- Kongress-Session: Digitalisierung aus Sicht der Radiologie
- „Künstliche Intelligenz in der Diagnostik“
- 11. April 2019, 10:10 - 10:30 Uhr
- Stage B, Halle 2.2

Möglichkeit, Versorgungsprozesse für Patienten neu zu denken und zu gestalten. Nicht nur das Krankenhaus selbst, sondern alle beteiligten Personen und Institutionen können direkt mit den relevanten Informationen versorgt und in den Prozess mit eingebunden werden – vom Einweiser über das Krankenhaus bis zur Rehaklinik und weiteren Nachbehandlern, vom ambulanten über den stationären Patienten bis zu Angehörigen und Besuchern. Die Zusammenarbeit von Pflege, Ärzten und sekundären Services in und zwischen den Häusern wird völlig neu aufgestellt werden. Dabei muss der Patient im Mittelpunkt stehen.

Welche Ideen gibt es aus dem Blick der Bildgebung? Wie, wann und durch wen können Sie umgesetzt werden? Was ist überhaupt sinnvoll und gewünscht? Was will der Patient? Welche weiteren positiven, aber auch negativen Aspekte können entstehen?

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Künstliche Intelligenz in der Diagnostik

Tim Conrad, Medical Bioinformatics Group
Freie Universität Berlin

Berlin Center for Machine Learning
ZUSE INSTITUTE BERLIN
BBDC BERLIN BIG DATA CENTER

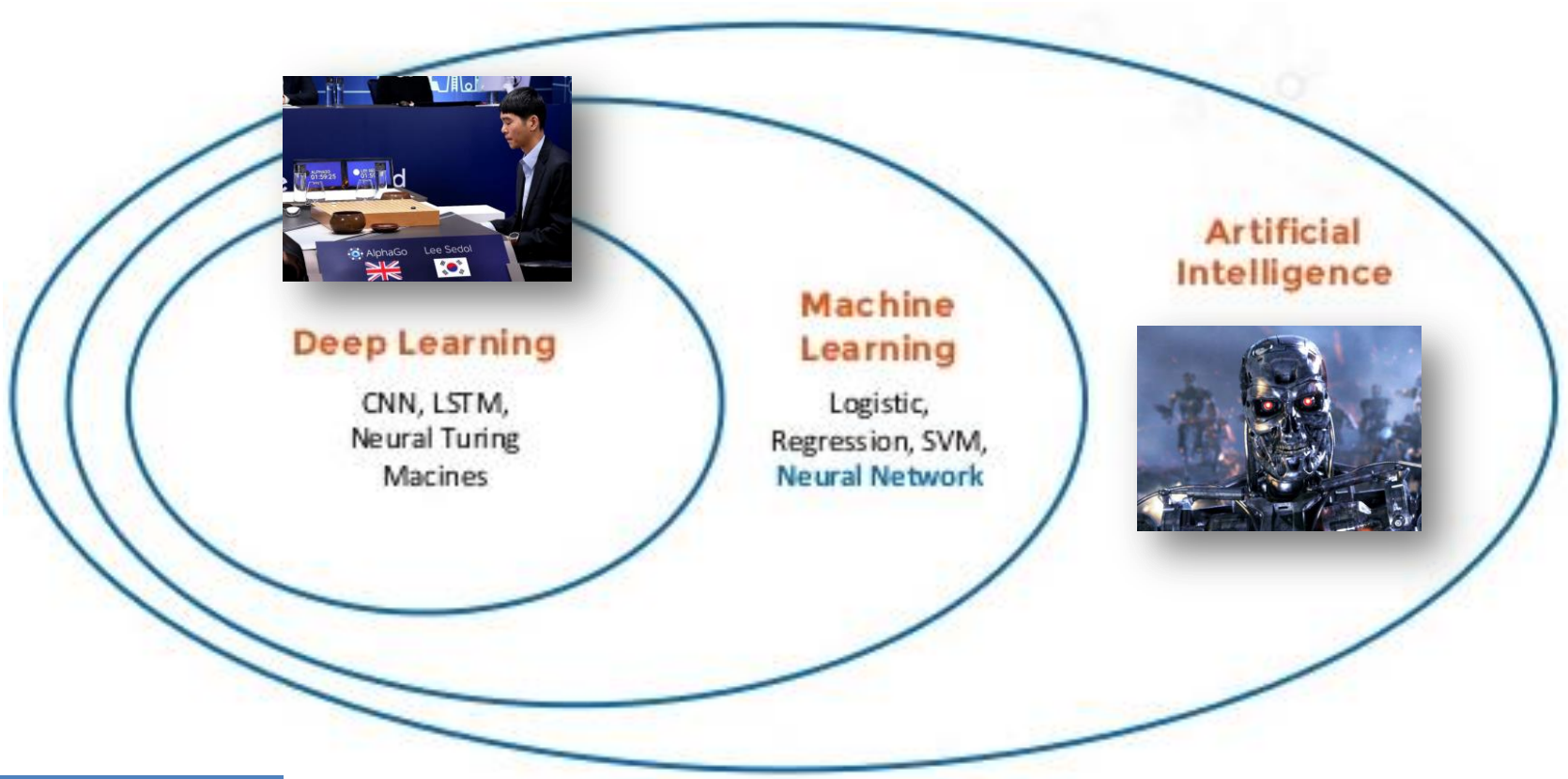
- “There’s a distinction […] between **generalized AI** and **specialized AI**.
- In science fiction, what you hear about is **generalized AI**, right? Computers start getting smarter than we are […]
- My impression, based on talking to my top science advisers, is that we’re still a reasonably long way

https://www.wired.com/2016/10/president-obama-mit-joi-ito-interview/

- "[…] **specialized AI** […] is about using algorithms and computers to figure out increasingly complex tasks.

