From Data to Actionable Insights in Healthcare

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20.11.2025

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Tragedies

DERSTANDARD

Inland › Bundesländer › Oberösterreich | International | Wirtschaft | Web | Sport | mehr...

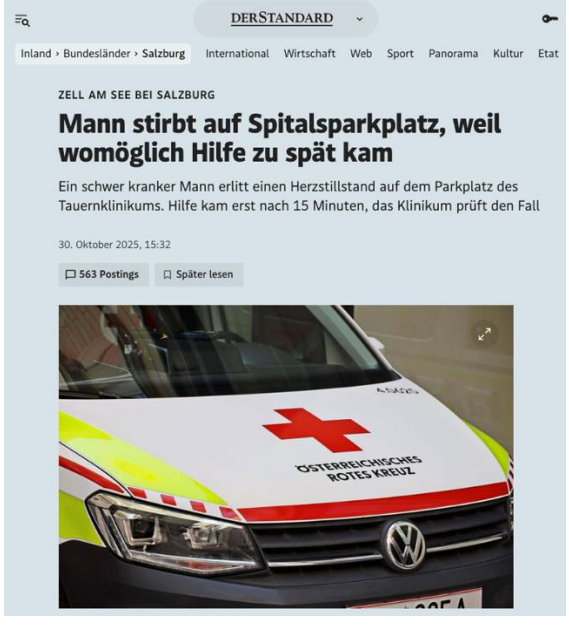
MEDIENBERICHT

Kein freies Intensivbett: 55-jährige Oberösterreicherin gestorben

Nachdem bei der Frau ein Einriss der Hauptschlagader festgestellt worden war, hätte sie in einem spezialisierten Krankenhaus weiterbehandelt werden sollen. Nur: Alle zuständigen Kliniken sagten ab

aktualisiert am 26. Oktober 2025, 19:19

2638 Postings | Später lesen



DERSTANDARD

Inland › Bundesländer › Salzburg | International | Wirtschaft | Web | Sport | Panorama | Kultur | Etat

ZELL AM SEE BEI SALZBURG

Mann stirbt auf Spitalsparkplatz, weil womöglich Hilfe zu spät kam

Ein schwer kranker Mann erlitt einen Herzstillstand auf dem Parkplatz des Tauernklinikums. Hilfe kam erst nach 15 Minuten, das Klinikum prüft den Fall

30. Oktober 2025, 15:32

563 Postings | Später lesen

KURIER

Abo

Schlagzeilen | Wien | NÖ | Burgenland | Österreich | Politik | Wirtschaft | Sport | Kultur | Freizeit | Gesund

OBERÖSTERREICH

Kein Platz im Spital: Wanderin nach Unfall am Traunstein verstorben

Eine 63-jährige Wanderin stürzte am Traunstein ab. Die Frau hätte für die Erstversorgung nach Gmunden geflogen werden sollen, doch dort war kein Platz. In der ZIB2 wurden die Vorwürfe zurückgewiesen.

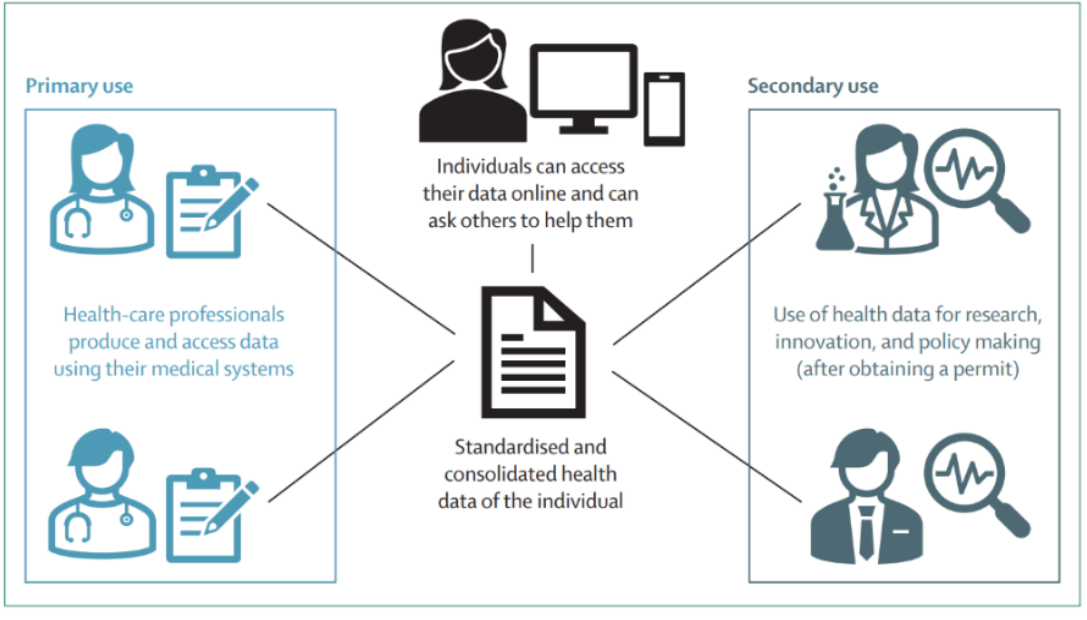
27.10.25, 22:37

Why Tragedies Still Happen?

