Inteligencia Artificial, Tecnologías Disruptivas y Educación Médica.

Alejandro Hernández-Arango MD Esp Msc

2º Congreso Mundial sobre Educación Médica
Cartagena 28 - 29 sep 2023
ASCOFAME 64 años

Conflictos de interés

Nombre	Tipo
Validación prospectiva de modelo de inteligencia artificial para diagnóstico de coronavirus en radiografía de tórax y tomografías de pacientes de hospitales de 3 y 4 nivel de la ciudad de Medellín	**MINISTERIO DE CIENCIA, TECNOLOGIA E INNOVACIÓN – MINCIENCIAS 890-2020**
HuMath Curie: decisiones medicas Confiables en Unidades de cuidado Respiratorio a partir de Inteligencia Artificial en Enfermedades pulmonares tipo COVID 19	**MINISTERIO DE CIENCIA, TECNOLOGIA E INNOVACIÓN – MINCIENCIAS 895-2021**
Universidad de Antioquia, U de Andes, Hospital Alma Máter, GHIPS, UPB, UCC-	**Financiero**
Tanque de pensamiento de IA en salud: AIpocrates	**No-Financieros**

LA DISRUPCIÓN TECNOLÓGICA DEL ACTO MÉDICO

Toll, Elizabeth. 2020. “The Cost of Technology.” JAMA. https://doi.org/10.1001/jama.2012.4946.

LA DISRUPCIÓN TECNOLÓGICA DEL ACTO MÉDICO

LA DISRUPCIÓN TECNOLÓGICA DEL ACTO MÉDICO

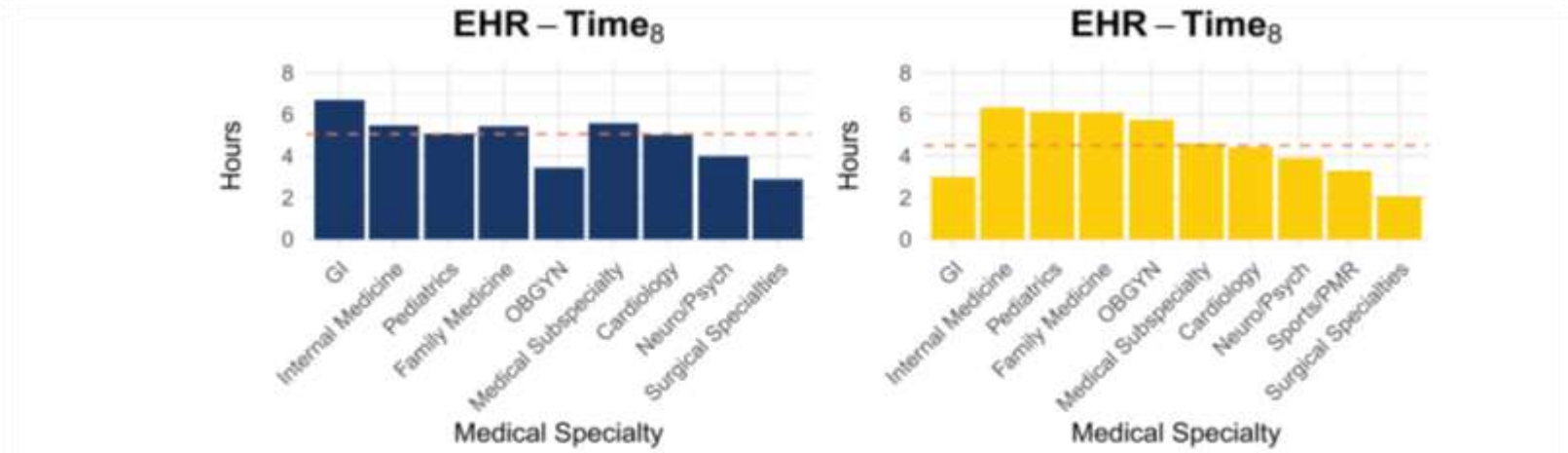


Figure 2. Normalized EHR core measures by specialty. Distribution of EHR core measures stratified by medical specialty and health system (Yale-New Haven on left and MedStar on right) and with each institution's median value noted with dotted coral pink line. Note that the metrics are not sufficiently aligned between Cerner and Epic to allow direct comparisons.

Melnick, Edward R., Shawn Y. Ong, Allan Fong, Vimig Socrates, Raj M. Ratwani, Bidisha Nath, Michael Simonov, et al. 2021. "Characterizing Physician EHR Use with Vendor Derived Data: A Feasibility Study and Cross-Sectional Analysis." Journal of the American Medical Informatics Association. https://doi.org/10.1093/jamia/ocab011.

LA DISRUPCIÓN TECNOLÓGICA DEL ACTO MÉDICO

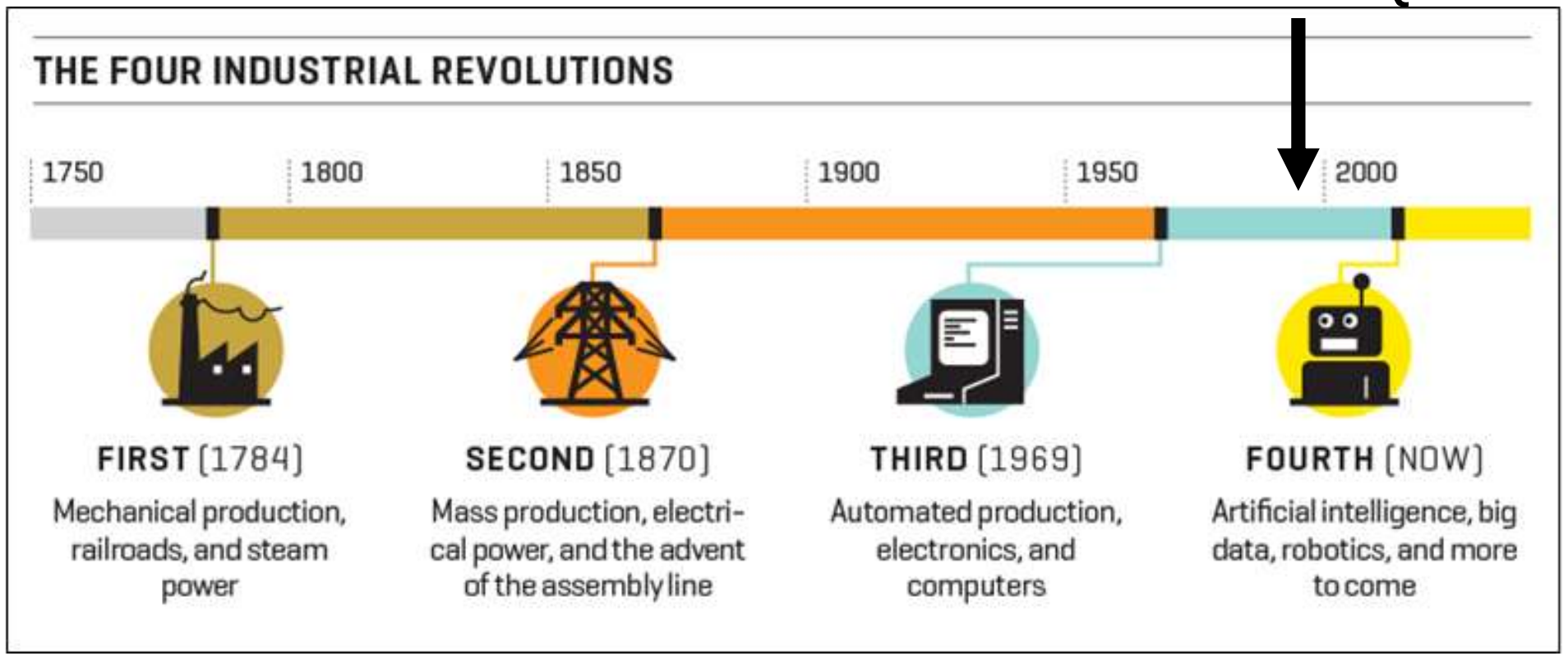
IDEAS AND OPINIONS | Annals of Internal Medicine

The Bedside Evaluation: Ritual and Reason

Abraham Verghese, MD; Erika Brady, PhD; Cari Costanzo Kapur, PhD; and Ralph I. Horwitz, MD

> *iPatients are handily discussed in the bunker, while the real patients keep the beds warm and ensure that the folders bearing their names stay alive on the computer.*

Medicina y Educación Médica Están AQUI

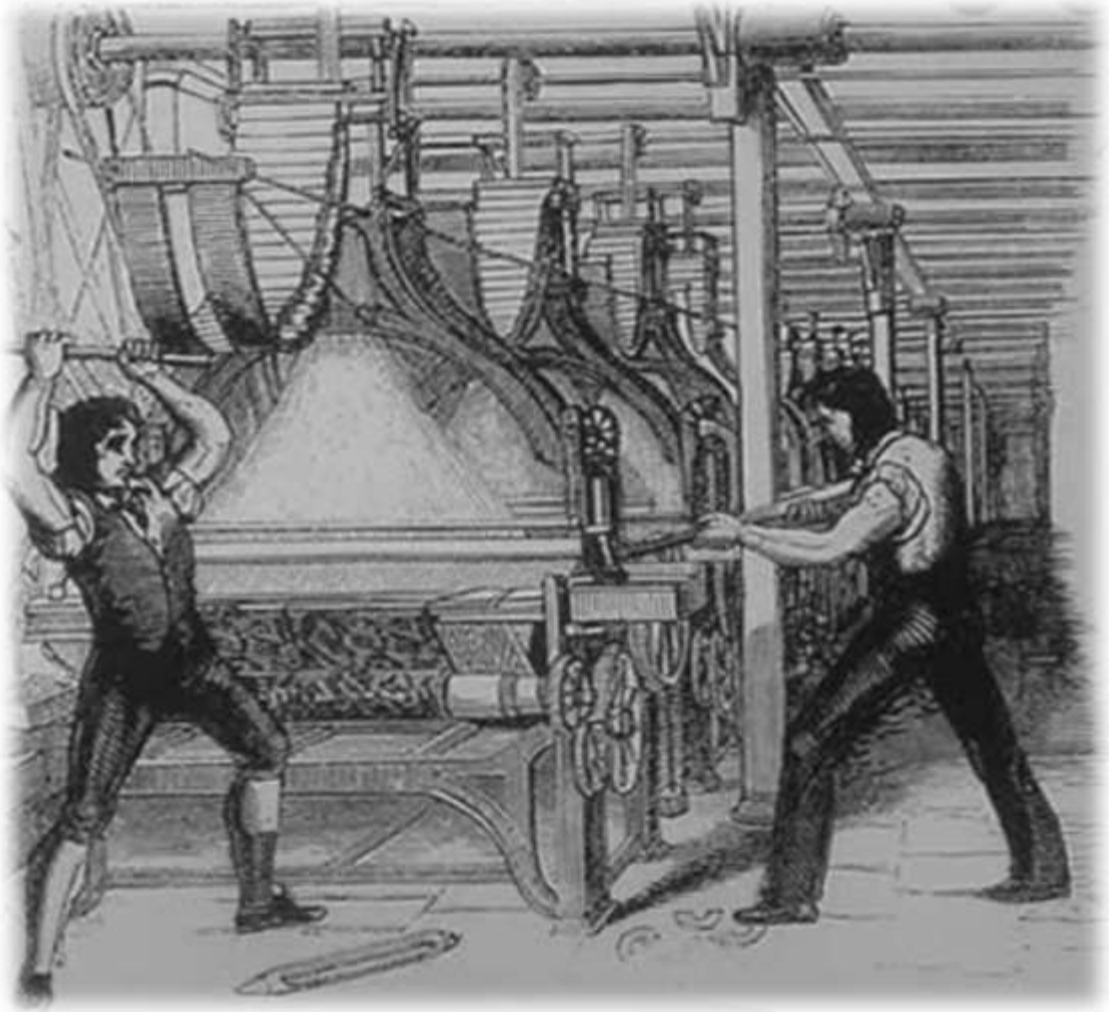


"The Fourth Industrial Revolution is not just about technology or business, **It's about society**."

