Transforming Healthcare in the era of AI

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Today's digitalization:
A coming together of…

Connected Things

IoT

The enormous potential of leveraging IoT and M2M connectivity to gather data from a plethora of sources (things, sensors, phones, medical devices)

Talking things

Big Data

Exponential increase in data – and data complexity going beyond traditional data processing software. 3Vs: Data Volume, Variety, Velocity (+veracity, +value).

Thinking things

AI and Machine Learning

Ability to draw inferences and recognize patterns in large volumes of data, with resultant algorithms able to make predictions

AI and Machine Learning

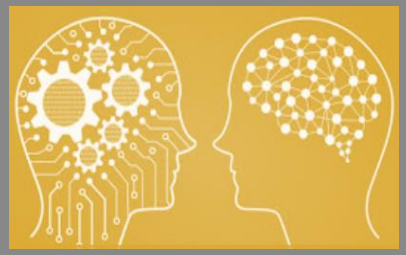
Fueled by Big Data and exponentially increasing processing power

ARTIFICIAL INTELLIGENCE

Use of computers to perform human-like cognitive functions

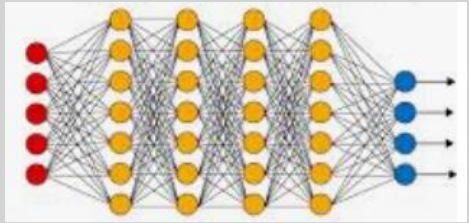
MACHINE LEARNING

AI techniques that give computers the ability to learn without being explicitly programmed to do so



