# AI in healthcare

Workshop
Institute for Futures Studies
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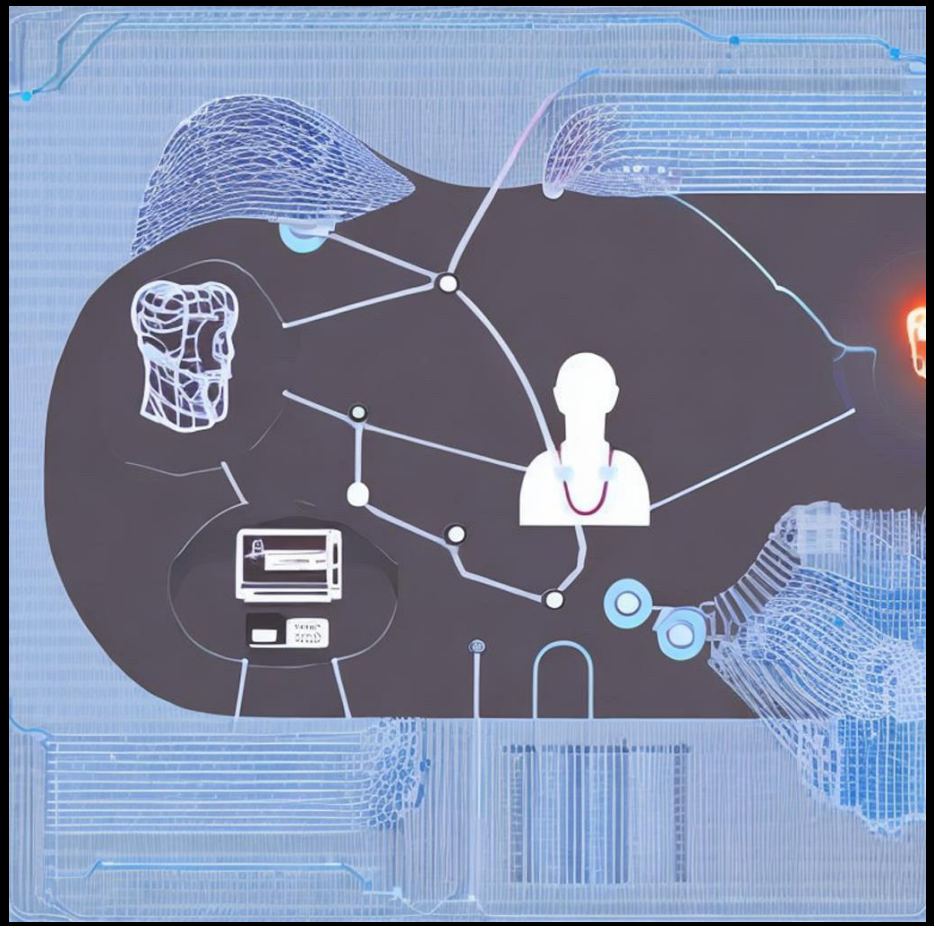