- Joe Kaeser, President and Chief Executive Officer Siemens AG

Horváth, B. (2018). The recognition of resource use through industrial development from a social perspective.

LA DISRUPCIÓN TECNOLÓGICA DEL ACTO MÉDICO

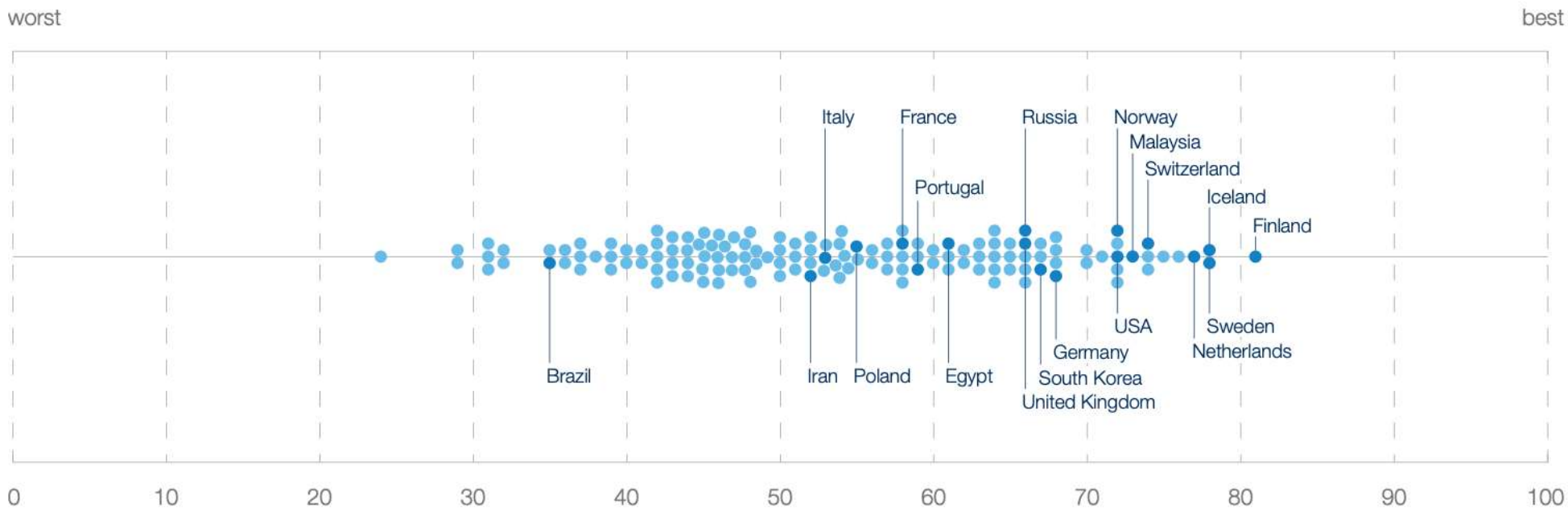


Morquin, D. 2020. “Résistance Légitime sans Technophobie : Analyse Des Impacts de L’informatisation Du Dossier Du Patient Sur Le Cœur Du Métier Médical.” La Revue de Médecine Interne. https://doi.org/10.1016/j.revmed.2020.03.011.

Schools of the Future

Defining New Models of Education for the Fourth Industrial Revolution

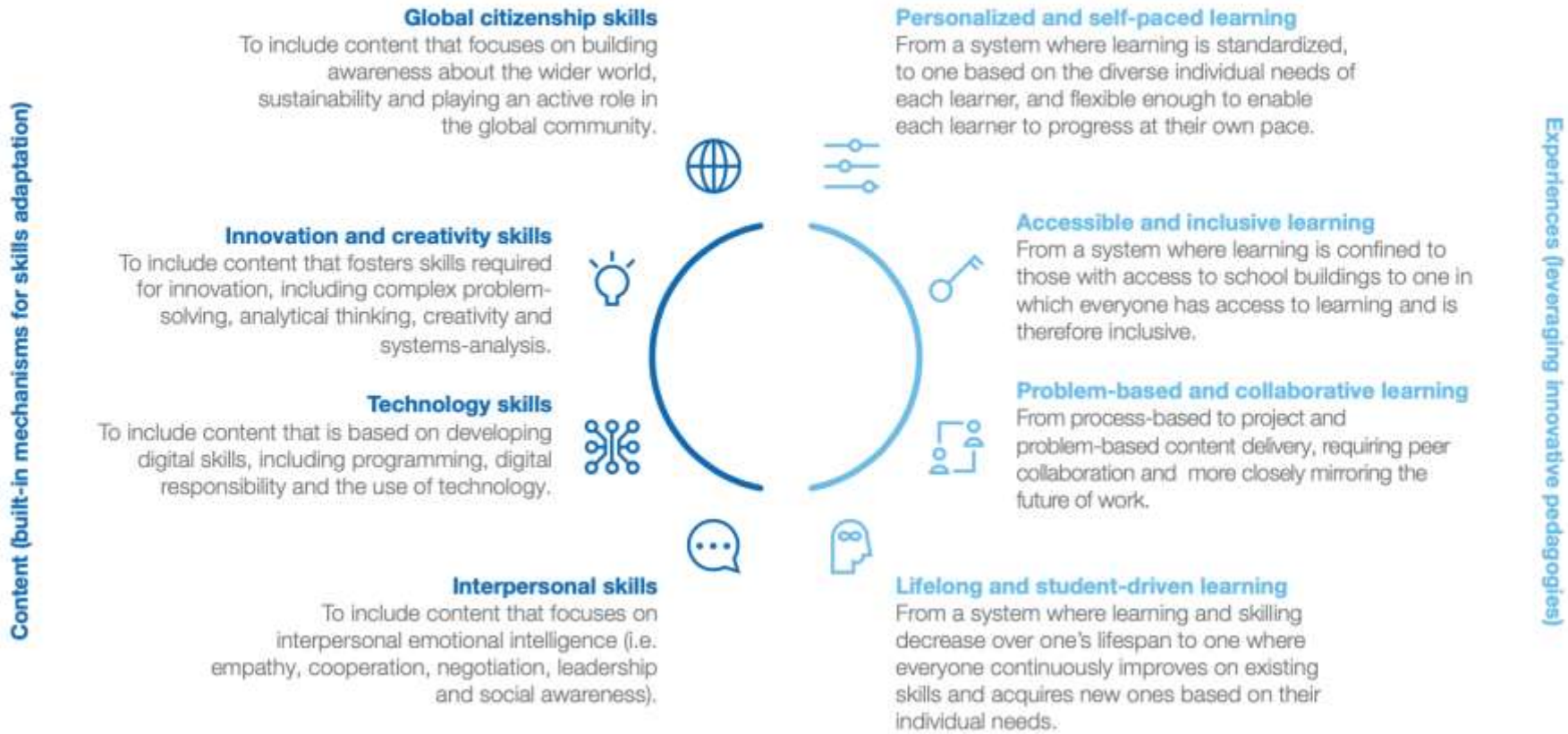
Figure 3: Which countries have the digital skills to master the Fourth Industrial Revolution?

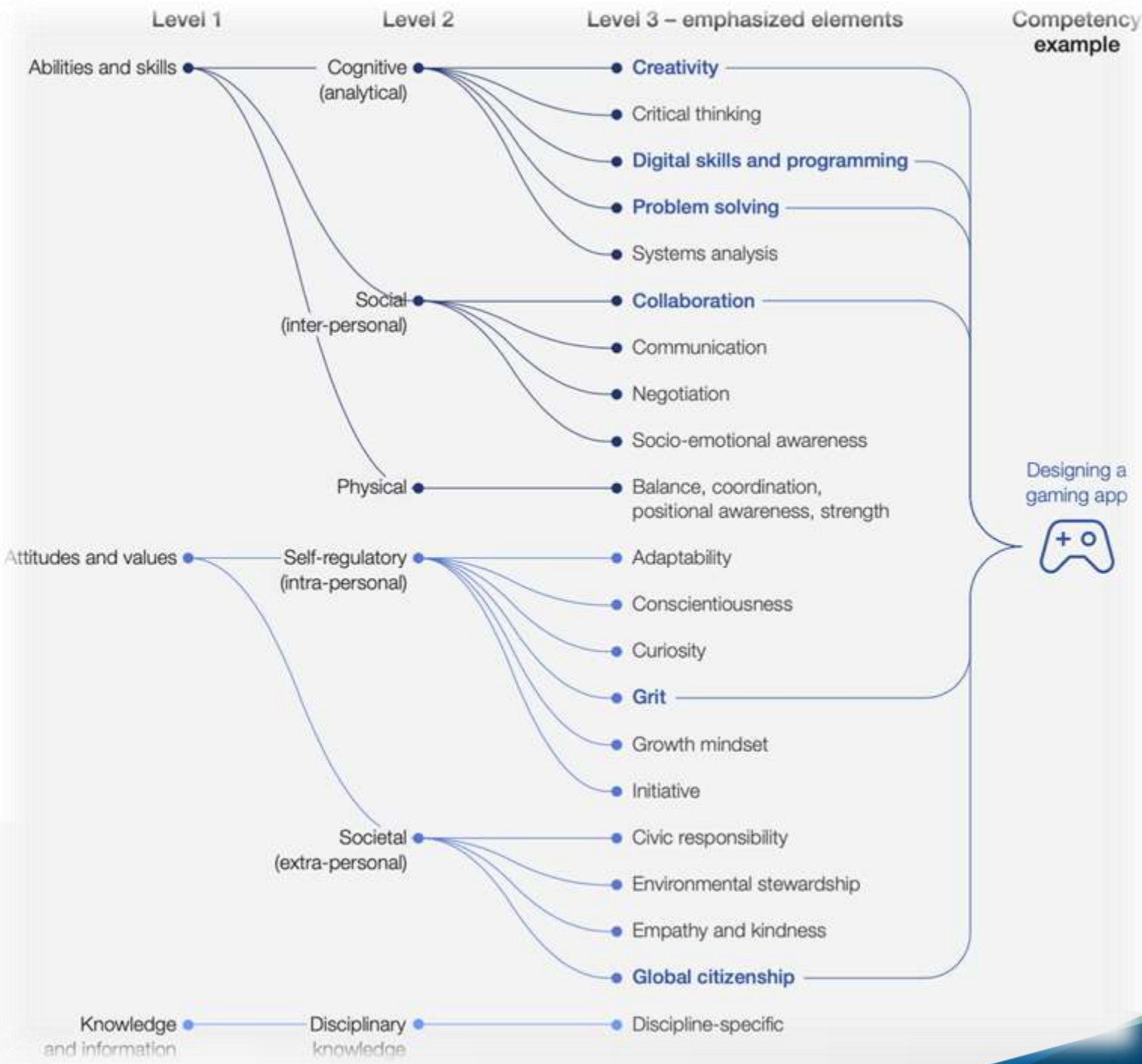


Source

Global Competiveness Report, World Economic Forum, 2019.

Figure 2: The World Economic Forum Education 4.0 Framework




Level 1
Level 2
Level 3 – emphasized elements
Competency example
Abilities and skills
Cognitive (analytical)
Creativity
Critical thinking
Digital skills and programming
Problem solving
Systems analysis
Social (inter-personal)
Collaboration
Communication
Negotiation
Socio-emotional awareness
Physical
Balance, coordination, positional awareness, strength
Attitudes and values
Self-regulatory (intra-personal)
Adaptability
Conscientiousness
Curiosity
Grit
Growth mindset
Initiative
Societal (extra-personal)
Civic responsibility
Environmental stewardship
Empathy and kindness
Global citizenship
Knowledge and information
Disciplinary knowledge
Discipline-specific
Designing a gaming app

AN INSPIRING MINDS SERIES

Student Use Cases for AI

Start by Sharing These Guidelines with Your Class

by Ethan Mollick and Lilach Mollick

September 24, 2023

Harvard Business Publishing Education

Beneficios y desafíos de trabajar con LLM

Alucinaciones → Sesgos → Privacidad

Eres responsable de tu propio trabajo.

