Predictive Analytics in Health Care

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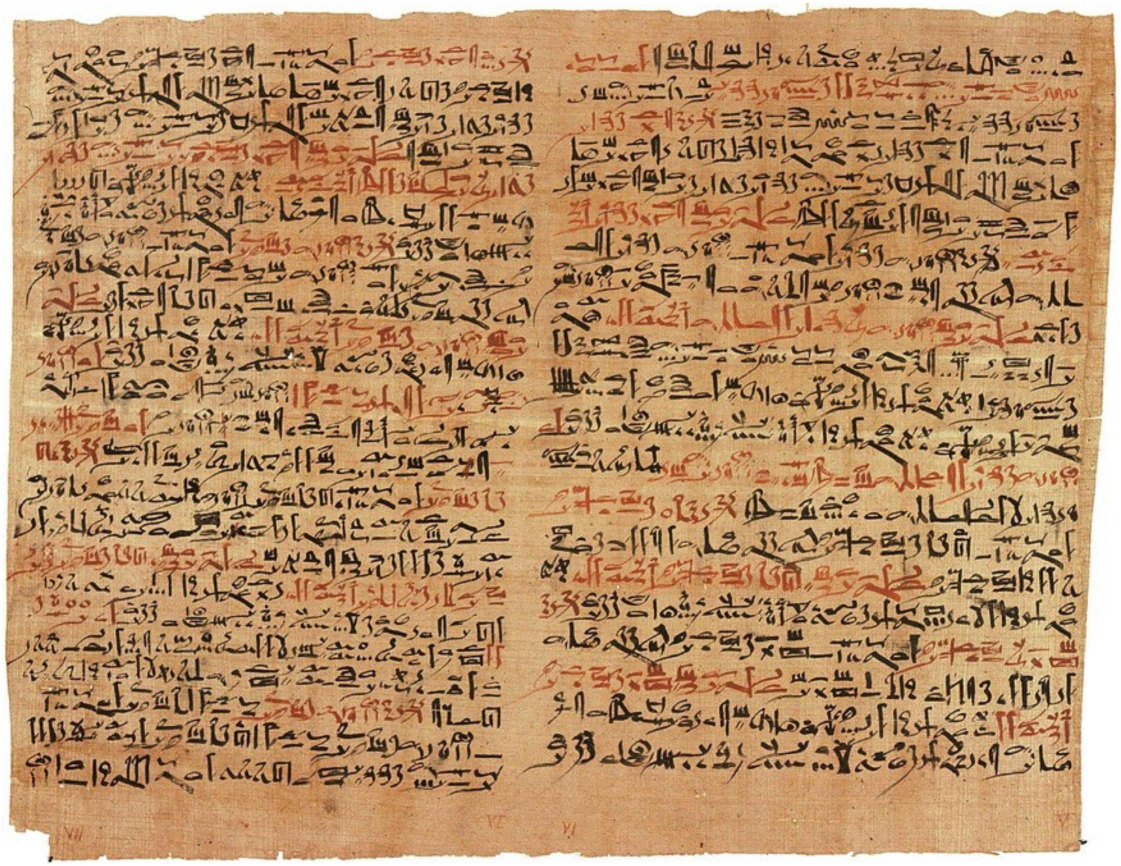
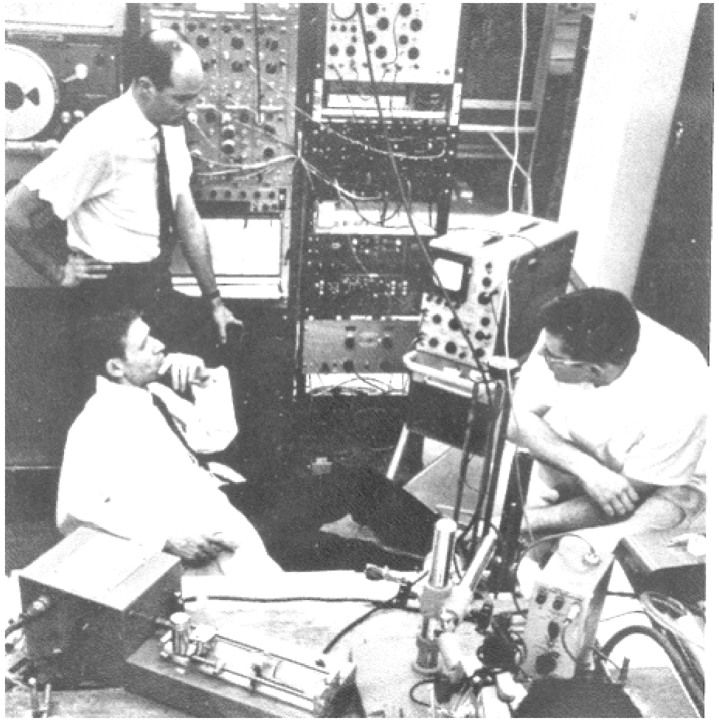
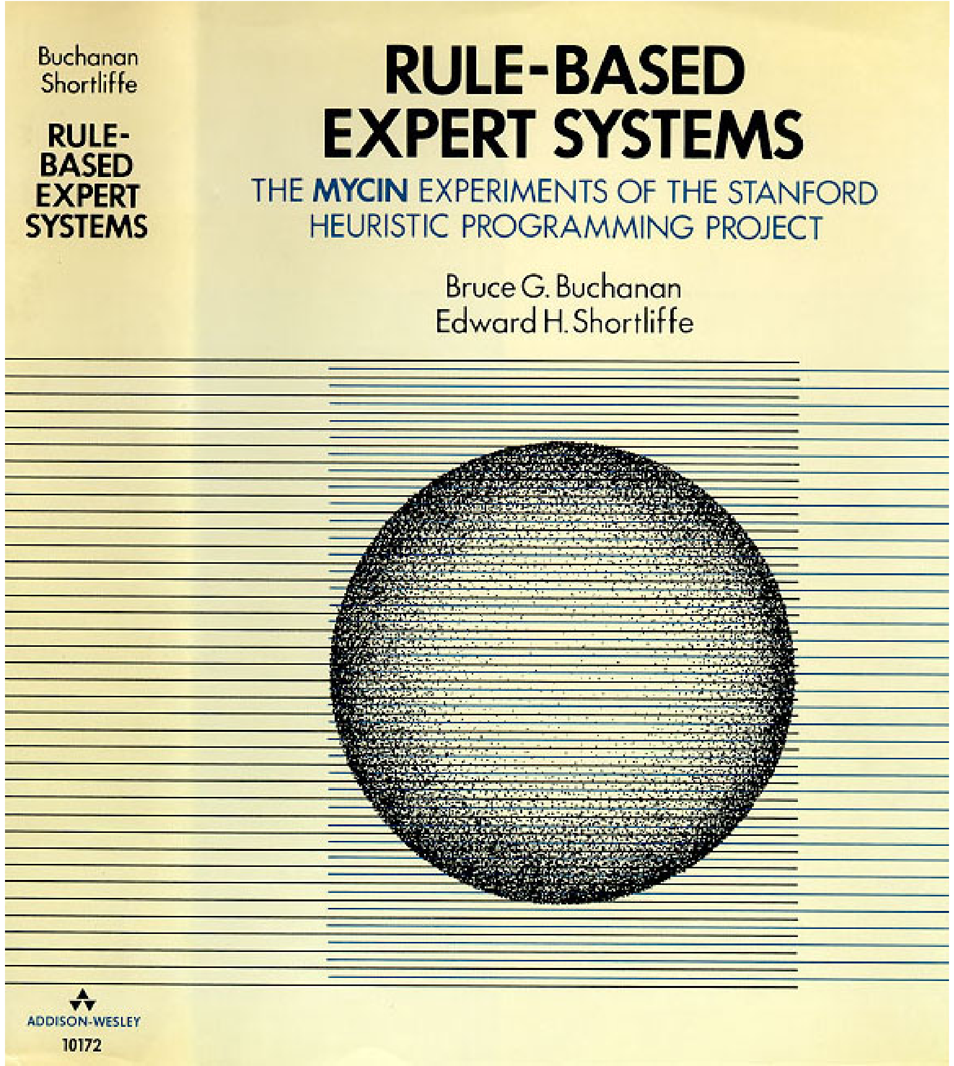


