

- 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



- “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

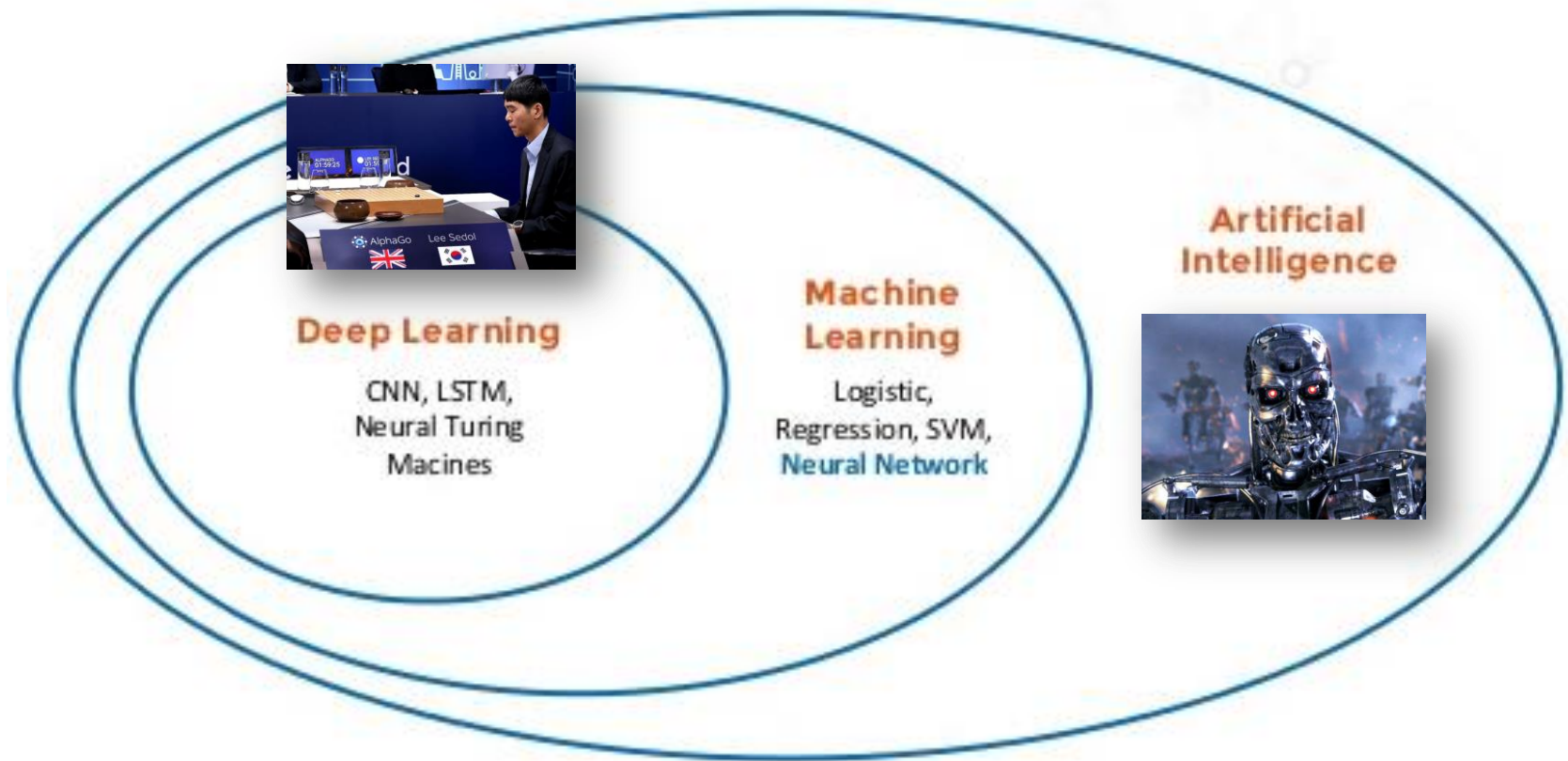
<https://www.wired.com/2016/10/president-obama-mit-joi-ito-interview/>



- “[...] **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, [...]”