La IA no es una persona, pero puede actuar como tal.
La IA es impredecible

Estás a cargo.

Comparte sólo lo que te sientas cómodo compartiendo.

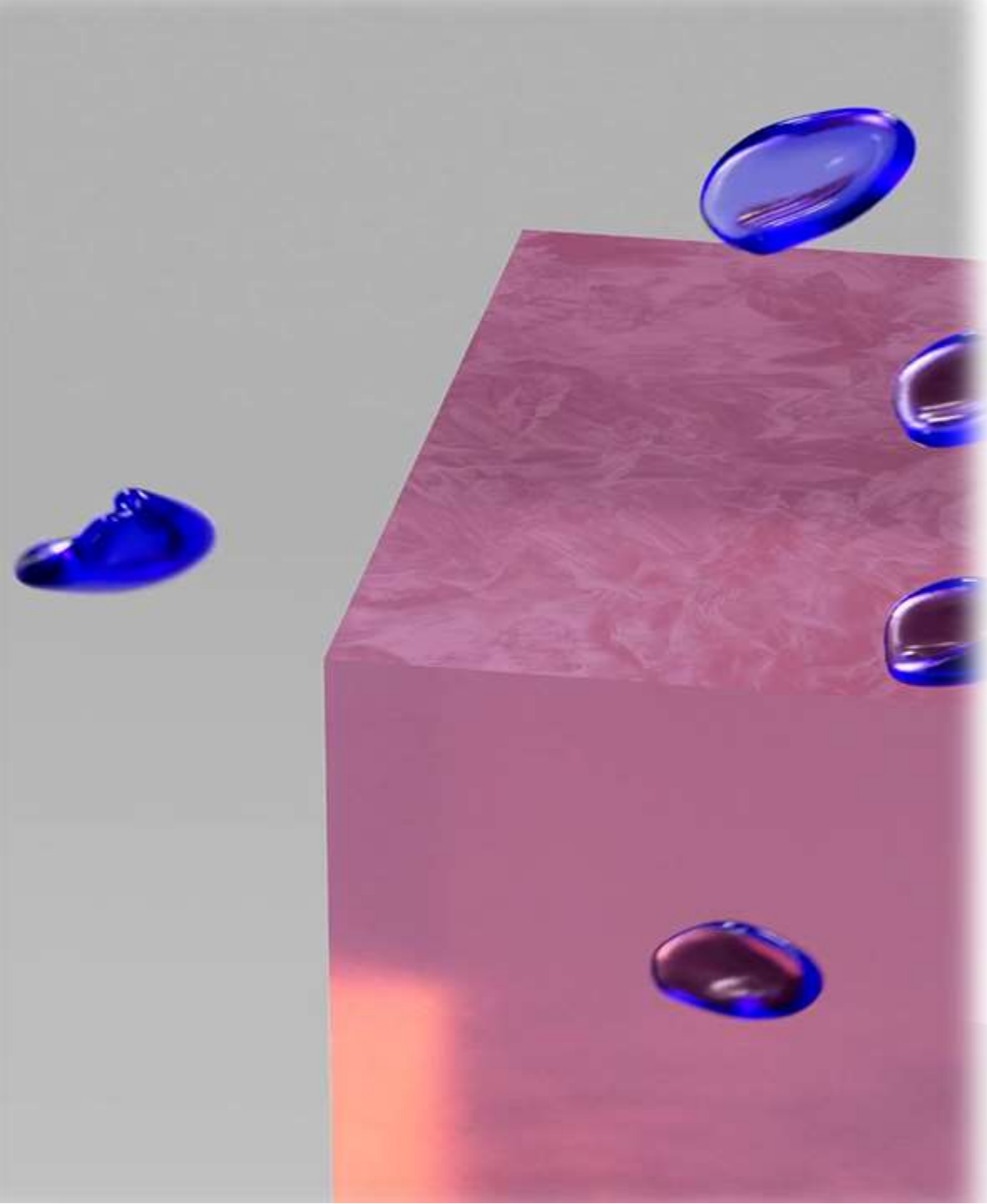
Comparte sólo lo que te sientas cómodo compartiendo.

Busque claridad.

Proporcionar contexto

No asuma que la IA está siguiendo la conversación


IA como generador de retroalimentación
IA como tutor personal
IA como entrenadora de equipo
La IA como aprendiz



Tecnologias 4.0

Salud Digital

↓

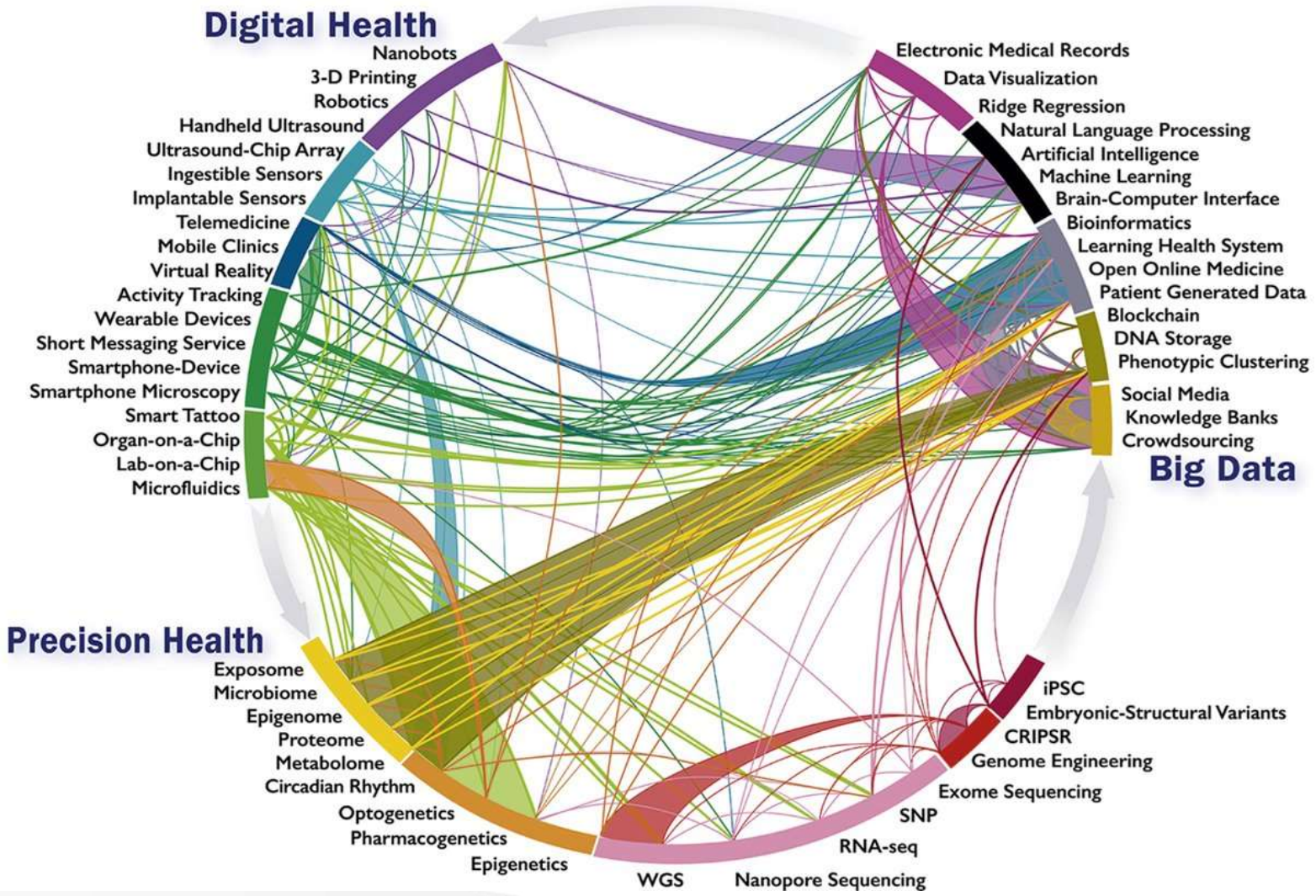
Big Data

↓

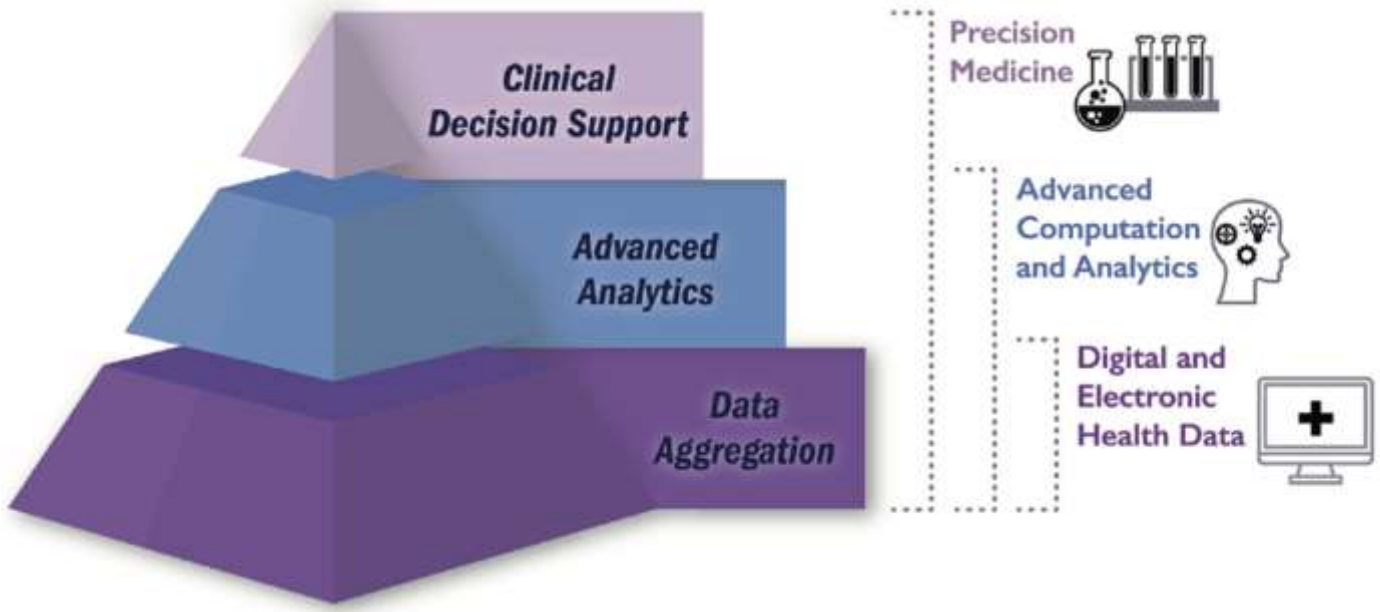
Inteligencia Artificial

↓

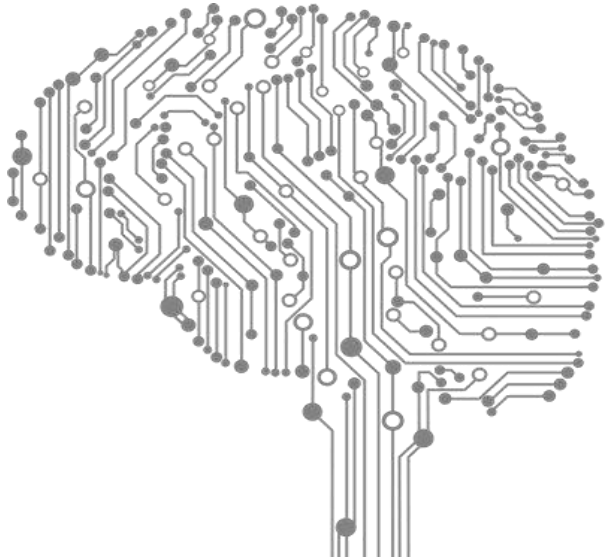
Medicina de Precisión



Bhavnani S, Parakh K, Atreja A, et al. 2017 Roadmap for Innovation—**ACC Health Policy Statement on Healthcare Transformation in the Era of Digital Health**, Big Data, and Precision Health. J Am Coll Cardiol. 2017 Nov, 70 (21) 2696–2718. https://doi.org/10.1016/j.jacc.2017.10.018



Bhavnani S, Parakh K, Atreja A, et al. 2017 Roadmap for Innovation—**ACC Health Policy Statement on Healthcare Transformation in the Era of Digital Health**, Big Data, and Precision Health. J Am Coll Cardiol. 2017 Nov, 70 (21) 2696–2718. https://doi.org/10.1016/j.jacc.2017.10.018



Rama de la informática que estudia la **capacidad de una máquina para imitar** el comportamiento humano **“inteligente”**

Matheny, M., S. Thadaney Israni, M. Ahmed, and D. Whicher, Editors. **2019.** *Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril.* NAM Special Publication. Washington, DC: **National Academy of Medicine**.

