
# Computational decision support in medicine

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# State of healthcare?

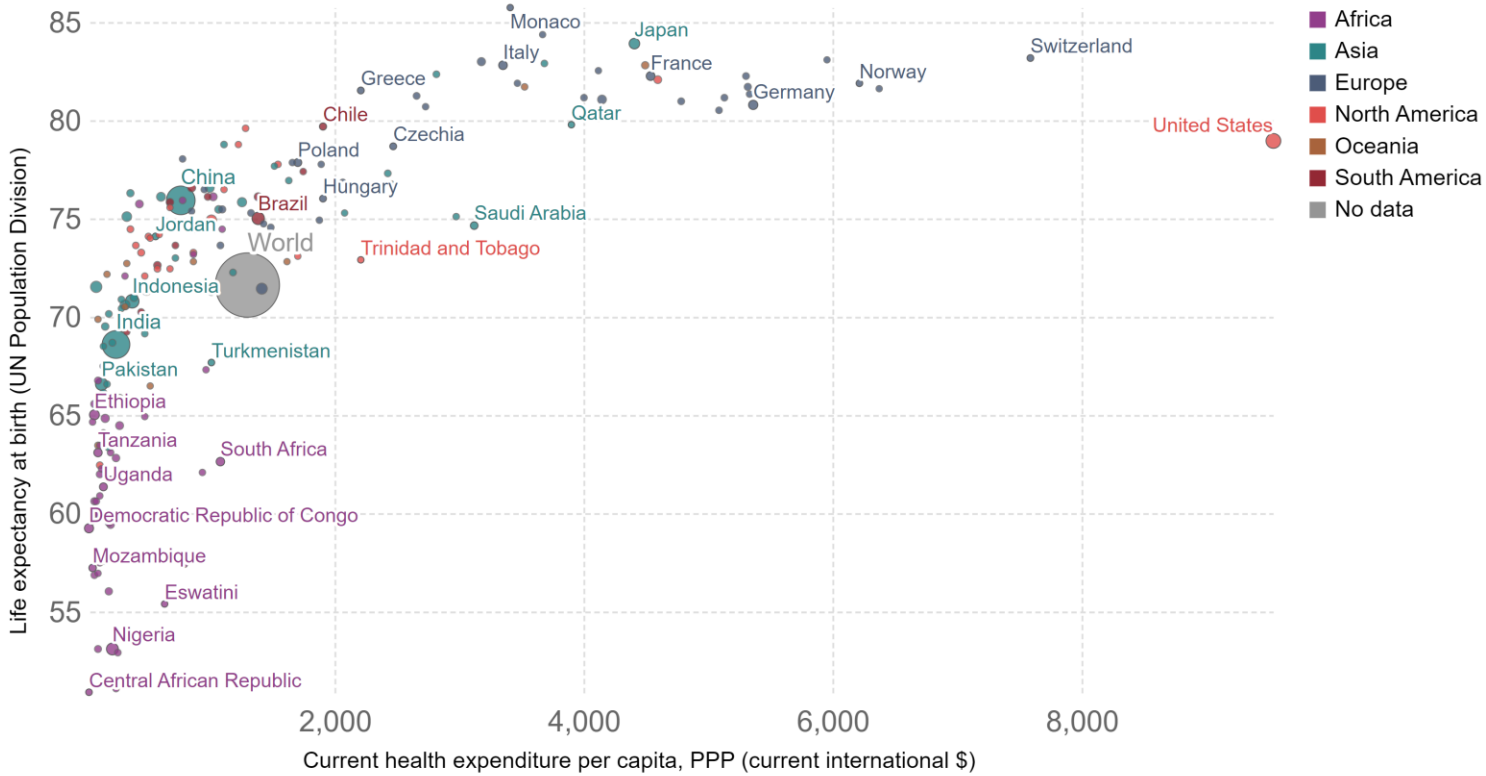
Medical error – the third leading cause of death in the US Makary and Daniel BMJ 2016;353

+ Shortage of doctors
+ Burnout
+ Rampant chronic conditions
+ Late term care
+ Cost

# Life expectancy vs. health expenditure per capita, 2015

Our World in Data

Life expectancy is the average number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. Total health expenditure is the sum of public and private health expenditures. It covers the provision of health services (preventive and curative), family planning, nutrition, and emergency aid but does not include provision of water or sanitation.