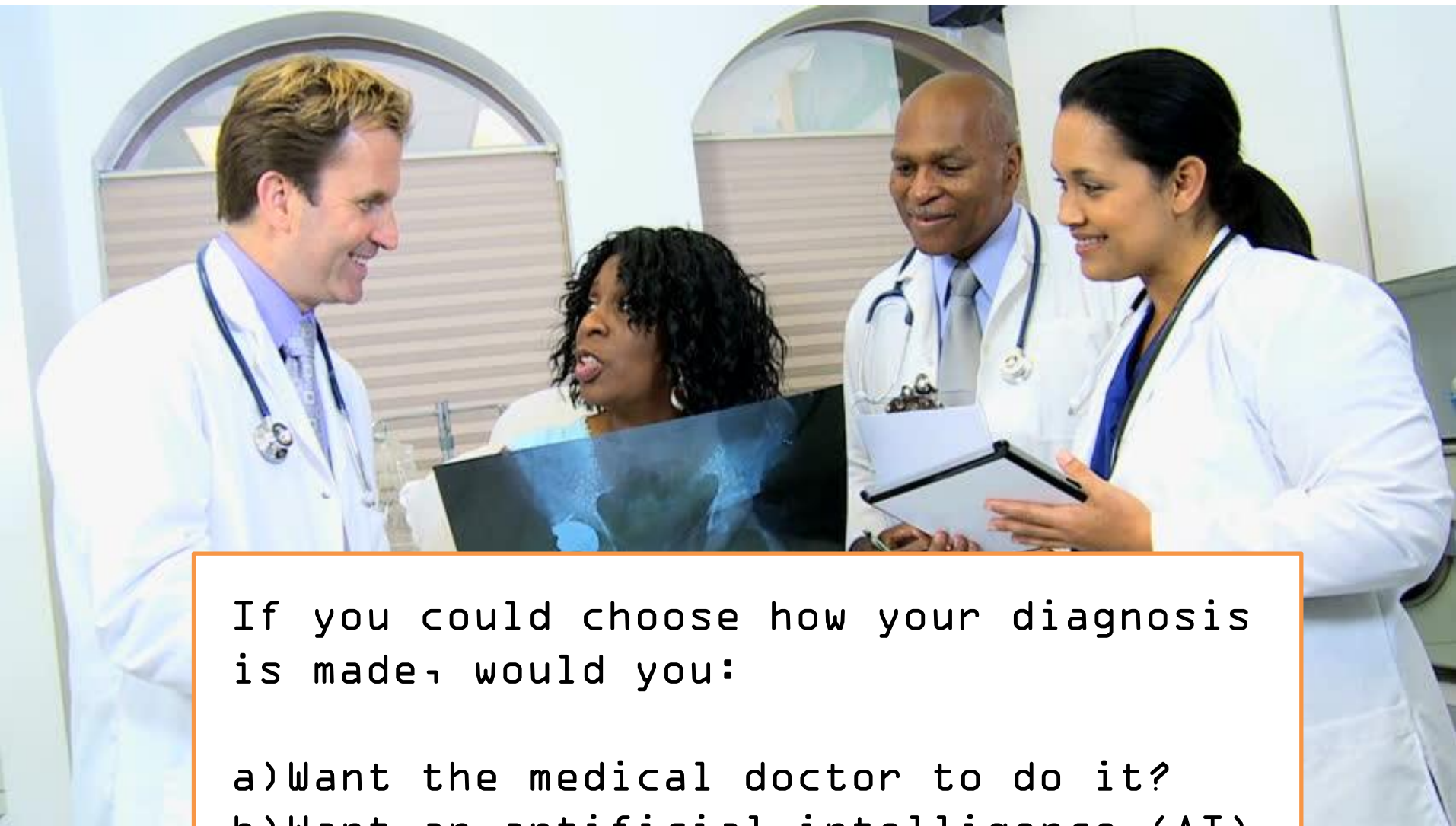
From AI to (Deep) Learning



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:

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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

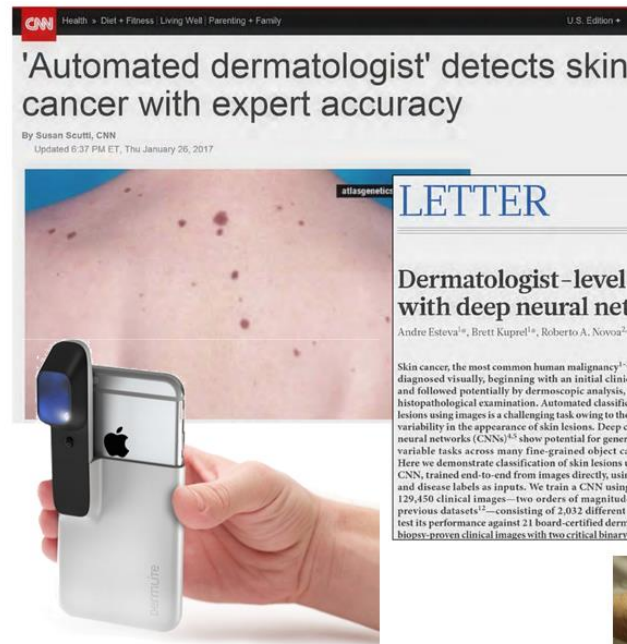
Rare
Diseases



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



01/26/2017

LETTER

Dermatologist-level classification of skin cancer with deep neural networks

Andre Esteva^{a,*}, Brett Kuprel^{a,*}, Roberto A. Novoa^{a,2,3}, Justin Ko², Susan M. Swetter^{a,4}, Helen M. Blau⁵ & Sebastian Thrun⁶

Skin cancer, the most common human malignancy¹⁻³, is primarily diagnosed visually, beginning with an initial clinical screening and followed potentially by dermoscopic analysis, a biopsy and histopathological examination. Automated classification of skin lesions using images is a challenging task owing to the fine-grained variability in the appearance of skin lesions. Deep convolutional neural networks (CNNs)^{4,5} show potential for general and highly variable tasks across many fine-grained object categories⁶⁻¹¹. Here we demonstrate classification of skin lesions using a single CNN, trained end-to-end from images directly, using only pixels and disease labels as inputs. We train a CNN using a dataset of 129,450 clinical images—two orders of magnitude larger than previous datasets¹²—consisting of 2,032 different diseases. We test its performance against 21 board-certified dermatologists on biopsy-proven clinical images with two critical binary classification

images (for example, smartphone images) exhibit variability in factors such as zoom, angle and lighting, making classification substantially more challenging^{13,14}. We overcome this challenge by using a data-driven approach—1.41 million pre-training and training images make classification robust to photographic variability. Many previous techniques require extensive preprocessing, lesion segmentation and extraction of domain-specific visual features before classification. By contrast, our system requires no hand-crafted features; it is trained end-to-end directly from image labels and raw pixels, with a single network for both photographic and dermoscopic images. The existing body of work uses small datasets of typically less than a thousand images of skin lesions^{15,16}, which, as a result, do not generalize well to new images. We demonstrate generalizable classification with a new dermatologist-labelled dataset of 129,450 clinical images, including 3,374 dermoscopy images.

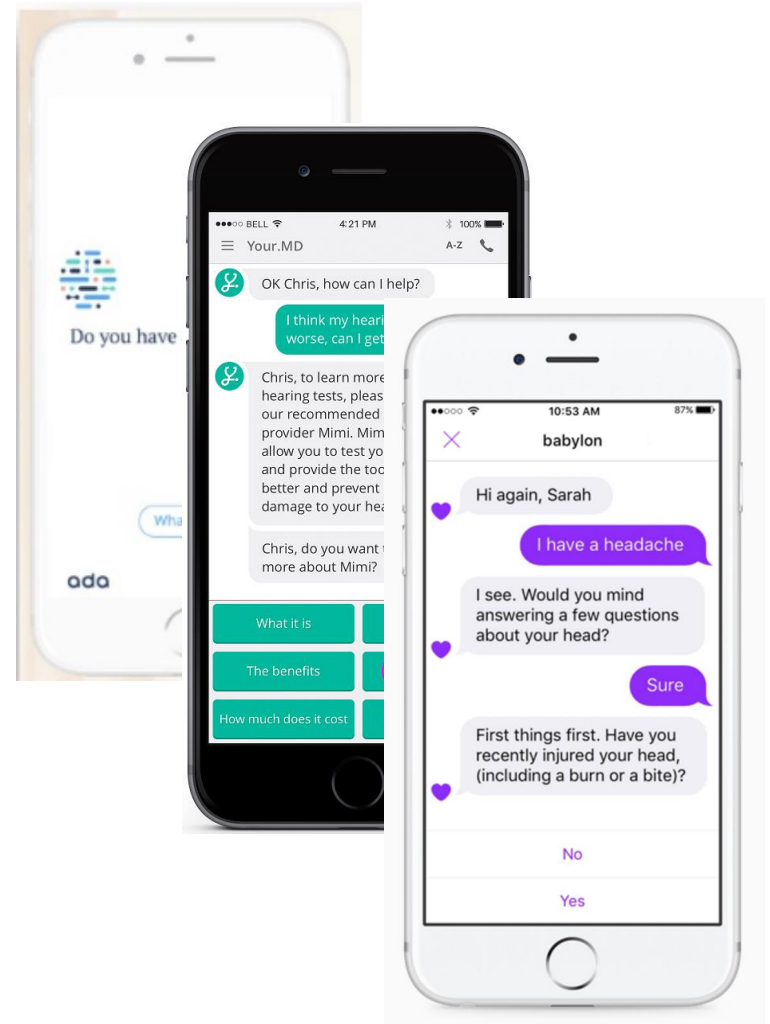


In the U.S., there are approximately 5.4 million new skin cancer diagnoses each year

