KNOW THE AUDIENCE

🙋 **SHOW OF HANDS**

Who has used AI in the last 24 hours — personally, or on a patient case?

🙋 **SHOW OF HANDS**

What tools?

LLMs, medical reference apps, scribes, something else?

🙋 **SHOW OF HANDS**

Anyone written any code in the last year…without AI?

💬 **DISCUSS**

Why is AI suddenly a THING?

What's driving it now?

💬 **DISCUSS**

What's the outcome of AI in society — and in our profession?

💬 **DISCUSS**

Would you trust an AI's differential Over a co-resident's?

Over an attending's?

Presented By: Troy E. Sybert, MD, MPH, CUA

"Reference Pinky and the Brain to lighten the mood. E.g., One is a genius, the other's insane—but together, AI and healthcare are plotting to revolutionize medicine!"

AI IN HEALTHCARE

PINKY AND THE BRAIN TAKE OVER THE WORLD

Disclosure: I have no financial relationships, nor do I endorse any company mentioned today.

OBJECTIVES

- Intro and Discussion
- AI Foundations: The Perceptron
- Key Drivers
- Impact of AI in Your Training

“Side-profile photograph of a young physician in a white coat and stethoscope, standing in a softly lit hospital corridor. They hold a smartphone in front of them at chest height; the screen is angled away from camera so its contents are not visible, just a faint blue glow on their face. Their gaze is lifted away from the phone, looking off into the middle distance, brow gently furrowed in thought. Shallow depth of field, 50mm lens, cool blue-grey palette with a warm accent catching the cheekbone. Mood: a deliberate moment of pau
Photorealistic editorial healthcare photography.”

INTRODUCTION: TROY E. SYBERT, MD, MPH, CUA

- Physician Informaticist with Informatics Patient Safety in the VA Central Office
- MD: University of Texas Southwestern, Dallas, TX 2001
- MPH: University of Texas Medical Branch Graduate School, Galveston, TX, 2005
- Internal Medicine/Preventive Medicine Residency 2002-2005
- Hospital Medicine Fellowship, Mayo Clinic, Rochester, MN 2006
- Served in several physician executive roles throughout my career in academic, for-profit, non-profit and industry.
- Came to area in 2010 as the CMIO of Wellmont…brought Epic into the area for the first time.
- Added Board Certification for Clinical Informatics 2021

AI SCOPE OF TERMS

AI

- Broad field of designing machines to mimic human intelligence
- Examples: clinical decision support, robotic surgery, chatbots, automated triage.

Machine Learning

- A subset of AI where systems learn from data to make predictions or decisions.
- Examples: predicting readmissions, diagnosing from ECGs, flagging abnormal labs.