Source: UN Population Division, World Bank WDI

Digital transformation: started in the 80’

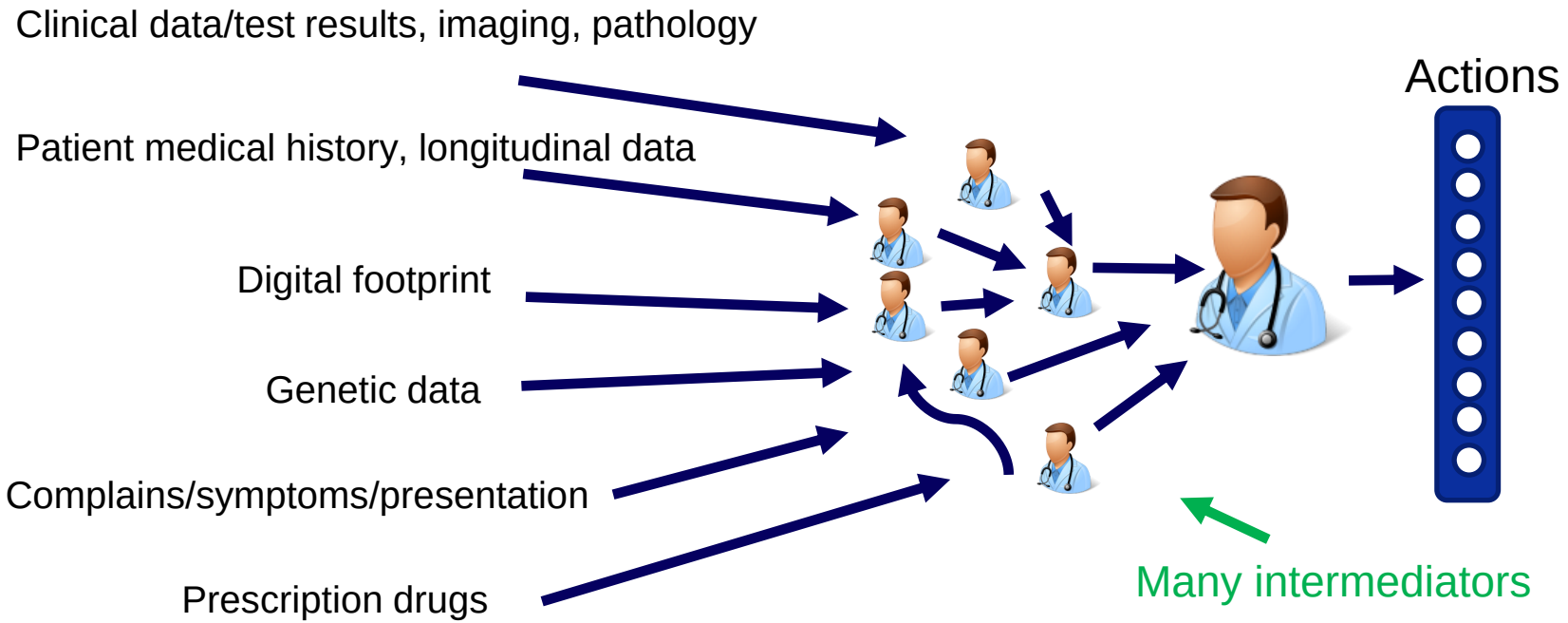
Technological boom: exabytes being generated