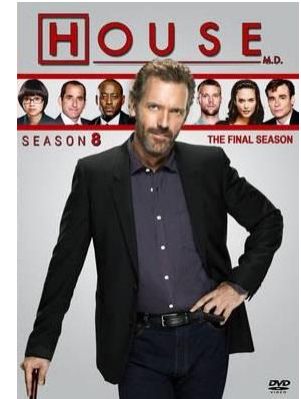
Current Applications of AI in Medical Diagnostics

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.



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

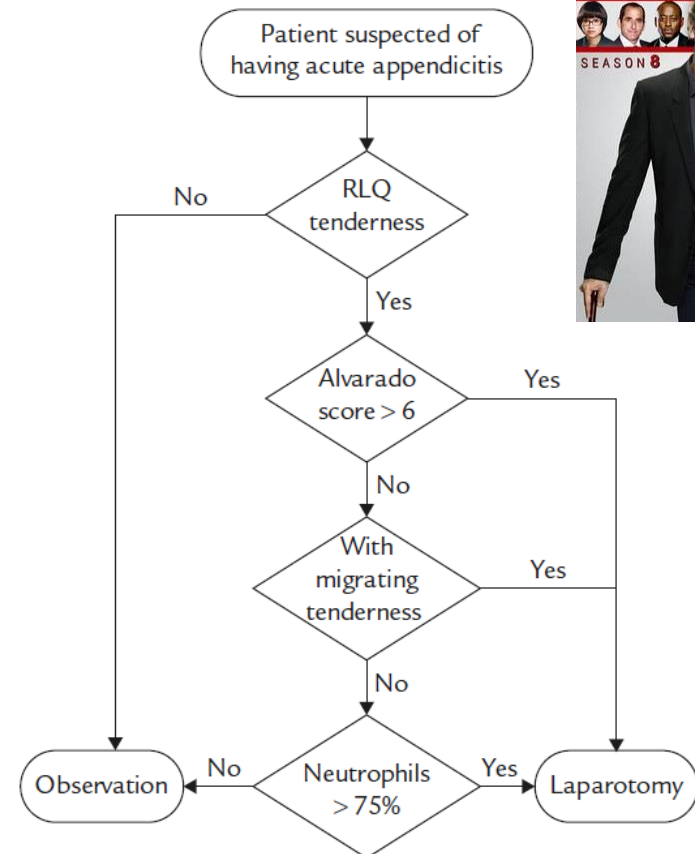
Review Article

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”

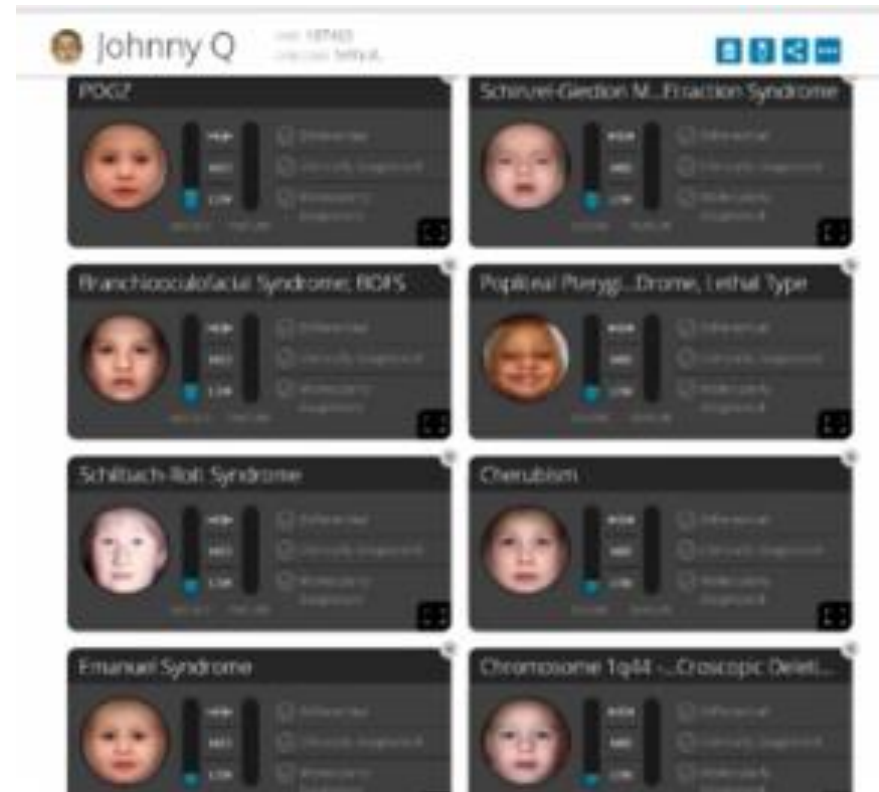


Decision Model for Acute Appendicitis Treatment With
Decision Tree
Technology—A Modification of the Alvarado Scoring System
Ting et al.
DOI: 10.1016/S1726-4901(10)70087-3