- **Information overload**
  - important signals get buried.
- **Human factors**
  - communication breakdowns and assumptions.
- **Too much tech**
  - tools aren’t integrated into workflows.
- **Systems interoperability**
  - critical information gets lost.
- **Infrastructure**
- …

A Data-Driven View of Health Digitalization

- National eHealth Strategy (2024-2030) highlights:
  - Increase in the **quantity and diversity** of healthcare data.
  - The use of **high-quality health data** for health care as well as for research and system control.
  - **Accessibility and linkability** in compliance with **data protection** regulations limits the usefulness of data sources.



SOURCE: RAAB ET AL. (2023)

Healthcare Data in Austria

Healthcare providers connected and supplying data				
Types of healthcare providers		Yes	No	Not applicable
Primary care physicians and community care centres	Public	●		
	Private		●	
Secondary and tertiary hospitals and clinics	Public	●		
	Private		●	
Rehabilitation centres	Public		●	
	Private		●	
Geriatric nursing homes	Public		●	
	Private		●	
Mental health facilities	Public		●	
	Private		●	
Pharmacies		●		

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Accessibility and Linkability?

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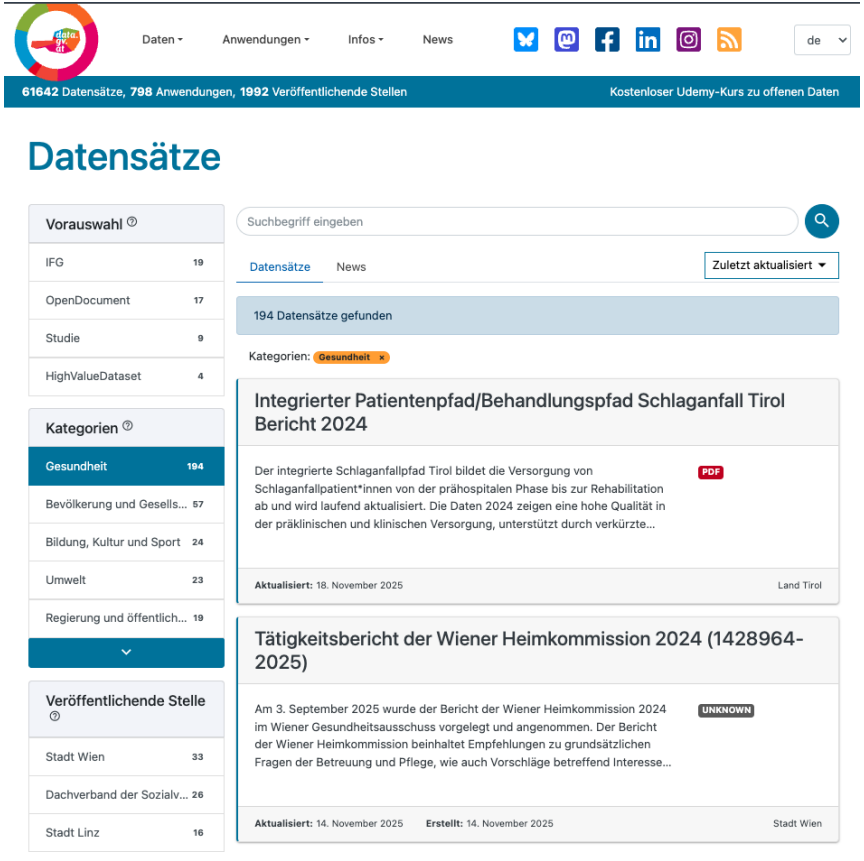
From Paper to Data