Looking ahead: it is going to get worse

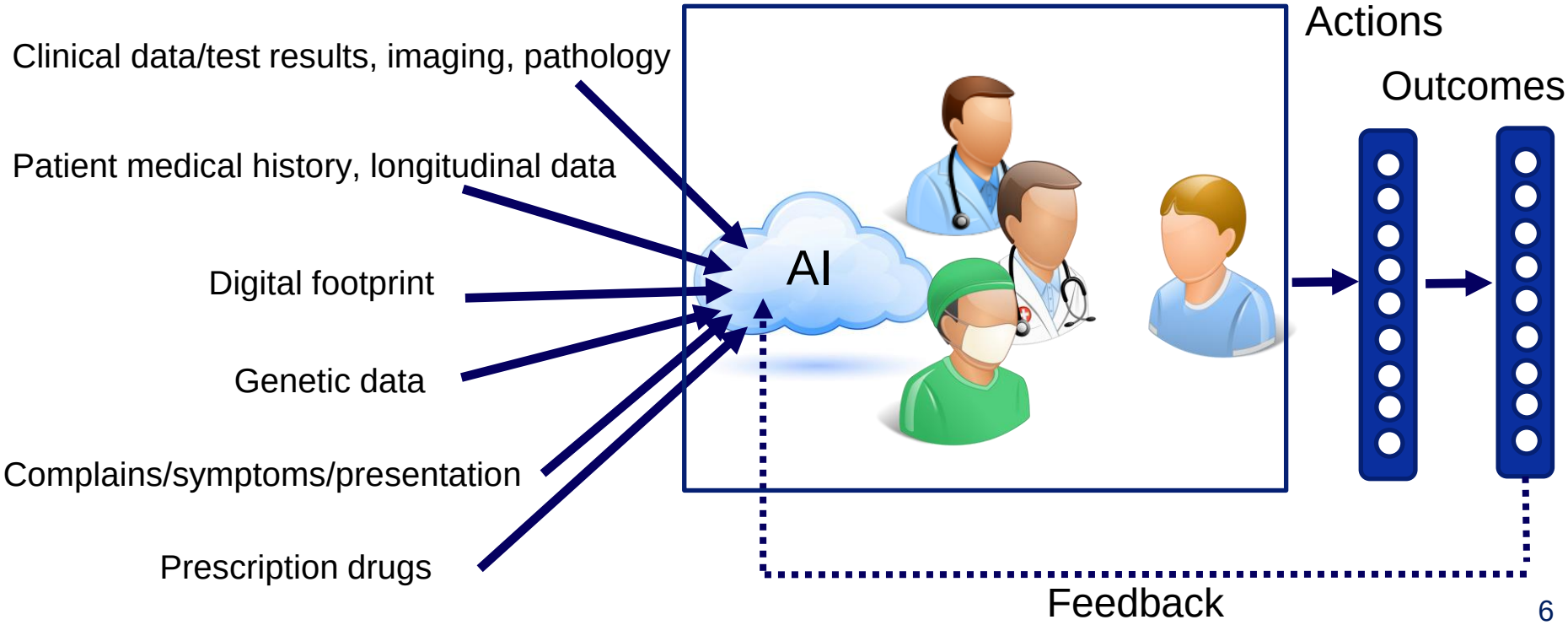
# Data overload

Various sources of data are often interpreted by humans

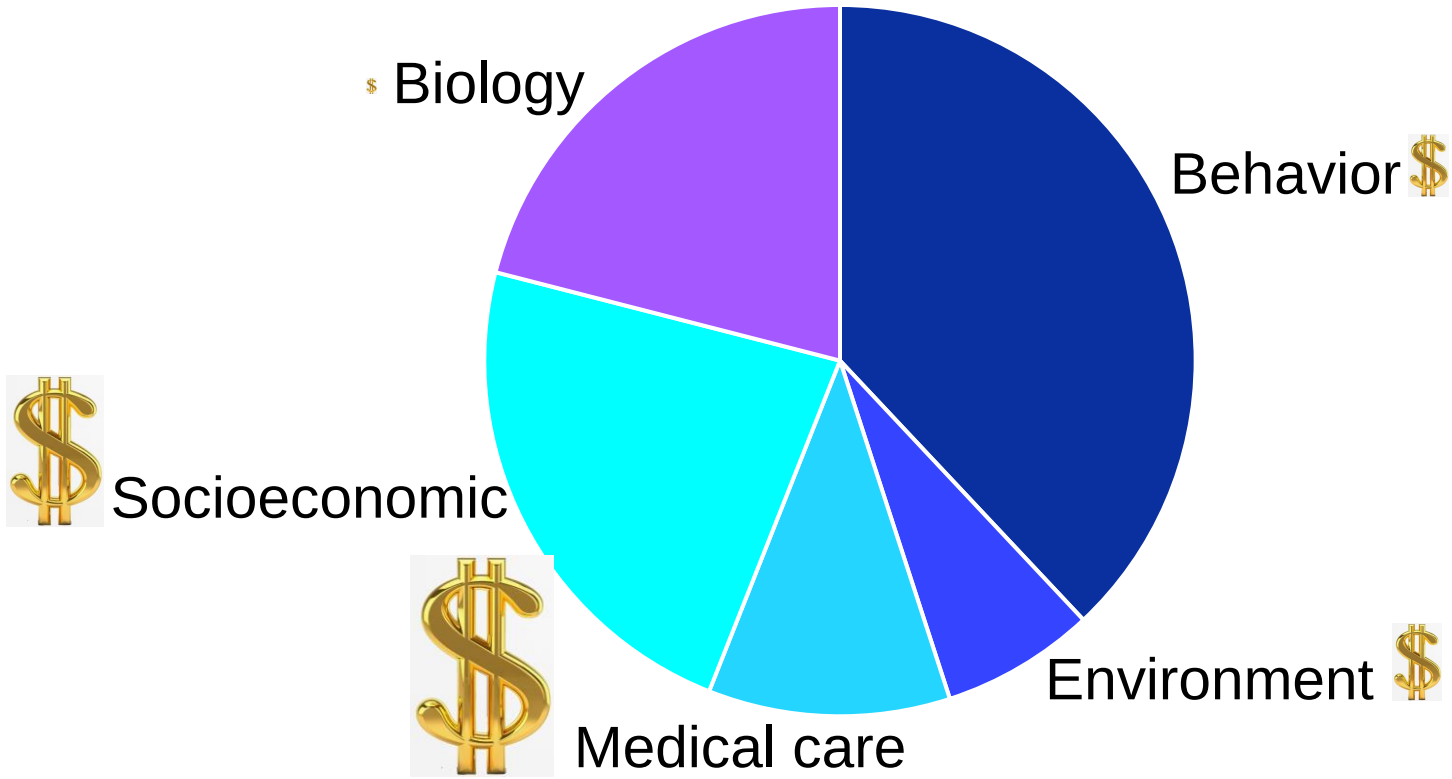
Too much information for a human to digest



# Clinical decision support



# Determinants of health (determinantsofheath.org)



Behavior +AI
- diet
- physical activity
- sleep
- mood (stress, anxiety)
- psychological assets
- drug use

Environment

Socioeconomic status

Medical records

sano

Personal advisor:
- Stay-healthy advice (engagement)
- Health literacy
- Behavior modifying apps

Healthcare administrators (value-based care)

