

Digital health: Preparing healthcare systems for the future

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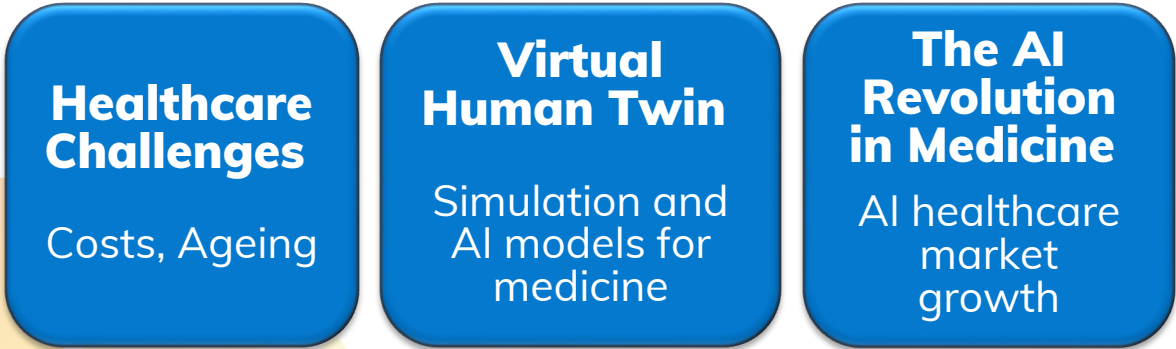
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Sano - International Research Foundation, Krakow

EU Teaming for Excellence and Polish FNP IRAP (since 2019)



Computational Medicine:



Objectives:



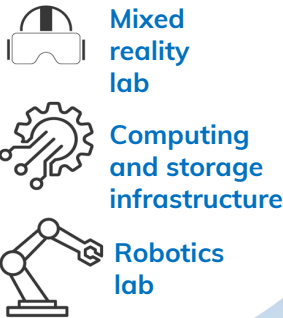
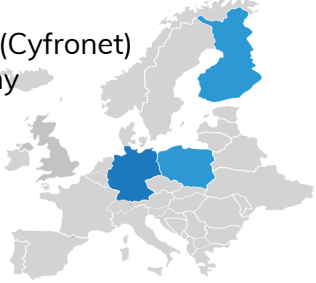
Teaming Partners:



Infrastructure

Supercomputers from HPC centres in:

- Poland (Cyfronet)
- Germany
- Finland



Focus of Sano research: Digital Twins in Healthcare

Physics-based and data-driven (AI) approaches

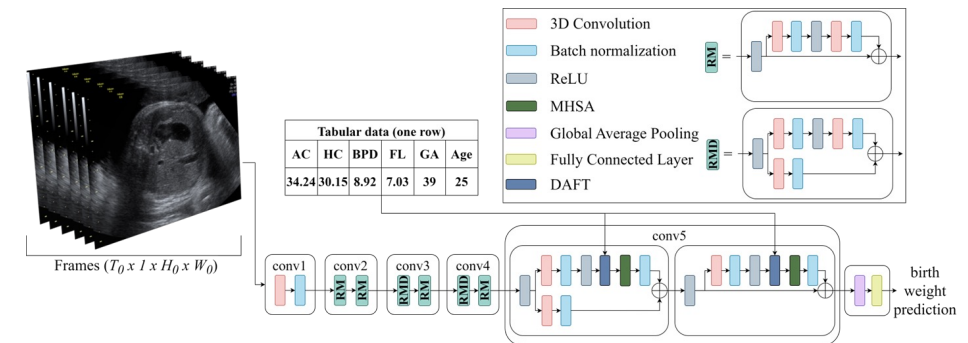
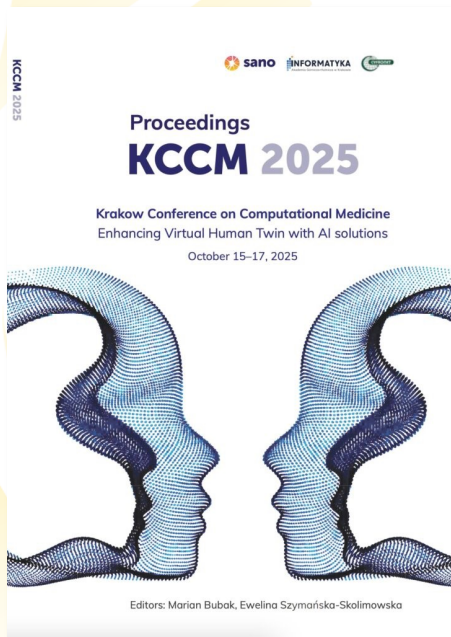
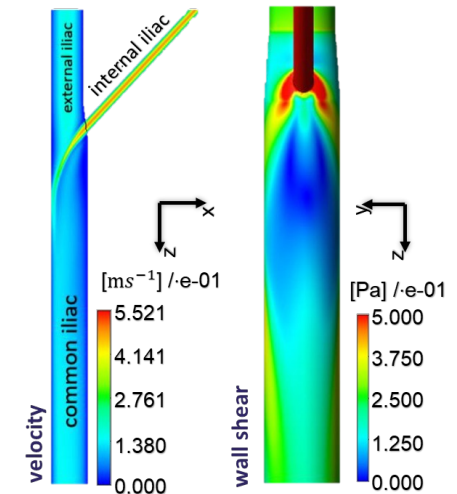
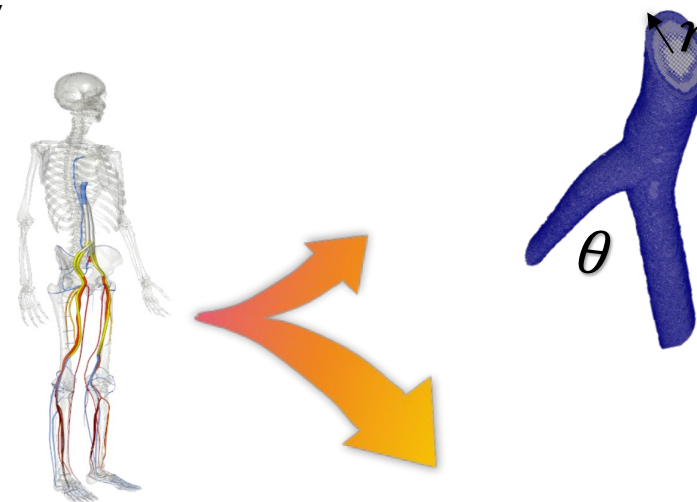


Digital Twin – a digital representation of a physical object, person or process of its environment

Digital Twin in Healthcare – developed with a specific clinical use in mind

Virtual Human Twin – an integrated, multi-scale, multi-temporal, multi-disciplinary representation of human physiology and pathology

- Simulation models – predictions based on fundamental laws of physics
- Data driven models: AI, machine learning – based on training data



Examples of Digital Twin solutions



Companies

- **HeartFlow**
 - First company providing simulation-based CT-guided intervention planning for coronary artery disease
 - <https://www.heartflow.com/>
- **FEops** – Materialise
 - Procedure Planning for Structural Heart Interventions
 - Transcatheter Aortic Valve Implantation
 - <https://www.feops.com/>

Projects

- **GEMINI**
 - Towards validated digital twins for haemorrhagic and ischemic stroke treatment
 - Clinical trial planned
 - <https://dth-gemini.eu>
- **ThromboRisk**
 - MSCA Doctoral Network
 - From cells to systems: pioneering multi-level thrombosis risk prediction models
 - <https://www.thromborisk.eu/>

Approved for reimbursement – but outside of EU



Paradox of AI in Medicine

- In 2016, the “Godfather of AI,” Geoffrey Hinton, declared AI would [soon kill the radiology](#) profession.
- ChatGPT report: *AI as a Healthcare Ally*, OpenAI, January 2026:
 - **More than 5%** of all messages globally are about healthcare
 - **One in four** active users submits a prompt about healthcare every week

AI adoption is happening faster than regulations can adapt!