Current Applications of AI in Medical Diagnostics

Rare Diseases

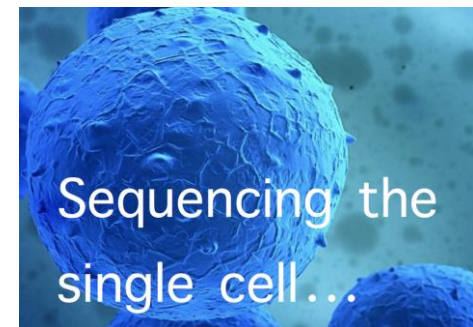
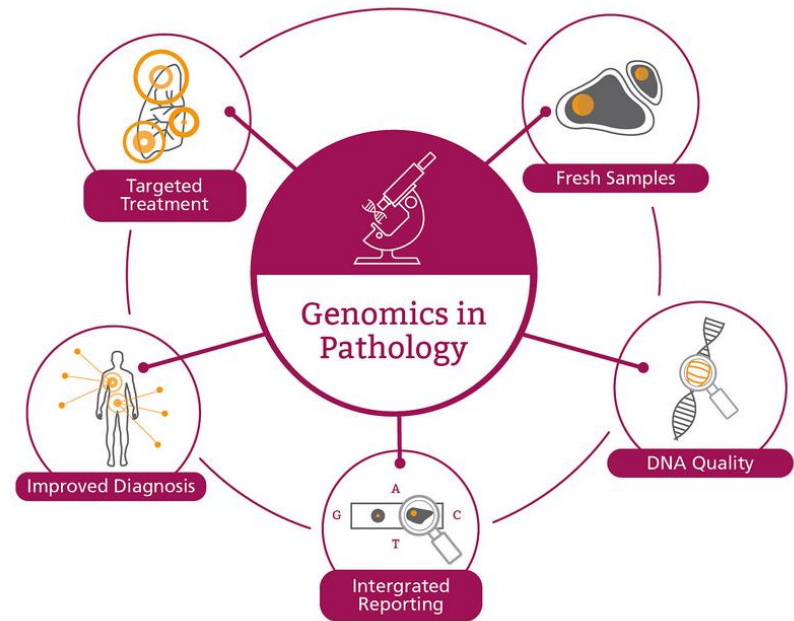
Patient photos are analyzed using facial analysis and deep learning to detect phenotypes that correlate with rare genetic



Current Applications of AI in Medical Diagnostics

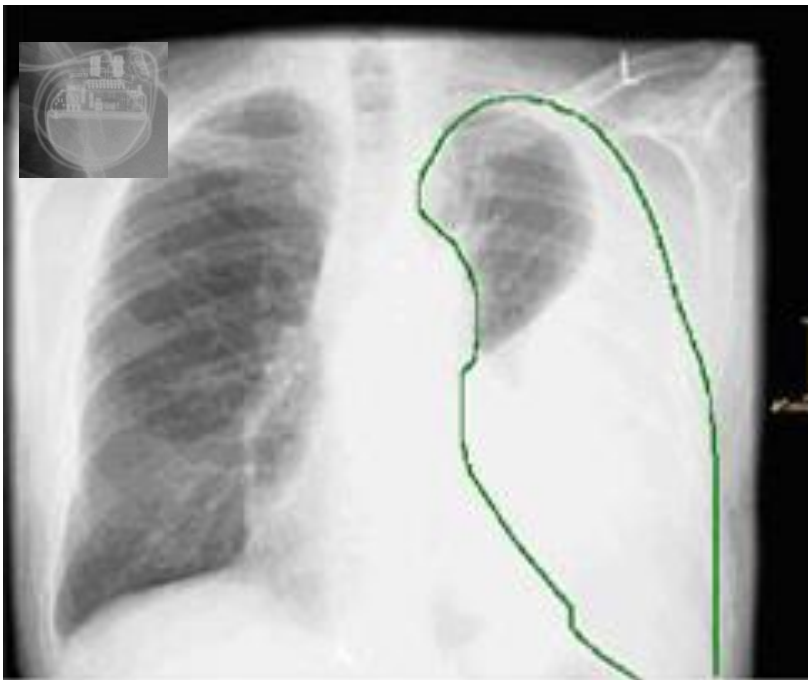
Pathology

- 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.

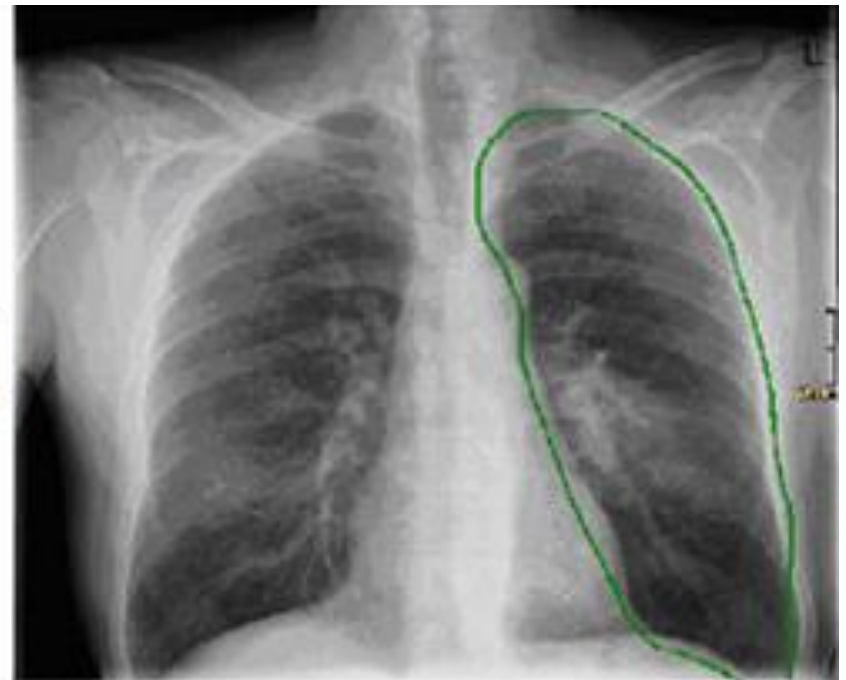


Challenges

TASK: Decide whether patient is healthy or not.