# How can two WASP-HS projects learn from each other?

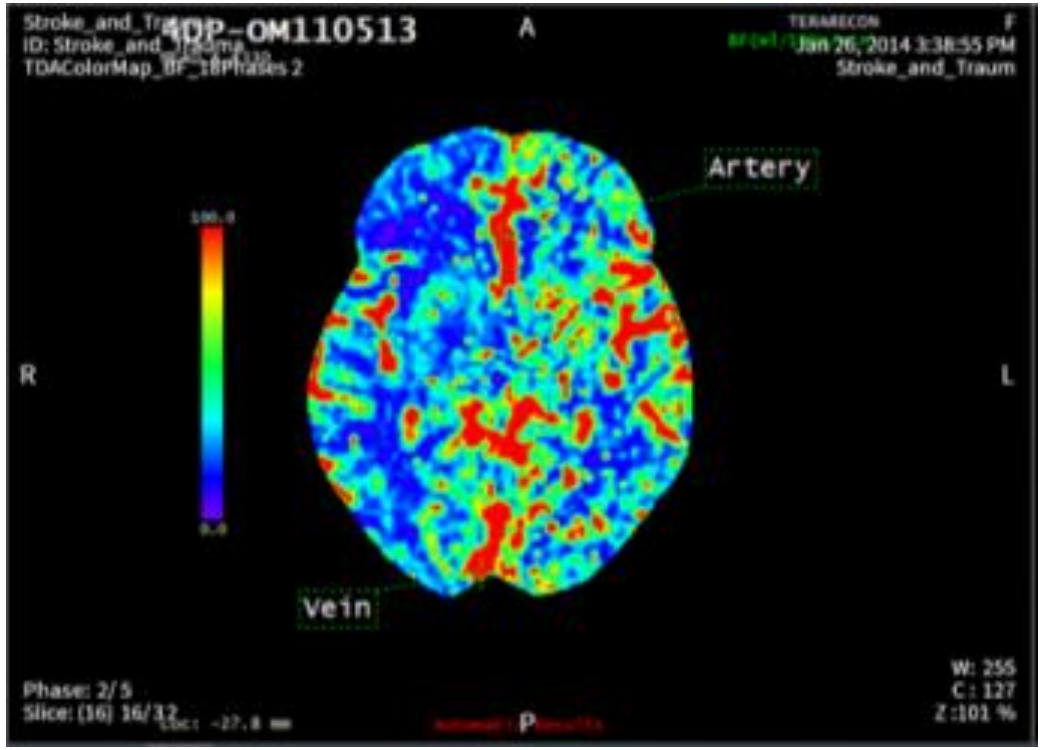
- AI and Automated Systems and the Right to Health
- Predicting the Diffusion of AI-Applications

*"The vision of WASP-HS is to realize excellent research and develop competence on the opportunities and challenges of artificial intelligence and autonomous systems with a strong investment on research in humanities and social science"*

WASP—HS

# AI in healthcare has a lot of promise (1/2)

- **Medical imaging**: Oncology, cardiology, ophthalmology, detection of brain injury and skin disease
- **Neurology**: Restore control of movement
- **Gene analytics:** Identify disease genotypes
- **Drug discovery**: Identify new therapies from information on existing medicines
- **Mental health**: Chatbot therapy, depression discovery
- **Primary care/triage**: Basic guidance and advice via chatbots
- **Preventive care**: Identify risks
- **Early discovery:** Predict diagnoses
- **Patient risk identification**: Predict re-admission risks
- **Treatment reminders**: Patient adherence
- **Personalized treatment/precision medicine**
- **Automation of administrative tasks**




Source: TeraRecon AI for stroke and trauma

# AI in healthcare has a lot of promise (2/2)

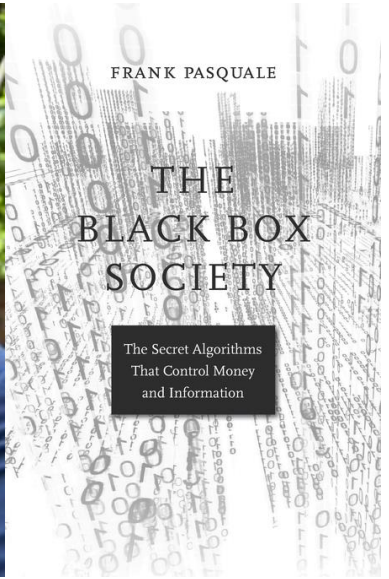
- Improve efficiency: provide better care at a lower cost
- Streamline tasks
- Reduce waiting times
- More equal access to healthcare
- Reduce stress among practitioners

This is urgently needed:

- U.S. spends **18% of GDP** on healthcare, of which 25% has been considered a **waste** (failure of care delivery and coordination, overtreatment, fraud, administrative complexity, etc.) (Shrank et al. 2019)
- The **global shortage of healthcare** workers will grow to 12.9 million by 2035, from 7.2 million in 2013 (WHO 2013)