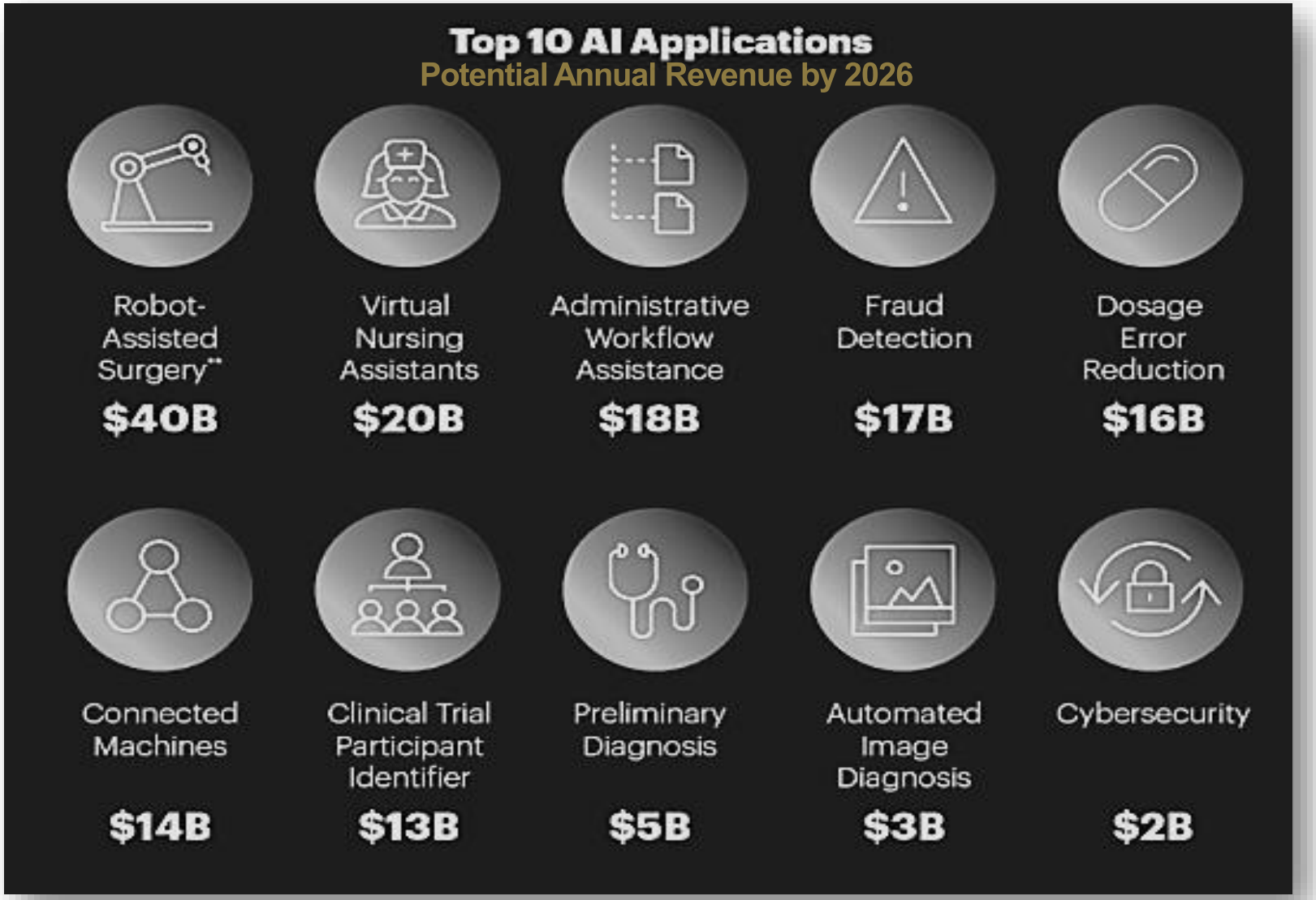
DEEP LEARNING

Subset of Machine Learning based on layered structure of "deep artificial neural networks"



1950s 1960s 1970s 1980s 1990s 2000s 2010s

The Promise of AI for Healthcare

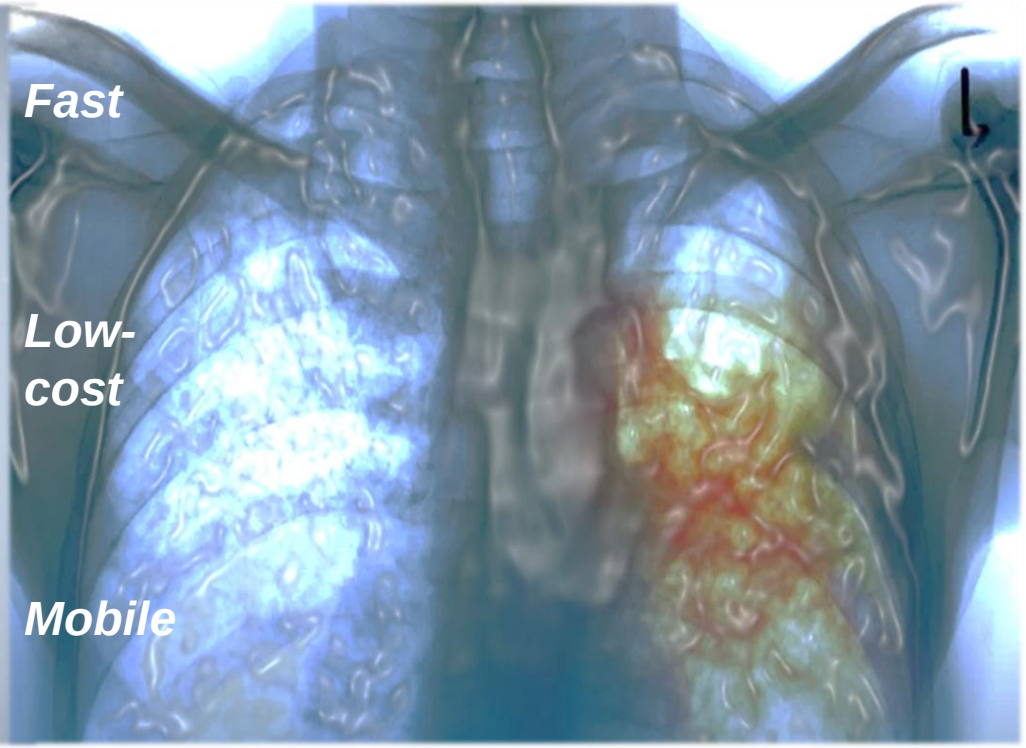


Source: Accenture

Big Data meets Big Health

Image diagnosis: AI for TB

Algorithm trained on a growing database of thousands of images was able to achieve detection accuracy greater than 95% (more than by human alone)



- ✓ Instant detection for less than **$1 per scan**
- ✓ Software analysis of chest X-ray **within 20 seconds**
- ✓ **Portable/remote**