Edwin Smith Papyrus [c. 1600 BCE]
(Medical summaries of trauma case studies)



Octo Barnett, MD
(Development of MUMPS)


Buchanan
Shortliffe
RULE-BASED EXPERT SYSTEMS
RULE-BASED EXPERT SYSTEMS
THE MYCIN EXPERIMENTS OF THE STANFORD HEURISTIC PROGRAMMING PROJECT
Bruce G. Buchanan
Edward H. Shortliffe
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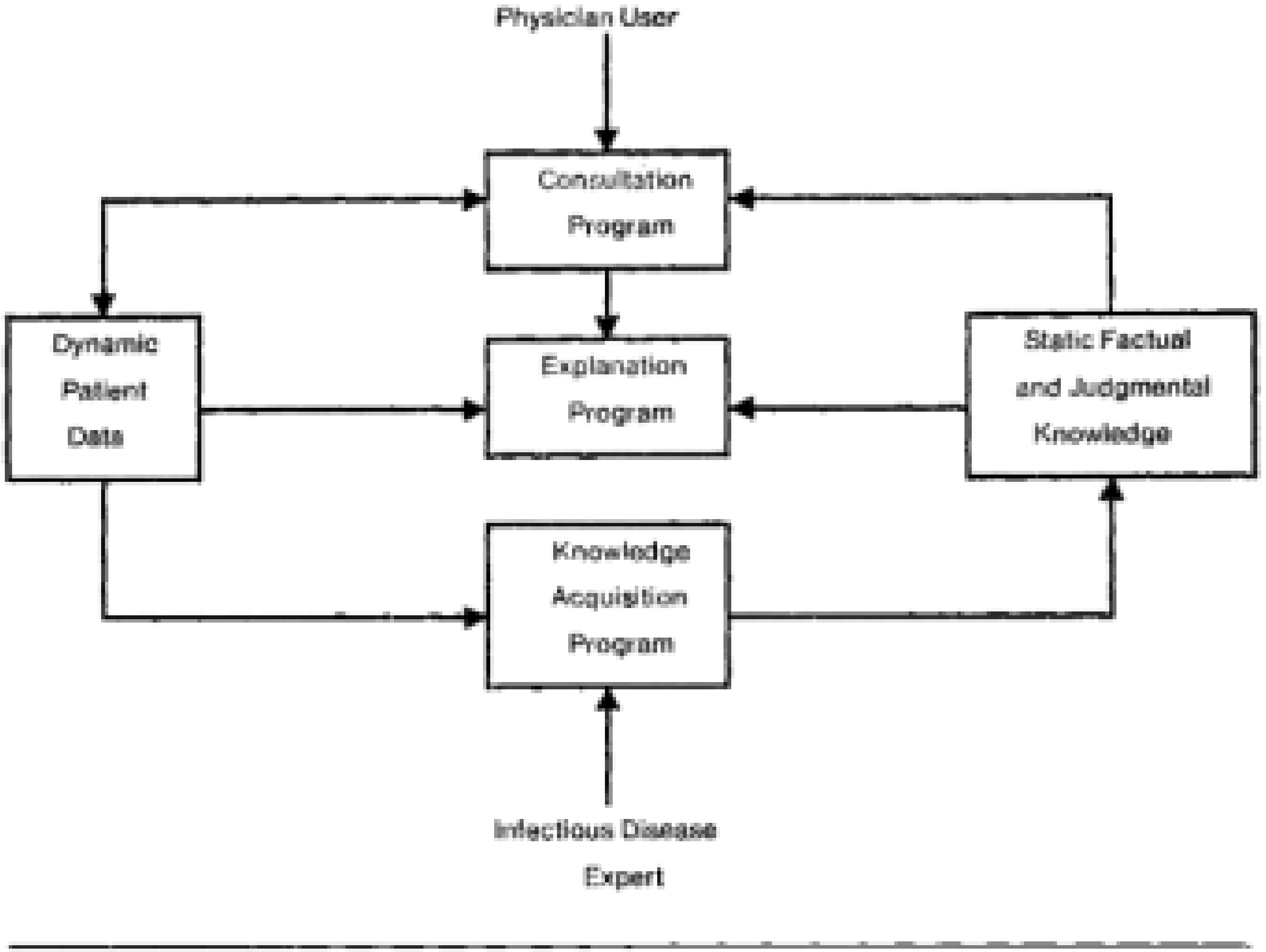
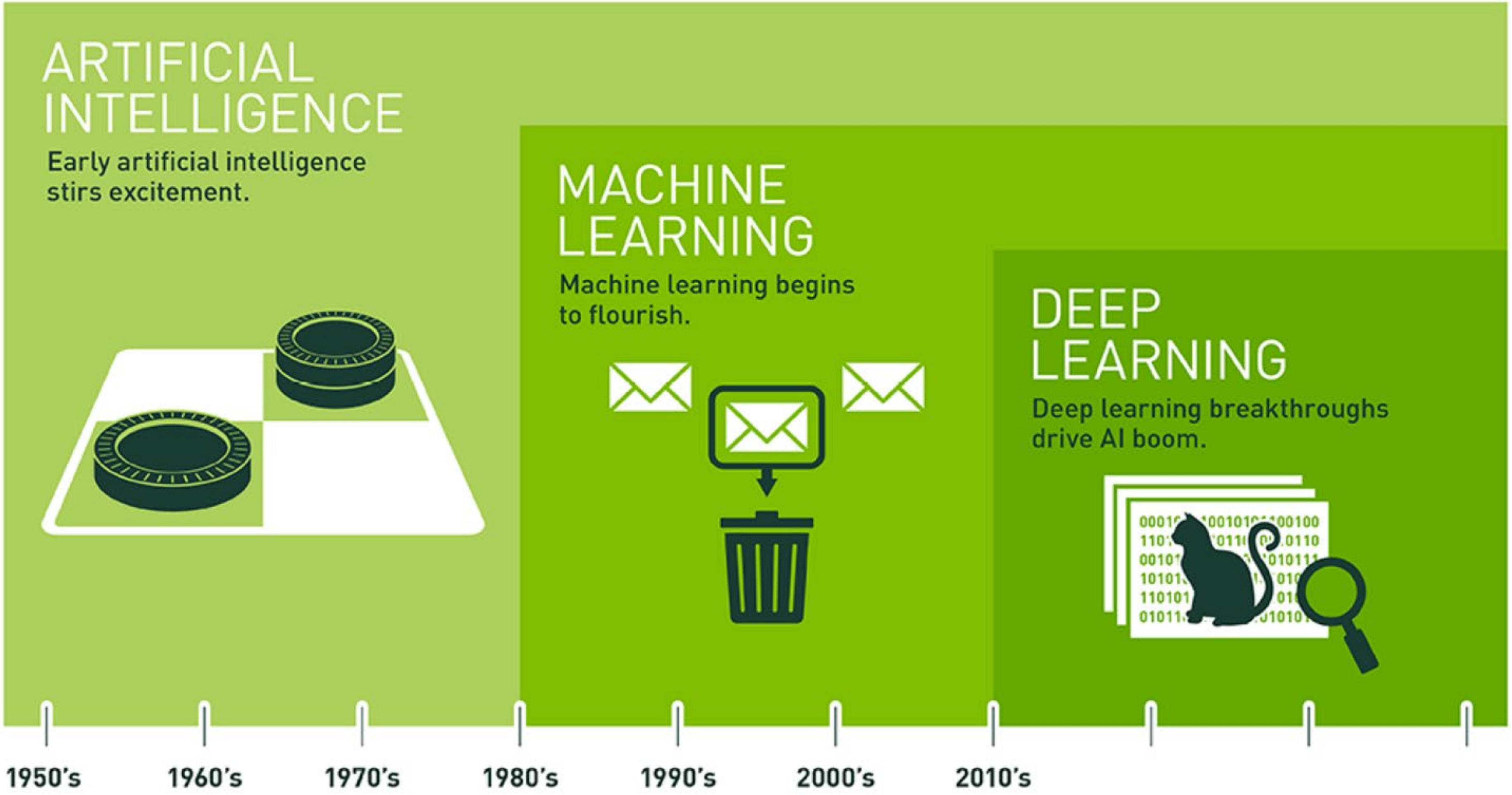