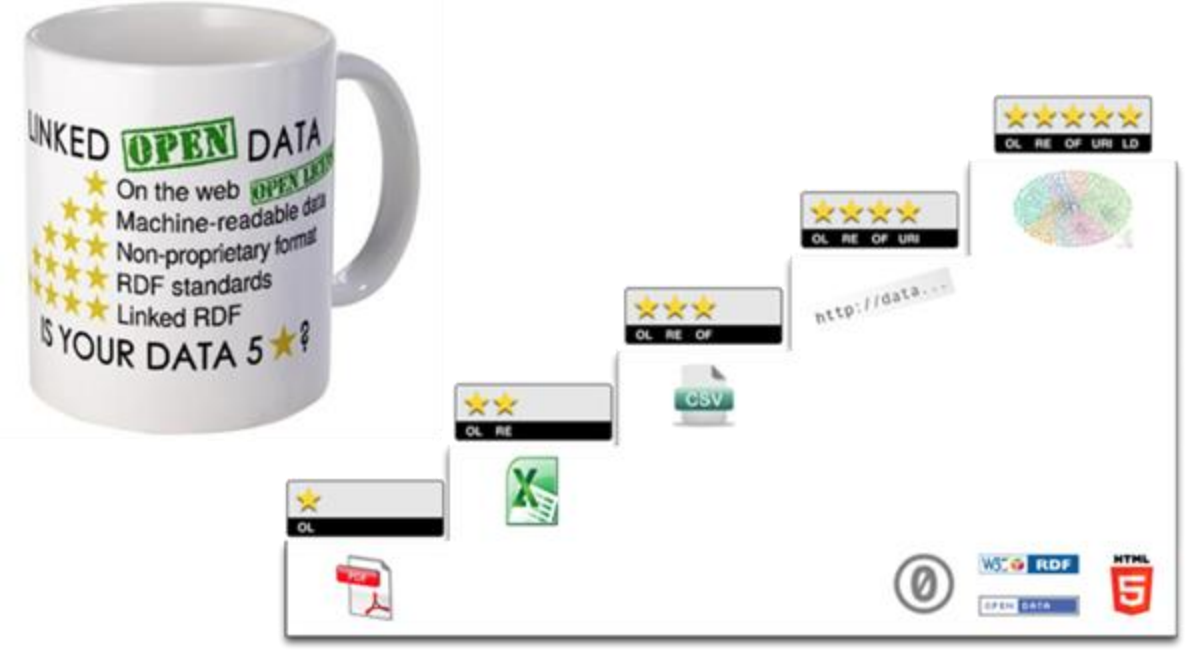
- ELGA
  - Enabling electronic, interoperable records instead of fragmented paper files
  - Faster access to data and avoids duplicate tests
  - Individuals access their own data

From Data to Open Data

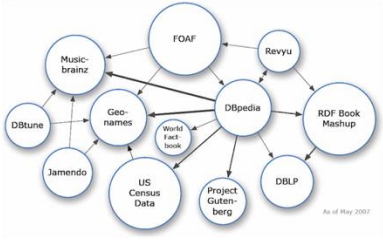
- Enables research, innovation, and data-driven policymaking (secondary use of data)
- Unlike other open data resources
  - Health data requires strong anonymization and privacy safeguards
  - Must balance public benefit with patient confidentiality
  - Quality, completeness, and provenance are essential



Data Availability and Quality

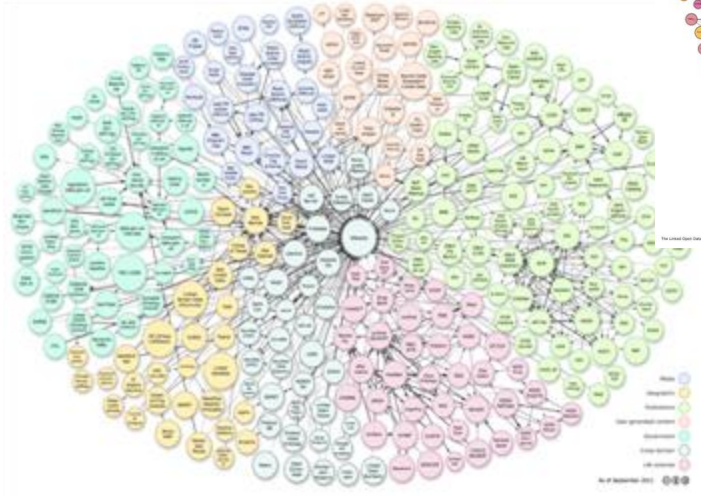


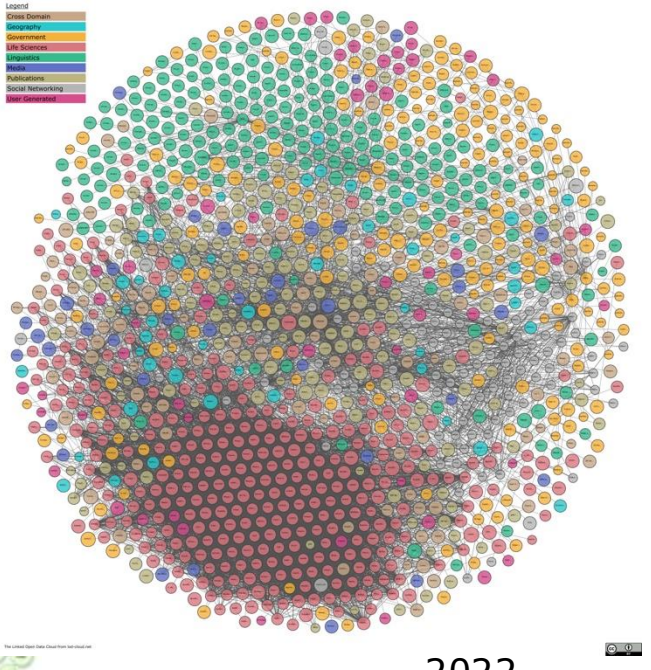
From Open Data to Web of Data



2007

2011





2022

Wikidata

Wikidata as a Large-scale collaborative Medical Database

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WIKIDATA English Donate Create account Log in