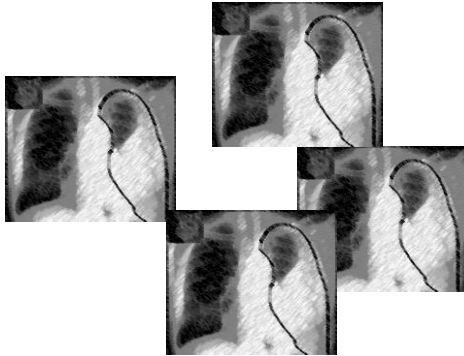
A) Pleuraerguss



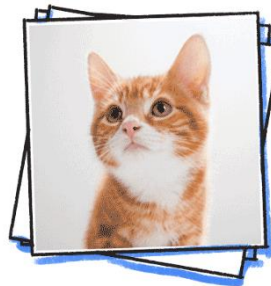
B) Normal Lung

AI is (mainly) based on learning from examples

Pleuraerguss



CAT

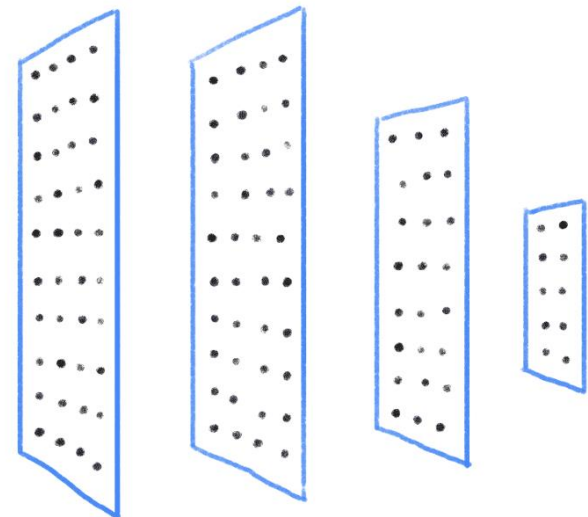
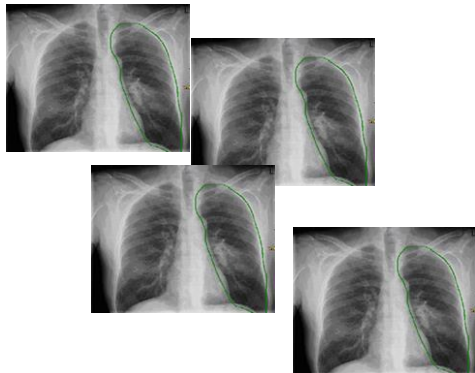


(LAELED
PHOTOS)

DOG



Normal Lung

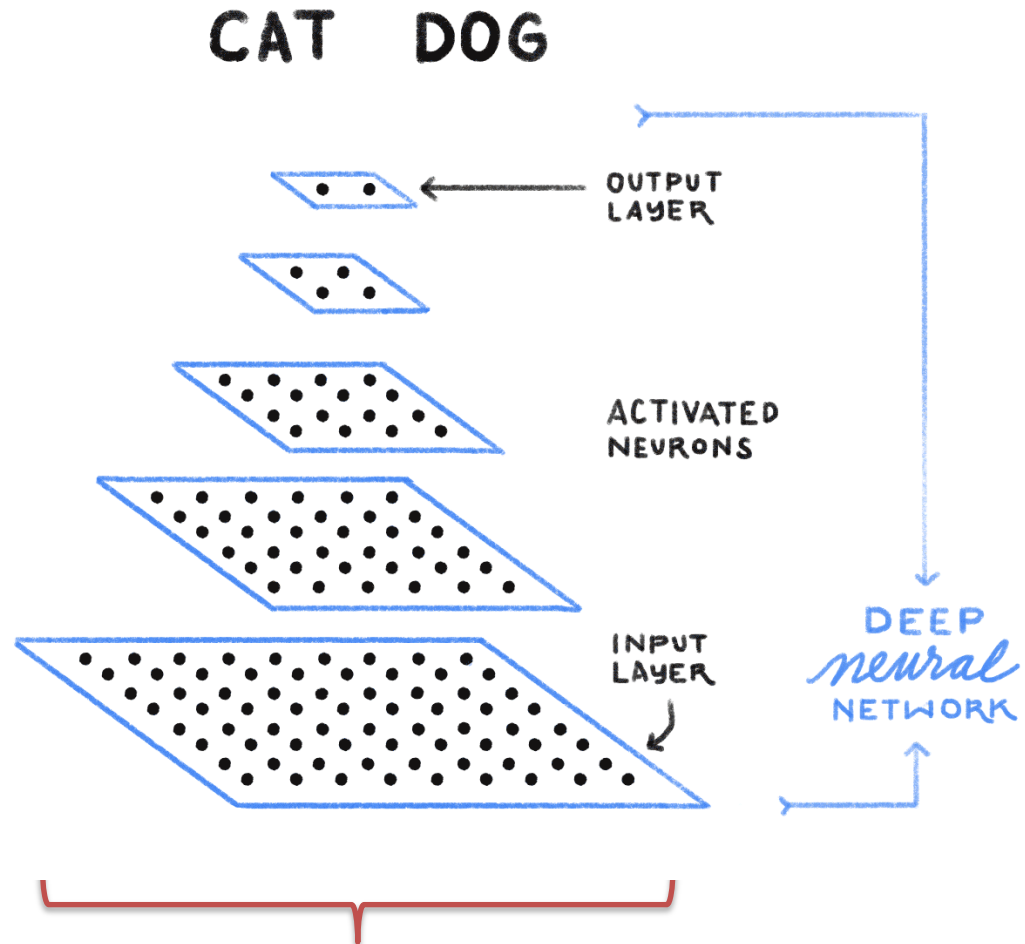


OUTPUT

LEARNING THE „AI“ FUNCTION

Results

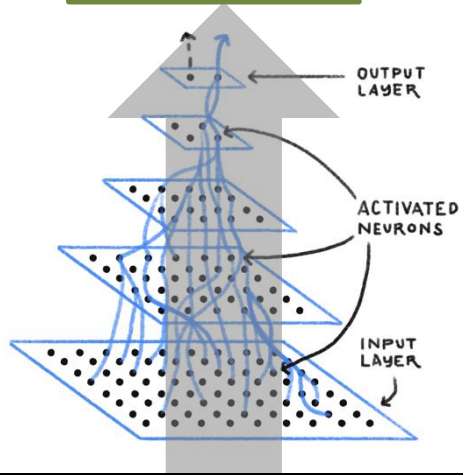
IS THIS A
CAT or DOG?