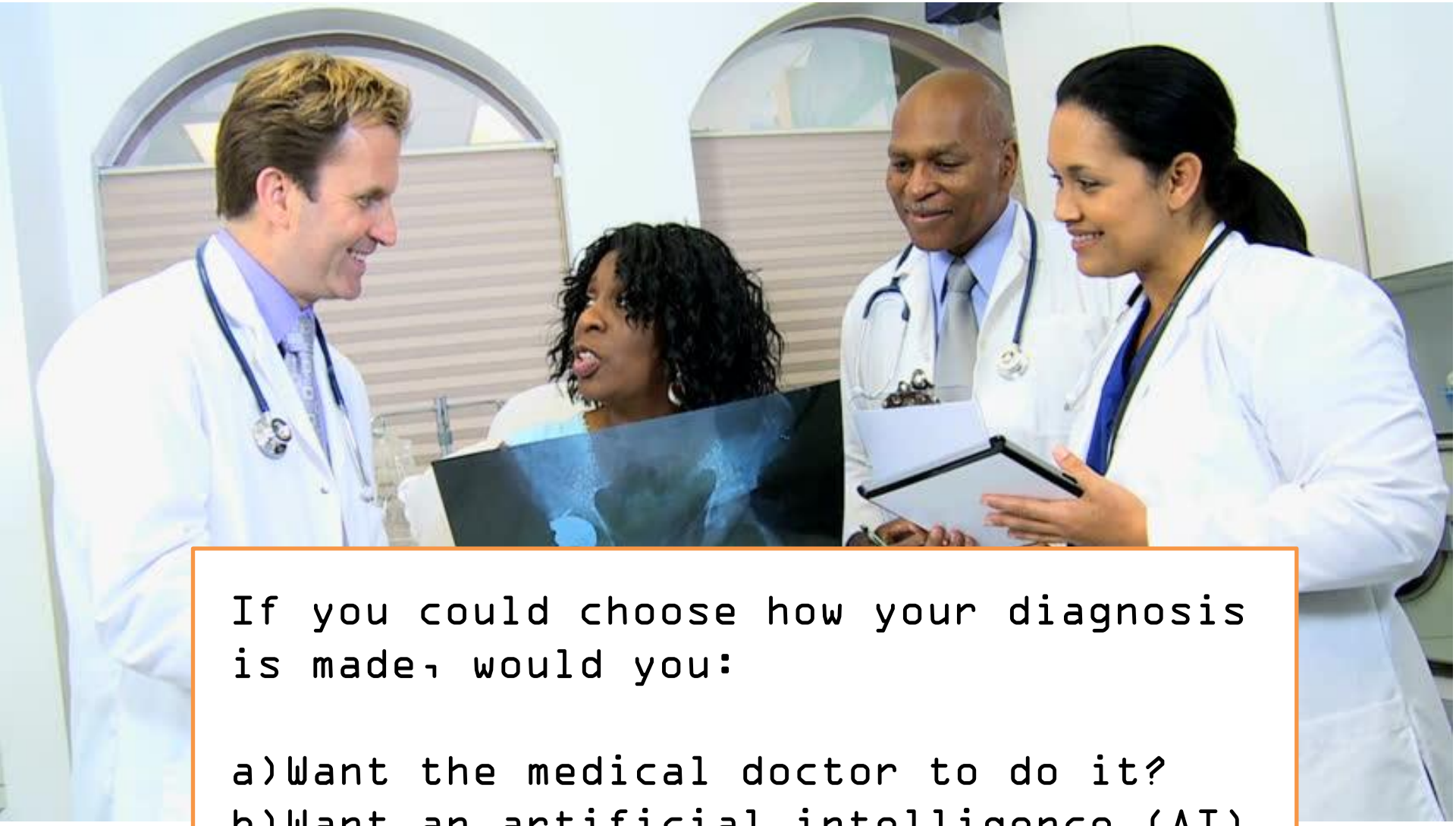
- We've been seeing specialized AI in every aspect of our lives, from medicine and transportation to how electricity is distributed, […]"

From AI to (Deep) Learning



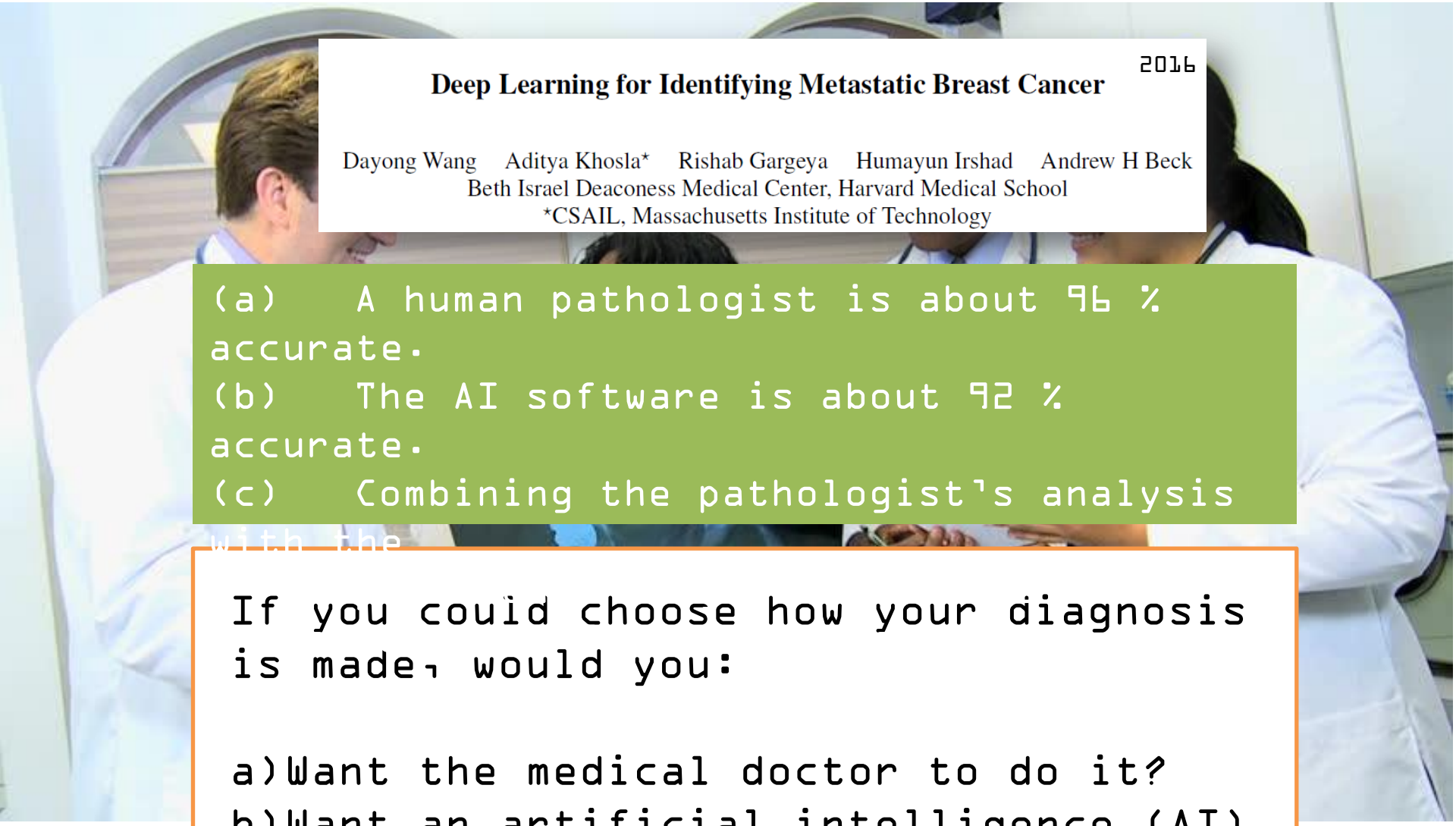
Current status:

Algorithms are good at **identifying patterns and (irr-)regularities** in the data and to then apply insights gleaned from that data to similar problems (e.g. patients).



If you could choose how your diagnosis is made, would you:

a) Want the medical doctor to do it?
b) Want an artificial intelligence (AI) to do it?
c) Want the medical doctor AND the AI to do it?



Deep Learning for Identifying Metastatic Breast Cancer 2016

Dayong Wang Aditya Khosla* Rishab Gargeya Humayun Irshad Andrew H Beck
Beth Israel Deaconess Medical Center, Harvard Medical School
*CSAIL, Massachusetts Institute of Technology

(a) A human pathologist is about 96 % accurate.
(b) The AI software is about 92 % accurate.
(c) Combining the pathologist's analysis with the

If you could choose how your diagnosis is made, would you:

a) Want the medical doctor to do it?
b) Want an artificial intelligence (AI) to do it?
c) Want the medical doctor AND the AI to do it?