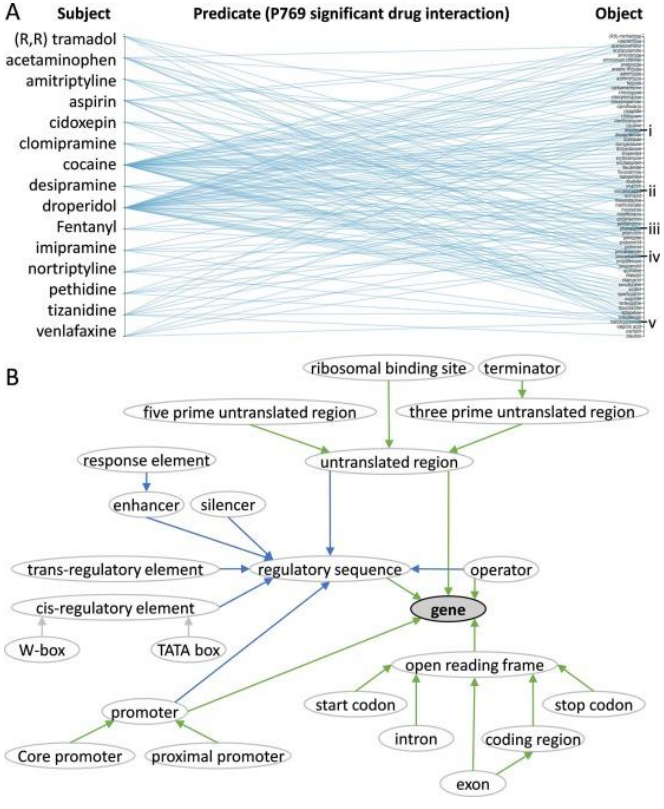
COVID-19 (Q84263196)

Item Discussion Read View history Tools

contagious disease caused by SARS-CoV-2
coronavirus disease 2019 | nCOVD-19 | 2019-nCoV acute respiratory disease
| Novel Coronavirus Pneumonia | Covid-19 | Severe Acute Respiratory Syndrome Coronavirus 2
| Wuhan respiratory syndrome | severe acute respiratory syndrome type 2 | nCOVD 19 | CD-19
| SARS-CoV-2 | 2019 novel coronavirus pneumonia | Wuhan pneumonia | COVID | COVID 19
| Coronavirus disease 2019 | nCOVD19 | 2019 NCP | COVID19
| 2019 novel coronavirus respiratory syndrome | seafood market pneumonia
| SARS-CoV-2 infection | COVID-2019 | WuRS

In more languages
Configure

Language	Label	Description	Also known as
default for all languages	COVID-19	–	
English	COVID-19	contagious disease caused by SARS-CoV-2	coronavirus disease… nCOVD-19
Persian	بیماری کروناویروس ۲۰۱۹	بیماری تنفسی ویروسی واگیردار که نخستین بار در سال ۲۰۱۹ (۱۳۹۸) شناسایی شد	
German	COVID-19	Infektionskrankheit hervorgerufen durch das Virus SARS-CoV-2	Covid-19 Coronavirus disease… Coronavirus-Krankh…



WAAGMEESTER, A., STUPP, G., BURGSTALLER-MUEHLBACHER, S., GOOD, B. M., GRIFFITH, M., GRIFFITH, O. L., ... & SU, A. I. (2020). WIKIDATA AS A KNOWLEDGE GRAPH FOR THE LIFE SCIENCES. *ELIFE*, *9*, E52614.

TURKI, H., SHAFEE, T., TAIEB, M. A. H., AOUICHA, M. B., VRANDEČIĆ, D., DAS, D., & HAMDI, H. (2019). WIKIDATA: A LARGE-SCALE COLLABORATIVE ONTOLOGICAL MEDICAL DATABASE. *JOURNAL OF BIOMEDICAL INFORMATICS*, *99*, 103292.