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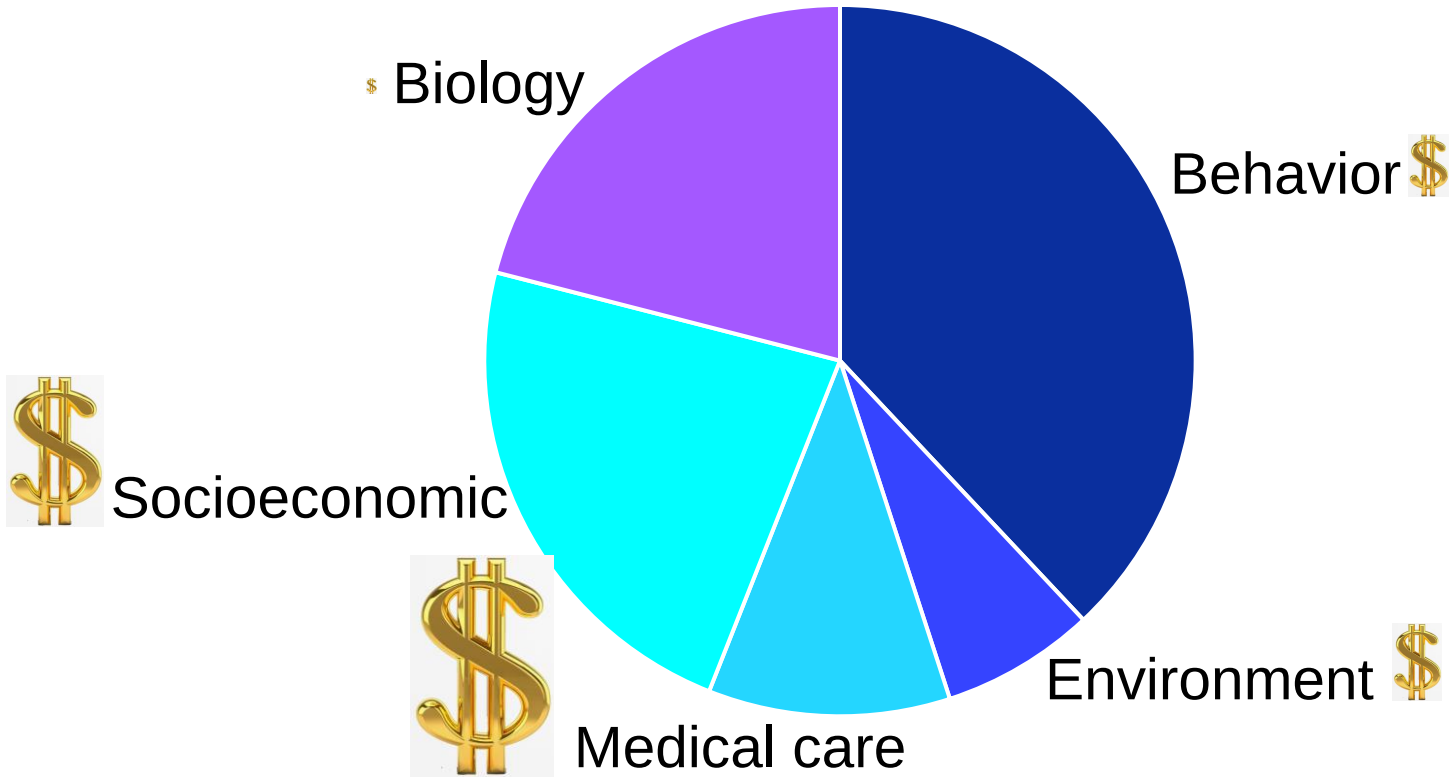