La Gran Metáfora Actual

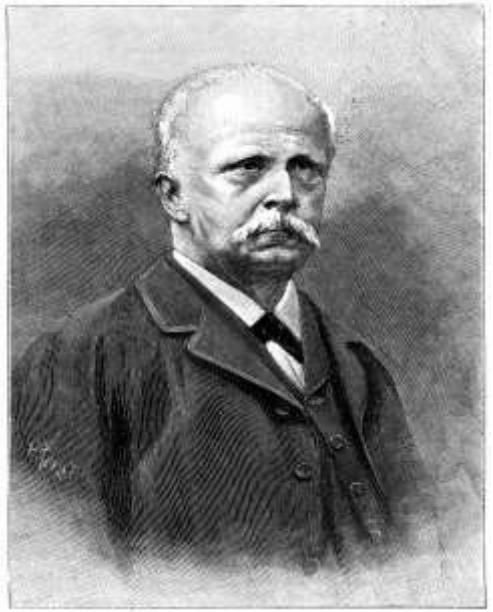
Valor Heuritistico demostrado con experimentación:

“Los organismos son algoritmos"

"La conciencia es algorítmica"

Claude Bernard

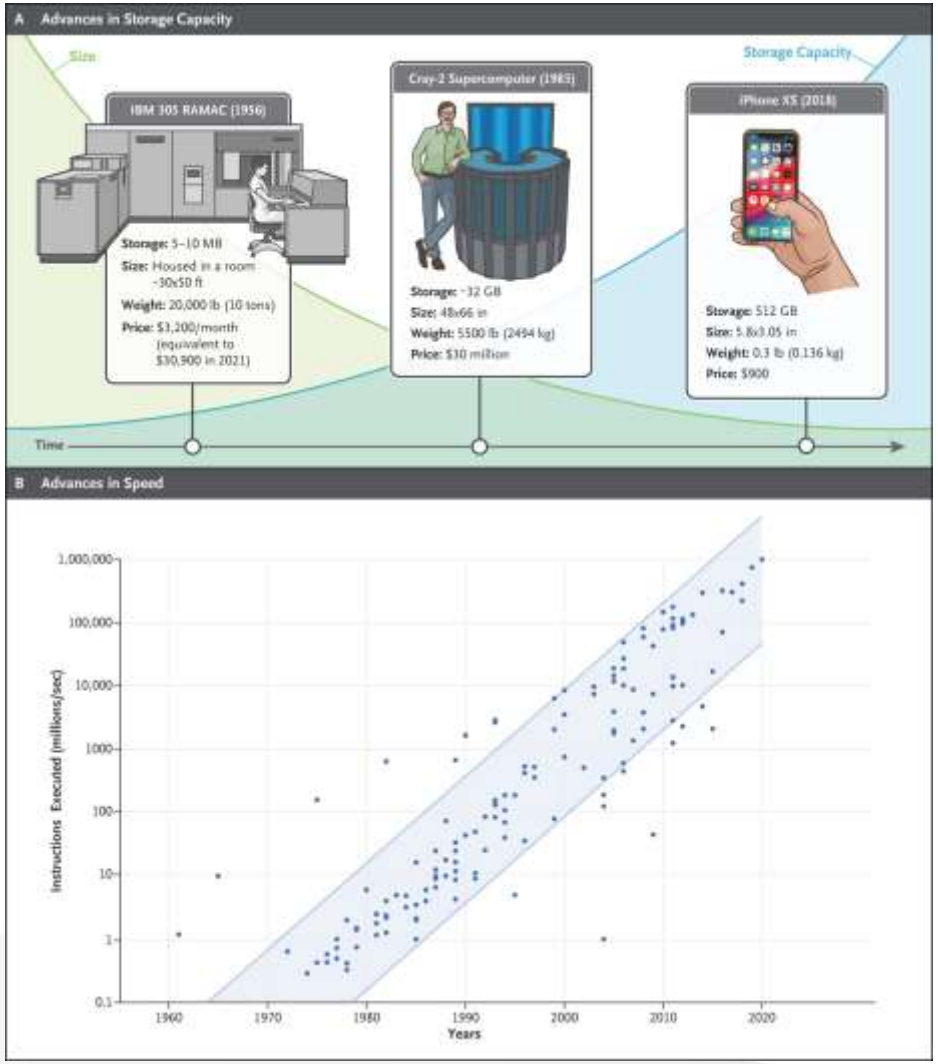
William Harvey



Helmholtz

Byung Chul Han

Mejoras a lo largo de 50 años en la capacidad de las computadoras para almacenar y procesar datos.



Haug CJ, Drazen JM. N Engl J Med 2023;388:1201-1208

Historia

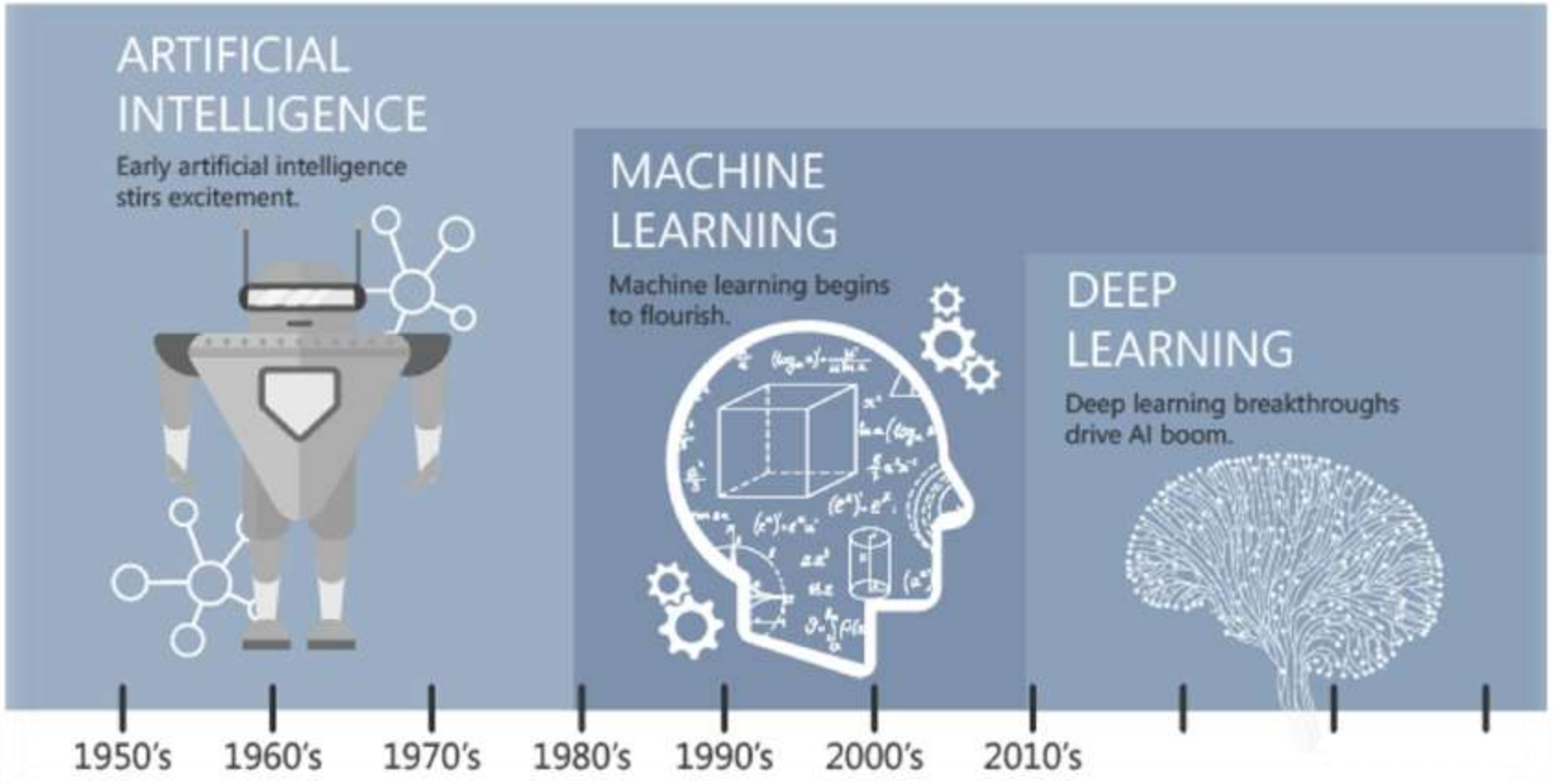


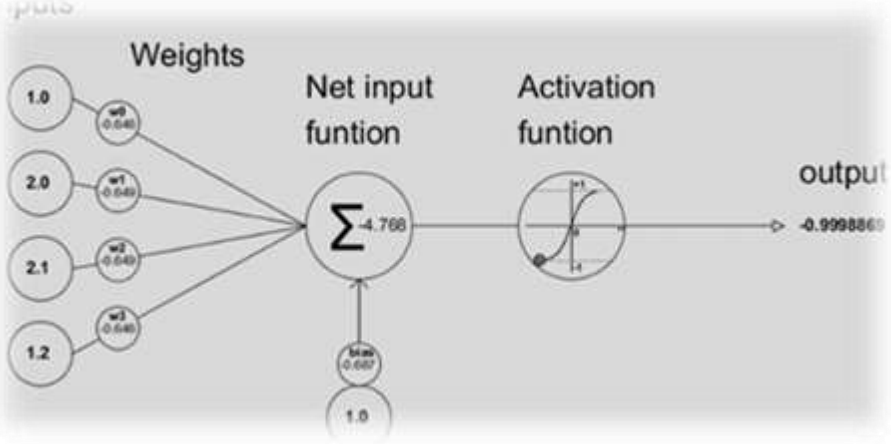
Figure 1. Evolution of Artificial Intelligence [23]

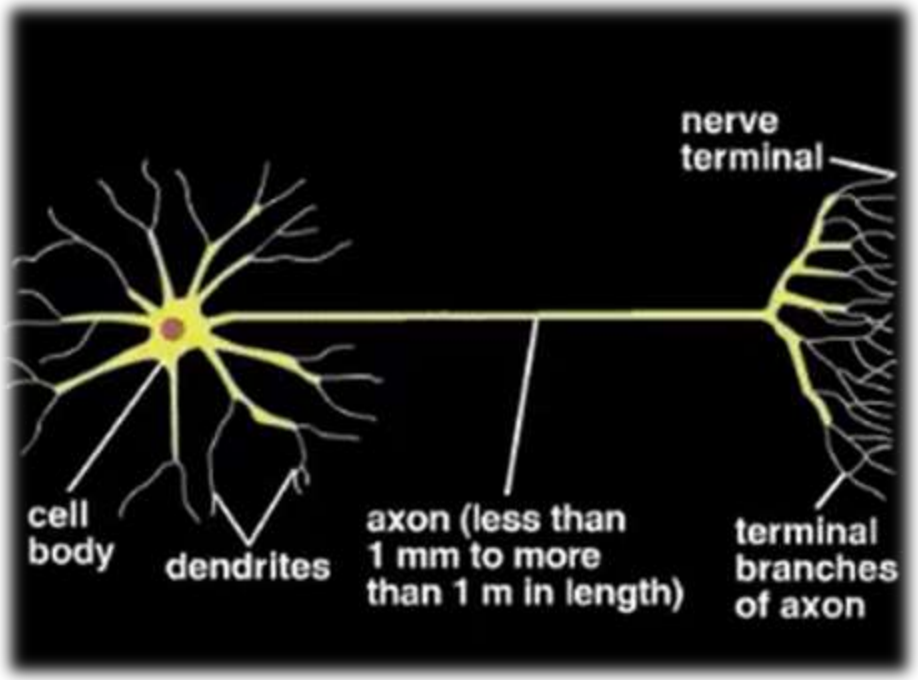
¿Inteligencia Aritificial General?