Physician User
Consultation Program
Dynamic Patient Data
Explanation Program
Static Factual and Judgmental Knowledge
Knowledge Acquisition Program
Infectious Disease Expert



https://www.datasciencecentral.com/profiles/blogs/artificial-intelligence-vs-machine-learning-vs-deep-learning

Viewpoint Paper ■

A "Fundamental Theorem" of Biomedical Informatics

CHARLES P. FRIEDMAN, PHD

Abstract This paper proposes, in words and pictures, a "fundamental theorem" to help clarify what informatics is and what it is not. In words, the theorem stipulates that a person working in partnership with an information resource is "better" than that same person unassisted. The theorem is applicable to health care, research, education, and administrative activities. Three corollaries to the theorem illustrate that informatics is more about people than technology; that in order for the theorem to hold, resources must be informative in addition to being correct; and that the theorem can fail to hold for reasons explained by understanding the interaction between the person and the resource.

■ **J Am Med Inform Assoc.** 2009;16:169–170. DOI 10.1197/jamia.M3092.

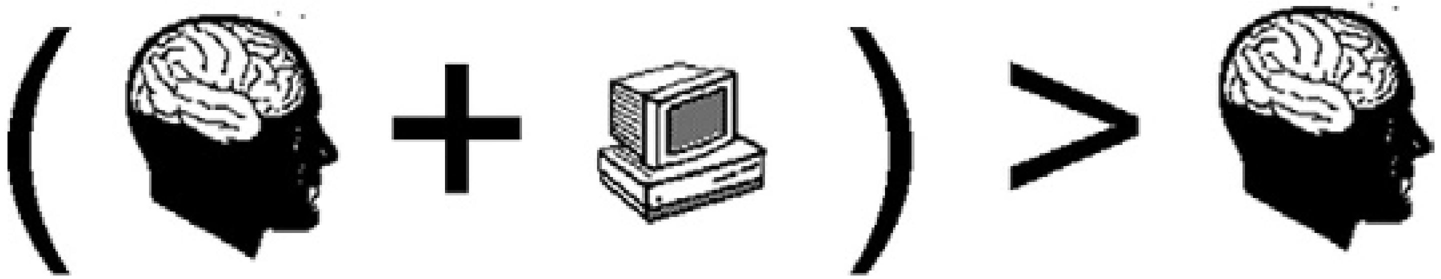
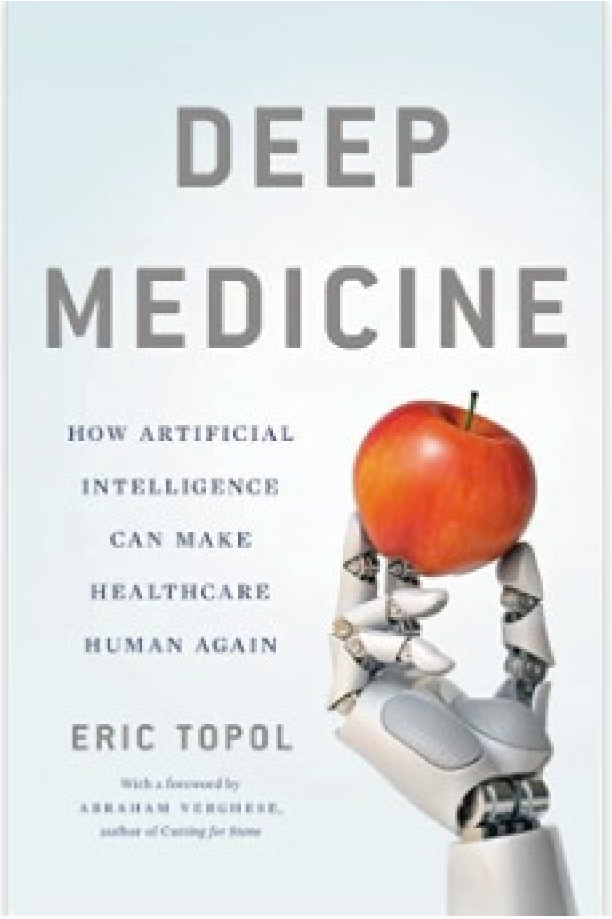
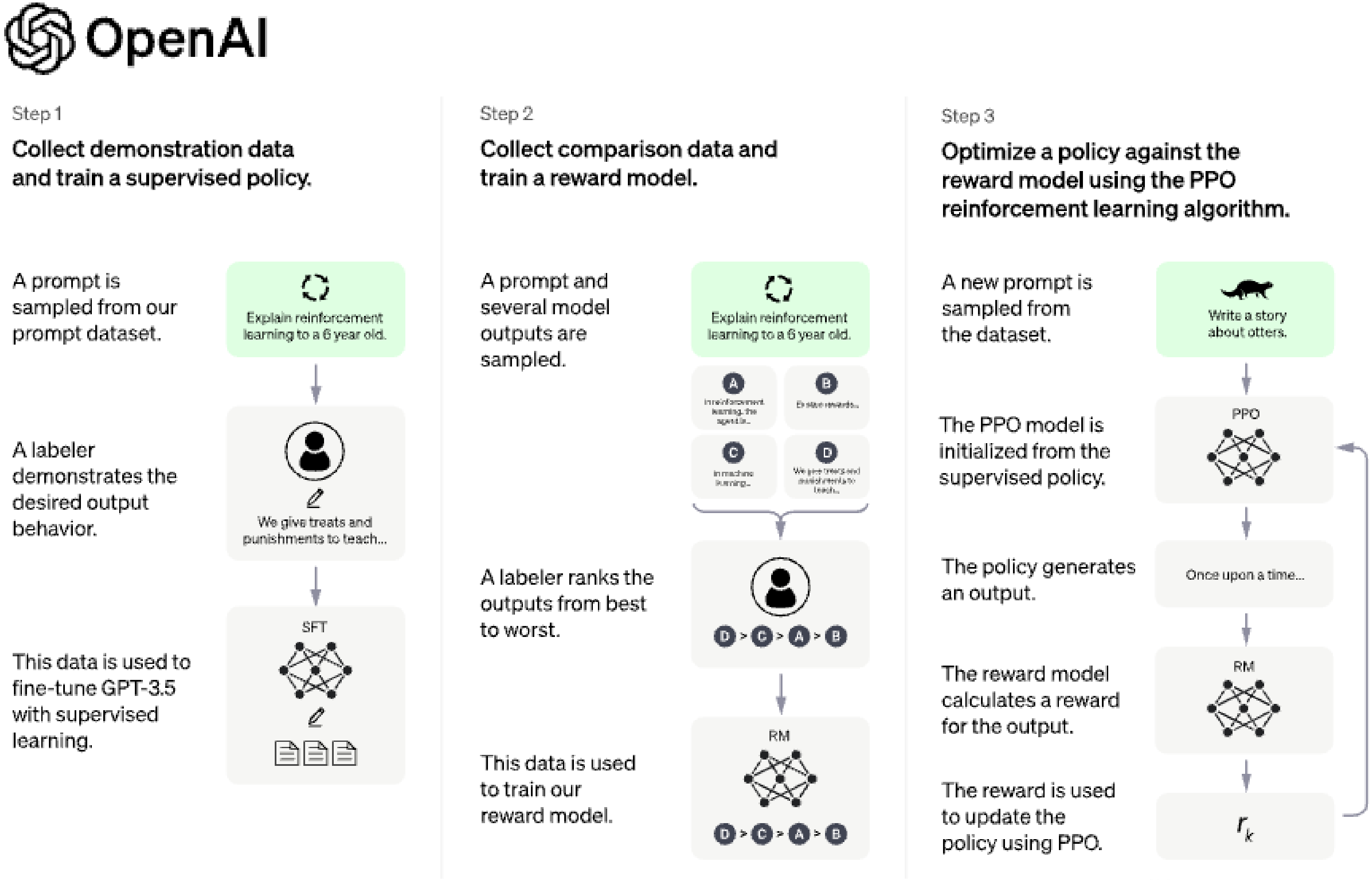


Figure 1. A "Fundamental Theorem" of informatics.