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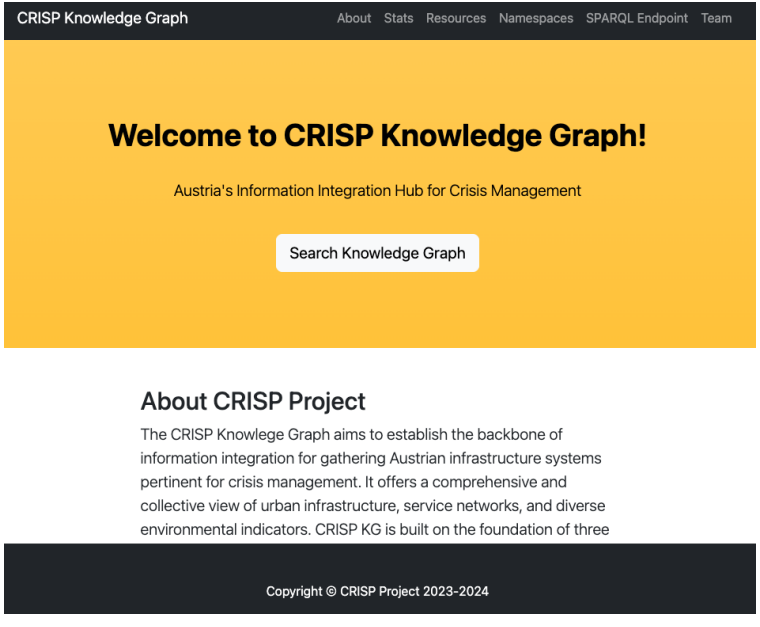
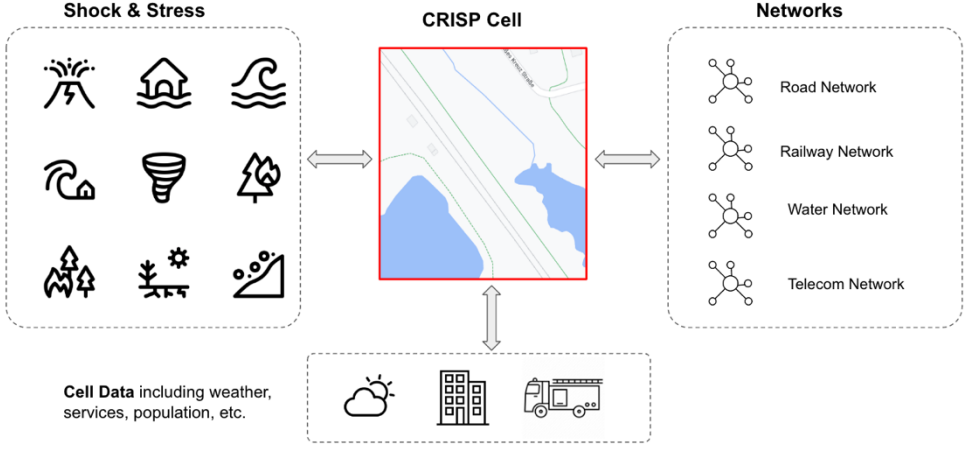
Knowledge Graphs

- knowledge graph is a graph of data intended to accumulate and convey knowledge of the real world, whose nodes represent entities of interest and whose edges represent relations between these entities.
- The phrase “Knowledge Graph” has been used in the literature since at least 1972.
- The concept become popular because of the 2012 announcement of the Google Knowledge Graph
- Followed by further announcements of the development of knowledge graphs by Airbnb, Amazon, eBay, Facebook, IBM, LinkedIn , Microsoft, Uber, and more besides

CRISP Knowledge Graph





http://crisp.ai.wu.ac.at/

Data Spaces

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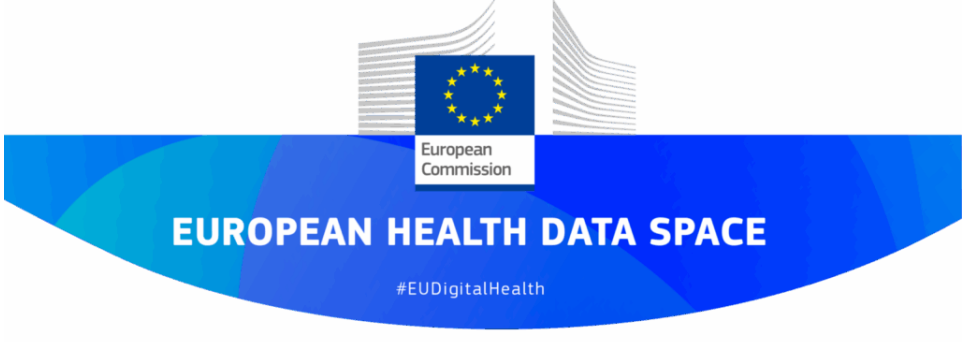
Data Spaces

- Why Data Spaces?
  - Centralized data platforms risk vendor lock-in, privacy loss, limited trust
  - Health domain requires secure cross-actor data exchange
  - Enable new services: flexible markets, AI services, etc.
- Data Spaces provide
  - Sovereignty – providers control their own data
  - Trust – certified identities, verifiable contracts
  - Interoperability – common standards and ontologies



Readiness Assessment of Health Data Spaces in Austria

- Interoperability: partial alignment, missing metadata catalogue
- Technical Infrastructure: strong baseline, limited secondary-use enablement
- Governance & Legal: fragmented structures, regulatory tensions
- Stakeholder Adoption: moderate readiness, low incentives

Comparative Readiness Overview

Dimension	Austria	Germany	Switzerland	Sweden
EHR Adoption	Medium	Low	High	Medium
Interoperability	Medium-High	Low	Medium	High
Governance	Corporatist	Fragmented	Federalist	Centralized
Patient Trust	Moderate	Low	Moderate	High

