

Artificial Intelligence in Medicine and Life Sciences - Introduction (NTF012F)

Sonja Aits

Lund University
2025-09-22



AI in Medicine and Life Sciences Courses

<https://www.compute.lu.se>

Introduction

2025

Python

2026

Language/Speech

2025

Images/Video

2026

Day 1 – 22/9

Time	Title
09:00 – 10:00	Introduction and practical info
10:00 – 11:00	Overview over AI and its uses in medicine and life sciences
11:00 – 11:30	Developing your AI project (exam instructions)
11:30 – 12:00	Data types and sources
12:00 – 13:00	Lunch break
13:00 – 15:00	AI technology – part 1

Day 2 – 23/9

Time	Title
10:00 – 12:00	AI technology – part 2
12:00 – 13:00	Lunch break
13:00 – 14:30	Computer vision in medicine and life sciences

Day 3 – 24/9

Time	Title
09:30 – 12:00	Societal, ethical and legal implications of AI
	Lunch break
12:00 – 13:00	Optional: AI Lund lunch seminar: Beyond AI Ethics Frameworks - Ethical Considerations and Responsibility in Public https://www.ai.lu.se/2025-09-24
13:00 – 14:15	Natural language processing in medicine and life science
14:15 – 15:15	Generative AI in medicine and life science
15:15 – 16:00	AI research in practice: project management, trouble shooting and useful resources

Day 4 – 29/9

Time	Title
09:00 – 16:00	Project presentations and opposition (exam)

What is AI?

And how can it be
used in medicine and
life sciences?



What is AI?

Maths

What is artificial intelligence?

Artificial intelligence

Imitation of natural intelligence in computers



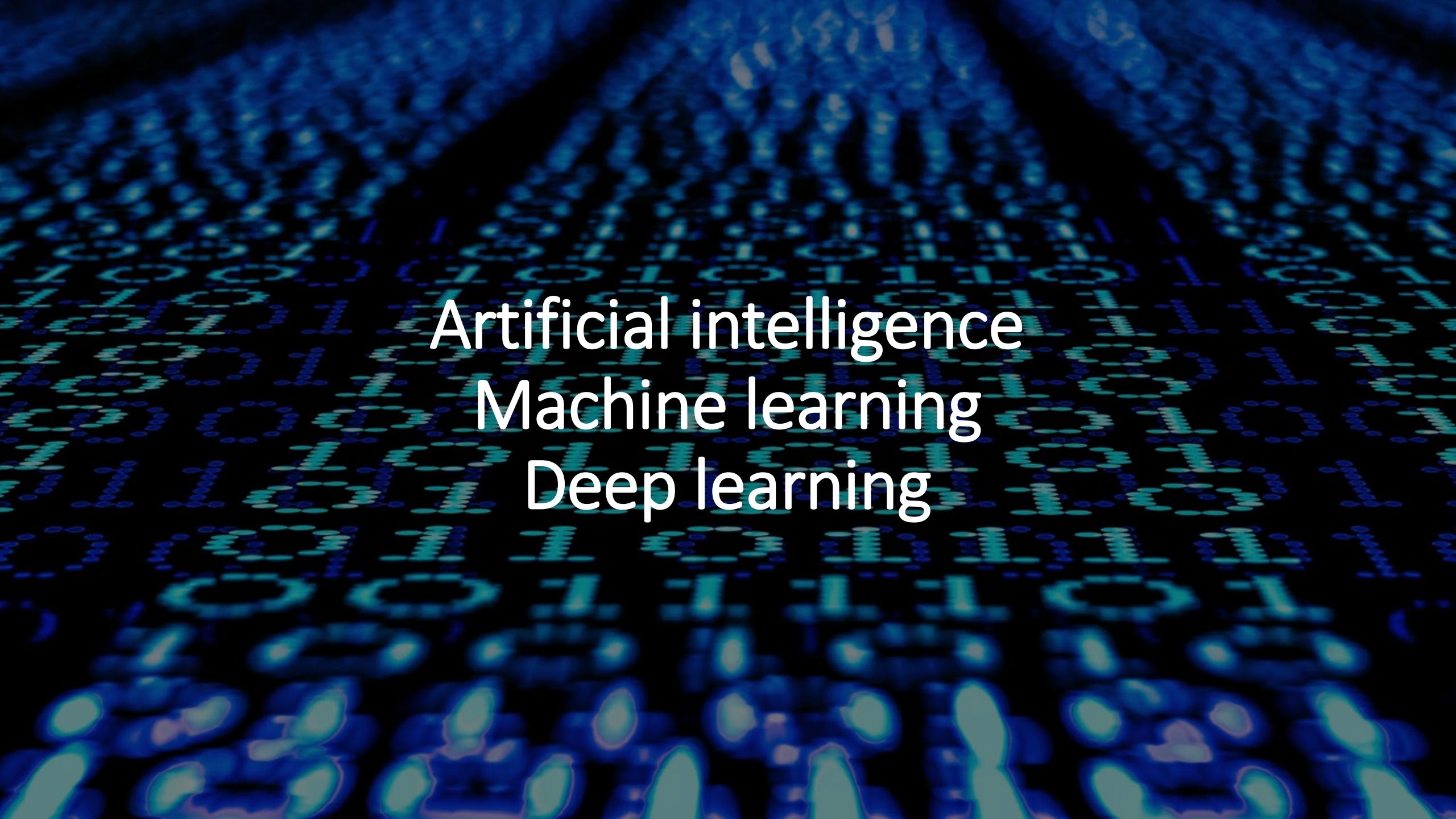
Sonja Aits



MyLifeUNIT 4 inch Yellow Rubber Bath Ducks for Child
★★★★★ 55
\$8.99

Jumbo Rubber Duck Bath Toy | Giant Ducks Big Duckie Baby Shower Birthday Party Favors 8...
★★★★★ 241
\$8.94





Artificial intelligence
Machine learning
Deep learning

What is artificial intelligence?

Artificial intelligence

Imitation of natural intelligence in computers

Machine learning

Computers learn decision rules from examples

Height	Movement	Decision
50 m	no	Plant
7 m	yes	Animal
10 cm	no	Plant
2 mm	yes	Animal
30 cm	yes	???

What is artificial intelligence?