The Right Data at the Right Time

http://ww2.kqed.org/futureofyou/2014/09/29/how-big-data-is-changing-medicine/





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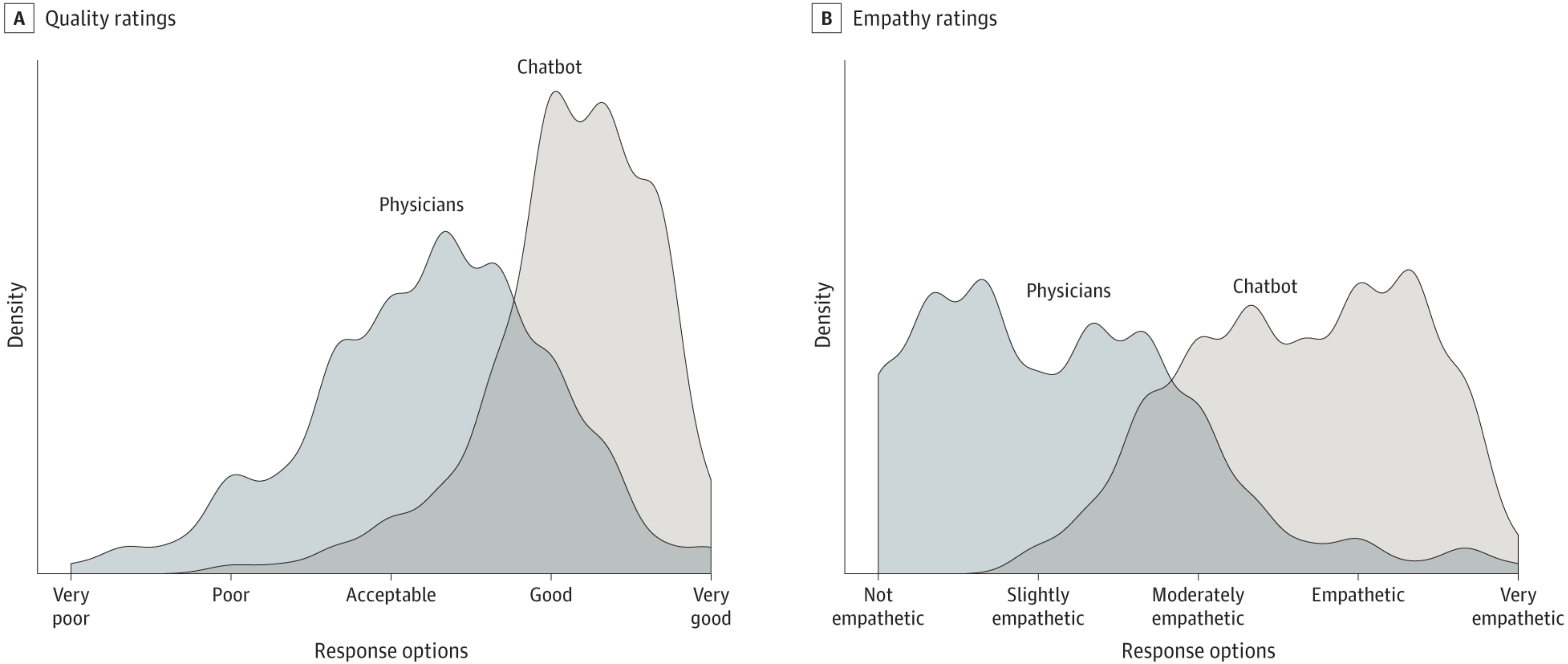
Original Investigation

ONLINE FIRST FREE

April 28, 2023

Comparing Physician and Artificial Intelligence Chatbot Responses to Patient Questions Posted to a Public Social Media Forum



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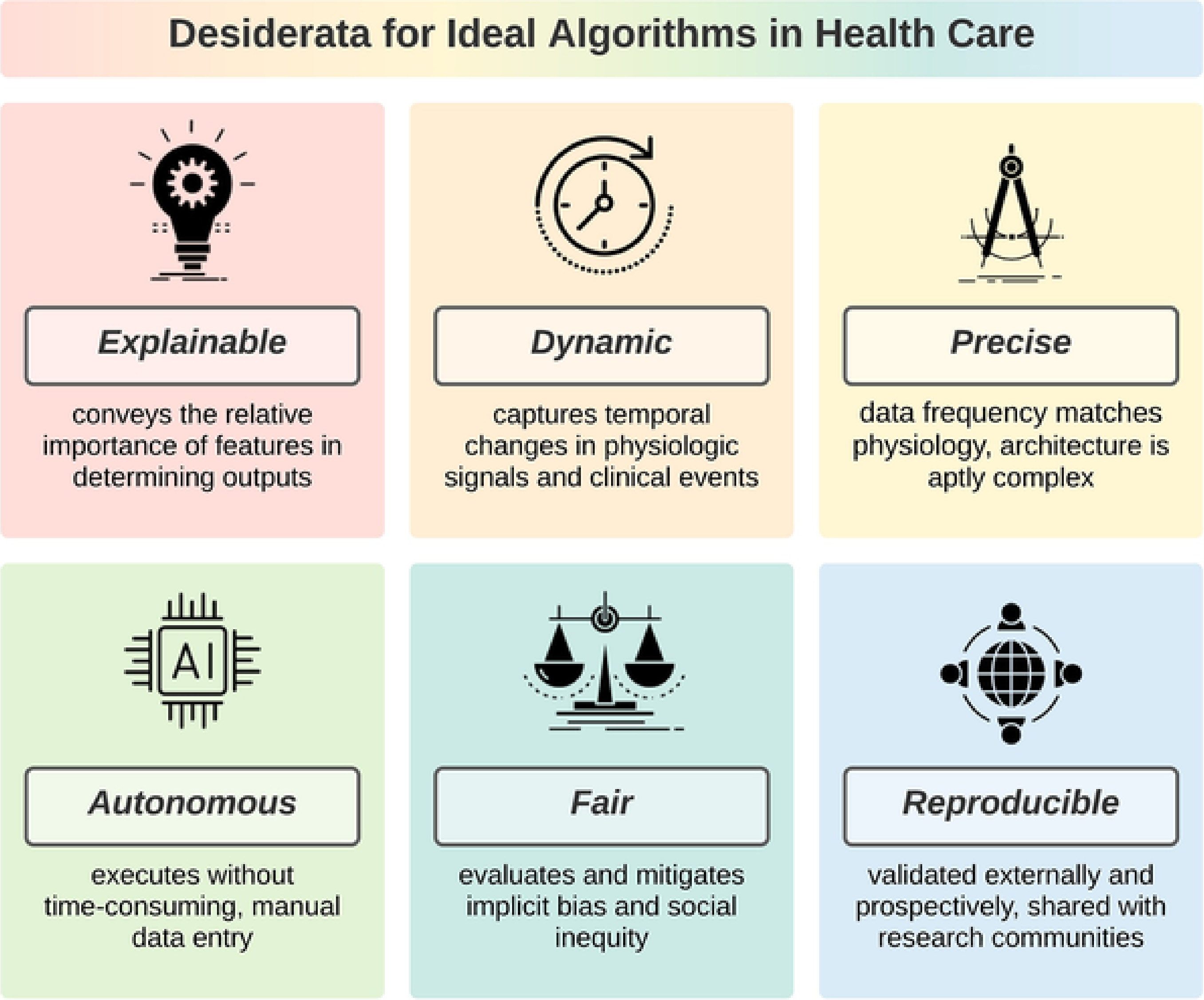
Limitations