AI, Language Models, and AI Agents

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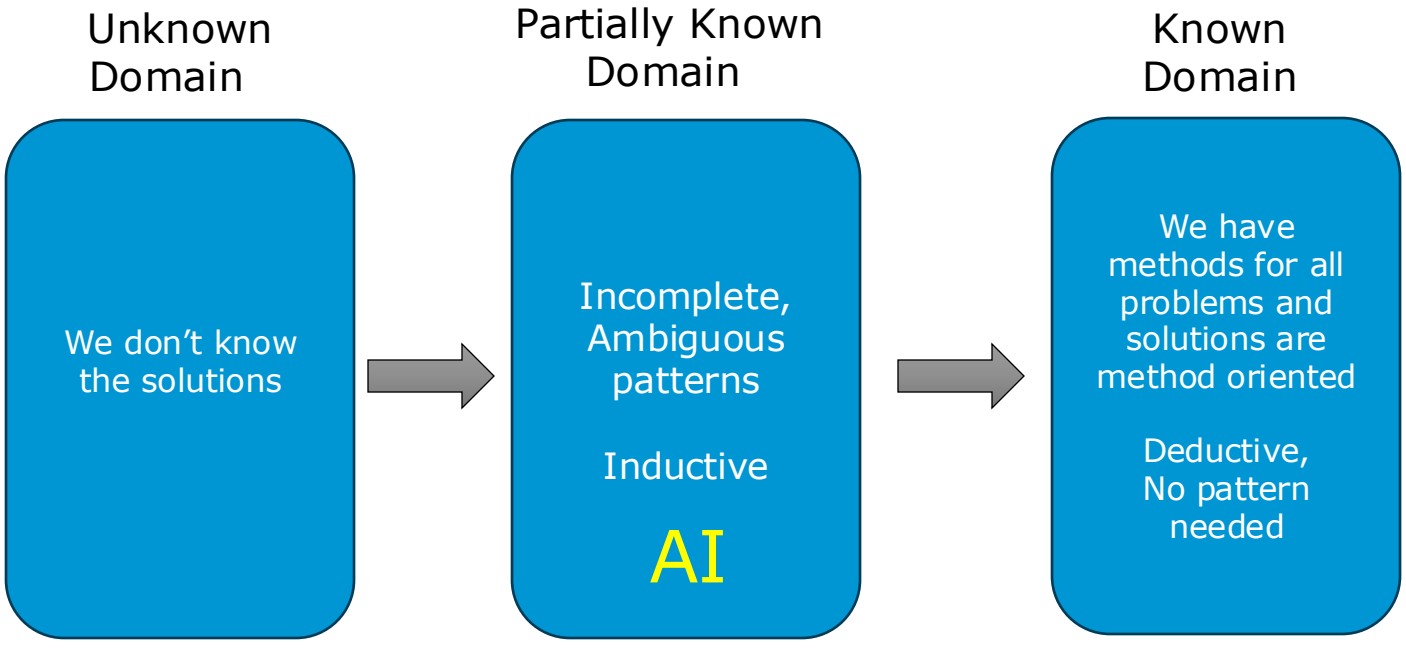
From Data to Intelligence



AI attempts to "Provide efficient solutions to problems in an ambiguous, incomplete pattern area"

Expectations from AI

Predictions of Herbert Simon and Allen Newell predicted that within ten years:

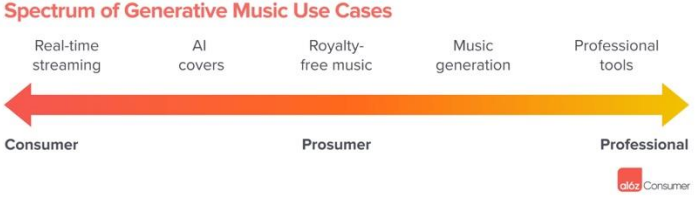
- a digital computer will be the world's chess champion
- a digital computer will discover and prove an important new mathematical theorem
- a digital computer will compose critically acclaimed music

Heuristic Problem Solving, 1958

MIT affiliates win AI for Math grants to accelerate mathematical discovery

Department of Mathematics researchers David Roe and Andrew Sutherland seek to advance automated theorem proving; four additional MIT alumni also awarded.

Sandi Miller | Department of Mathematics
September 22, 2025



Semantic Web Vision using Agents (2001)