# …however, also, a lot of challenges (1/2)

- Data access: How use sensitive data while ensuring patient **privacy** and **data security?**
- Ethics of **data ownership**: How share data across healthcare providers and AI developers?
- Data quality: human health data involves **a range of data types** of various type and resolution
- Training data may be **poor**, leading to ungrounded decisions
- Training data may be **biased**, leading to discriminatory decisions
- The **“Black box”** nature of AI hinders scrutiny and trust
- Hard to know how **who is liable** with AI




Frank Pasquale, expert on AI law, serves on the U.S. National Artificial Intelligence Advisory Committee, which advises the U.S. President

# …however, also, a lot of challenges (2/2)

- **Unpredictable** mistakes – a lack of common sense
- The technology **changes over time** and in the interaction with humans, and so its social and ethical implications are difficult to assess
- It is **trained in a specific context**, and so its implications *in another context* are hard to foresee
- Preexisting **social inequities may be enhanced** by an AI that works better in some demographic groups
- The hand-over of tasks to machines may lead to **human deskilling** and the **shifting of power** towards the technology's providers
- Users may be **manipulated** or misled by the technology's similarity to humans, developing emotional bonds
- Public commitments to welfare systems may depend on **genuine uncertainty** – which may be undermined with AI that is "too good"

# Therefore, implementation of AI in healthcare involves many perspectives

- **Healthcare practitioners**: How use AI while ensuring patient safety? Is it just another tool? Or will the profession change fundamentally?
- **Medicine**: When and how does AI improve prevention, diagnostics and treatment of disease?
- **Technology**: How can we improve the software to reduce errors? What data do we need?
- **Psychology**: How does it influence users? Over time? Who is afraid of it? Why?
- **Sociology**: Which implications does it have on equality of access to health? Does usage of AI shift power towards the technology's providers?
- **Economics**: What are the costs and benefits of AI in healthcare? What actors drive the development and adoption of AI and why? What is the future of work in healthcare?
- **Philosophy**: Is the technology beneficial for us? Can it be harmful? What values should guide its development and adoption?
- **Political science and law**: What principles should govern the use of AI in the public sector? What regulations are needed? Do we have conflicts of interest? Which are the trade-offs involved?
- **History of technology**: How have we handled similar technological revolutions in the past?

# Aim of this workshop

While many agree that AI would benefit healthcare, its implementation has a lot of challenges

*Today we want*

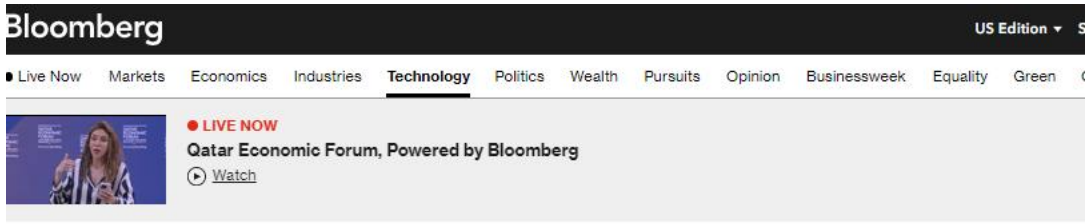
- To explore this complex and hot topic with humility and curiosity
- To get a better understanding the challenges faced by different actors
- To enable dialogue and learning across scientific disciplines, and across sectors: research institutions, public authorities and private companies