- ChatGPT sometimes writes plausible-sounding but incorrect or nonsensical answers. Fixing this issue is challenging, as: (1) during RL training, there's currently no source of truth; (2) training the model to be more cautious causes it to decline questions that it can answer correctly; and (3) supervised training misleads the model because the ideal answer depends on what the model knows, rather than what the human demonstrator knows.
- ChatGPT is sensitive to tweaks to the input phrasing or attempting the same prompt multiple times. For example, given one phrasing of a question, the model can claim to not know the answer, but given a slight rephrase, can answer correctly.
- The model is often excessively verbose and overuses certain phrases, such as restating that it's a language model trained by OpenAI. These issues arise from biases in the training data (trainers prefer longer answers that look more comprehensive) and well-known over-optimization issues.[1, 2]
- Ideally, the model would ask clarifying questions when the user provided an ambiguous query. Instead, our current models usually guess what the user intended.
- While we've made efforts to make the model refuse inappropriate requests, it will sometimes respond to harmful instructions or exhibit biased behavior. We're using the Moderation API to warn or block certain types of unsafe content, but we expect it to have some false negatives and positives for now. We're eager to collect user feedback to aid our ongoing work to improve this system.



Loftus TJ, Tighe PJ, Ozrazgat-Baslanti T, Davis JP, Ruppert MM, et al. (2022) Ideal algorithms in healthcare: Explainable, dynamic, precise, autonomous, fair, and reproducible. PLOS Digital Health 1(1): e0000006. https://doi.org/10.1371/journal.pdig.0000006
https://journals.plos.org/digitalhealth/article?id=10.1371/journal.pdig.0000006

Table 1. Checklist for ideal algorithms in healthcare.

Desiderata	Criteria	Yes	Location	No	N/A
Explainable Yes[a] Partially[b] No[c] N/A[d]	*Feature importance*: conveys the relative importance of features in determining algorithm outputs				
	Descriptive accuracy: describes what the algorithm has learned (e.g., weights in a neural network)				
	Simulatability: clinicians can understand and mentally simulate the model's process for generating predictions				
	Relevance: describes relevancy as judged by the algorithm's target human audience				
Dynamic Yes[a] Partially[b] No[c] N/A[d]	*Temporality*: captures temporal changes in physiologic signals and clinical events				
	Continuous monitoring: performance is reassessed at several time points, including the point at which performance is expected to plateau				
Precise Yes[a] Partially[b] No[c] N/A[d]	*Data frequency*: rate of data collection matches the rate of physiologic changes				
	Complexity: algorithm complexity matches the complexity of the prediction or classification task				
Autonomous Yes[a] Partially[b] No[c] N/A[d]	*Efficiency*: the algorithm executes without the need for time-consuming, manual data entry by the end user (i.e., patient, provider, or investigator)				
Fair Yes[a] Partially[b] No[c] N/A[d]	*Generalizability*: algorithm is developed and validated across diverse patient demographics and practice settings				
	Selectivity: excludes features that lack pathophysiologic or linguistic association with outcomes, but may introduce bias				
	Objectivity: includes variables that are minimally influenced by clinician judgments (e.g., vital signs)				
Reproducible Yes[a] Partially[b] No[c] N/A[d]	*Generalizability*: validated externally, prospectively				
	Collaboration: algorithm is shared with the research community				
	Compliance: fulfills SPIRIT-AI extension guidelines (if trial) and fulfills CONSORT-AI guidelines				

[a]Overall adjudication is "Yes" when all criteria are either met or not applicable.
[b]Overall adjudication is "Partially" when some but not all criteria are either met or not applicable.
[c]Overall adjudication is "No" when no criteria are met.
[d]Overall adjudication is "N/A" when all criteria are not applicable.
CONSORT-AI, Consolidated Standards of Reporting Trials-Artificial Intelligence; N/A, not applicable; SPIRIT-AI, Standard Protocol Items: Recommendations for Interventional Trials-Artificial Intelligence.