Current Applications of AI in Medical Diagnostics

Many of today's diagnostic applications "powered by AI" can be categorized into the following four categories:

- Chat Bots
- Oncology
- Pathology
- Rare Diseases

Current Applications of AI in Medical Diagnostics

Oncology

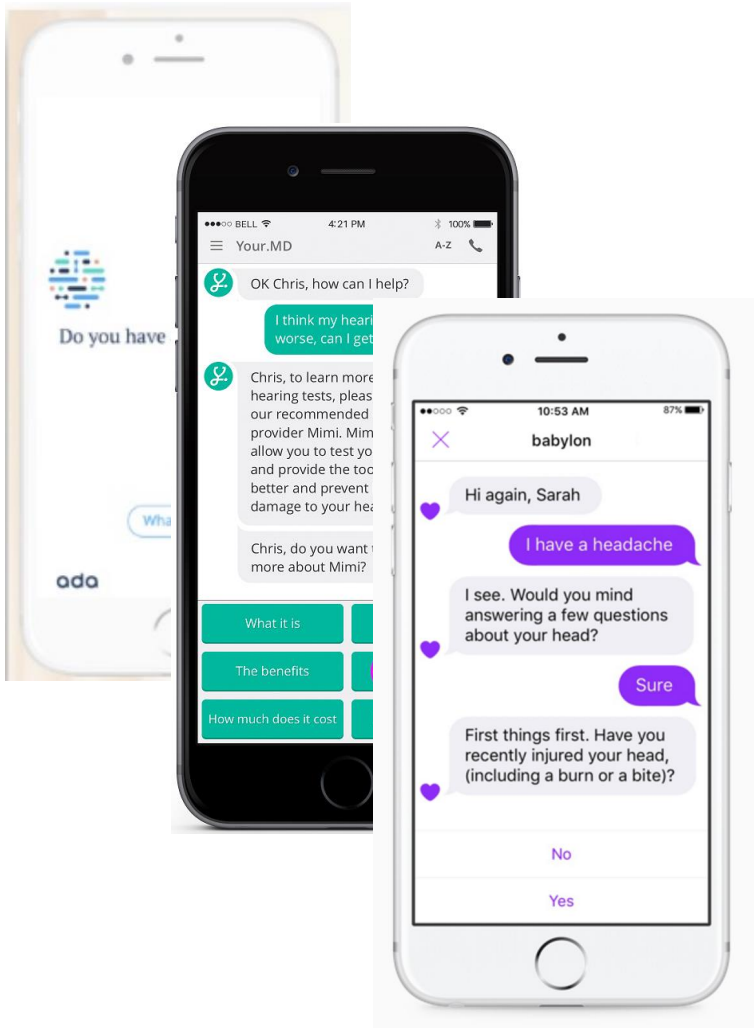
- Most methods based on Deep Learning for medical imaging data.
- Able to recognize cancerous tissue at a level comparable

In the U.S., there are approximately 5.4 million new skin cancer diagnoses each year

Current Applications of AI in Medical Diagnostics

Chat Bots

AI-chatbots based on natural language processing (NLP) can identify patterns in patient symptoms and make a potential diagnosis, prevent disease and/or recommend an appropriate course of action.



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Mathematical Optimization and Data Analysis Laboratories

Healthcare is Driven by Decision Trees

SOCIOLOGY OF HEALTH & ILLNESS

Sociology of Health & Illness Vol. 31 No. 2 2009 ISSN 0141–9889, pp. 278–299
doi: 10.1111/j.1467-9566.2008.01152.x

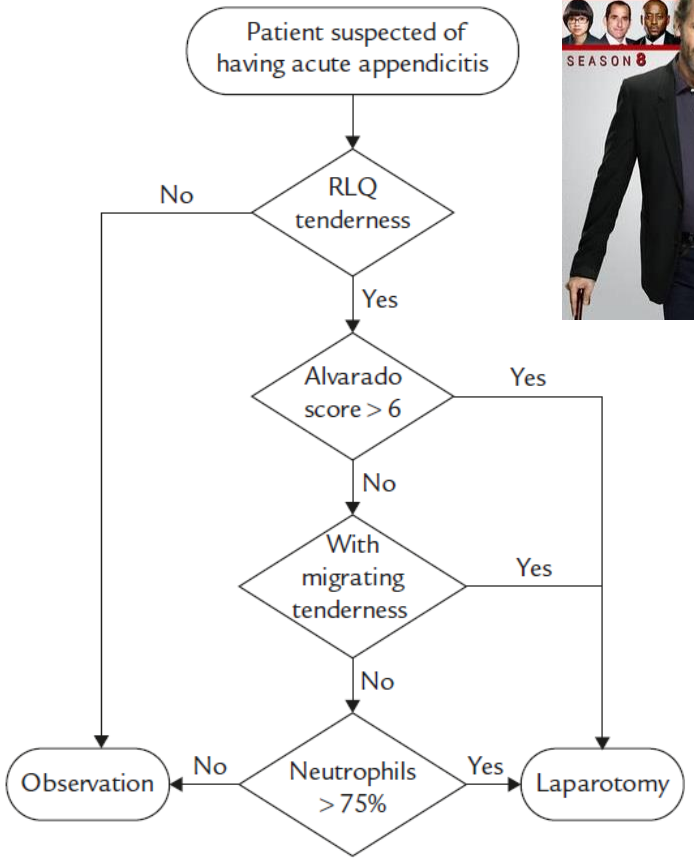
Review Article

Sociology of diagnosis: a preliminary review

Annemarie Jutel

School of Midwifery, Otago Polytechnic, New Zealand

„Diagnosis can be described as both a process and a classification scheme, or a "pre-existing set of categories agreed upon by the medical profession to designate a specific condition"



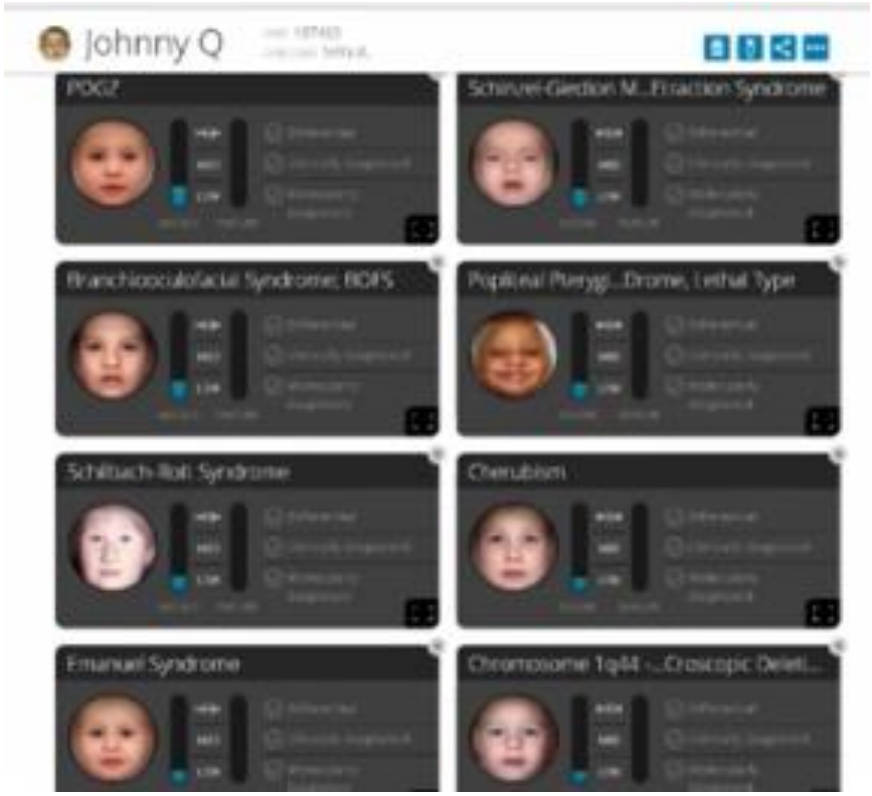
Decision Model for Acute Appendicitis Treatment With Decision Tree
Technology—A Modification of the Alvarado Scoring System
Ting et al.
DOI: 10.1016/S1726-4901(10)70087-3