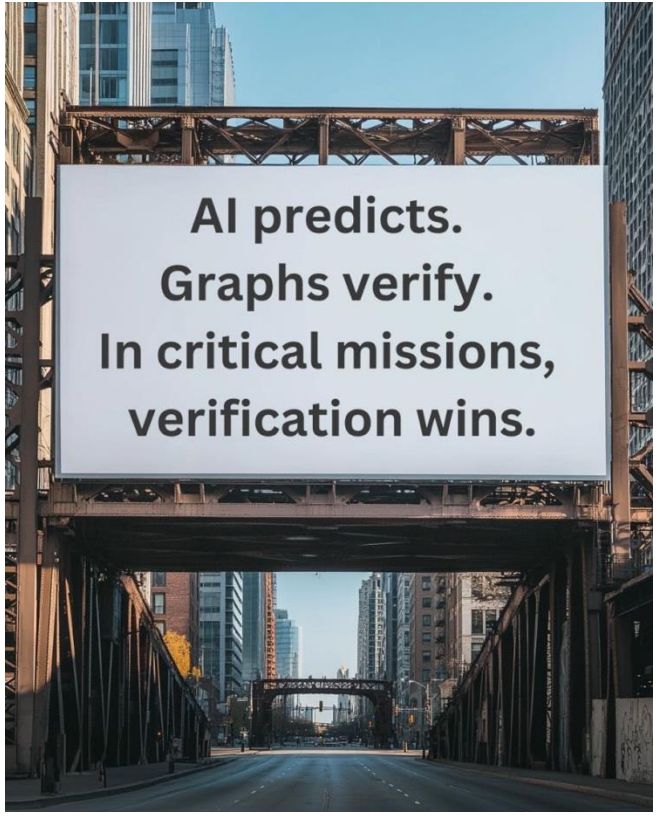
doctor's office: "Mom needs to see a specialist and then has to have a series of physical therapy sessions. Biweekly or something. I'm going to have my agent set up the appointments." Pete immediately agreed to share the chauffeuring. At the doctor's office, Lucy instructed her Semantic Web agent through her handheld Web browser. The agent promptly retrieved information about Mom's *prescribed treatment* from the doctor's agent, looked up several lists of *providers*, and checked for the ones *in-plan* for Mom's insurance within a *20-mile radius* of her *home* and with a *rating* of *excellent* or *very good* on trusted rating services. It then began trying to find a match between available *appointment times* (supplied by the agents of individual providers through their Web sites) and Pete's and Lucy's busy schedules. (The emphasized keywords indicate terms whose semantics, or meaning, were defined for the agent through the Semantic

BERNERS-LEE, T., HENDLER, J., & LASSILA, O. (2001). SCIENTIFIC AMERICAN: FEATURE ARTICLE: THE SEMANTIC WEB.

AI Limitations

- Limitations by training data
- Struggling with true creativity
- Lacking nuanced understanding
- Context adoptability
- Data privacy and security

- **Neuro-symbolic AI**
  - Bridge the gap between symbolic and subsymbolic approaches
  - Symbolic AI contributes real-world knowledge and reasoning capabilities to subsymbolic models (e.g., ML systems and LLMs)
  - Enabling more reliable, interpretable, and context-aware results.

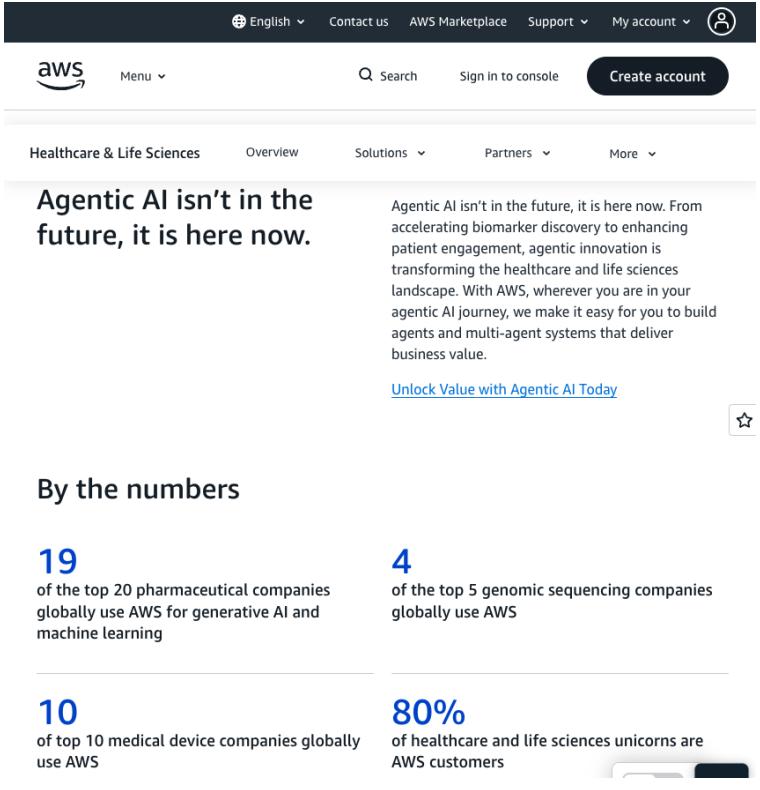


DANIEL BUKOWSKI

From Intelligence to Actionable Insight

- Relevant, timely, clear, and trustworthy insight to enable concrete decisions for better outcomes, more efficient care, and smarter health systems
  - Identifying high-risk patients
  - Choosing personalized treatments
  - Optimizing workflows
  - Improving public health responses

- How can technology help?
  - Agentic AI: a new era of integrated care and discovery