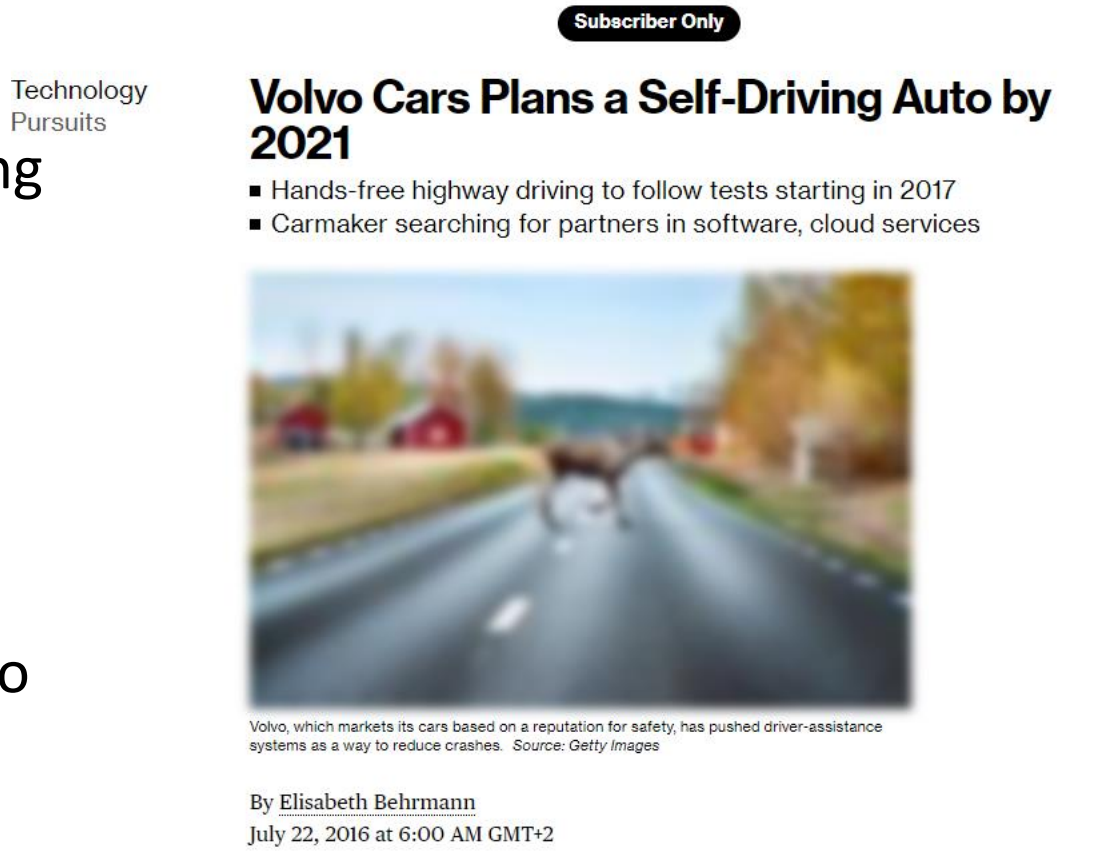
The overall aim is to contribute to speed up safe adoption of AI in healthcare

# Comparing AI implementation across domains: finding similarities, differences and influencing factors (ongoing work)

## Background

- The diffusion of AI has been super-fast in the digital consumer domain
  - Mobile apps and web sites with virtual assistants, chatbots, spam filters, recommender systems (Engström and Strimling 2020)
  - Already in 2017, 85% of Americans regularly used devices, programs or services with AI (Gallup 2018)
- But it has been slower than expected in other fields, such as transport
  - Why? What can we learn from these sectors to better understand AI's implementation in healthcare?



# AI in transport: Great expectations expressed by experts and public officials

- The main motivation is to **save lives** – in addition to save time, reduce congestion and enable more equal access to mobility, etc.
- This is important because car crashes cause about 1.3 million deaths globally each year (WHO 2022)
- Autonomous vehicles could **essentially eliminate highway deaths**, according to Mark Rosekind, former head of the National Highway Traffic Safety Administration (CNBC 2018)

# Risks were acknowledged

Rosekind reasoned that to get self-driving cars to eliminate traffic deaths, they will first have to be tested, which may cause accidents:

*"Unfortunately, there will be crashes. People are going to get hurt and there will be some lives lost."*

*"All of that I think is going to be, I hope, focused on the service of trying to save lives."*

Thus, Rosekind argued that a future without crashes is **worth the risk of allowing imperfect** self-driving cars today

# Three fatal accidents

- A pedestrian struck by an Uber test vehicle for self-driving technology (Volvo XC-90) in Arizona in March 2018
- Tesla Model X operating in autopilot mode collided with a highway barrier in California in March 2018
- Tesla Model 3 on autopilot crashed into a trailer truck, killing driver, in Florida in March 2019

# People distrust the technology

- 6 in 10 Americans would not want to ride a driverless car (Pew Research Center 2022)
- Human errors are preferred

*"… the Power/NAMIC study found that the public **seems far more willing to accept frequent crashes with a human** at the wheel than even an occasional one involving a driverless vehicle"* (CNBC 2018)

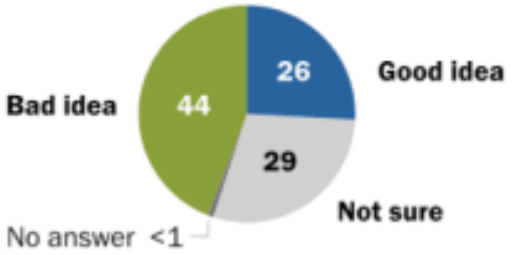
- Complete safety is demanded of the technology

*"Fully 56 percent of those surveyed would **demand 100 percent safety** before they would take a ride*" (CNBC 2018)

# People distrust the technology

**Americans more likely to say the widespread use of driverless cars would be bad rather than good for society**

*% of U.S. adults who say the widespread use of driverless cars would be a ___ for society*




**Here's how people were asked to think about driverless cars:**

"Driverless passenger vehicles, sometimes called self-driving cars, are equipped with software allowing them to operate with computer assistance. In the future, driverless passenger vehicles are expected to be able to operate entirely on their own without a human driver."

Note: Figures may not add up to 100% due to rounding.
Source: Survey conducted Nov. 1-7, 2021.
"AI and Human Enhancement: Americans' Openness Is Tempered by a Range of Concerns"

**PEW RESEARCH CENTER**

Pew Research Center (2022)

# Taking a step back

In April 2019, the CEO of Ford Motor Company, James Hackett, acknowledged:

"*We overestimated the arrival of autonomous vehicles*"

# How then has AI been implemented in transport thus far?

Incremental introduction of **semi-autonomous** features, with humans becoming ever more redundant

- Increasing use of Advanced Driver Assistance Systems (ADAS), e.g., autocruise, blind-spot monitoring and lane-keeping assist
- Some new cars function with minimal human assistance (Pew Research Center 2022)

*"Proponents, in general, are betting that as more vehicles using semi- and fully autonomous technology, never mind completely driverless products, take to the road, the comfort level will increase and more people will say they're willing to go for a ride*." (CNBC 2018)

# AI across domains: conceptual map of differences and similarities (work in progress)

| | Online consumer domain (AI features in apps) | Transportation (autonomous vehicles) | Healthcare (medical AI technology) |
|---|---|---|---|
| Adoption rate | | | |
| Main purpose of AI | | | |
| Tolerance of errors | | | |
| Testing by trial-and-error possible | | | |
| Nature of negative implications | | | |
| Visibility of AI | | | |
| Main user group | | | |
| Implementation | | | |

# AI across domains: conceptual map of differences and similarities (work in progress)

| | Online consumer domain (AI features in apps) | Transportation (autonomous vehicles) | Healthcare (medical AI technology) |
|---|---|---|---|
| **Adoption rate** | Fast | | |
| **Main purpose of AI** | Have fun, pass the time (& increase efficiency) | | |
| **Tolerance of errors** | High | | |
| **Testing by trial-and-error possible** | Yes | | |
| **Nature of negative implications** | Emerging, invisible and societal (spread of misinformation, polarization, erosion of trust, overuse and depression) | | |
| **Visibility of AI** | No: hidden, inconspicuous use | | |
| **Main user group** | Consumers | | |
| **Implementation** | Successive, by app version updates | | |