https://doi.org/10.1371/journal.pdig.0000006.t001

Loftus TJ, Tighe PJ, Ozrazgat-Baslanti T, Davis JP, Ruppert MM, et al. (2022) Ideal algorithms in healthcare: Explainable, dynamic, precise, autonomous, fair, and reproducible. PLOS Digital Health 1(1): e0000006. https://doi.org/10.1371/journal.pdig.0000006
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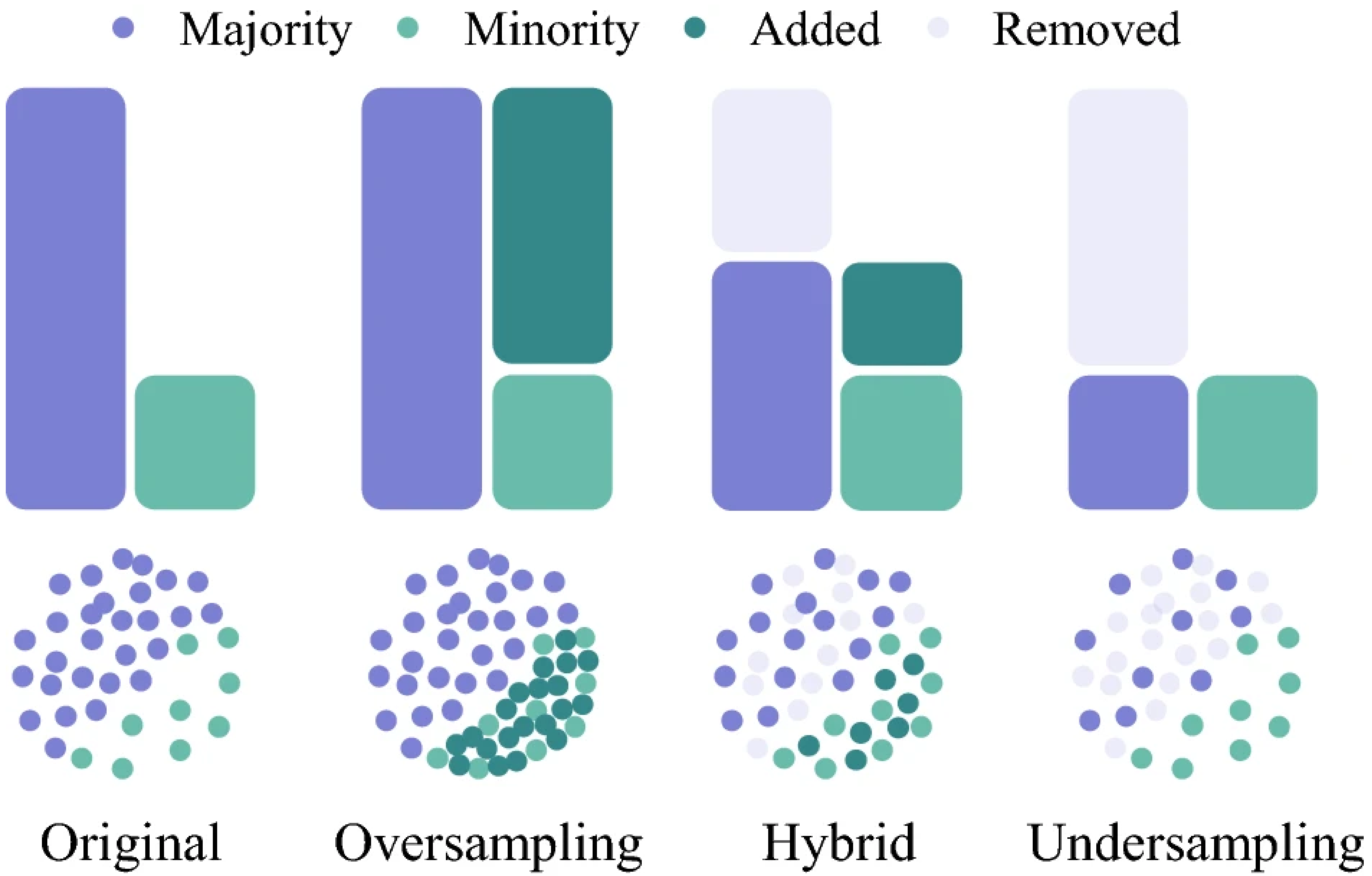

Imbalanced data preprocessing techniques for machine learning: a systematic mapping study

Vitor Werner de Vargas, Jorge Arthur Schneider Aranda, Ricardo dos Santos Costa, Paulo Ricardo da Silva Pereira & Jorge Luis Victória Barbosa

Knowledge and Information Systems **65**, 31–57 (2023) | Cite this article

April 15, 2021

Algorithmovigilance—Advancing Methods to Analyze and Monitor Artificial Intelligence–Driven Health Care for Effectiveness and Equity

Peter J. Embi, MD, MS[1]

» Author Affiliations | Article Information

JAMA Netw Open. 2021;4(4):e214622. doi:10.1001/jamanetworkopen.2021.4622

U.S. FOOD & DRUG ADMINISTRATION

The Software Precertification (Pre-Cert) Pilot Program: Tailored Total Product Lifecycle Approaches and Key Findings

September 2022

Thank You!

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