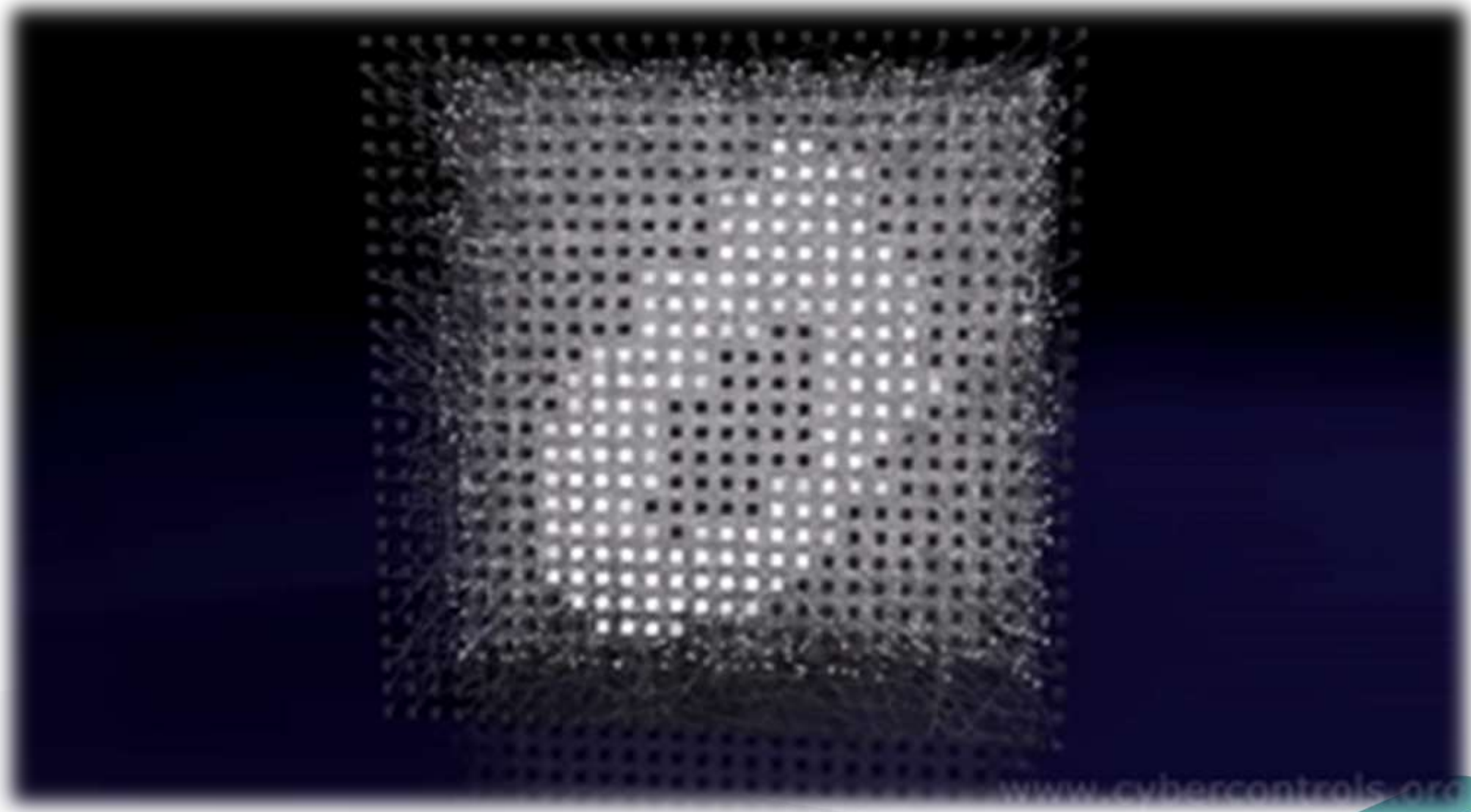
2023…

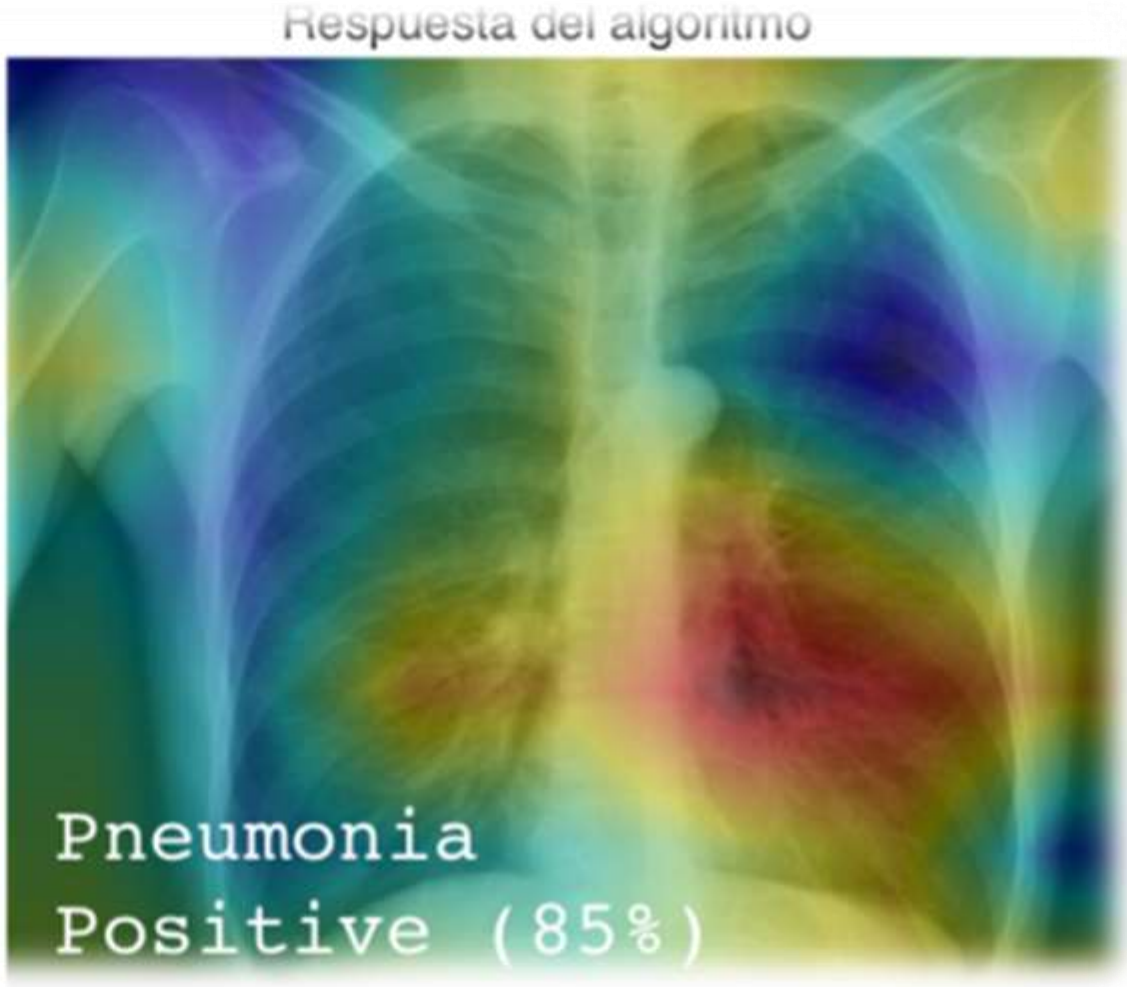
Lee D, Yoon SN. Application of Artificial Intelligence-Based Technologies in the Healthcare Industry: Opportunities and Challenges. *International Journal of Environmental Research and Public Health*. 2021; 18(1):271. https://doi.org/10.3390/ijerph18010271

La metáfora de la red neuronal






www.cybercontrols.org



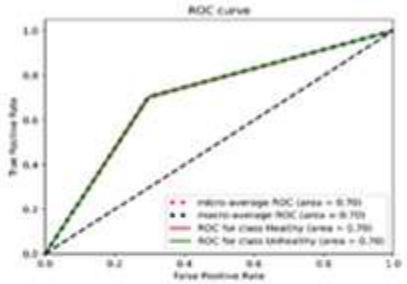
Irvin, J. *et al.* CheXpert: A Large Chest Radiograph Dataset with Uncertainty Labels and Expert Comparison. *Proceedings of the AAAI Conference on Artificial Intelligence* vol. 33 590–597 (2019).