# AI across domains: conceptual map of differences and similarities (work in progress)

| | Online consumer domain (AI features in apps) | Transportation (autonomous vehicles) | Healthcare (medical AI technology) |
|---|---|---|---|
| **Adoption rate** | Fast | Slow | |
| **Main purpose of AI** | Have fun, pass the time (& increase efficiency) | Save lives (& increase efficiency) | |
| **Tolerance of errors** | High | Low | |
| **Testing by trial-and-error possible** | Yes | No | |
| **Nature of negative implications** | Emerging, invisible and societal (spread of misinformation, polarization, erosion of trust, overuse and depression) | Immediate, visible and individual (car crashes) | |
| **Visibility of AI** | No: hidden, inconspicuous use | High for autonomous cars, low for semi-autonomous features | |
| **Main user group** | Consumers | Consumers | |
| **Implementation** | Successive, by app version updates | Successive, by semi-autonomous features in cars | |

# AI across domains: conceptual map of differences and similarities (work in progress)

| | Online consumer domain (AI features in apps) | Transportation (autonomous vehicles) | Healthcare (medical AI technology) |
|---|---|---|---|
| **Adoption rate** | Fast | Slow | Slow |
| **Main purpose of AI** | Have fun, pass the time (& increase efficiency)? | Save lives (& increase efficiency) | Save lives (& increase efficiency) |
| **Tolerance of errors** | High | Low | Low |
| **Testing by trial-and-error possible** | Yes | No | No |
| **Nature of negative implications** | Emerging, invisible and societal (spread of misinformation, polarization, erosion of trust, overuse and depression) | Immediate, visible and individual (car crashes) | Mainly immediate, visible and individual (wrong treatment)? |
| **Visibility of AI** | No: hidden, inconspicuous use | High for autonomous cars, low for semi-autonomous features | High for professionals, low for patients? |
| **Main user group** | Consumers | Consumers | Professionals |
| **Implementation** | Successive, by app version updates | Successive, by semi-autonomous features in cars | Successive? |

# AI in healthcare – a case study

- AI systems with machine learning technology have already been introduced in **healthcare**, and their use is **expected to increase** dramatically in the coming years all over the world
- AI has enormous potential in improving population-wide breast cancer screening programs
  - massive numbers of radiologists' hours are spent on assessing healthy women
  - a sizable proportion cancer is not detected despite regular screening participation

# The setting

- AI-system for diagnostics in a clinical trial at Capio Sankt Göran hospital in 2021 and 2022
- In a prospective clinical trial in a period of over a year, involving mammogram data collection from 55 581 women (under review)
- This trial provided a unique opportunity to assess radiologists' and women's perceptions of using AI in a real clinical setting

