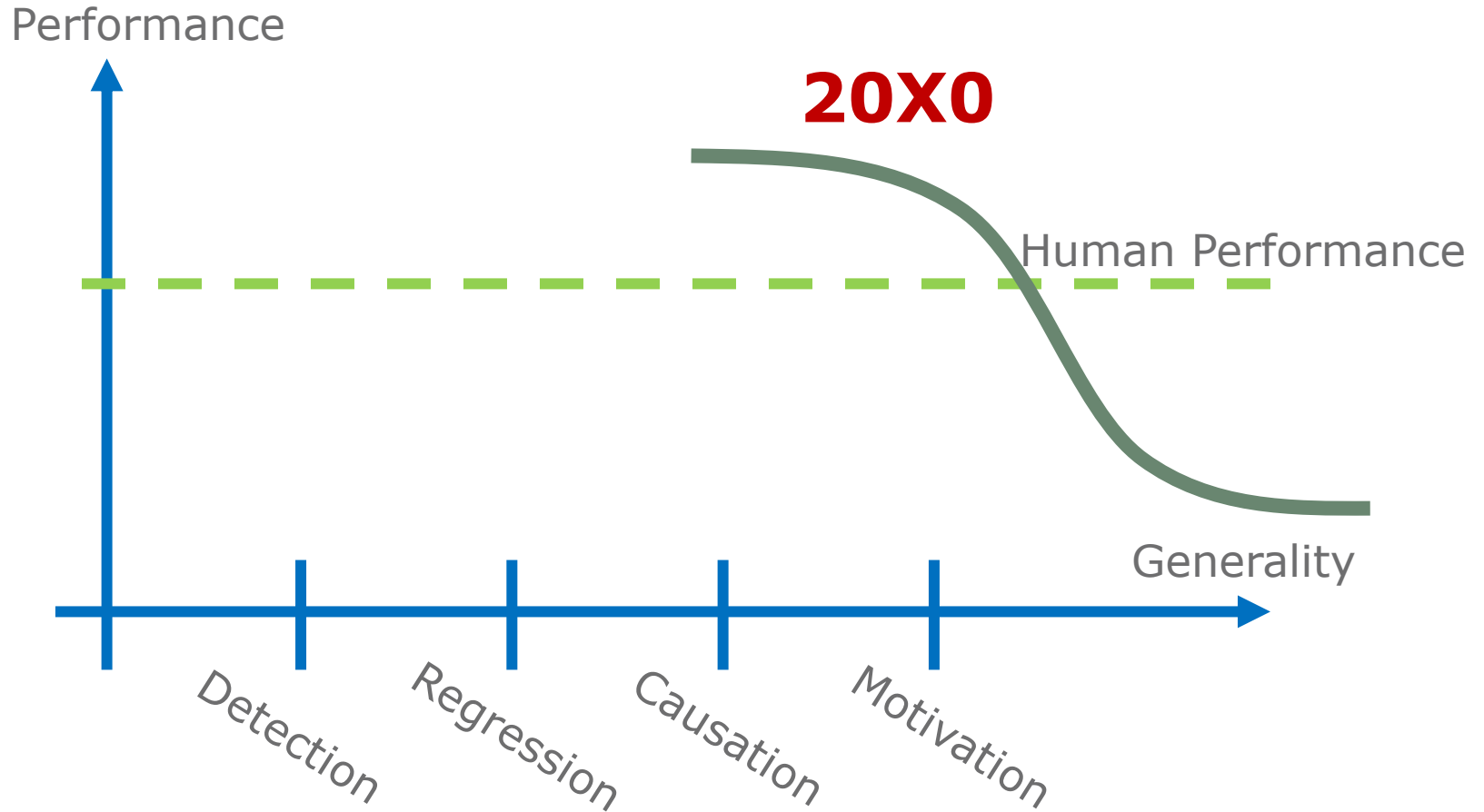


AI Performance







AI Performance





Will Artificial Intelligence Replace Radiologists?

 Curtis P. Langlotz 

▼ Author Affiliations

Published Online: May 15 2019 |
<https://doi.org/10.1148/ryai.2019190058>

accordio

 Sections  PDF

As we are lifted by the latest AI bubble,
“Will AI replace radiologists?”
is the wrong question.

The right answer is:
***Radiologists who use AI
will replace radiologists who
don’t.***

The question of whether Machines Can Think is about as relevant as the question of whether Submarines Can Swim.

– Edsger Dijkstra, 1984

Introduction