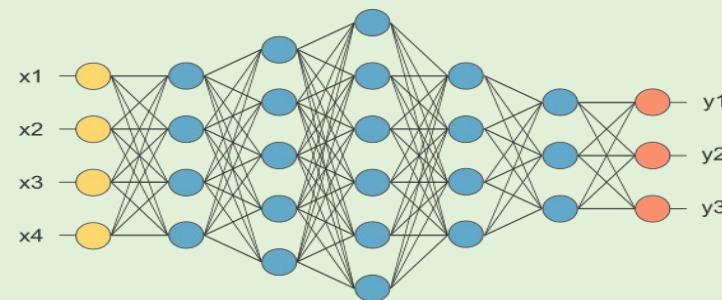
Artificial intelligence

Imitation of human intelligence in computers

Machine learning

Computers learn decision rules from examples

Deep learning



Illustrations: Niklas Elmehed

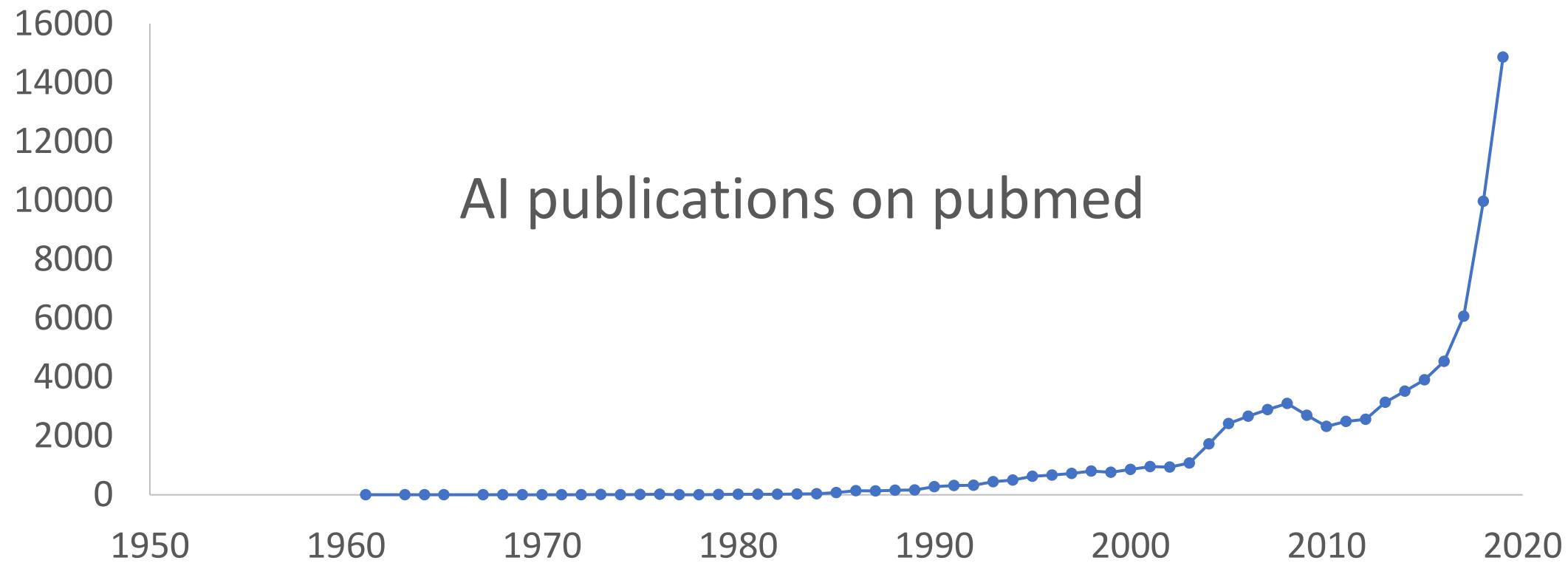


John J. Hopfield

Geoffrey E. Hinton

"for foundational discoveries and inventions
that enable machine learning
with artificial neural networks"

AI revolution



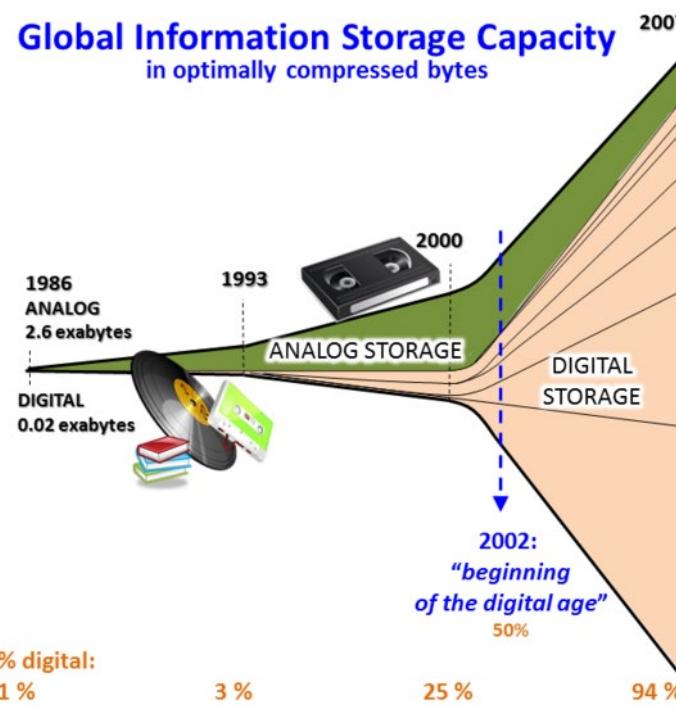
Why now?

Why now?

Potent hardware



Big data



Methodological advances

ImageNet Classification with Deep Convolutional Neural Networks

Alex Krizhevsky
University of Toronto
kriz@cs.utoronto.ca

Ilya Sutskever
University of Toronto
ilya@cs.utoronto.ca

Geoffrey E. Hinton
University of Toronto
hinton@cs.utoronto.ca

Attention Is All You Need

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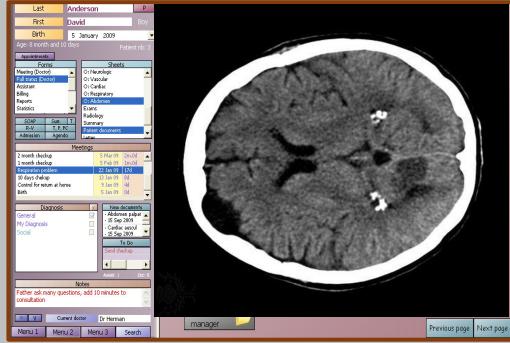
Illia Polosukhin* ‡
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mailto:illia.polosukhin@gmail.com

There is urgent need for better solutions ...

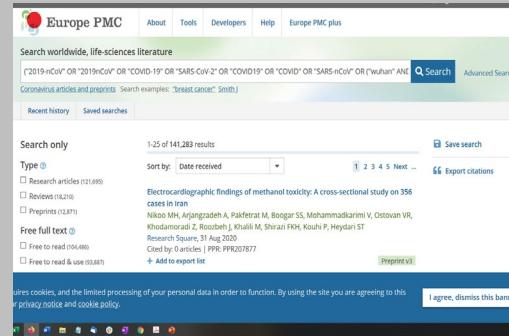
- Climate change
- Biodiversity loss
- Global health crises

Medical/Life science data is abundant...