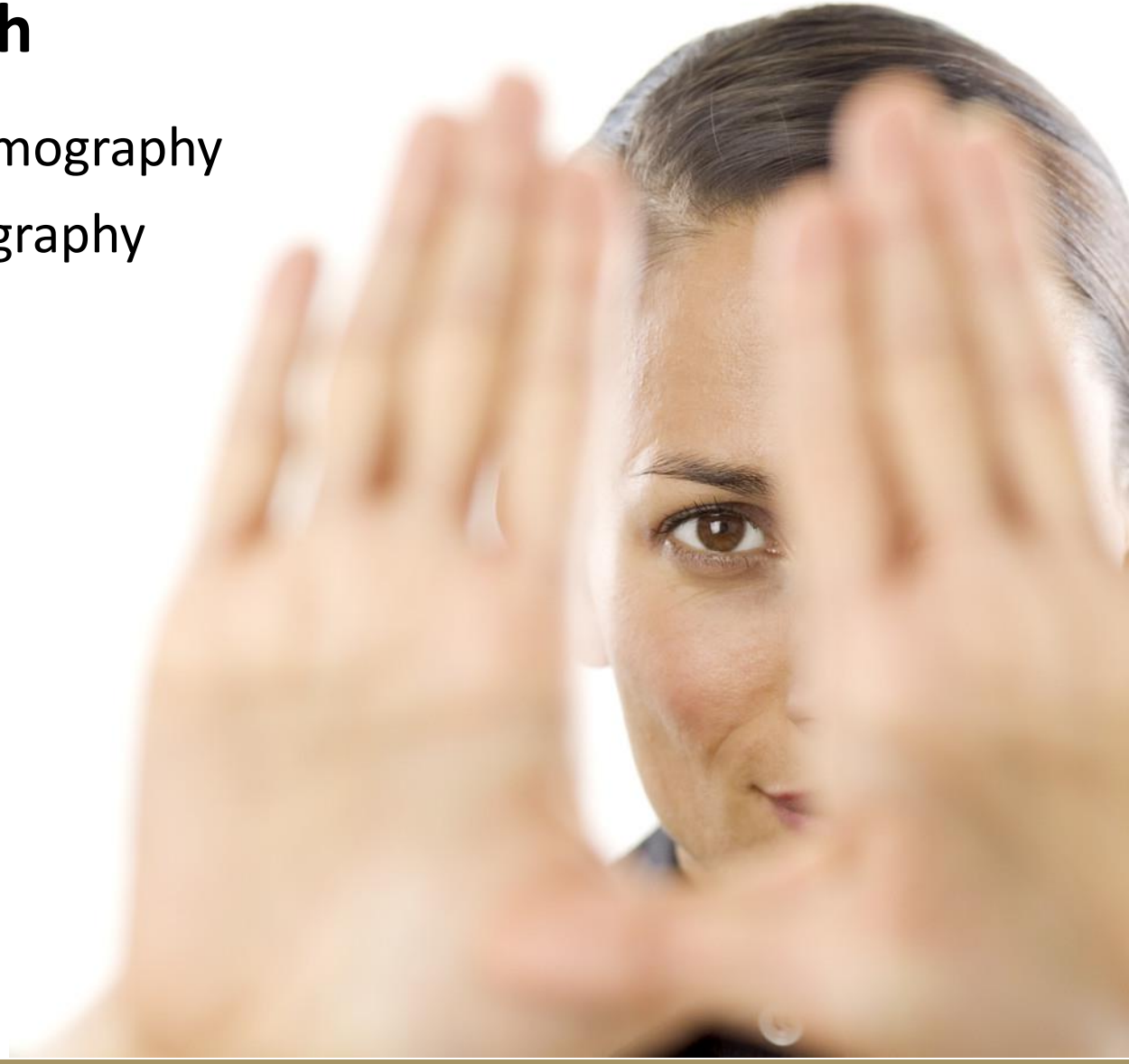
https://time.com/5754183/google-ai-mammograms-breast-cancer/

The standard procedure: **two radiologists independently reviewed** mammograms. The images that they found relevant for further discussion were then **sent to a second round.** In the second round, **several experienced radiologists looked** at the mammograms and decided whether the woman in question should be encouraged to **revisit the hospital** for further examinations.

The trial investigated the **performance of an AI algorithm** combined with **two radiologists** assessing mammograms in a true screening population, as compared to the standard-of-care with two radiologists. Comparisons would regard the **accuracy** of the **AI.**

# Preliminary results from our research

- Radiologists' perceptions of using AI in mammography
- Women's perceptions of using AI in mammography



# Method

- All the radiologists at the clinic (N=7)
- Sixteen women (N=16, 63 asked)
- Semi-structured interview guide with open-ended questions
- Qualitative content analysis (Burnard 2008)
  - identify meaning units, that is, phrases, sentences, or paragraphs that expressed the radiologists' experiences of using AI
  - coded each meaning unit using the open coding technique
  - the software Atlas.ti Web and Microsoft Excel to assist
  - jointly discussed and interpreted
  - compared the meaning units, examining their similarities and differences
  - codes that reflected similar concept were grouped and subcategories and categories were formulated and discussed