- Challenges:
 - Regulatory classification ambiguity for digital twins/VHT/AI models (MDR / AI Act / GDPR)
 - Need for proper Data Infrastructure and Learning Environment
 - Need for the right incentive structure

Angus DC, et al *JAMA*. 2025;334(18):1650–1664. doi:10.1001/jama.2025.18490

Mandl, K.D., et al. *Nat Med* **30**, 631–634 (2024). <https://doi.org/10.1038/s41591-023-02783-w>



FORTUNE

A decade after the ‘Godfather of AI’ said radiologists were obsolete, their salaries are up to \$571K and demand is growing fast

Special Communication | AI in Medicine

AI, Health, and Health Care Today and Tomorrow The JAMA Summit Report on Artificial Intelligence

Derek C. Angus, MD, MPH^{1,2}; Rohan Khera, MD, MS^{1,2}; Tracy Lieu, MD, MPH^{1,3}; [et al](#)

Comment | Published: 30 January 2024

Integration of AI in healthcare requires an interoperable digital data ecosystem

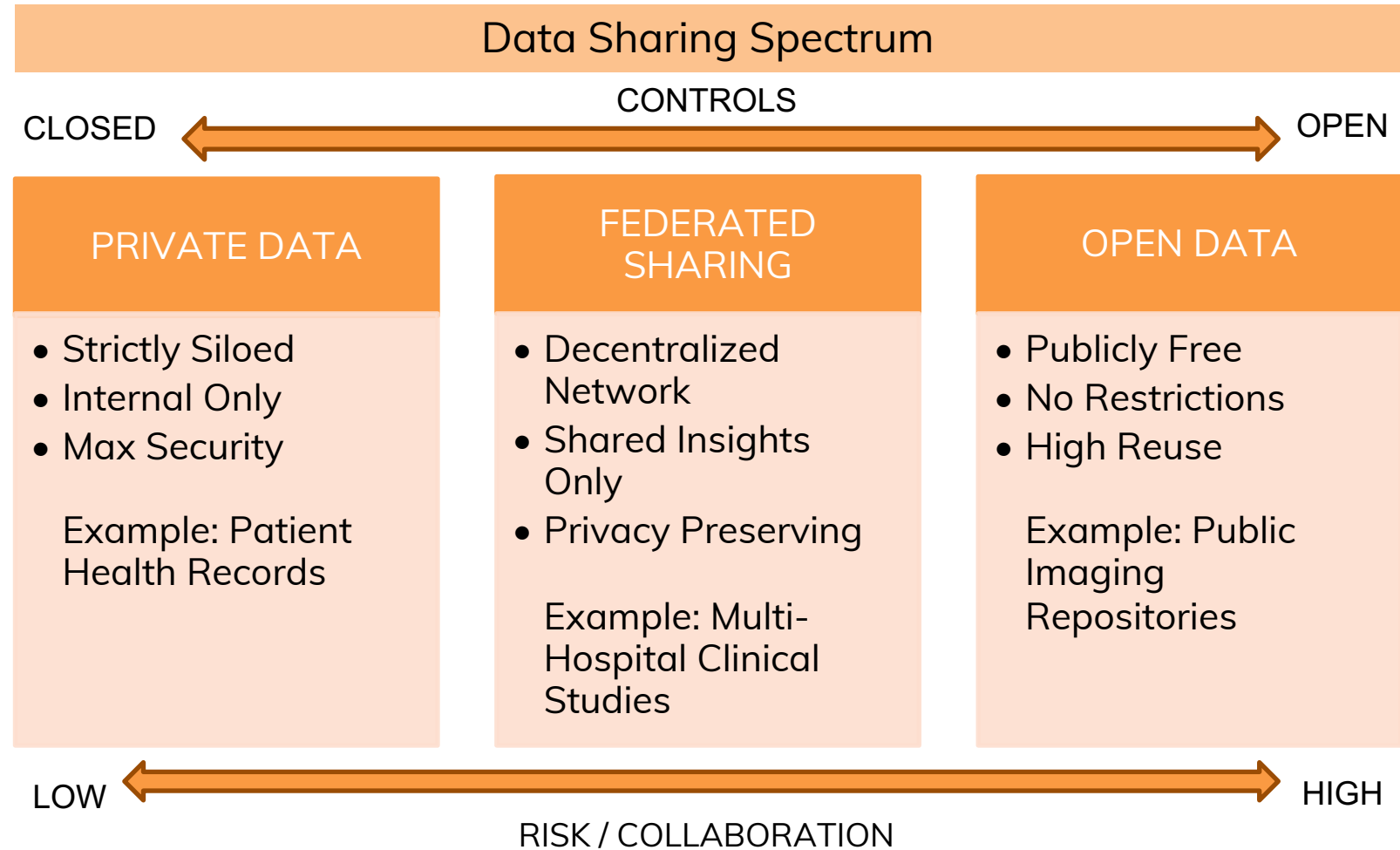
[Kenneth D. Mandl](#) ✉, [Daniel Gottlieb](#) & [Joshua C. Mandel](#)