Patient journals



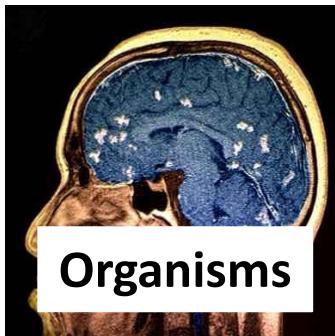
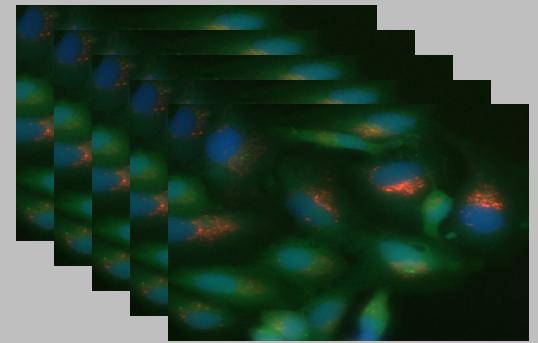
Scientific literature and other texts



Databases



Large unstructured research datasets



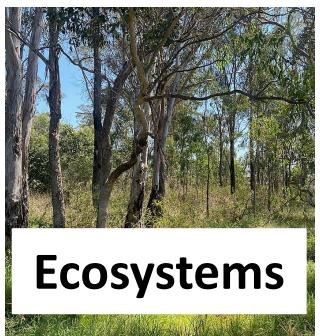
Organisms



Diseases



Therapies



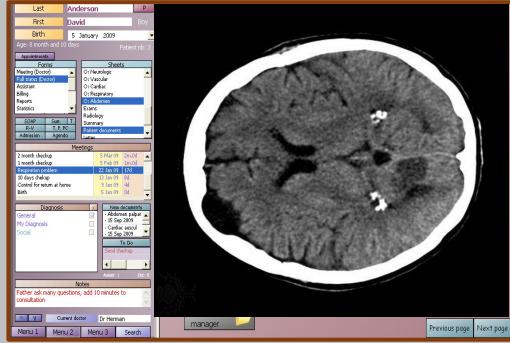
Ecosystems



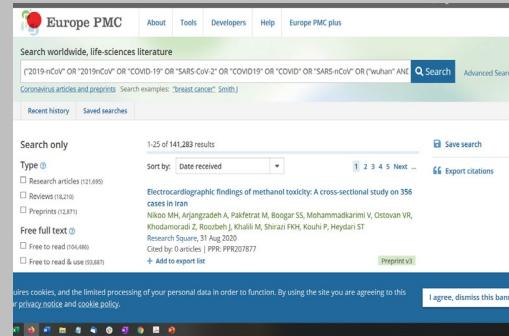
Policies

...but scattered and very complex

Patient journals



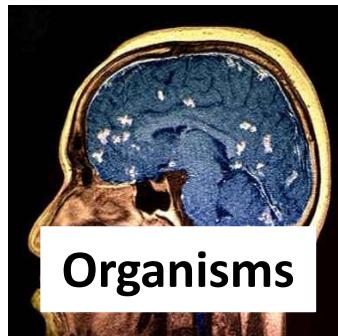
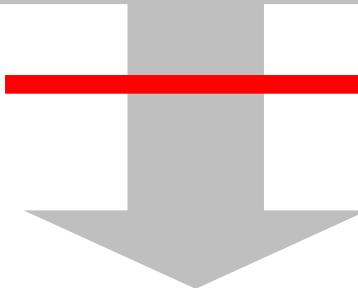
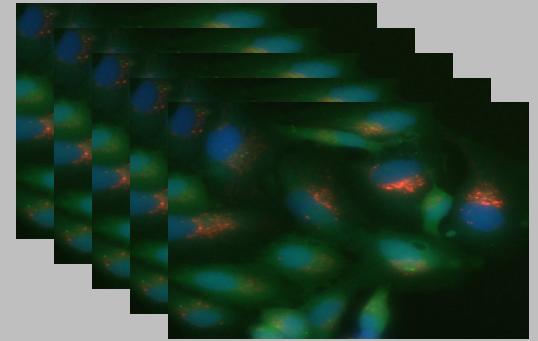
Scientific literature and other texts



Databases



Large unstructured research datasets



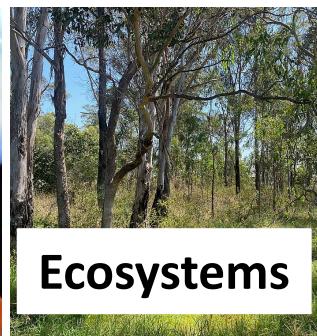
Organisms



Diseases



Therapies



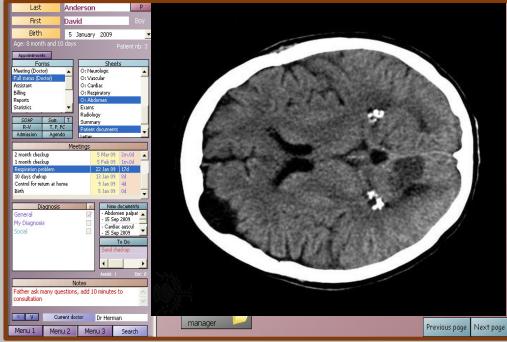
Ecosystems



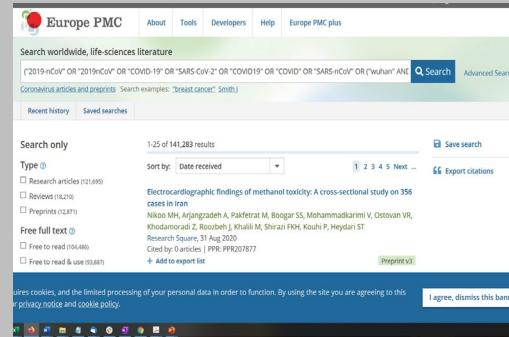
Policies

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Patient journals



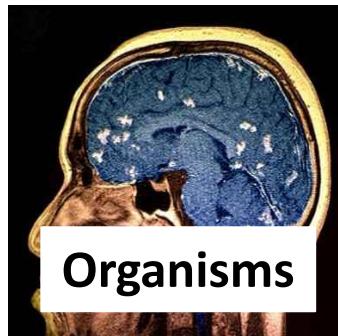
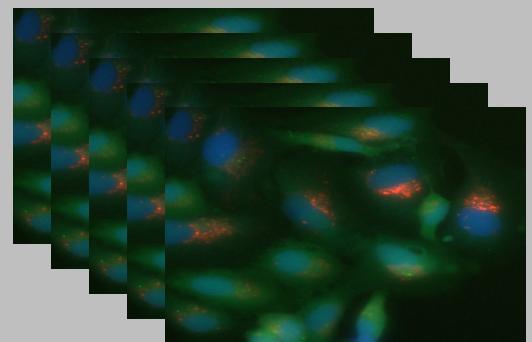
Scientific literature and other texts



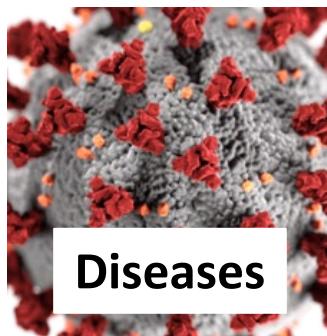
Databases



Large unstructured research datasets



Organisms



Diseases



Therapies



Ecosystems



Policies

There are many reasons we need AI

- Information overload
- System complexity
- High costs
- Staff shortages
- Human variability, biases and errors
- Harm to humans/animals

What can we do with AI?