APPLYING THE KNOWN „AI“ FUNCTION

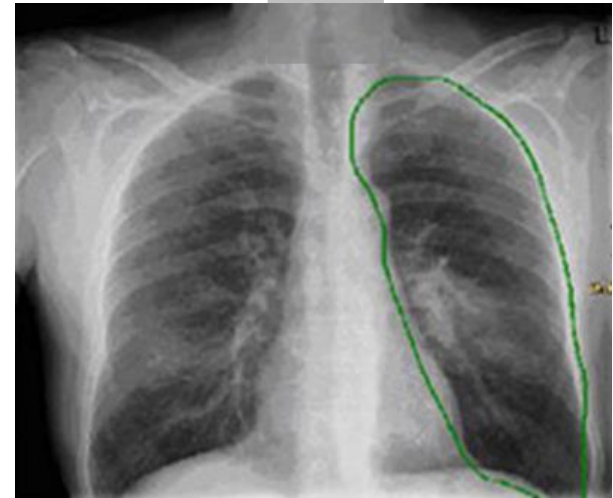
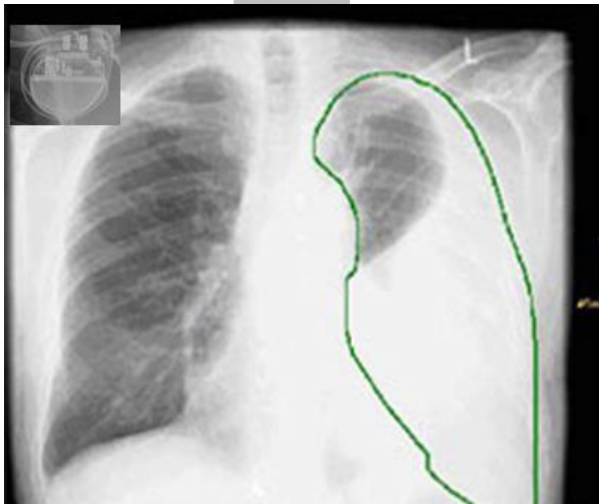
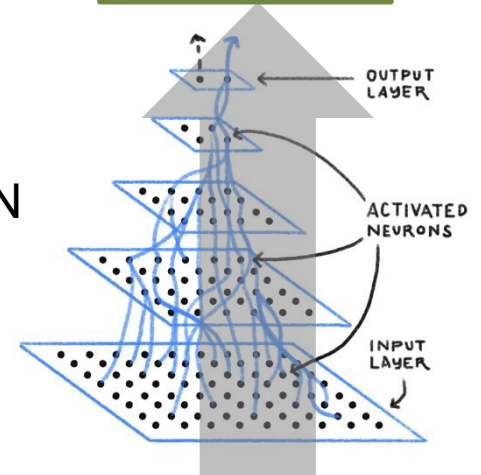
Results

Pleuraerguss



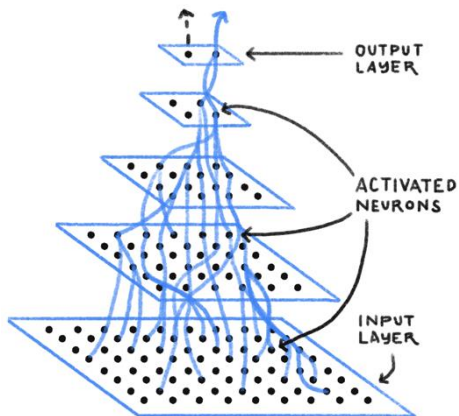
APPLYING THE „AI“ FUNCTION

Normal Lung

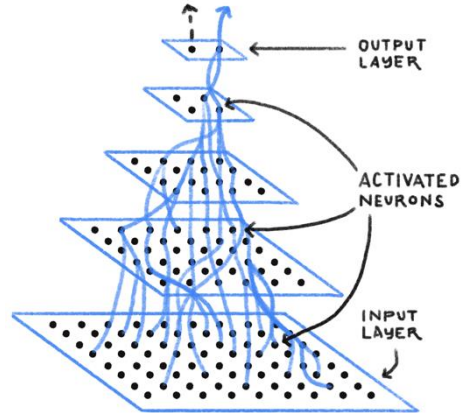


Results

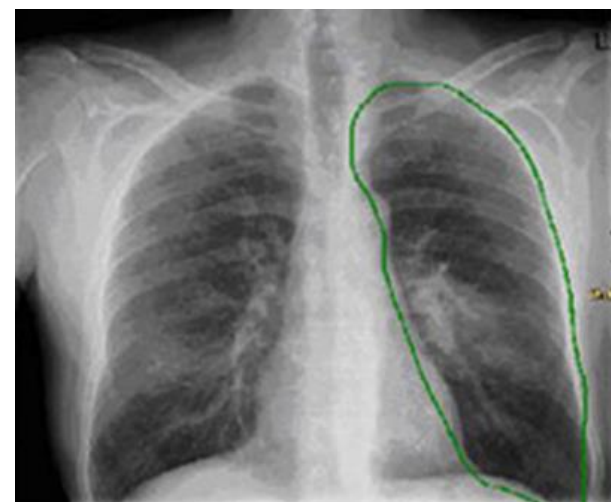
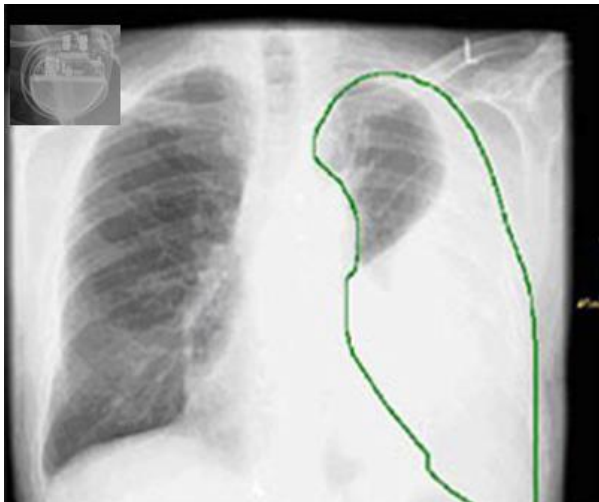
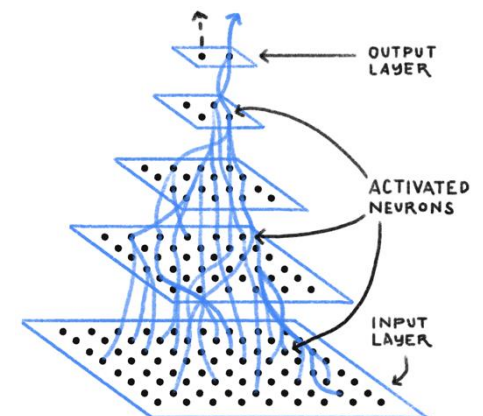
Pleuraerguss