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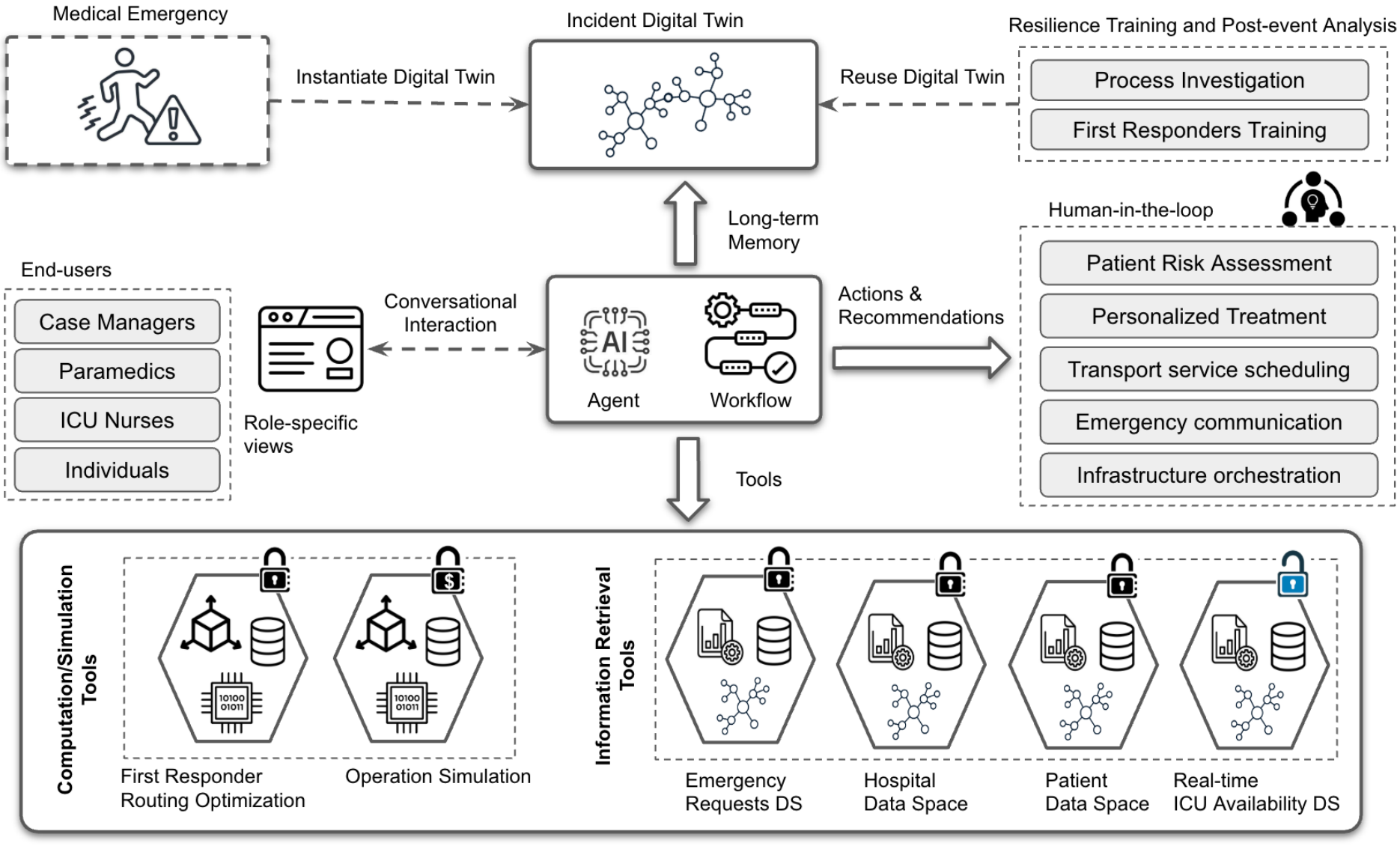
Medical Emergency
Instantiate Digital Twin
Incident Digital Twin
Reuse Digital Twin
Resilience Training and Post-event Analysis
Process Investigation
First Responders Training
Long-term Memory
Human-in-the-loop
End-users
Case Managers
Paramedics
ICU Nurses
Individuals
Conversational Interaction
Role-specific views
AI
Agent
Workflow
Actions & Recommendations
Patient Risk Assessment
Personalized Treatment
Transport service scheduling
Emergency communication
Infrastructure orchestration
Tools
Computation/Simulation Tools
First Responder Routing Optimization
Operation Simulation
Information Retrieval Tools
Emergency Requests DS
Hospital Data Space
Patient Data Space
Real-time ICU Availability DS

Conclusions

- Data Spaces are the foundation for trustworthy and sovereign data sharing.
- High-quality data and meaningful data linking are essential for impactful Data Space applications.
- Enabling technologies like Knowledge Graphs and AI Agents are key disruptors that enhance Data Space use and unlock actionable insights.

Thanks for your attention!

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https://anjomshoaa.github.io/