[Nature Medicine](#) **30**, 631–634 (2024) | [Cite this article](#)

Models are as good as data they were trained and validated on



- Issues
 - Small populations of data to develop new models
 - Lack of generalization
 - Bias towards specific populations
 - Lack of incentive to share the data (from patient or hospital perspective)
- Need to
 - Make data available
 - Share the data in federated model
 - Incentivise data sharing



No clear support in GDPR, EHDS, nor AI Act for Federated Learning and validation

Dominika Ciupek, Maciej Malawski, Tomasz Pieciak, Federated learning: A new frontier in the exploration of multi-institutional medical imaging data, Computer Methods and Programs in Biomedicine, Volume 284, 2026, 109454, <https://doi.org/10.1016/j.cmpb.2026.109454>⁶

European VHT initiative



The VHTnet project

- develops and operates a secure, high-performance European platform
- to support advanced VHT models for health and life sciences.

The platform enables

- Large-scale simulations,
- AI-driven modelling,
- Federated data access across trusted computing environments in the EU.

Consortium

- Engineering Informatica
- Cineca
- Sano
- NTT Data
- In Silico Trials

- Still only for research and not integrated with clinical data
- Need to provide further developments for direct access to data in hospitals
- Need to align with other EU infrastructures (EBRAINS, Imaging, Biobanking)



VHTnet

 **conference
VPH2026**
1-4 September, Milano, Italy

AI for Science – need for sovereignty



THE WALL STREET JOURNAL.

TECHNOLOGY • ARTIFICIAL INTELLIGENCE • SCIENCE OF SUCCESS

A Famous Math Problem Stumped Humans for 80 Years. AI Just Cracked It.

The math world is losing its mind over the new solution to an Erdős problem. This is what AI found, how we missed it—and why it matters.

If you place n points in the plane, how many pairs of points can be exactly distance 1 apart?

It was done using an OpenAI **internal** model

Not available publicly!

The need for **sovereign** AI

Infrastructures

Models

Research

We need to develop, deploy and operate local models

Examples from Poland:

- Polish LLMs PLUM and Bielik trained and served at Cyfronet
- Thanks to digital transformation many hospitals have GPU servers for AI

<https://openai.com/index/model-disproves-discrete-geometry-conjecture/>



BIELIK.AI



AI and computational medicine needs infrastructures for data sharing and processing

- Good examples:
 - EuroHPC Joint Undertaking
 - 19 AI Factories
 - €20 billion for up to 5 AI Gigafactories
- Gaia AI Factory in Krakow
 - Health as one of key application areas
 - Not only infrastructure, but also competences
- Challenges
 - Fragmentation in AI Factories
 - Missing connection of research infrastructures to healthcare systems



Policy ask: translate EU health AI from research to care



EU strengths: research, digital twins, federated data, sovereign AI/HPC and VHT platforms.
The missing link is clinical translation.

RECOMMENDATIONS

- 1 Make EHDS, AI Act, GDPR usable for training and validation of health AI/VHT systems**
Harmonise in-silico trial standards, risk classification, CE support and reimbursement guidance.
- 2 Support federated data sharing in R&I projects by bringing clinics into projects from day one**
Involve and incentivise clinical partners for needs definition, workflow fit, validation and data provision.
- 3 Coordinate EU research infrastructures and health systems for sovereign AI/VHT models**
Fund sovereign foundation models for health and IP/licensing frameworks to translate research into practice.
- 4 Simplify compliance for SMEs and non-profits**
Digital Omnibus: provide clear legal basis for research, tailored exemptions and coordinated medical/security rules.

Support translation, not only research — so EU-made AI and virtual-human-twin solutions reach patients faster.



sano

From research to real-world
impact in healthcare

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