2 Results on Validation Datasets

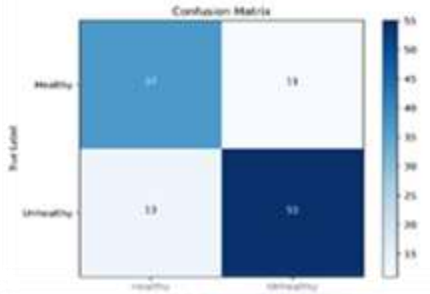
Colombian Hospitals Dataset

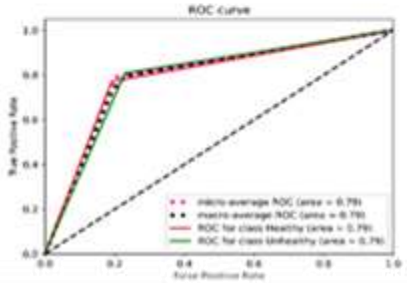
Model: Healthy vs. Unhealthy

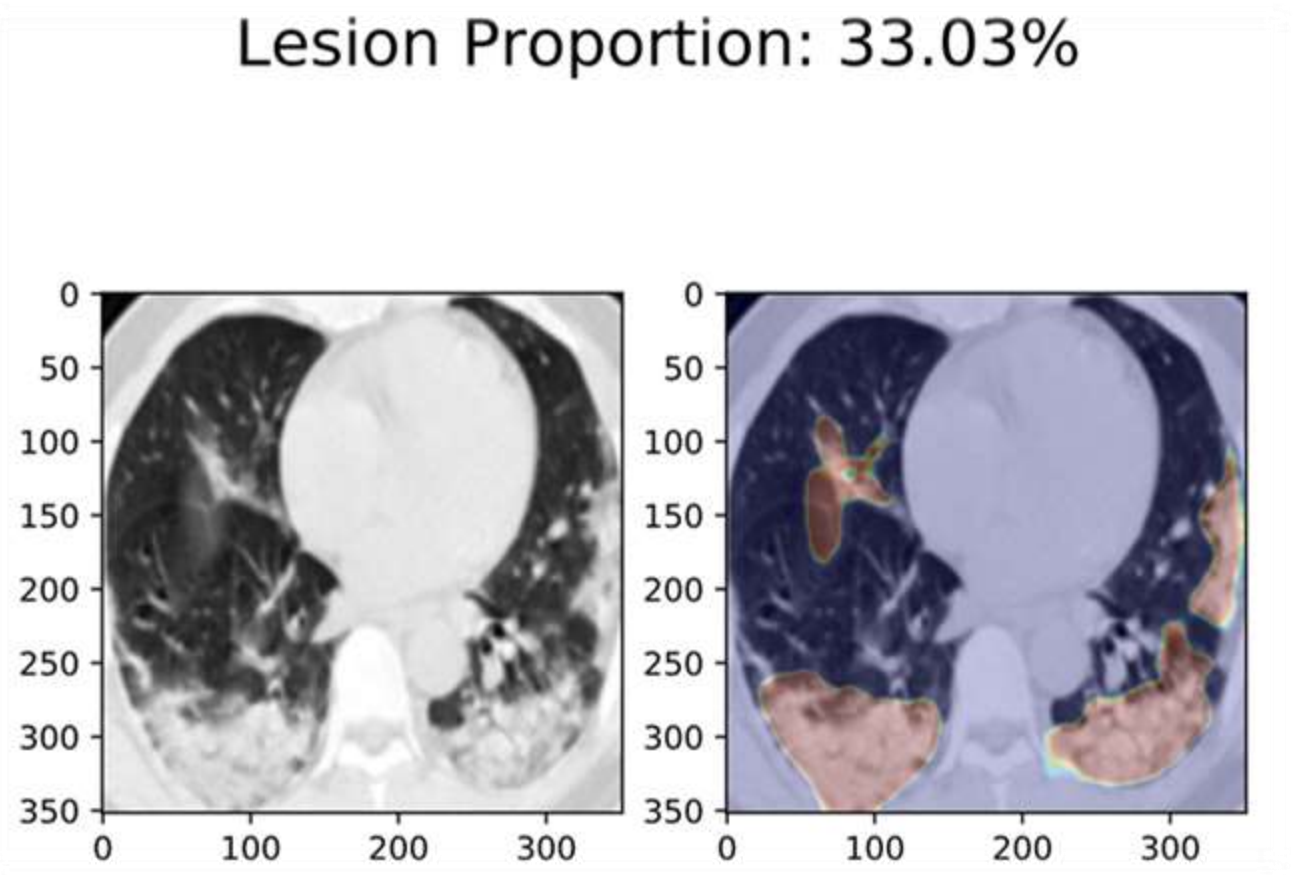
Metric: Accuracy Per Stack



Metric: Stacks Average in each Study







Murillo-González A, González D, Jaramillo L, Galeano C, Tavera F, Mejía M, Hernández A, Rivera DR, Paniagua JG, Ariza-Jiménez L, Garcés Echeverri JJ, Diaz León CA, Serna- Higuita DL, Barrios W, Arrázola W, Mejía MA, Arango S, Marín Ramírez D, Salinas-Miranda E and Quintero OL (2022) Medical decision support system using weakly-labeled lung CT scansFront. Med. Technol. 4:980735. doi:

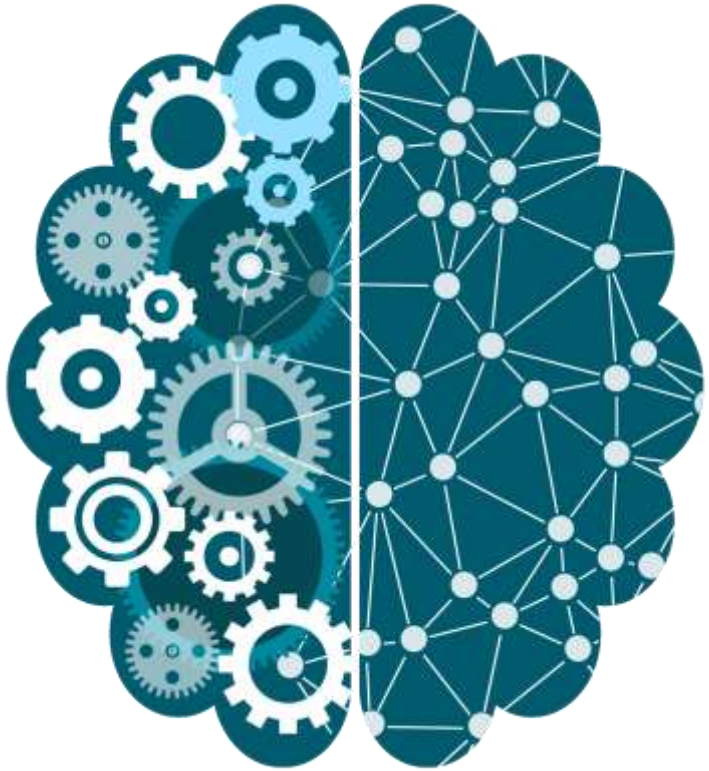
10.3389/fmedt.2022.980735

Inteligencia artificial vs Razonamiento clínico humano

Enfoque analitico

Modo inductivo

Mueve todos los datos existentes hacia la solución



Hipotético-deductivo

Formula hipótesis y busca datos para probarlas

Intuitivo

.

Explican relación causa- efecto

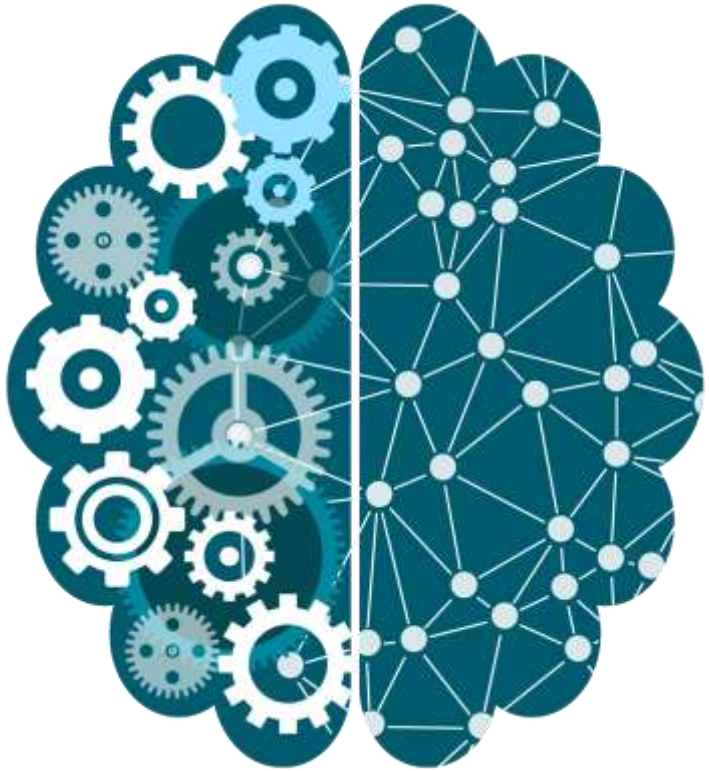
Deconstructing the diagnostic reasoning of human versus artificial intelligence. *CMAJ* **192**, E17 (2020).

Inteligencia artificial vs Razonamiento clínico humano

Mal diseño del modelo

Black box

Mala definición de “**la verdad”**



Error diagnóstico (15%)

Cierre prematuro
Anclaje
Disponibilidad
Confirmación

Deconstructing the diagnostic reasoning of human versus artificial intelligence. *CMAJ* **192**, E17 (2020).

	Assistive AI algorithms		Autonomous AI algorithms		
	Level 1	Level 2	Level 3	Level 4	Level 5
					
	Data presentation	Clinical decision-support	Conditional automation	High automation	Full automation
Event monitoring	AI	AI	AI	AI	AI
Response execution	Clinician	Clinician and AI	AI	AI	AI
Fallback	Not applicable	Clinician	AI, with a backup clinician available at AI request	AI	AI
Domain, system, and population specificity	Low	Low	Low	Low	High
Liability	Clinician	Clinician	Case dependent	AI developer	AI developer
Example	AI analyses mammogram and highlights high-risk regions	AI analyses mammogram and provides risk score that is interpreted by clinician	AI analyses mammogram and makes recommendation for biopsy, with a clinician always available as backup	AI analyses mammogram and makes biopsy recommendation, without a clinician available as backup	Same as level 4, but intended for use in all populations and systems

Source: Bitterman, D. S., H. J. W. L. Aerts, and R. H. Mak. 2020. Approaching autonomy in medical artificial intelligence. The Lancet Digital Health 2(9):447-449. https://doi.org/10.1016/S2589-7500(20)30187-4. Reprinted with permission under Creative Commons Attribution (CC BY 4.0).

CONSENSUS STATEMENT NATURE MEDICINE

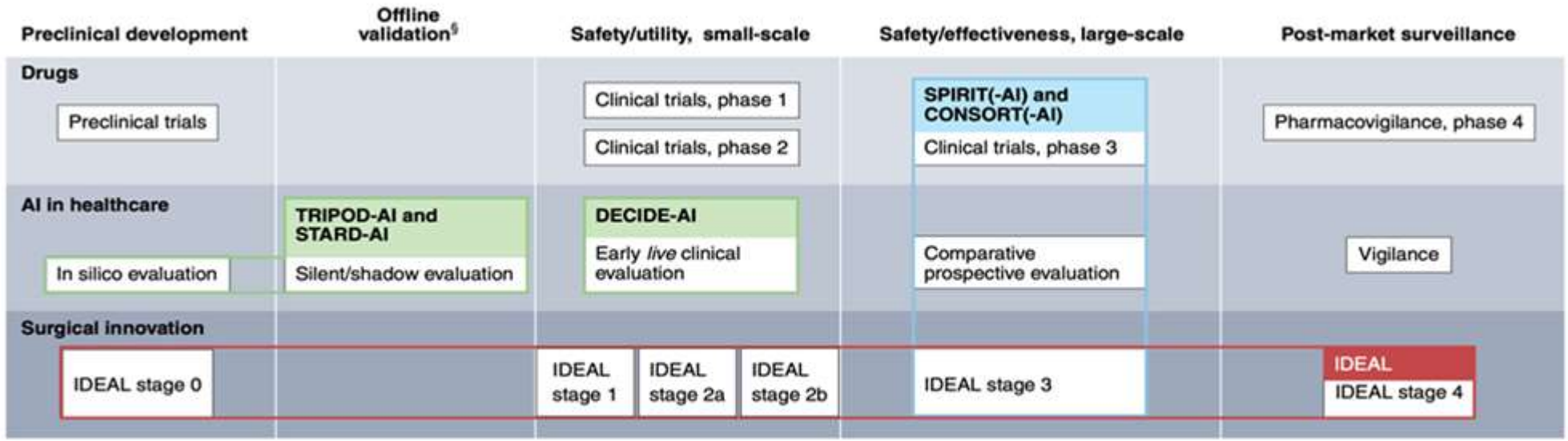
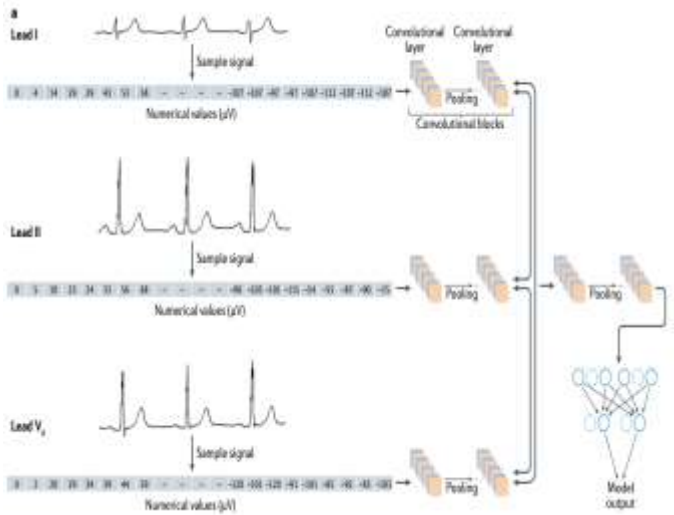
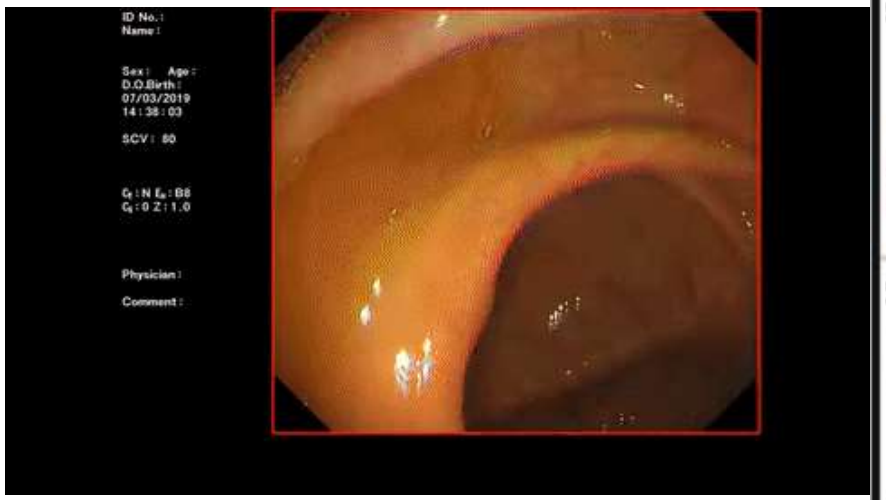