# Sano: Research Institute working towards better healthcare through computing

Located in Krakow at AHG Campus – Centrum Energetyki

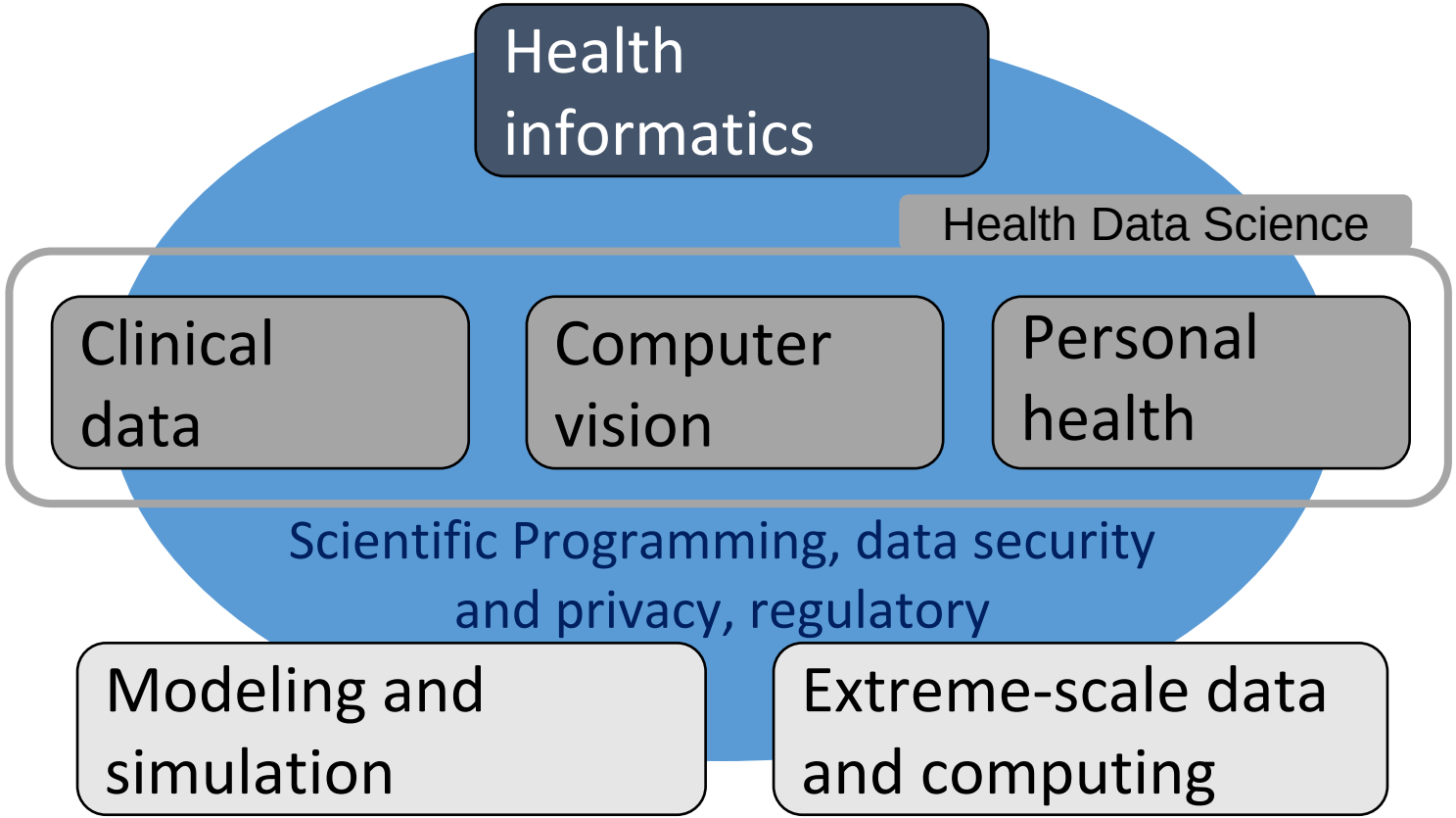
Non-profit independent research institute
(30 people now and ~60 people in second part of 2022)

Multidisciplinary team (CS, programming, math, statistics, physics)

Passionate, brilliant, diverse, eager

Personalization, Prediction, Prevention, Participation
What are we working on exactly? See seminars at http://sano.science

# Sano's research structure



# Selected research topics

# “Invisible” gorilla? Psychological Science 24(9) 1848–1853, 2013

Task: 24 radiologists were asked to find nodules in lung CT

- Investigators real goal was to find if radiologist will spot a picture of gorilla artificially added to the image
- 83% failed to see gorilla some even despite looking directly at it

# What is going on

Inattantion bias/blindness

Brain filters the sensory information to prevent overload

It fills the gaps

Radiologist attention “captured” by nodule

# Inattentional blindness in radiology

sano develops AI to reduce/prevent inattentional and other errors in radiology

How: we develop AI which works as a second reader who “activates” when it detects potential cognitive overload (distractions, tiredness, potential misses)