# Why a qualitative investigation?

# Radiologists' perceptions of using AI in mammograph

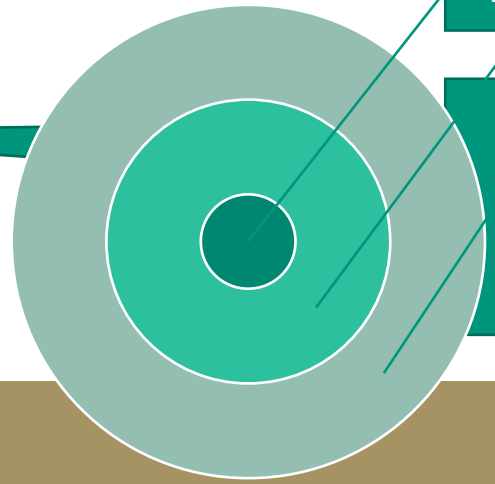
| Category | Sub-category |
|---|---|
| AI in society | AI and the function of mammography |
| | AI develops radiology and its operations |
| | AI can relieve the load on healthcare |
| AI-Human interactions | AI and the work routine |
| | AI needs us to work well |
| | AI and the radiologist's cognitive capacity |
| | AI gives support |
| AI as a tool among others | AI and saving lives |
| | AI's ability to see what we don't see |
| | AI gives more work |

*'...then it is my sole responsibility, I will have a harder time accepting it... the burden becomes heavier if I can only blame myself...Did I do my best?'*

'Humans think outside the pixels'

*'...the brain needs a few simple cases to rest on, to be able to keep the concentration up on all more difficult cases.'*

The AI 'messed it up'



# **Women's perceptions of using AI in mammography** – *work in progress*

- Finding cancer is more important regardless of how
- Error tolerance and their acceptance of AI failing to detect cancer

1. It is unacceptable for technology to make mistakes
   - it needs to work well/have high security/should not make mistakes
   - questioned the reason to implement it
   - consequences can be catastrophic since the errors are systematic
   - would feel bad/disappointed/cheated if the AI would make mistakes

2. It is more acceptable for a radiologist to make mistakes
   - it is human to make errors

3. Neither humans nor AI can be 100% correct all the time
   - AI is based on data and statistical predictions
   - no system is always correct

# Schedule in brief – 30 min each with 5 min breaks in between

- Tariq Osman Andersen, Dep. Computer Science at University of Copenhagen
- Johan Sundström, Dep. of Medical Sciences, Uppsala University

Break 10:55

- Charlotte Högberg, Dep. of Technology and Society, Lund University
- Fredrik Strand, KI, & Karin Dembrower, Capio S:t Göran's hospital
- Maja Fjaestad, IFFS and KI

Lunch at Urban deli 12:50

- Vera Lúcia Raposo, Law & Technology Dep., NOVA University of Lisbon
- Gabriel Westman, Swedish Medical Products Agency

Break 15:10

- Åsa Gyberg Karlsson, Swedish National Council on Medical Ethics (SMER)
- Alireza Salehi, RISE Stockholm
- Mats Snäll, Agency for Digital Government

Drinks and dinner at Haymarket 17:45

# Questions?

# Questions that we wanted to get better answers to today

- Considering urgent needs, what prevents AI's implementation in healthcare?
- What are the specifics of AI that have proven so challenging in this setting?
- What can we learn from case studies?
- What are the main challenges for widespread adoption? Do they mainly regard processes, people, regulations, infrastructure, or the technology itself?
- Are we expecting too much of  a still-fledgling technology?
- Are there goal conflicts? How can/should we tackle them?
- How can hurdles to adoption be overcome?