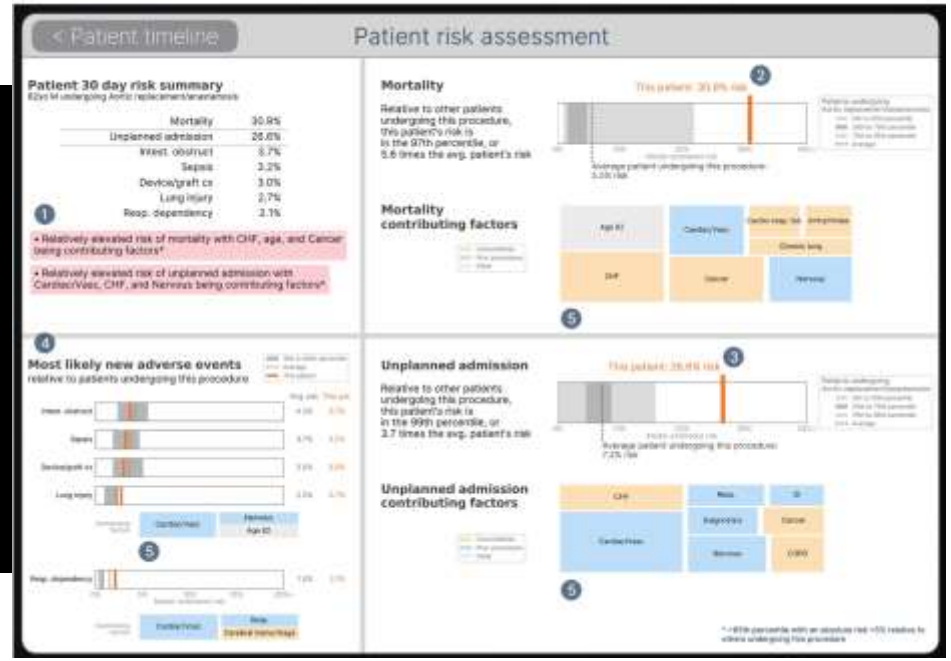
Fig. 1 | Comparison of development pathways for drug therapies, AI in healthcare and surgical innovation. The colored lines represent reporting guidelines, some of which are study design specific (TRIPOD-AI, STARD-AI, SPIRIT/CONSORT and SPIRIT/CONSORT-AI); others are stage specific (DECIDE-AI and IDEAL). Depending on the context, more than one study design can be appropriate for each stage. §Apply only to AI in healthcare.

Reporting guideline for the early-stage clinical evaluation of decision support systems driven by artificial intelligence: DECIDE-AI https://doi.org/10.1038/s41591-022-01772-9

Aplicaciones clínicas





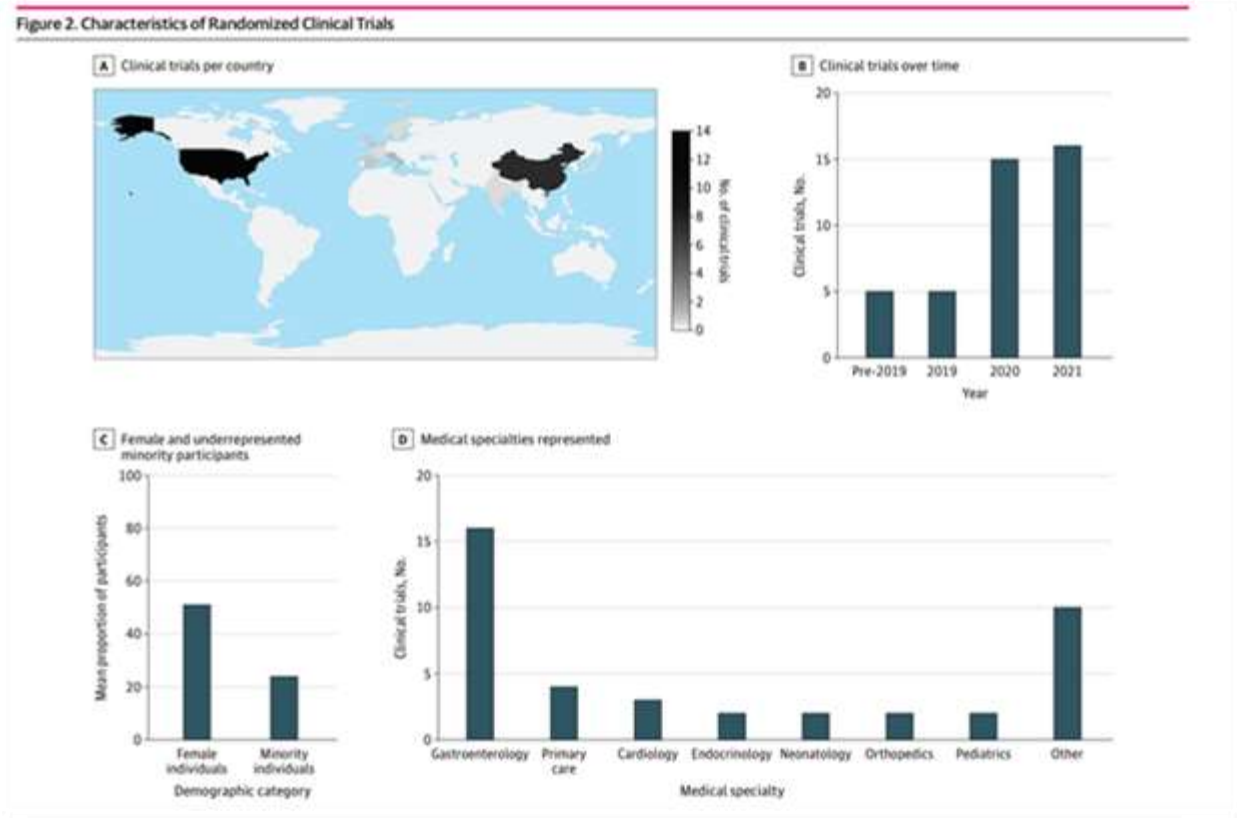


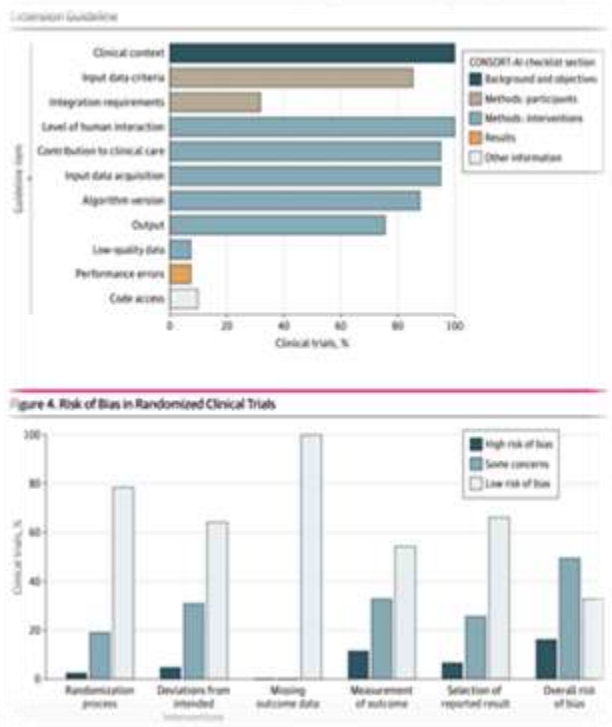
MacKay EJ, Stubna MD, Chivers C, Draugelis ME, Hanson WJ, Desai ND, et al. (2021) Application of machine learning approaches to administrative claims data to predict clinical outcomes in medical and surgical patient populations. PLoS ONE 16(6): e0252585.

Siontis KC, Noseworthy PA, Attia ZI, Friedman PA. Artificial intelligence-enhanced electrocardiography in cardiovascular disease management. Nat Rev Cardiol. 2021 Jul;18(7):465-478. doi: 10.1038/s41569-020-00503-2. Epub 2021 Feb 1. PMID: 33526938; PMCID: PMC7848866.

Wang, P., Liu, X., Berzin, T. M., Glissen Brown, J. R., Liu, P., Zhou, C., … Zhou, G. (2020). *Effect of a deep-learning computer-aided detection system on adenoma detection during colonoscopy (CADe-DB trial): a double-blind randomised study. The Lancet Gastroenterology & Hepatology.* doi:10.1016/s2468-1253(19)30411-x

Sesgos





Plana D, Shung DL, Grimshaw AA, Saraf A, Sung JJY, Kann BH. Randomized Clinical Trials of Machine Learning Interventions in Health Care: A S**ystematic Review. JAMA** Netw Open. **2022:**5(9):e2233946. doi:10.1001/jamanetworkopen.2022.33946

STANDING Together

STANdards for data Diversity, INclusivity and Generalisability

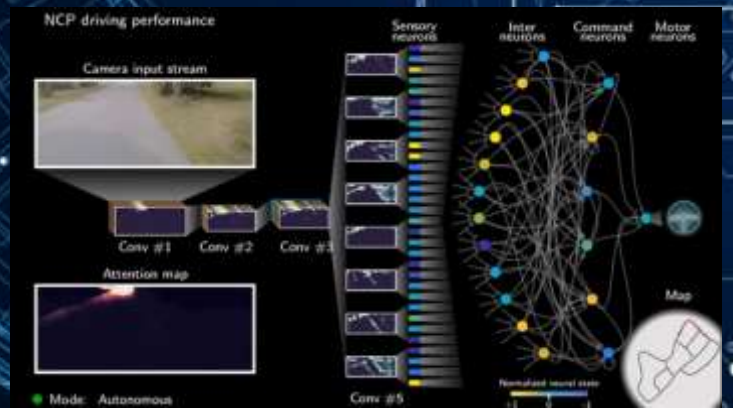
Datasets for healthcare AI should...