Today's version of digitalized personalized medicine is but a start

- Even today, we normally rely on what we can **explicitly understand**: relatively simple relationships that can be identified and validated (e.g. through clinical trials)

- But the field of biology is a complex and complicated matter: there are dozens and hundreds of **interacting variables** to consider, including those that are easily observable and those that are not so

- AI and ML have the potential to grasp these complex underlying biological relationships, using **algorithms for validation** rather than clinical trials

High Quality data is needed…

- Whether we are talking about artificial intelligence, or machine learning, or deep learning, one thing is clear: if the data being used is flawed, then the insights and information extracted will be flawed
- For AI and machine learning to continue to advance, the data driving the algorithms and decisions needs to be of high-quality and unbiased
- In health care, this represents a particularly critical challenge

.. for getting at the “Truth”

- Data completeness
- Data availability
- Data relevance
- Data accuracy
- Data timeliness
- Data granularity
- Data consistency

INGEST → CLEAN & TRANSFORM → EXPLORE → TRAIN

International collaboration:
Focus Group on Artificial Intelligence for Health

AI for Health
An ITU Focus Group
In collaboration with WHO

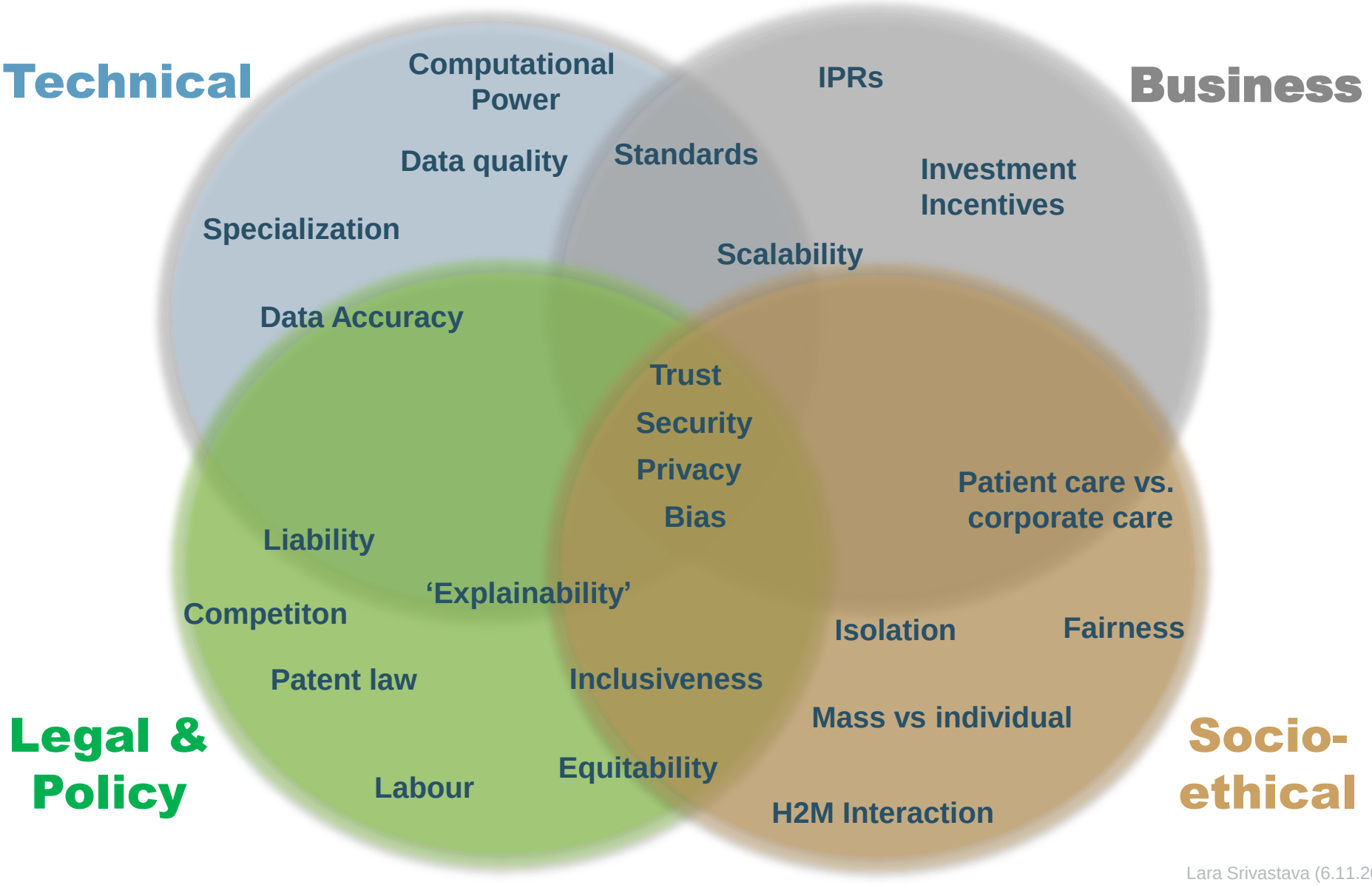
- *Identifying structured + standardized medical data required for testing AI algorithms*
- *Providing use case-specific benchmarking for AI candidate algorithms*
- *Drafting technical reports and specifications for assessment frameworks for AI for health, including for example data formats, interfaces, architecture, and protocols.*