Natural language processing



What are the symptoms of covid19?



what are the symptoms of **covid 19 in dogs**



what are the symptoms of **covid 19 virus**



what are the symptoms of **covid 19 in babies**



what are the symptoms of **covid 19 in toddlers**



what are the symptoms of **covid 19 ***



what are the symptoms of **covid 19 uk**

AI chatbots

ChatGPT

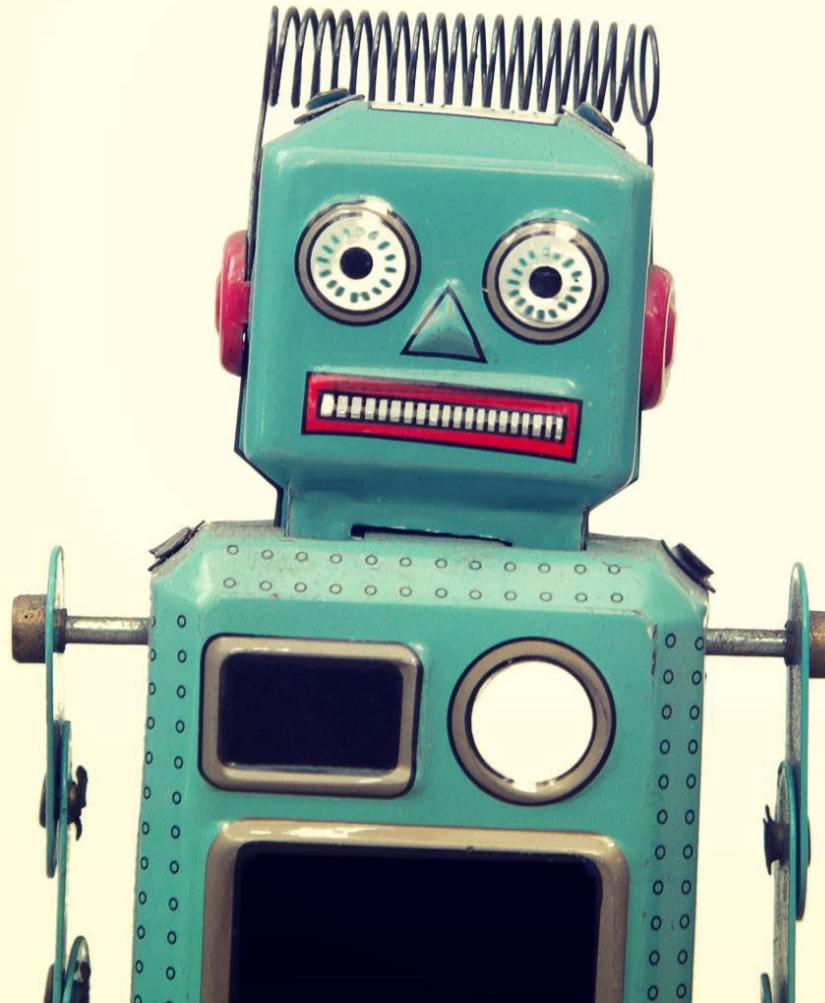
Google Gemini

Microsoft Copilot

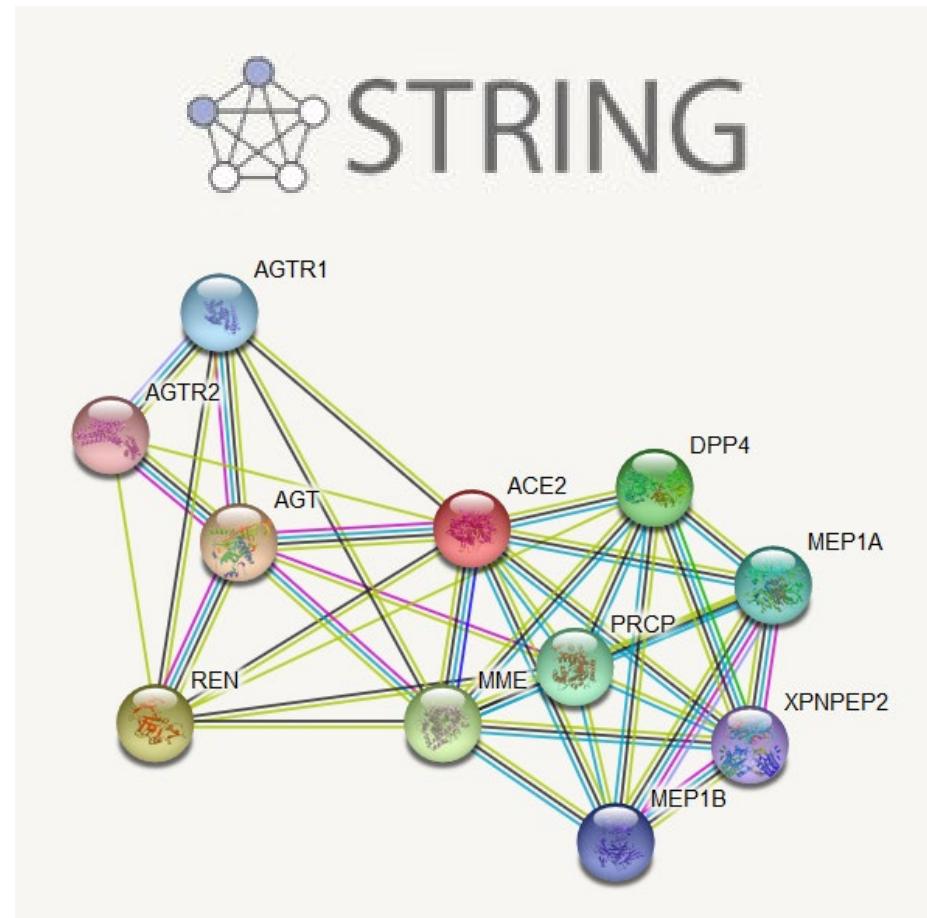
HuggingChat

Claude

Perplexity



Information extraction



<https://string-db.org/>

Computer vision

Image analysis

**Classifying and
scoring images**



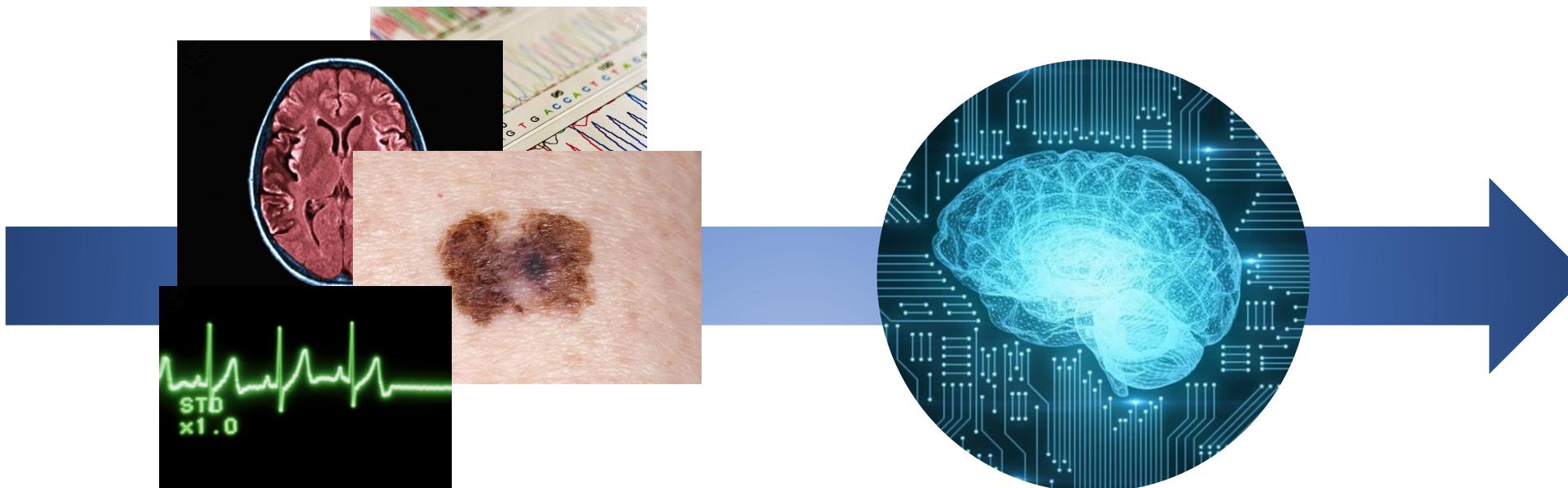
**Counting and
tracking objects**



**Distinguishing
structures**



AI-based diagnostic tools



Structural biology

Google's DeepMind aces protein folding

By Robert F. Service | Dec. 6, 2018 , 12:05 PM



Demis Hassabis @demishassabis

Follow