# Inattentional blindness in medicine

*A nurse picks out a prefilled syringe of pain medication for her patient. She reads the label and administers the medication intravenously. The patient receives hydromorphone instead of morphine and experiences a respiratory arrest (https://www.ismp.org/)*

sano develops AI to reduce/prevent inattentional and other errors in medicine

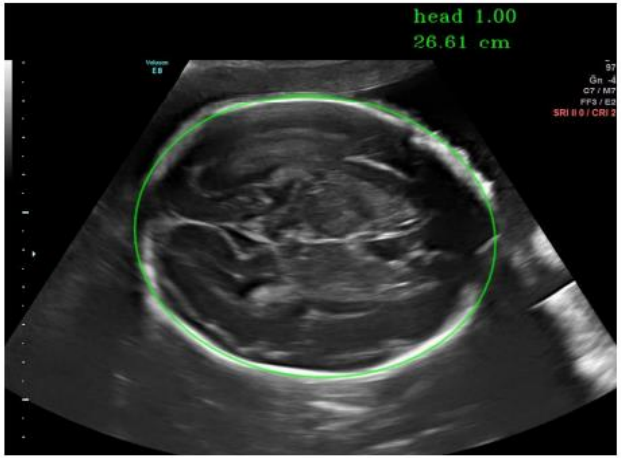
How: we use video monitoring[1] which is analyzed by AI. In case of potential error, **warning**[2] is raised

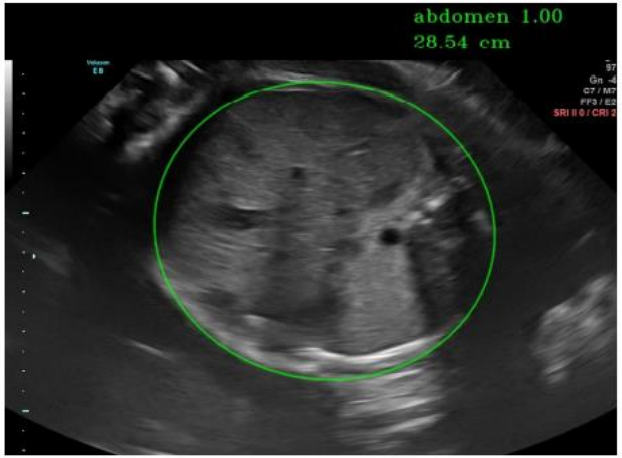
1. Ethical considerations
2. **warning** can be missed too

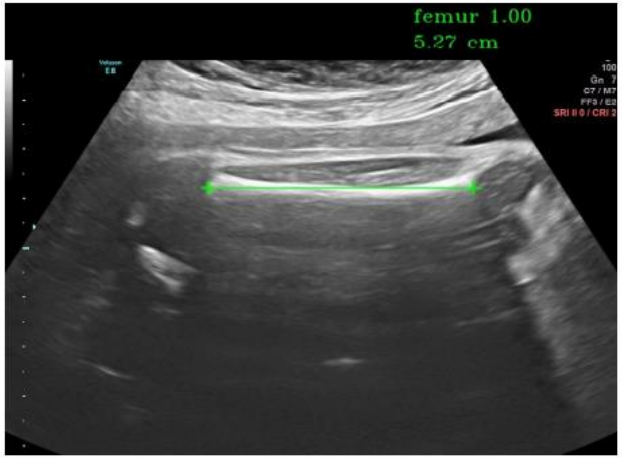
# Radiology

sano develops AI remove boring and time consuming tasks

# Automated measurements of body parts on fetal ultrasound




Plotka *et al.*, International Conference on Neural Information Processing, Bali, Indonesia, December 8-12, 2021 (accepted)
Plotka *et al.*, Physics in Medicine and Biology, 2021 (submitted)