MODAL Mathematical Optimization and Data Analysis Laboratories

Current Applications of AI in Medical Diagnostics

Rare Diseases

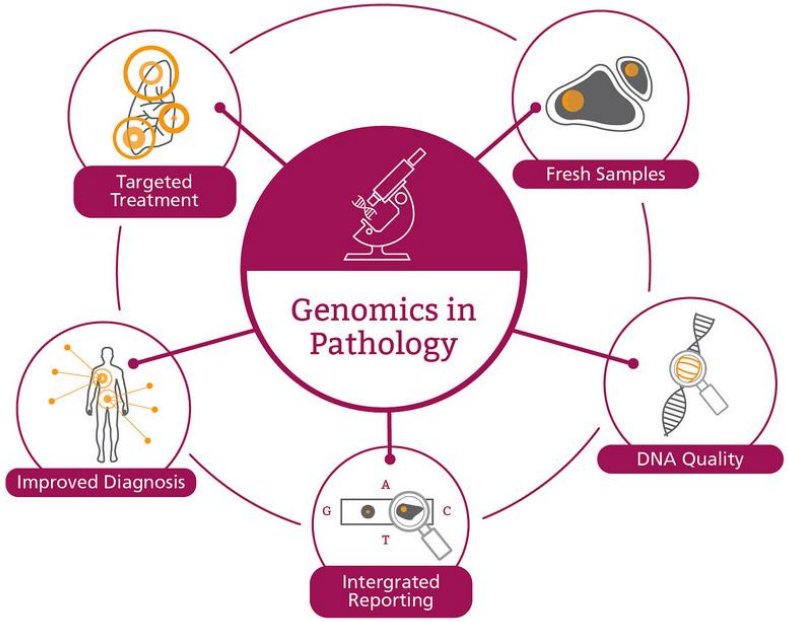
Patient photos are analyzed using facial analysis and deep learning to detect phenotypes that correlate with rare genetic

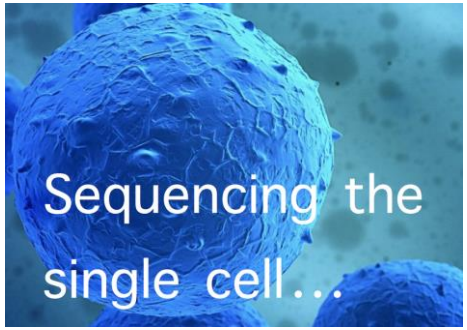


Current Applications of AI in Medical Diagnostics

Pathology

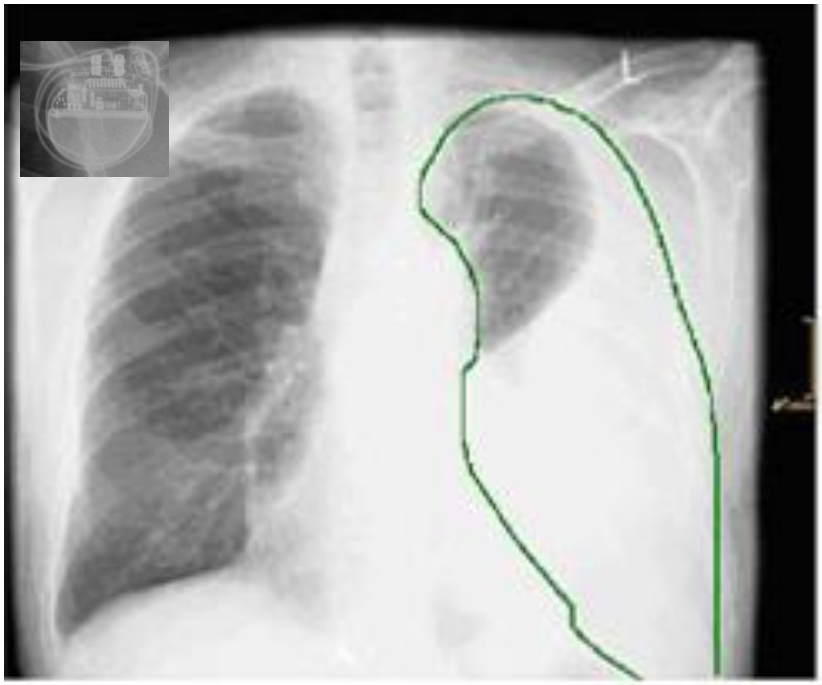
- Diagnosis of diseases based on the laboratory analysis of body fluids and tissues.
- Machine vision and other machine learning technologies can enhance the efforts traditionally left only to pathologists with microscopes.



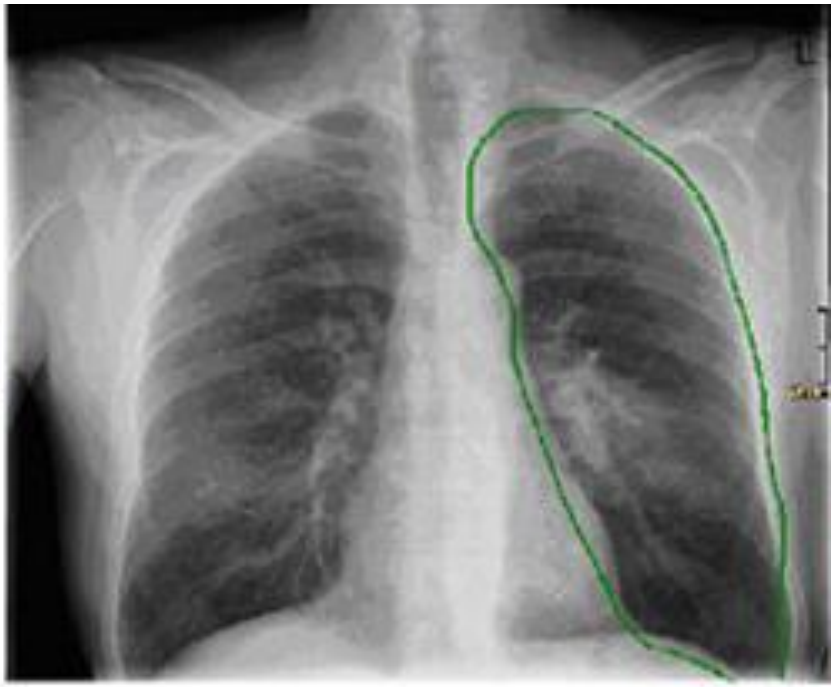


Challenges

TASK: Decide whether patient is healthy or not.