Normal Lung

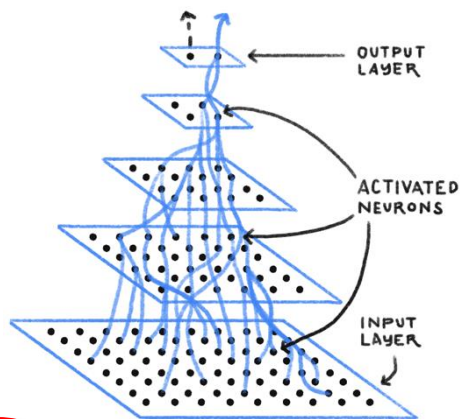


Normal Lung

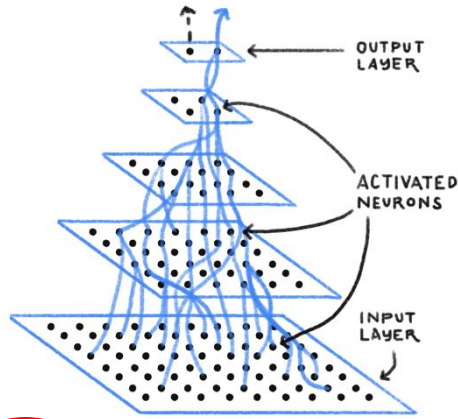


Results

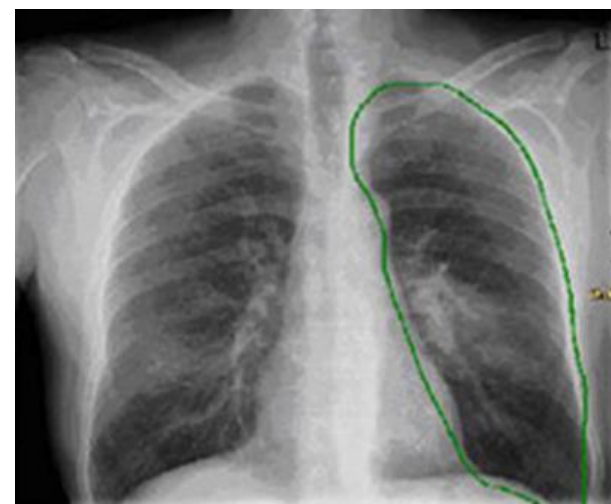
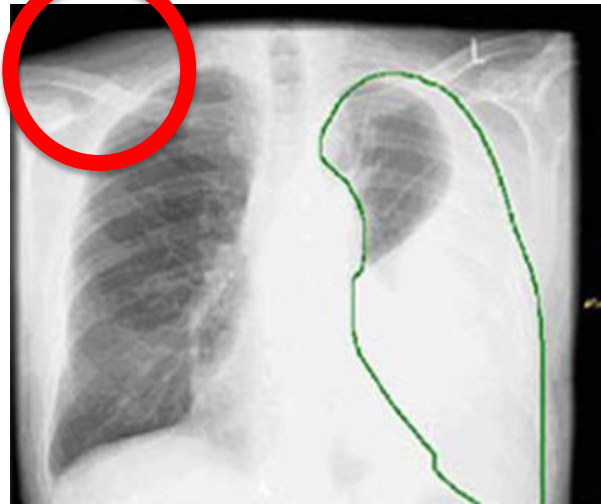
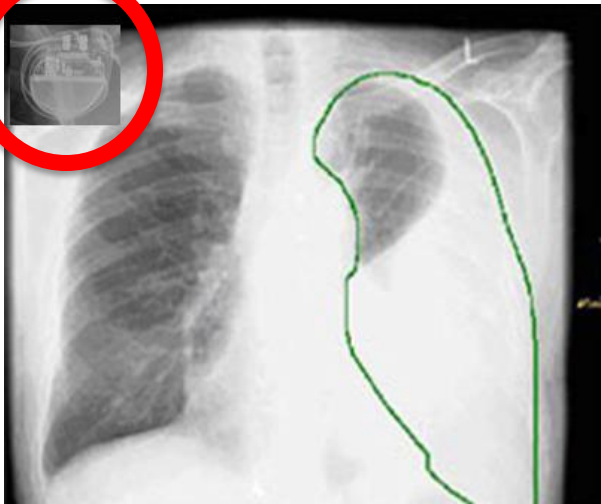
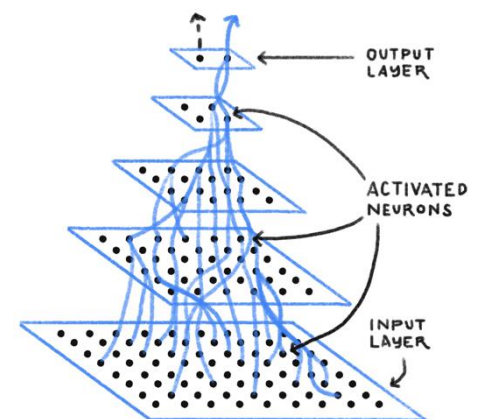
Pleuraerguss



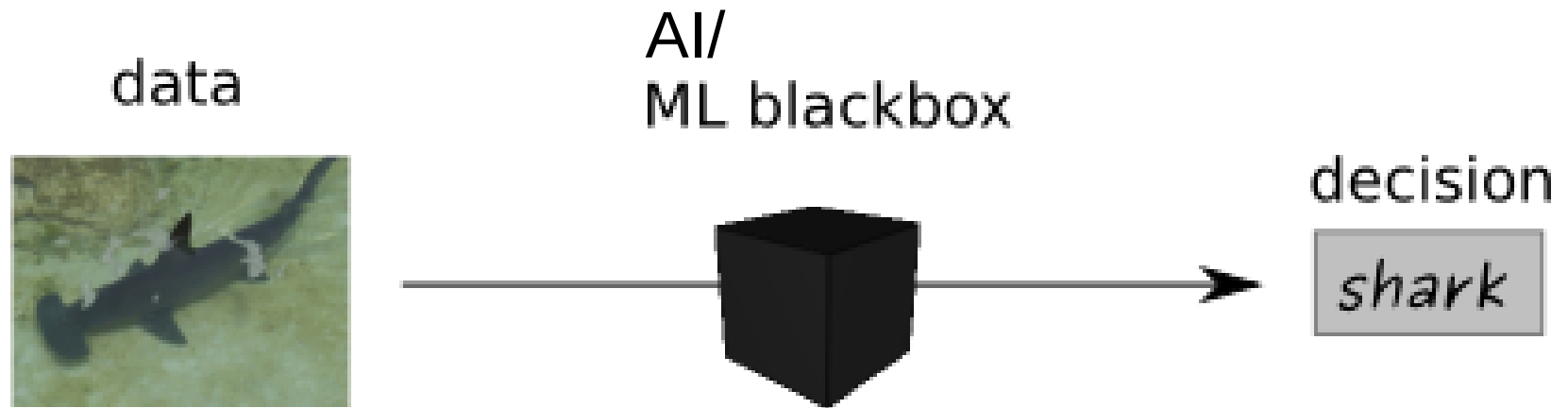
Normal Lung



Normal Lung



AI is often a black box!