Politechnika Warszawska ← Done with collaboration with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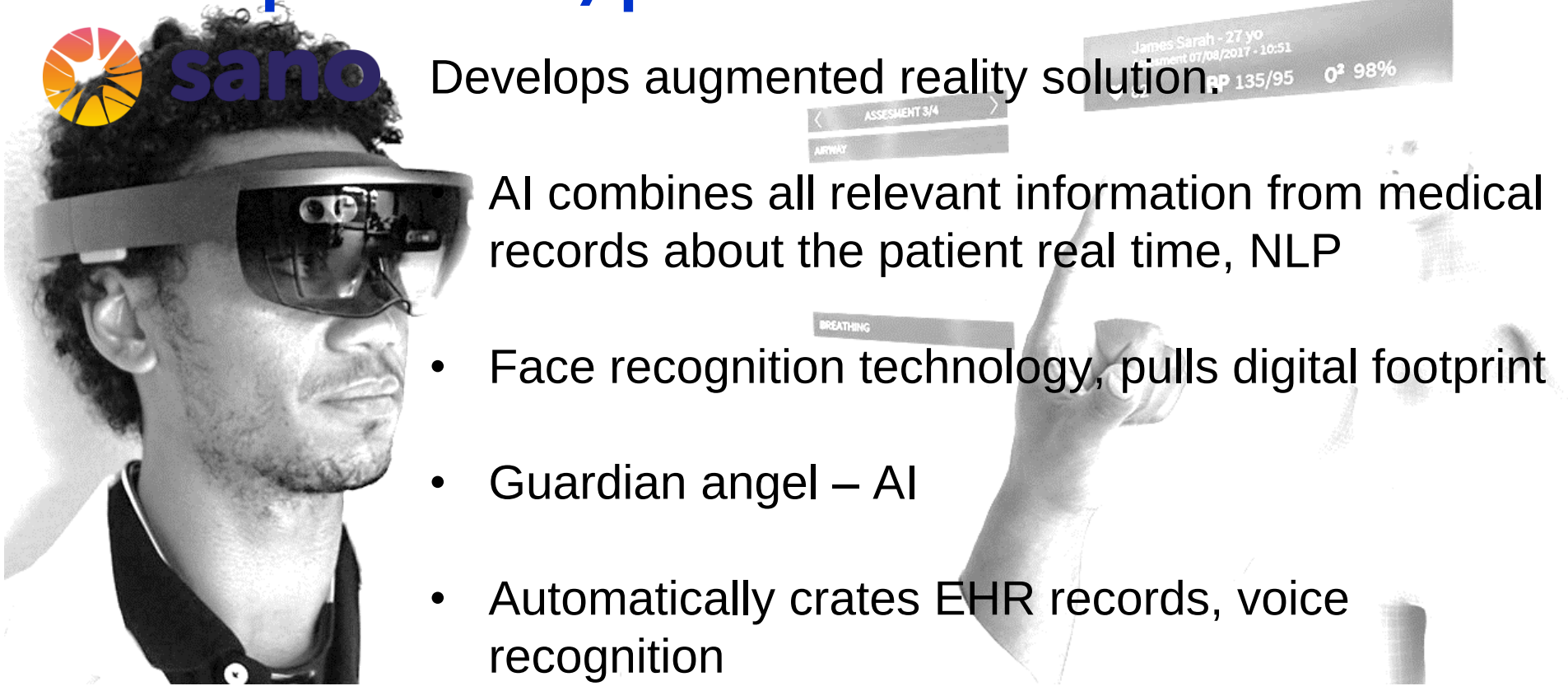
NITRILE

- Emergency department / haotic environment
- Life and death decisions
- Information- and time-critical decisions
- Need for documentation (electronic health records, EHR)

# ED Department/paramedics




Develops augmented reality solution.

AI combines all relevant information from medical records about the patient real time, NLP

- Face recognition technology, pulls digital footprint
- Guardian angel – AI
- Automatically crates EHR records, voice recognition

Image: https://hololens.reality.news/

Other selected topics currently pursued in Sano:

1. Telemedicine remote diagnosis and monitoring
2. Telemedicine: AI, digital teleportation
3. Telemedicine: Patient experience, AI controlled avatars
4. Fetal surgery: navigation
5. Fetal surgery: data visualization, VR, 3D modelling
6. Natural history simulations (effect of covid, economic impact)
7. Neuroscience (headed by Alessandro Crimi)
8. Population science (headed by Jose Sousa, Nov 1)
9. Federated learning and computing (headed by Maciej Malawski)

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# We welcome …

… anyone who shares our passion for improving healthcare through computing and data to collaborate or join

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