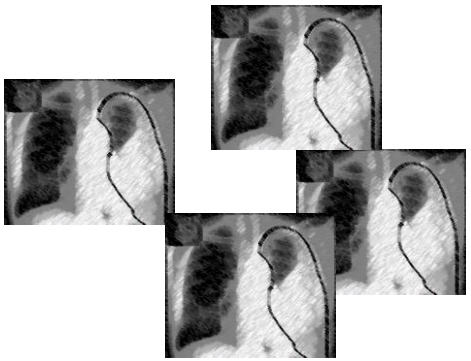
A) Pleuraerguss



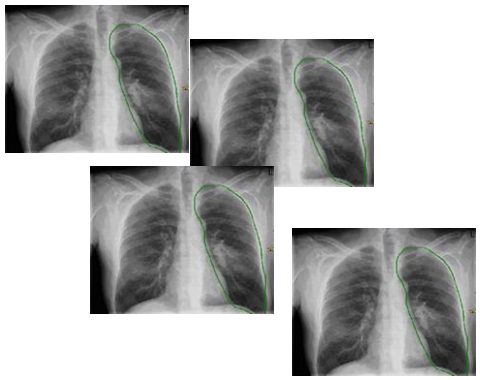
B) Normal Lung

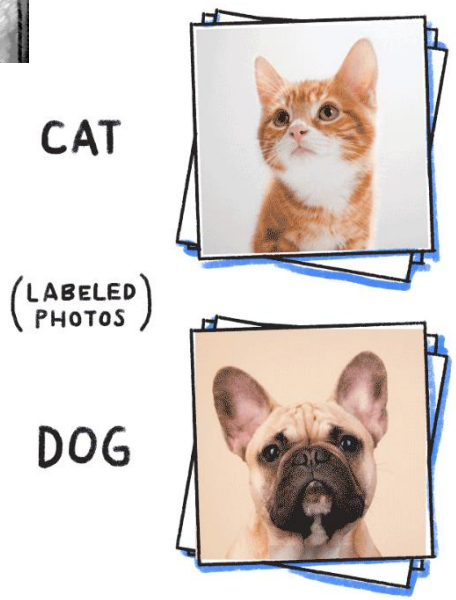
AI is (mainly) based on learning from examples