See our website:
Draft Classification Scheme + Call for Proposals on use cases & data

JOIN US @ AI4H:

1. Columbia University, NYC, 14-16 November 2018
2. EPFL, Lausanne, Switzerland, 22-25 January 2019
3. Shanghai, China, week of 1-5 April 2019

Multi-faceted opportunities = Multiple challenges

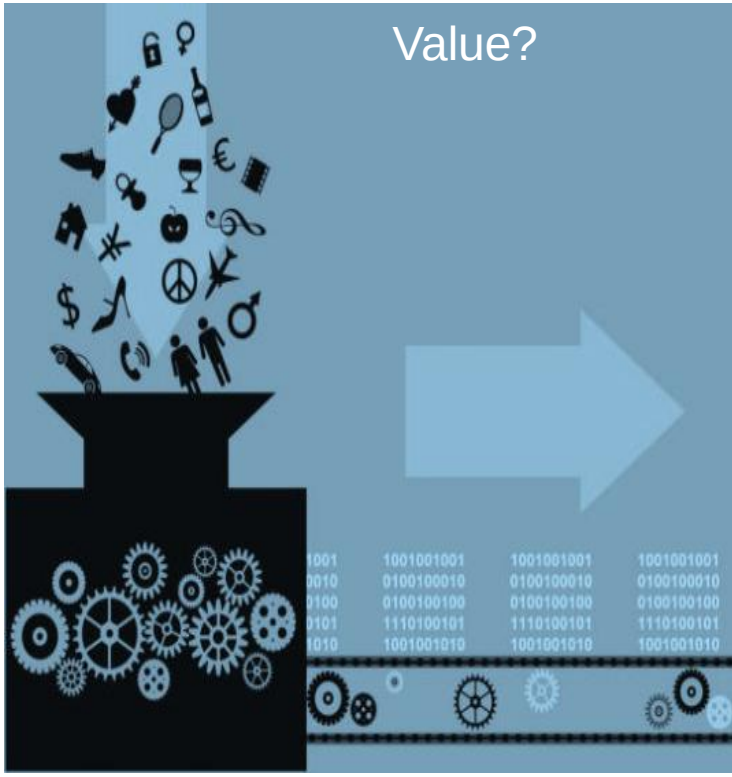


Incentivizing innovation

- The development and commercialization of useful AI for healthcare will require **significant incentives** to flourish