Proteins are essential to life. Predicting their 3D structure is a major unsolved challenge in biology and could impact disease understanding and drug discovery. I'm excited to say we have won the CASP competition! #AlphaFold

Google's DeepMind predicts 3D shapes of proteins

INTELLIGENCE ARTIFICIELLE SCIENCE

DeepMind a développé une IA pour modéliser des protéines

Une avancée majeure dans le monde scientifique, qui devrait notamment permettre de d'améliorer considérablement le traitement de

Technology

Alphabet's DeepMind AI Algorithm Wins Protein-Folding Contest



AlphaFold Protein Structure Database

Developed by DeepMind and EMBL-EBI

Search for protein, gene, UniProt accession or organism or sequence search

BETA

Search

Examples:

MENFQKVEKIGEGTYGV...

Free fatty acid receptor 2

At1g58602

Q5VSL9

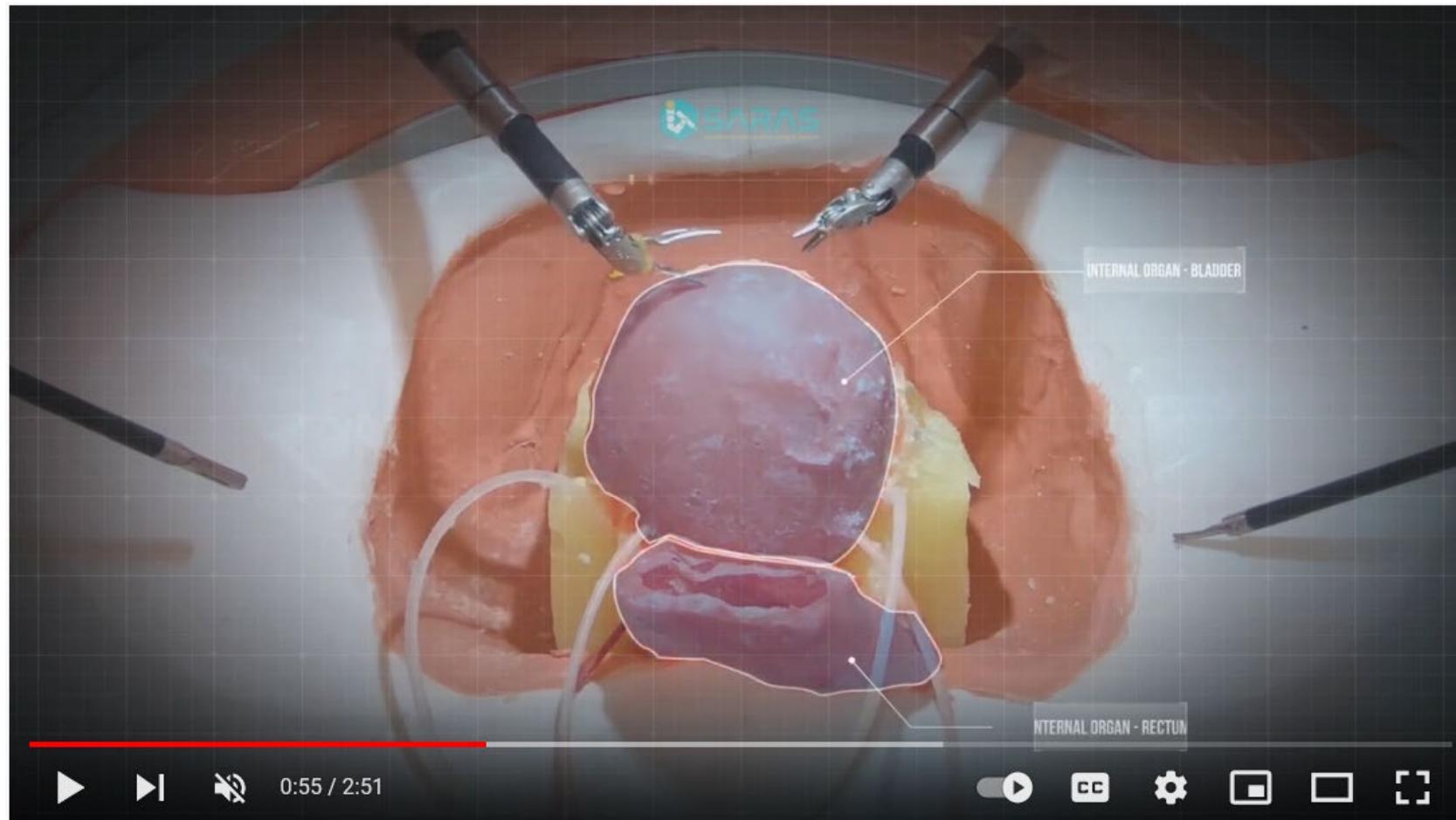
E. coli

See search help 

AlphaFold DB provides open access to over 200 million protein structure predictions to accelerate scientific research.