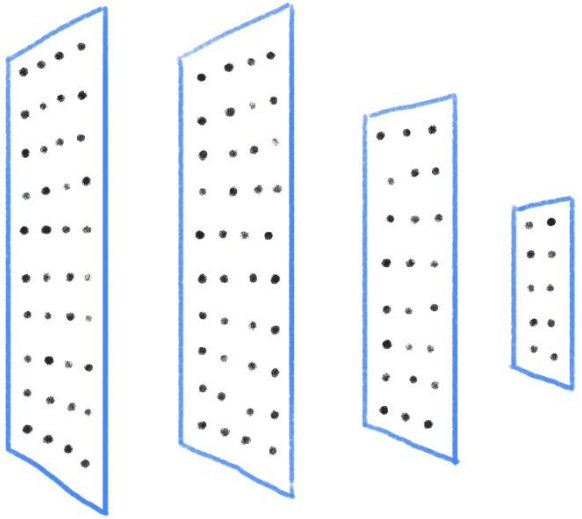
Pleuraerguss



Normal Lung

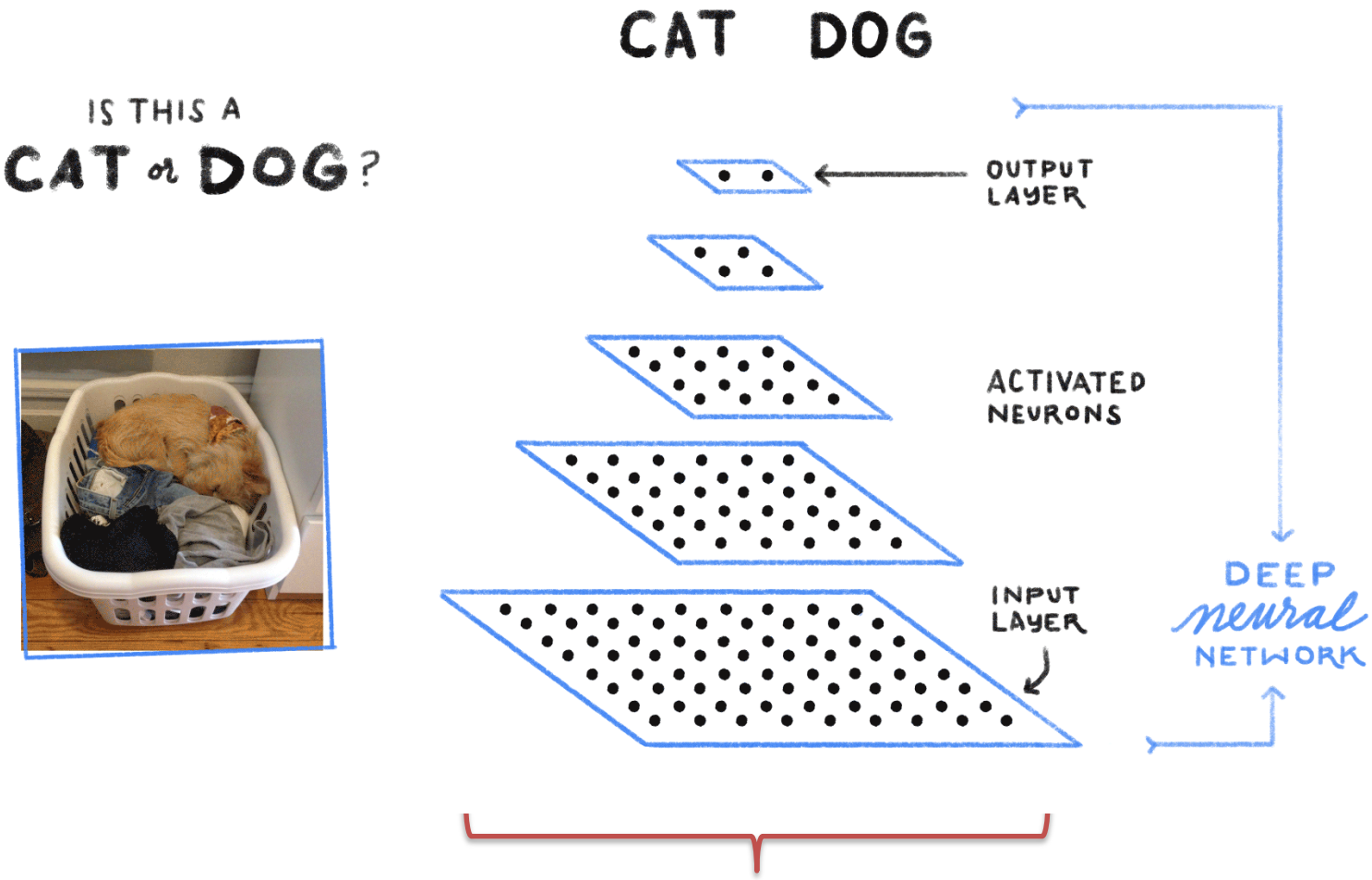






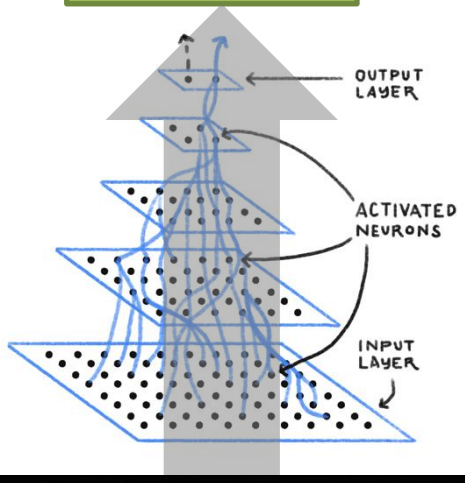
LEARNING THE „AI“ FUNCTION

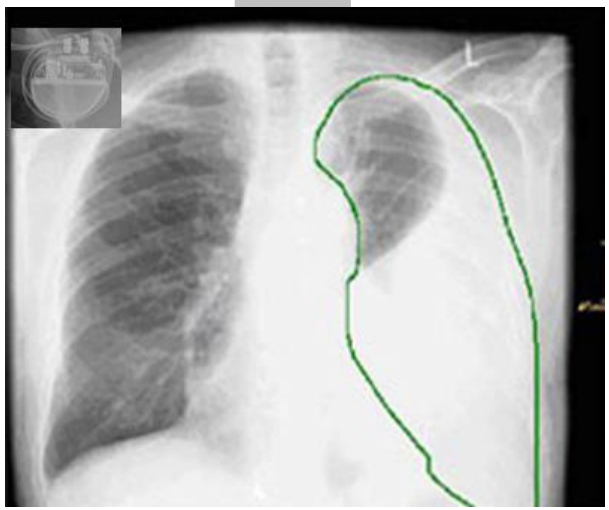
Results


IS THIS A
CAT or DOG?
CAT DOG
OUTPUT LAYER
ACTIVATED NEURONS
INPUT LAYER
DEEP neural NETWORK
APPLYING THE KNOWN „AI“ FUNCTION