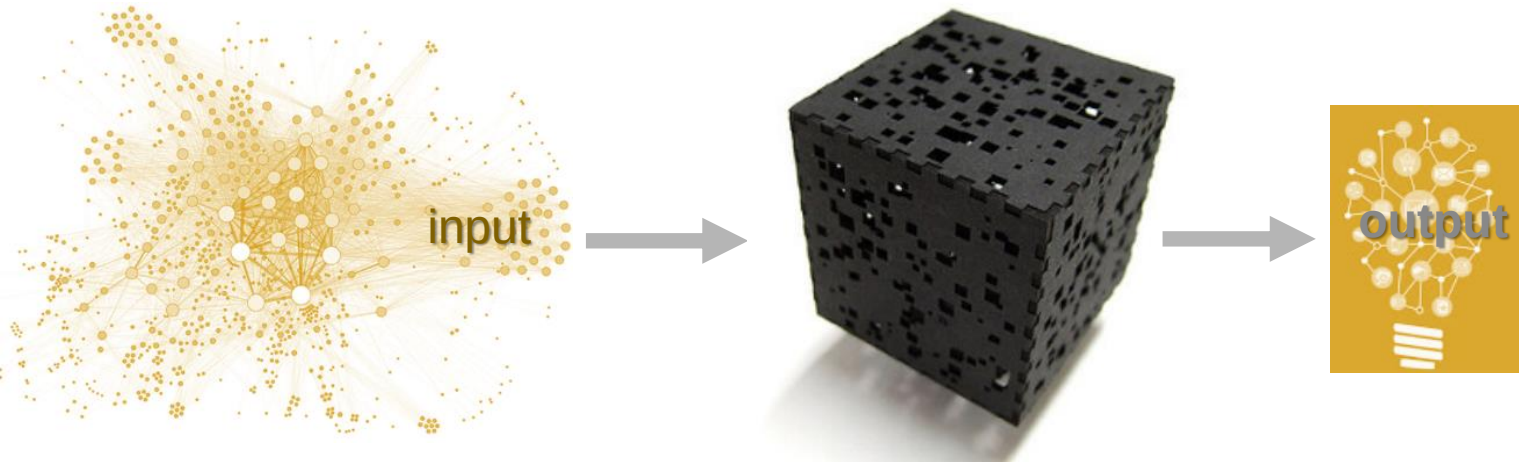
- Current IPR regimes are not fully equipped to tackle the value of collected data **vs.** patterns discovered by that data, **vs.** validation of those patterns…

- Blackbox medicine is dynamic, constantly changing – but patents are relatively static and don't tend to protect new uses effectively



Looking into that black box

- Predictive analytics made possible by AI and ML hold **tremendous potential** for health care
- However, typically, such decision-making cannot be explicitly understood, and sometimes cannot even be explicitly stated.
- The **WHY or HOW** a conclusion is reached is not clear by the very nature of the process itself



"We can build these models but we don't know how they work"

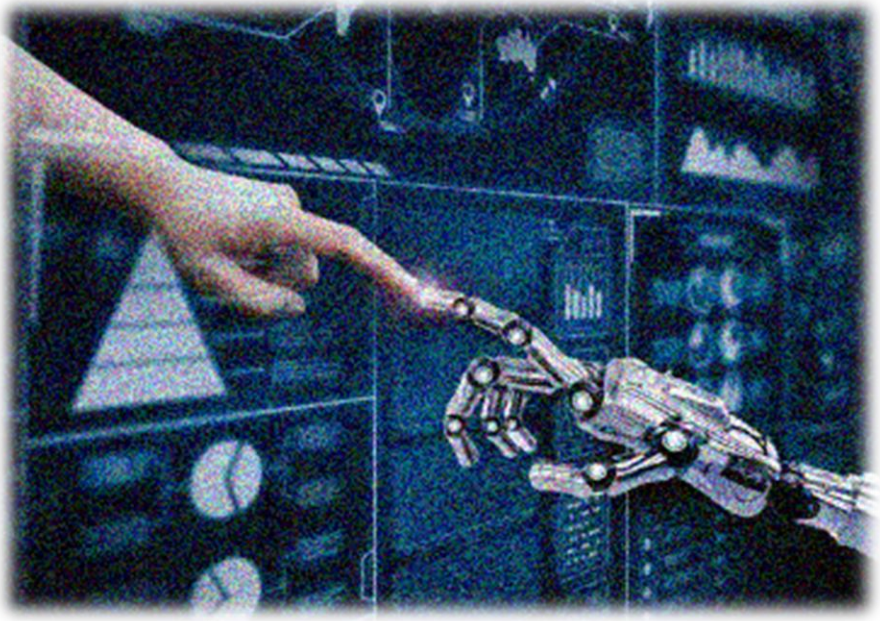
J. Dudley, *Deep Patient* Mount Sinai

- This means there is already an **inherent opacity** to the process (before any is added externally)

Creating Responsible AI

How can we ensure AI systems for health reflect core values of *equality, justice ,diversity, human dignity, human rights?*

Who will benefit from advances in AI for health?



Should Data become the Doctor?

Will AI perpetuate/magnify historical biases or will AI teach us to better understand them ?

Thank You

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