…be diverse

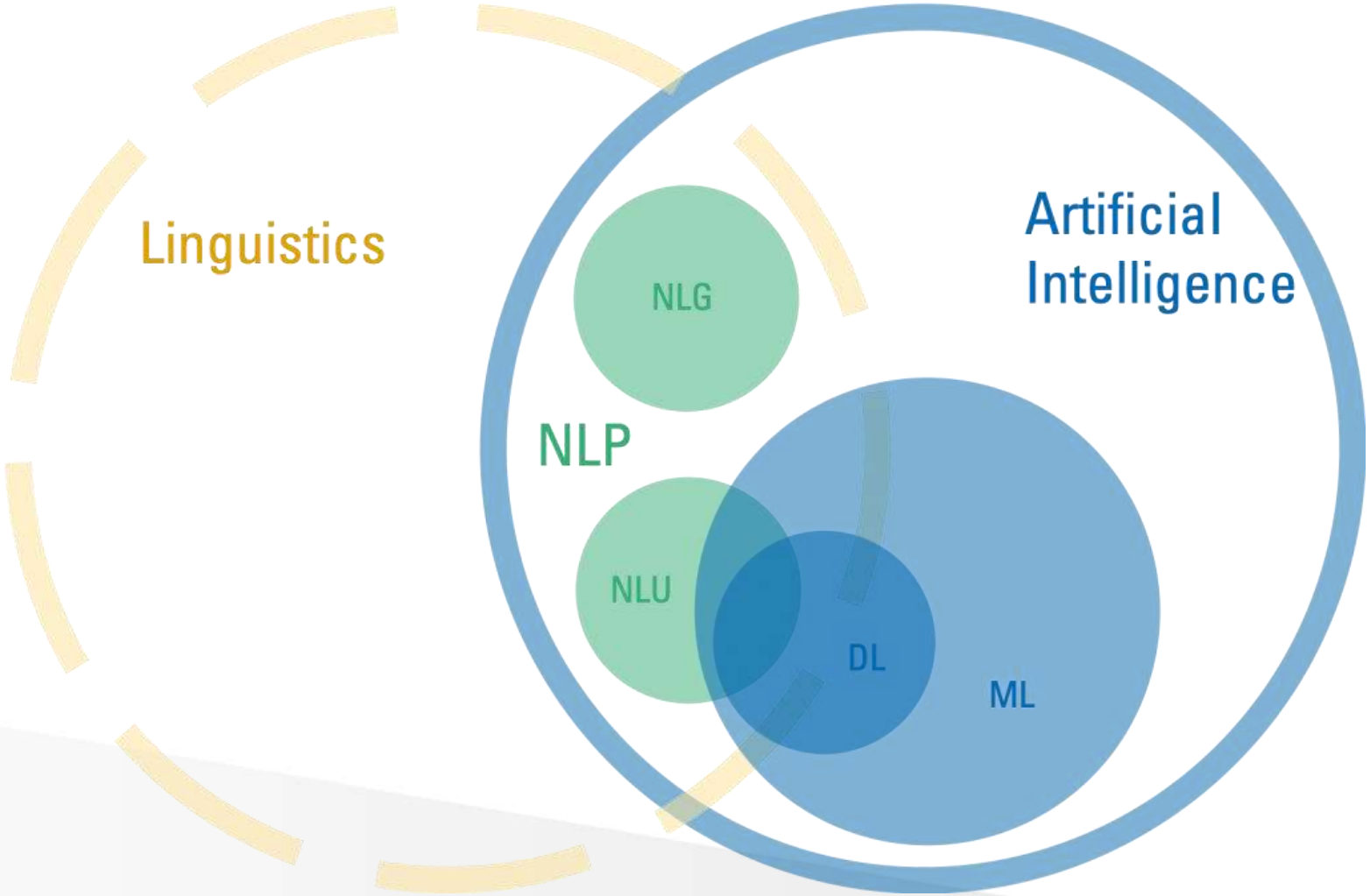
…be inclusive

…be representative

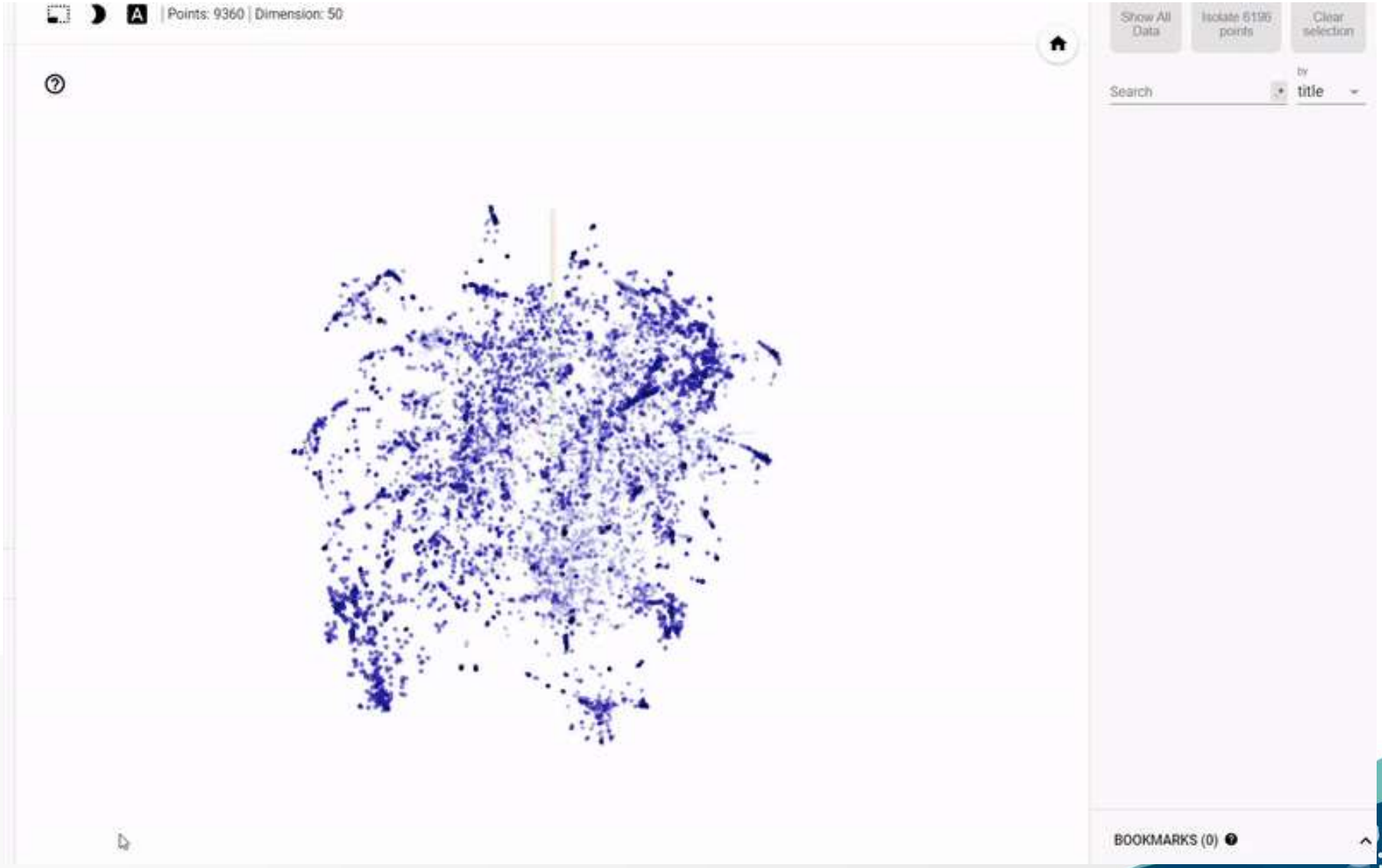
…be transparent


NCP driving performance
Sensory neurons
Inter neurons
Command neurons
Motor neurons
Camera input stream
Conv #1
Conv #2
Conv #3
Attention map
Map
Conv #5
Mode: Autonomous

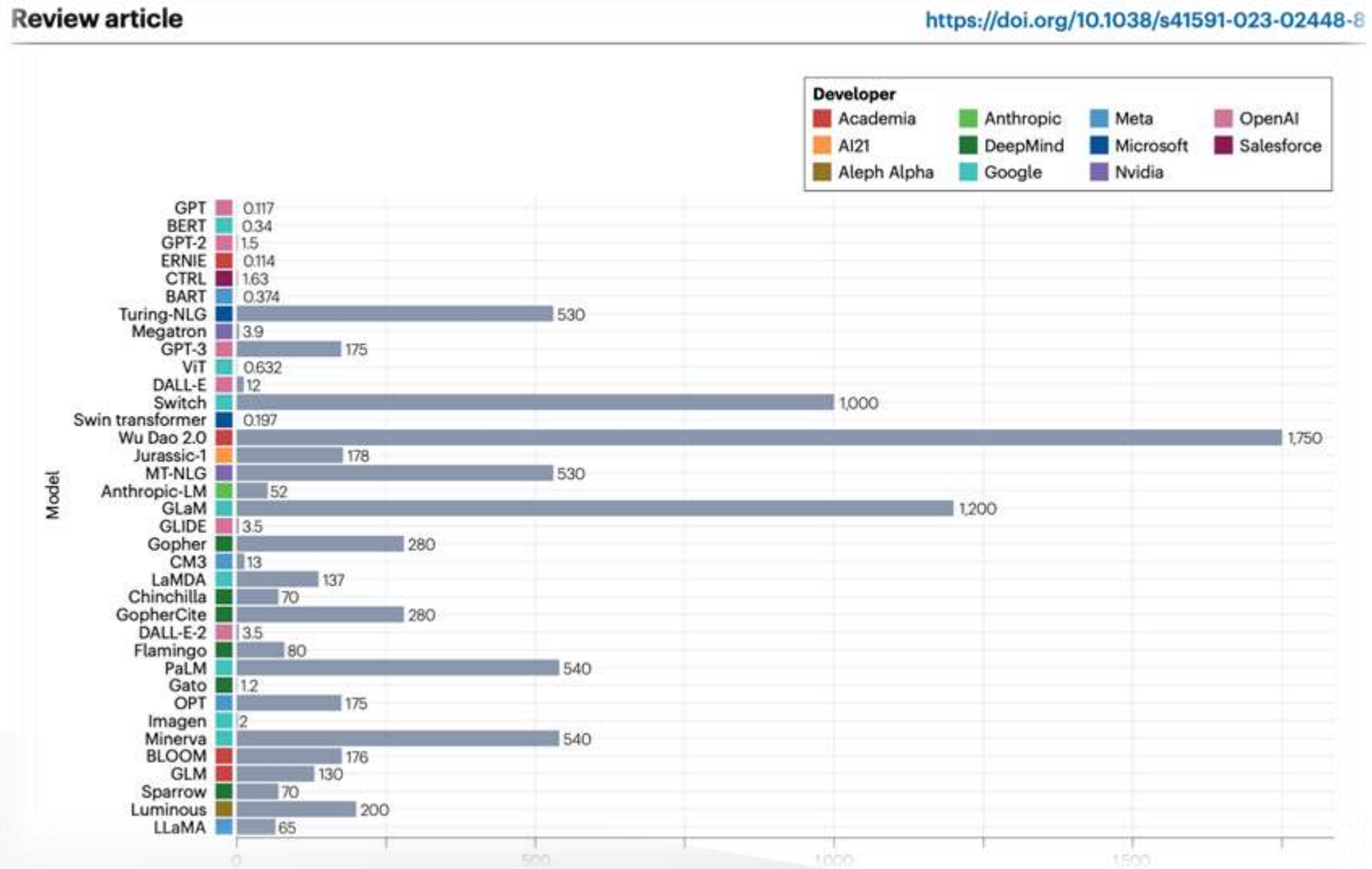
LA INTERSECCIÓN DE LA LINGUISTICA CON LA IA



Bases de datos vectoriales



LLMs en Medicina



Thirunavukarasu, A.J., Ting, D.S.J., Elangovan, K. *et al.* Large language models in medicine. *Nat Med* (2023). https://doi-org.udea.lookproxy.com/10.1038/s41591-023-02448-8

Iniciativas para romper la barreras

Aipocrates Tanque de pensamiento sobre IA

Gracias

@arangolejo