Results

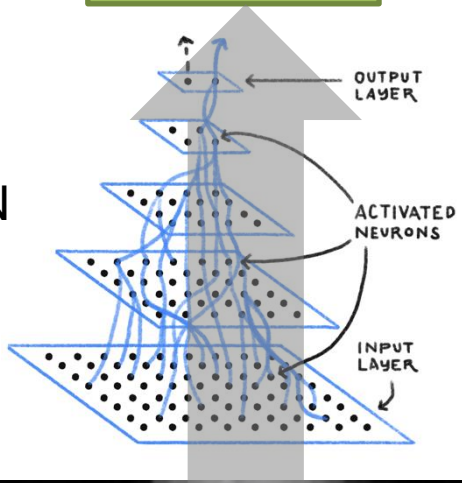
Pleuraerguss

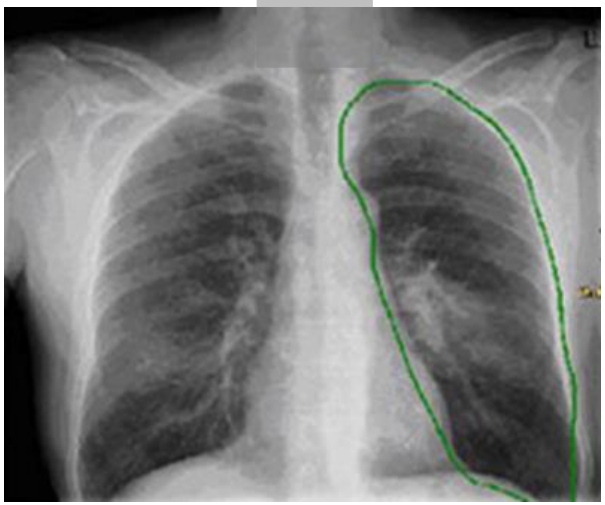




APPLYING THE „AI“ FUNCTION

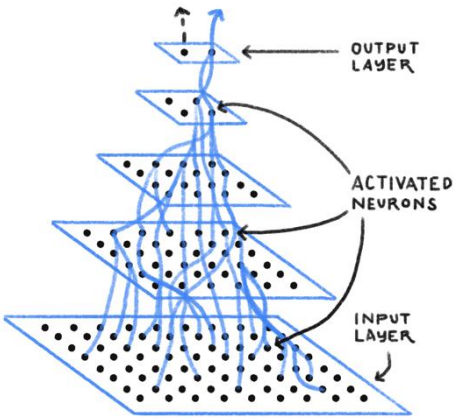
Normal Lung

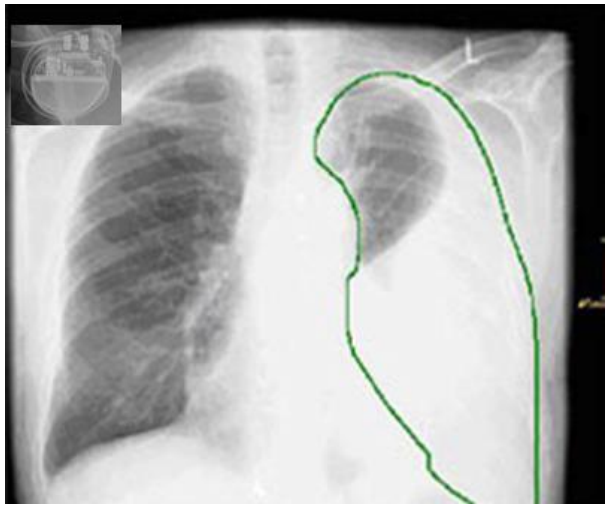




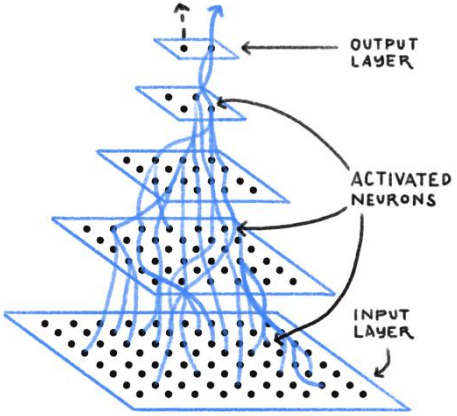
Results

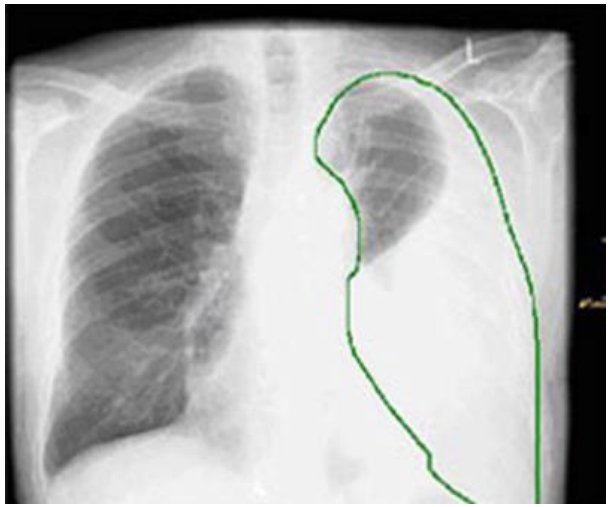
Pleuraerguss



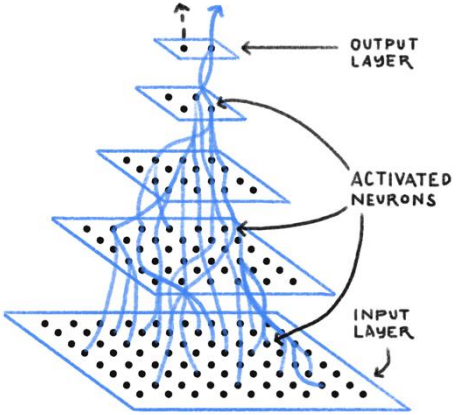


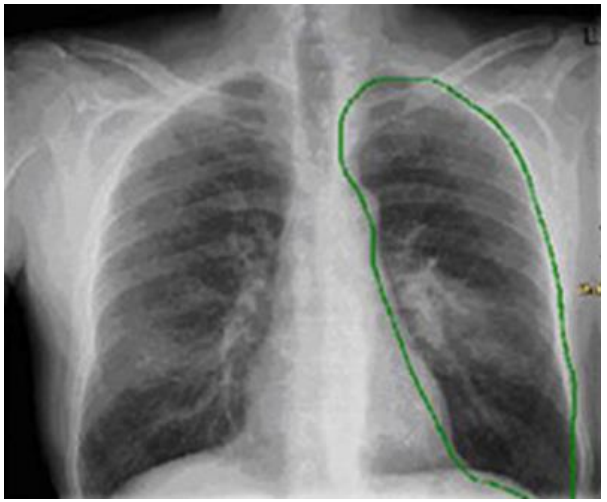
Normal Lung





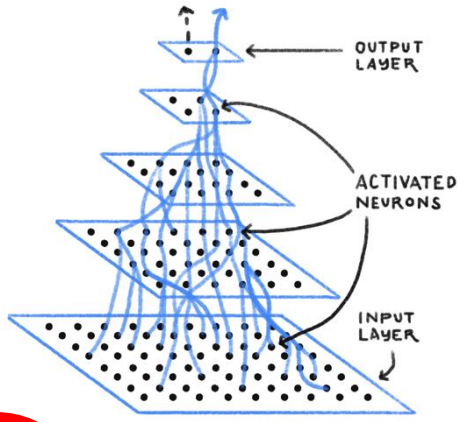
Normal Lung

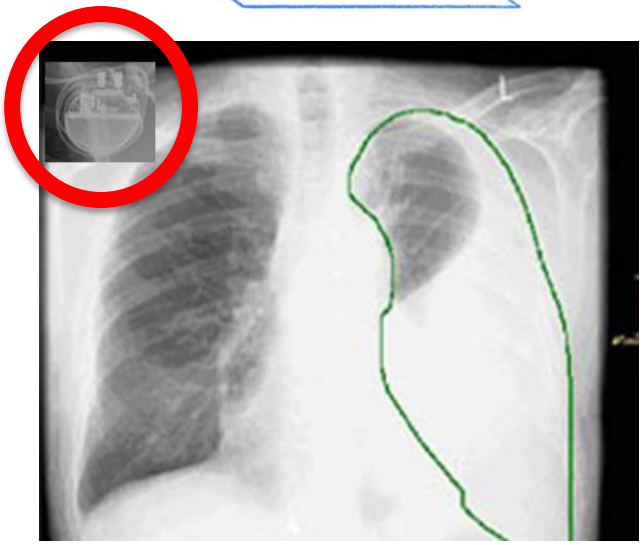




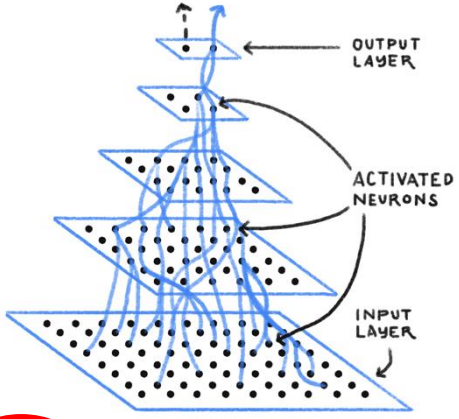
Results

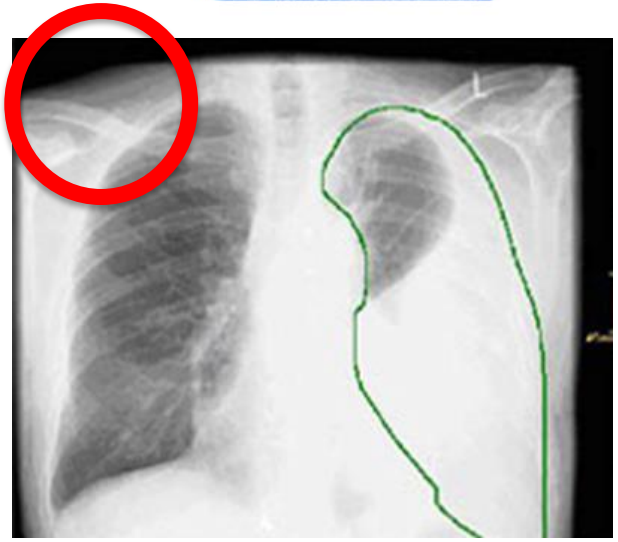
Pleuraerguss



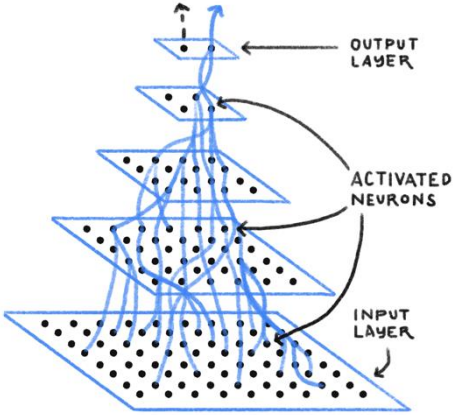


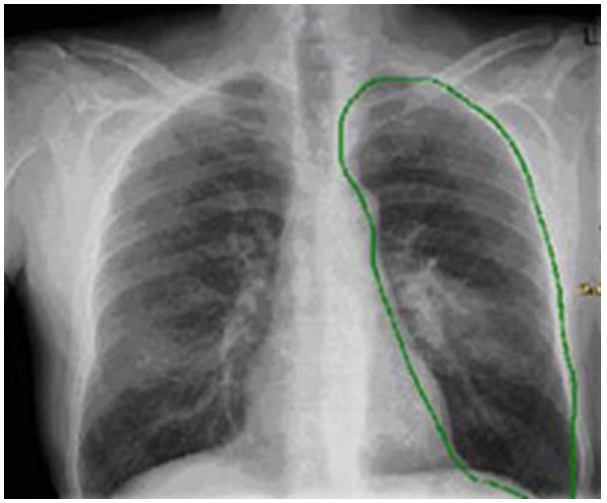
Normal Lung



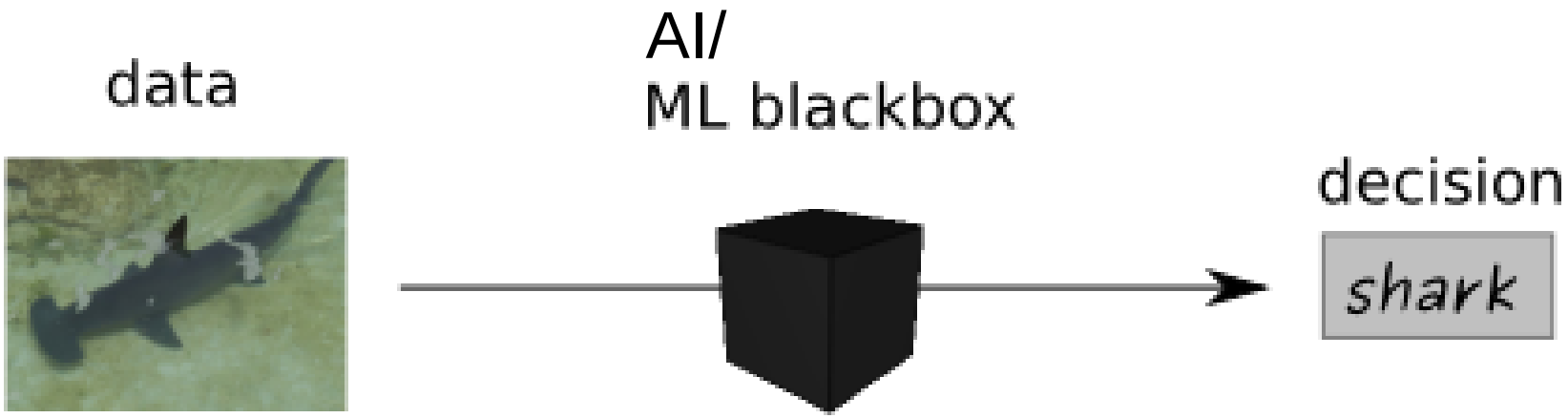


Normal Lung





AI is often a black box!