Explainability is critical!

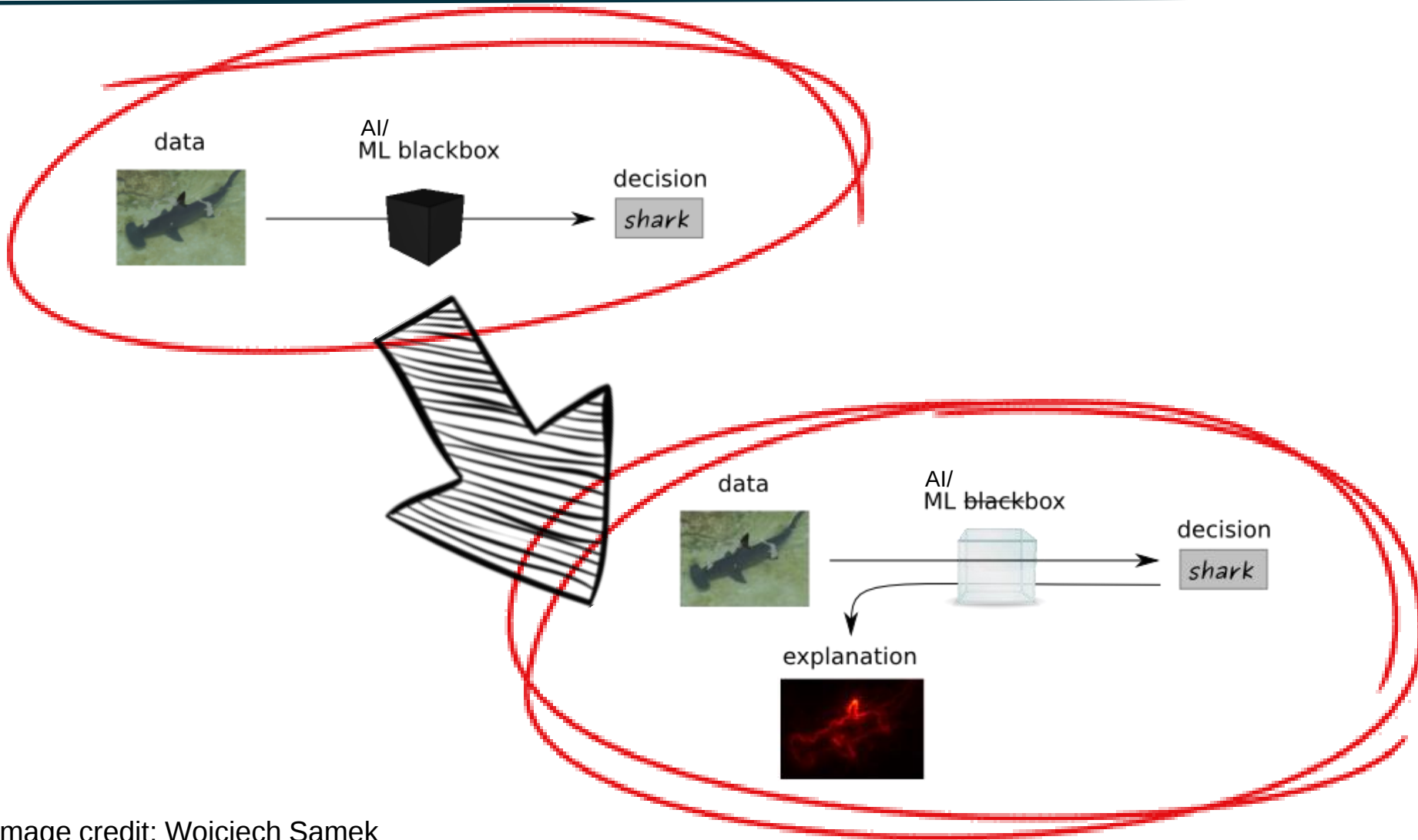


Image credit: Wojciech Samek

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%

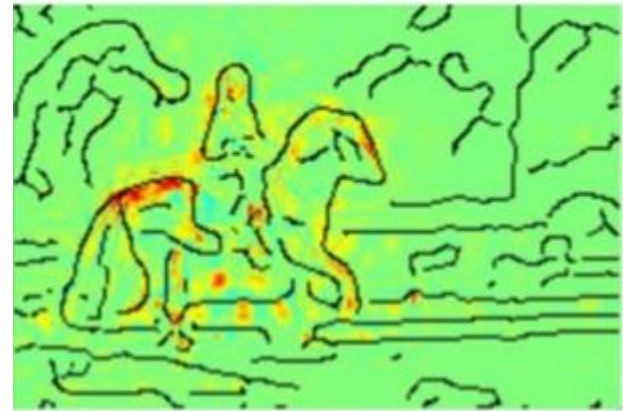
Image



FV



DNN



Outlook

Frankfurter Allgemeine

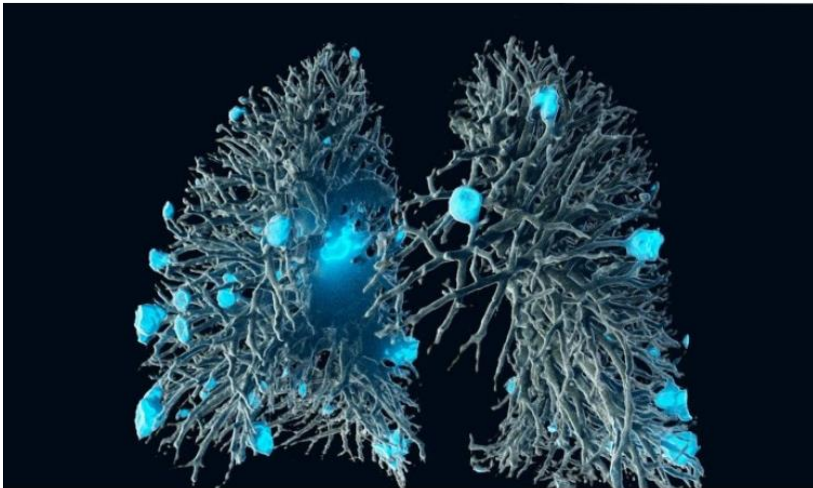
Medizin & Ernährung

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?

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