Robotics

Robotic surgery

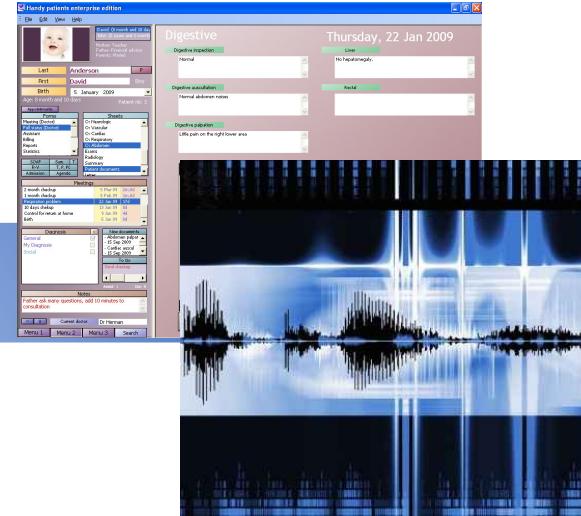
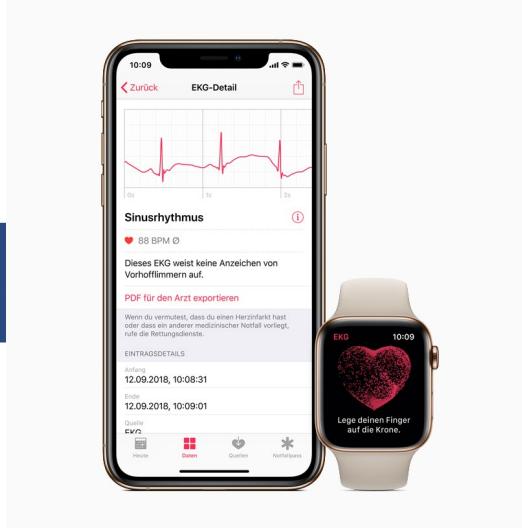


AI-supported transport/surveillance



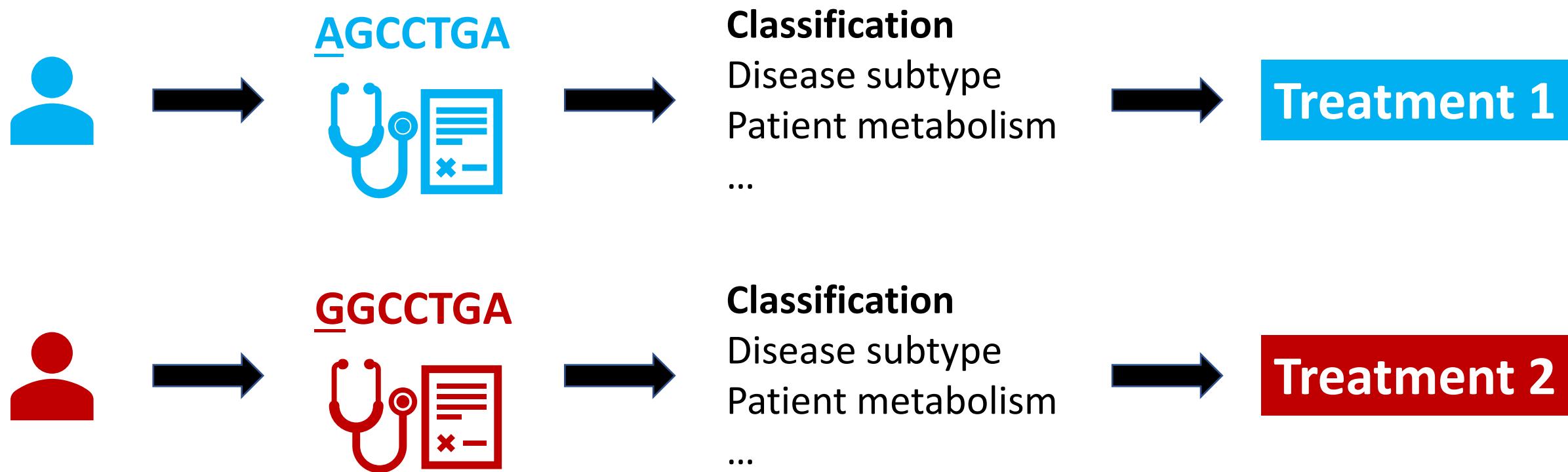
Personalized health care

Health apps and speech recognition for collection of patient history

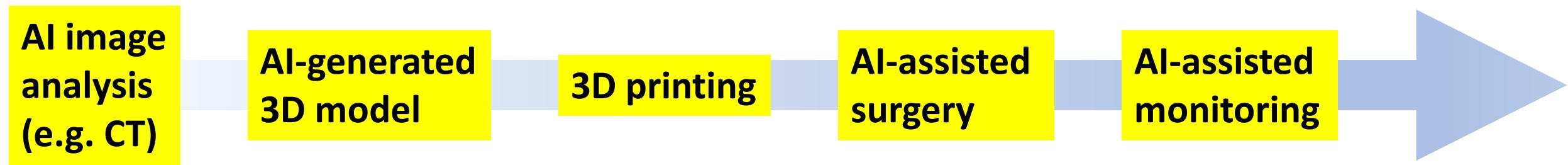


Structured and comprehensive patient history

AI-based predictions for personalized medicine



Custom-made implants



Other applications

AI for omics analysis

- Denoising
- Peak calling
- Variant calling
- Clustering
- Outlier detection
- Spatial omics analysis
- Multi-omics integration
- ...

AI for drug development



Drug discovery

Gene-disease mapping
Biomarker discovery
Drug repurposing
Drug target identification
Lead ranking
Adverse event prediction

Clinical trials

Patient identification
Patient monitoring
Pharmacogenomics
Regulatory document preparation

Pharmacovigilance

Adverse event detection
Drug-drug interaction mapping
Patient data anonymization

AI for public health monitoring

Research Article | **Open Access** | Open Peer Review | Published: 08 November 2019

Deep learning for pollen allergy surveillance from twitter in Australia

Jia Rong, Sandra Michalska 

BMC Medical Informatics and

243 Accesses | 11 Altmetric

Forecasting influenza activity using self-adaptive AI model and multi-source data in Chongqing, China

Kun Su^{a,b,1}, Liang Xu^{c,1}, Guangqiao Li^{d,1}, Xiaowen Ruan^c, J
Xiong^b, Shaofeng Lu^c, Li Qi^b, Chaobo Shen^c, Wenge Tang^c,
Xu^c, Xuanling Shi^d, Zhihong Yang^c, Qi Zhang^d, Ziqi Zhuar^{*}
   

Open Access  PlumX Metrics

DOI: <https://doi.org/10.1016/j.ebiom.2019.08.024>

Article | **Open Access** | Published: 18 April 2019

Measuring social, environmental and health inequalities using deep learning and street imagery