Explainability is critical!

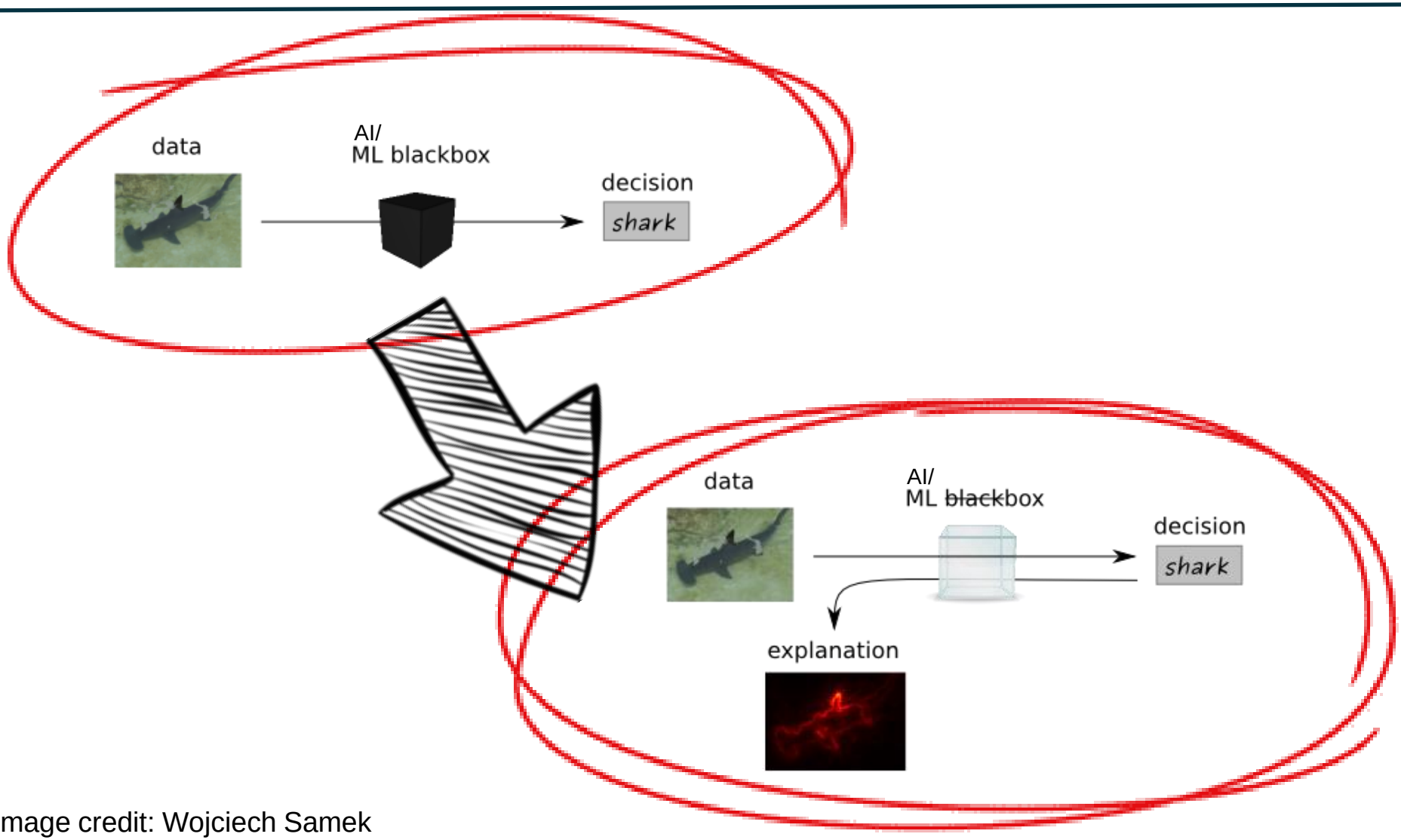


Image credit: Wojciech Samek

Klaus-Robert Müller et al.

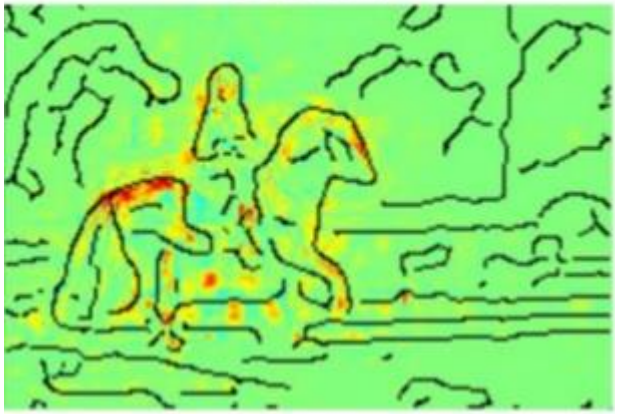
Test error for various classes:

	aeroplane	bicycle	bird	boat	bottle	bus	car
Fisher	79.08%	66.44%	45.90%	70.88%	27.64%	69.67%	80.96%
DeepNet	88.08%	79.69%	80.77%	77.20%	35.48%	72.71%	86.30%
	cat	**chair**	**cow**	**diningtable**	**dog**	**horse**	**motorbike**
Fisher	59.92%	51.92%	47.60%	58.06%	42.28%	80.45%	69.34%
DeepNet	81.10%	51.04%	61.10%	64.62%	76.17%	81.60%	79.33%
	person	**pottedplant**	**sheep**	**sofa**	**train**	**tvmonitor**	**mAP**
Fisher	85.10%	28.62%	49.58%	49.31%	82.71%	54.33%	59.99%
DeepNet	92.43%	49.99%	74.04%	49.48%	87.07%	67.08%	72.12%

Image

FV

DNN



Outlook

Frankfurter Allgemeine

Medizin & Ernährung

OG MEDIZIN GENE KLIMA WELTRAUM GARTEN NETZRÄTSEL ZUKUNFTSLABOR LINDAU

DATENFLUT IN DER MEDIZIN

Da hilft nur noch Kollege Computer

VON MICHAEL BRENDLER - AKTUALISIERT AM 14.04.2018 - 12:21

Moderne bildgebende Verfahren liefern den Ärzten immer mehr Informationen. Mit der Auswertung sind sie zunehmend überfordert. Künstliche Intelligenz könnte ein Ausweg sein. Ersetzt sie bald den ausgebildeten Fachmediziner?

Tim Conrad
FU Berlin

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conrad@math.
fu-berlin.de