Esra Suel , John W. Polak, James E. Bennett & Majid Ezzati

Scientific Reports **9**, Article number: 6229 (2019) | Cite this article

5986 Accesses | 1 Citations | 141 Altmetric | Metrics



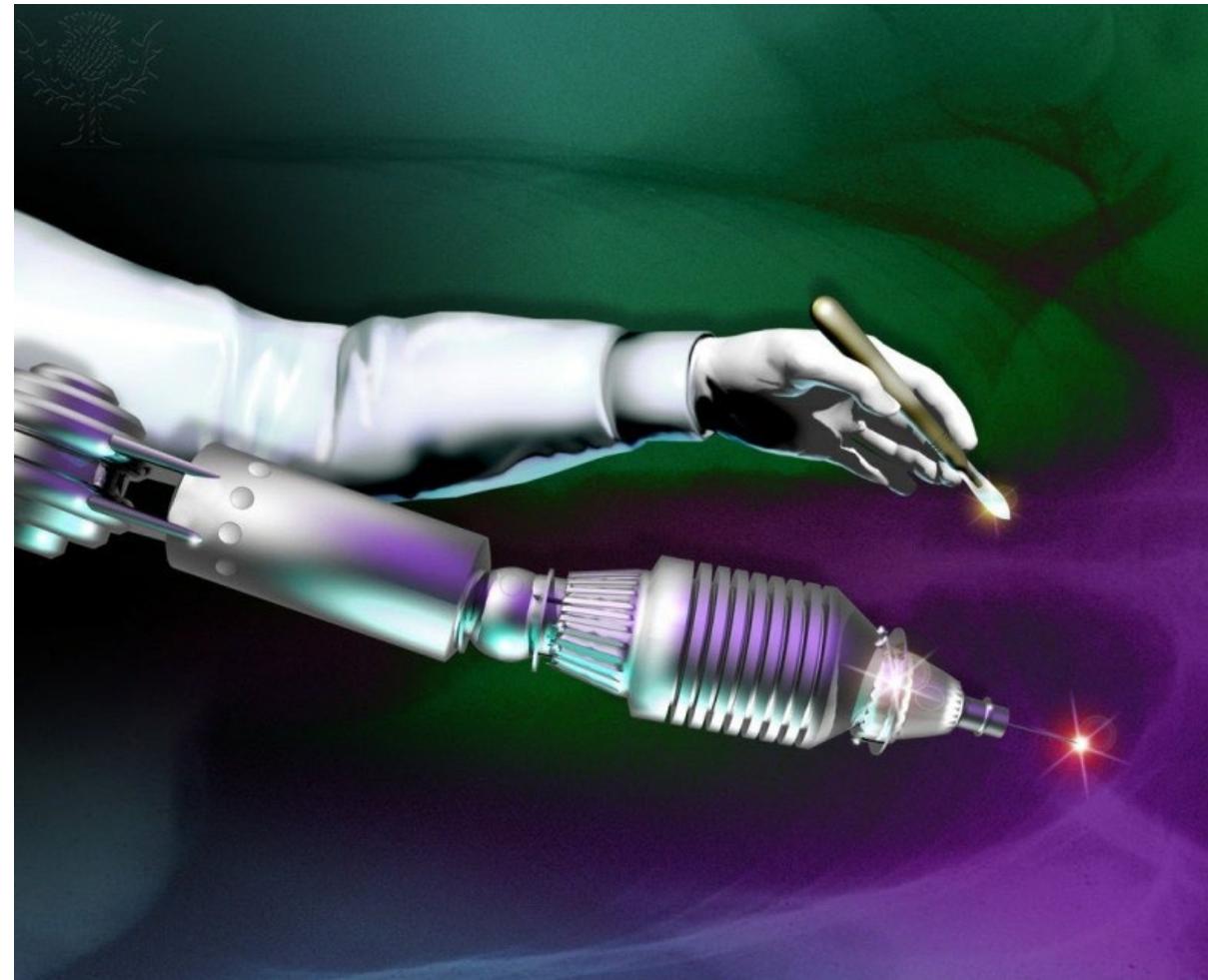
How Canadian AI start-up BlueDot spotted Coronavirus before anyone else had a clue



By [Jerry Bowles](#) March 10, 2020

SUMMARY: An AI-based infectious disease surveillance system that searches the world around-the-clock for possible pandemics should have your attention.

Is AI the doctor and scientist of the future?



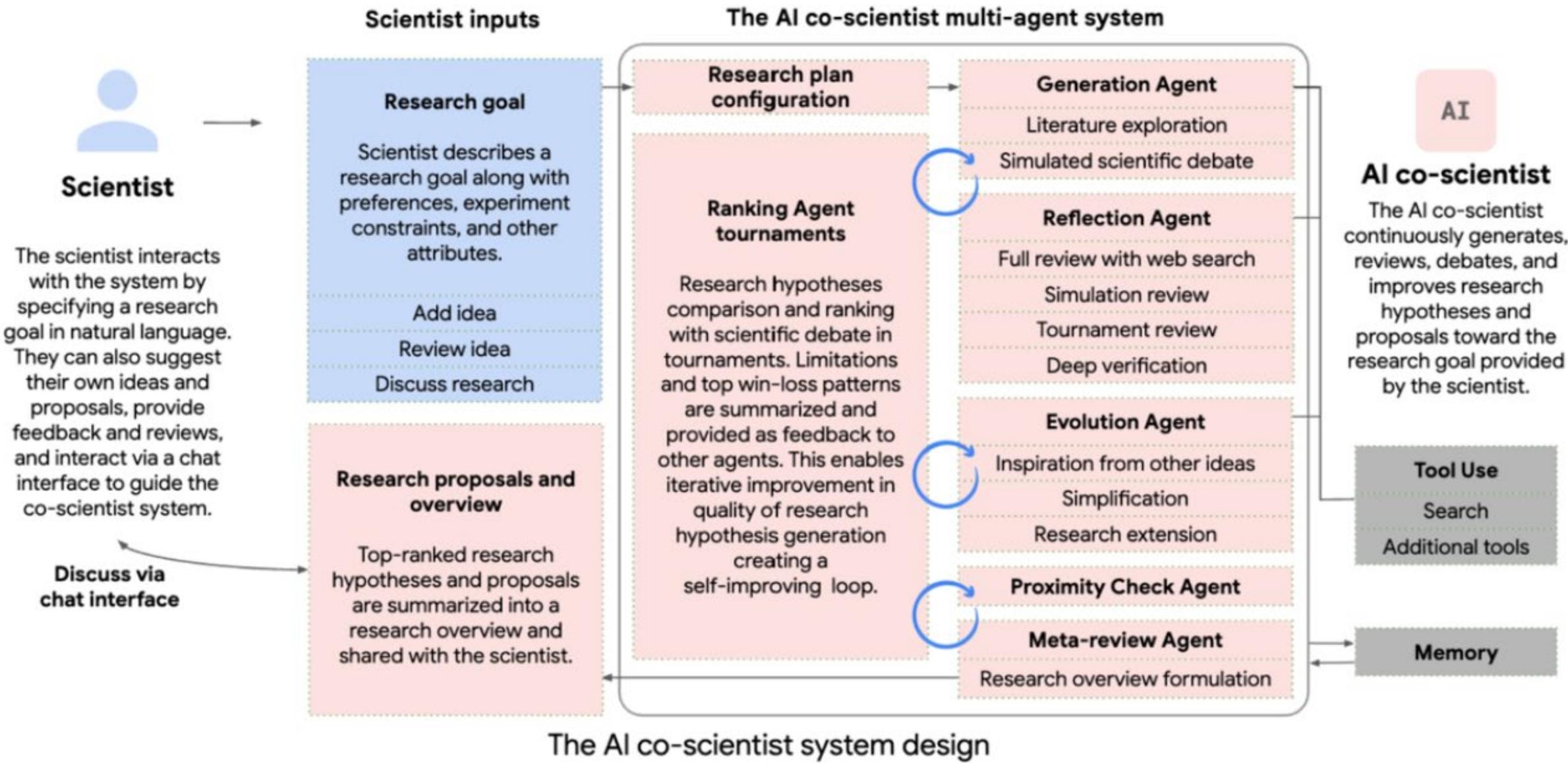
Microsoft says AI system better than doctors at diagnosing complex health conditions

NEWS | 09 May 2025

Google AI better than human doctors at diagnosing rashes from pictures

Chatbot can analyse health-care imagery, such as PDFs of test results, to accurately diagnose a range of medical conditions.

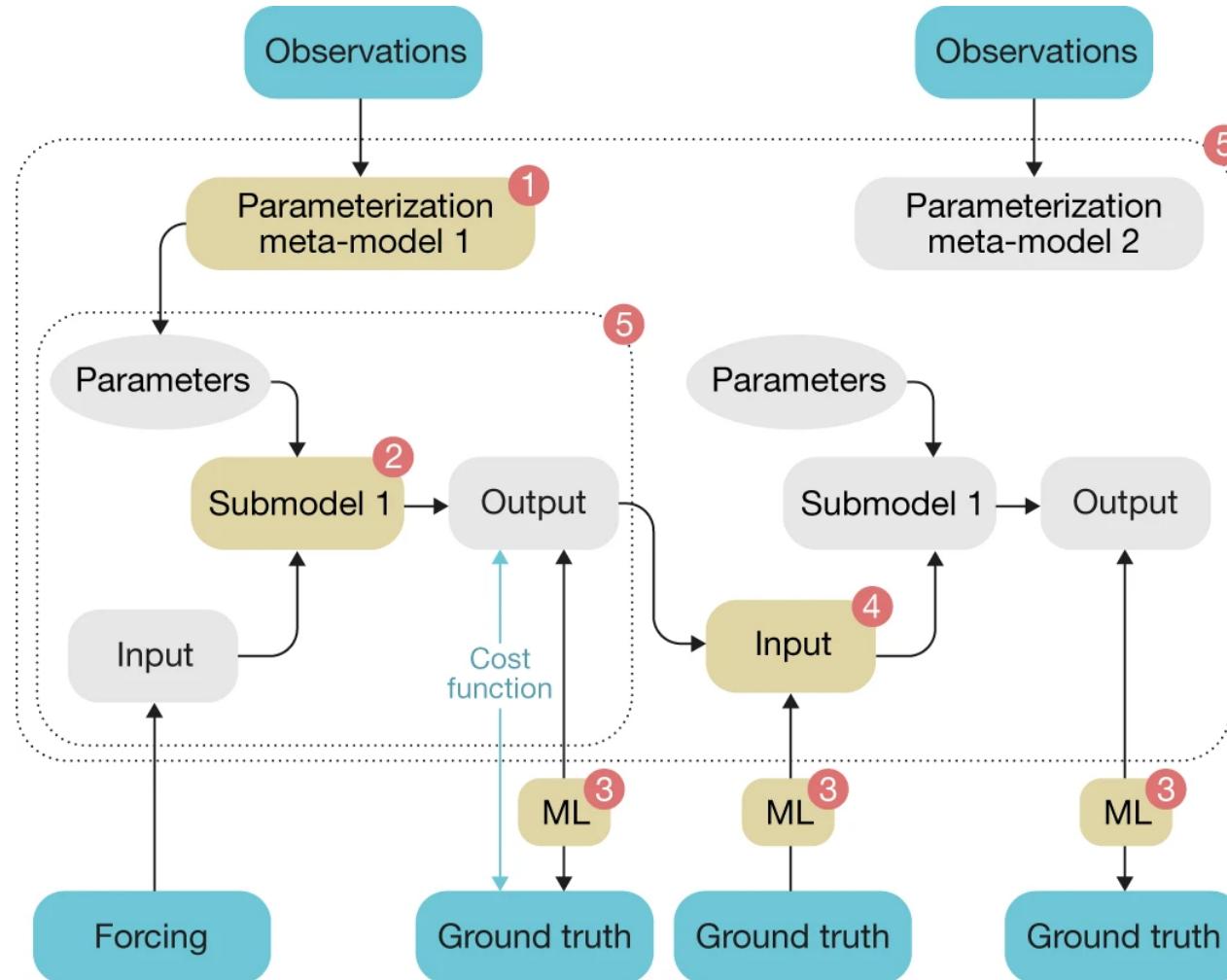
Company	FDA Approval	Indication
Apple	September 2018	Atrial fibrillation detection
Aidoc	August 2018	CT brain bleed diagnosis
iCAD	August 2018	Breast density via mammography
Zebra Medical	July 2018	Coronary calcium scoring
Bay Labs	June 2018	Echocardiogram EF determination
Neural Analytics	May 2018	Device for paramedic stroke diagnosis
IDx	April 2018	Diabetic retinopathy diagnosis
Icometrix	April 2018	MRI brain interpretation
Imagen	March 2018	X-ray wrist fracture diagnosis
Viz.ai	February 2018	CT stroke diagnosis
Arterys	February 2018	Liver and lung cancer (MRI, CT) diagnosis
MaxQ-AI	January 2018	CT brain bleed diagnosis
Alivecor	November 2017	Atrial fibrillation detection via Apple Watch
Arterys	January 2017	MRI heart interpretation



Best of two worlds: combining experimental and AI methods

Experimental approaches	AI approaches
Structural biology (MAXIV/ESS)	Structure prediction
Cell/molecular biology	Prediction of protein-protein interactions
Animal models, clinical samples	AI analysis of public (pre)-clinical data
Drug screening and optimization	Computational screening/AI-based drug design

AI can enhance “traditional” modelling



Using AI for medicine/life science is challenging

Report: IBM Watson delivered ‘unsafe and inaccurate’ cancer recommendations

JULY 25, 2018 BY FINK DENSFORD — LEAVE A COMMENT

Biased Data the Real Danger of AI

By Oliver Mitchell | March 19, 2018

REGULATION

There's No Such Thing as Anonymous Data

by Scott Berinato

FEBRUARY 09, 2015

'Godfather of AI' shortens odds of the technology wiping out humanity over next 30 years

Geoffrey Hinton says there is 10% to 20% chance AI will lead to human extinction in three decades, as change moves fast

- **'We need dramatic changes': is societal collapse inevitable?**



Take home message

AI has MANY applications in medicine/life sciences
but ensuring its responsible use is a MAJOR
challenge