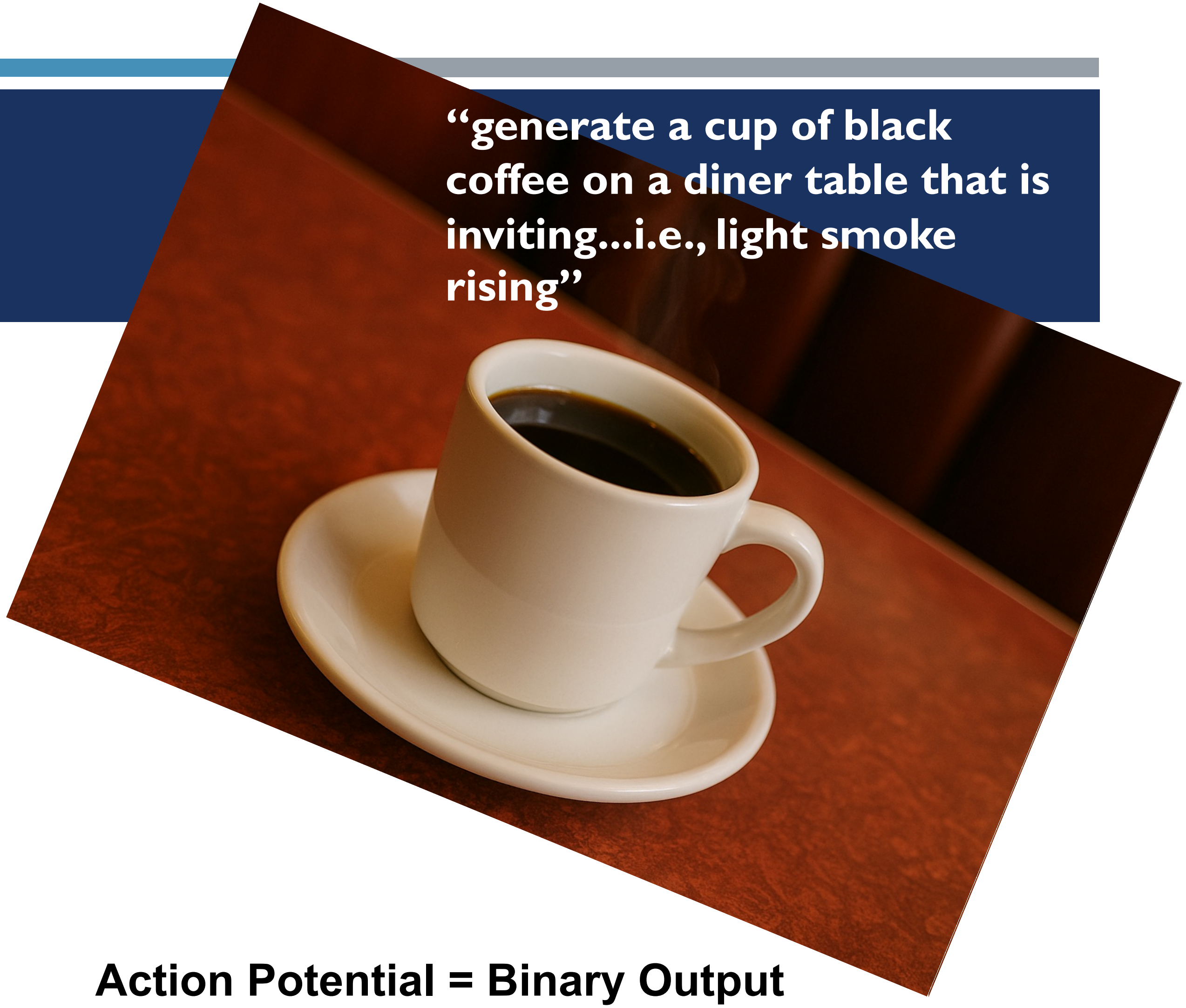
Neural Networks

- Algorithms inspired by the brain's structure — neurons, weights, and activations: shallow and deep

Deep Learning

- A specialized type of ML using layered neural networks to detect patterns in complex data.
- Examples: analyzing imaging (X-rays, CTs), interpreting raw ECG waveforms

COFFEE AND PERCEPTRON



External Stimuli = Input Features
Visual recognition of the coffee cart, the smell of espresso, and even your fatigue level all act like "inputs" to the system.

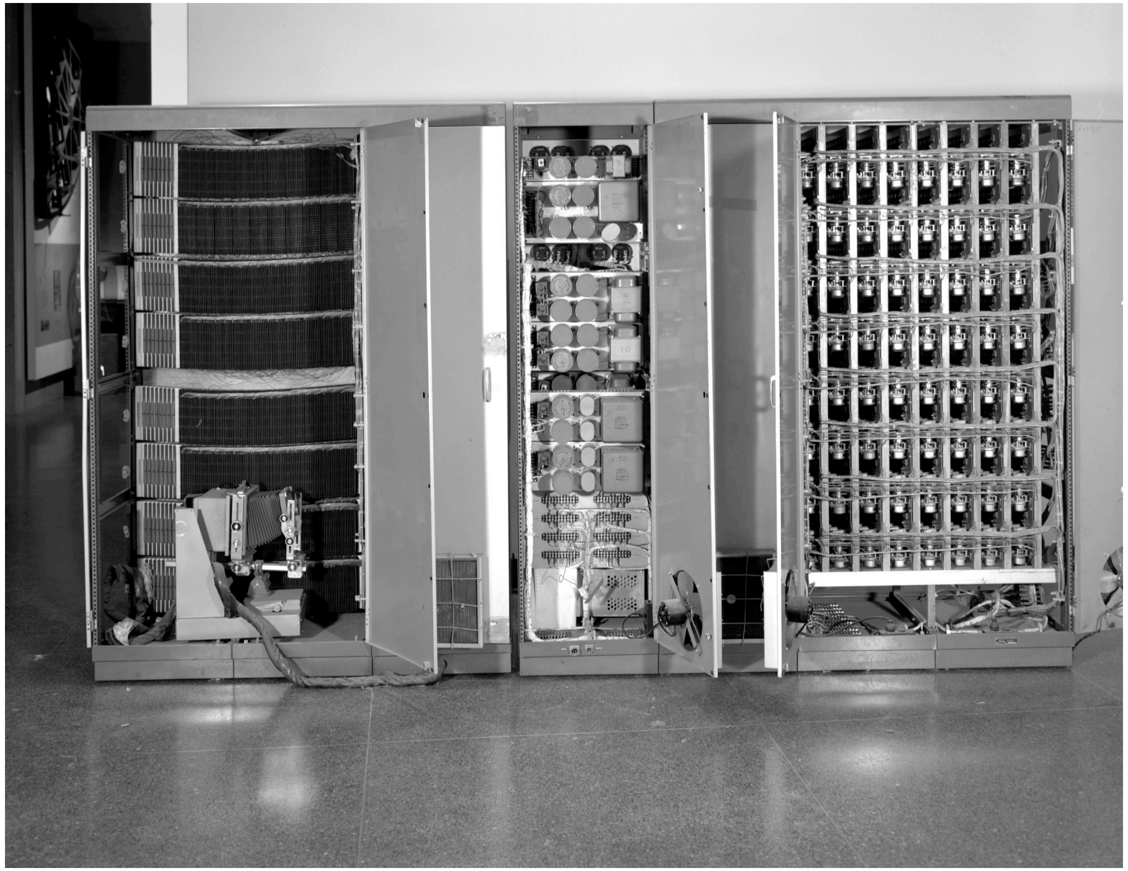
Synaptic Strengths = Weights
Your brain assigns value to each signal — maybe smell carries more weight today than sight because you're exhausted. These weights are **like model parameters** in a perceptron.

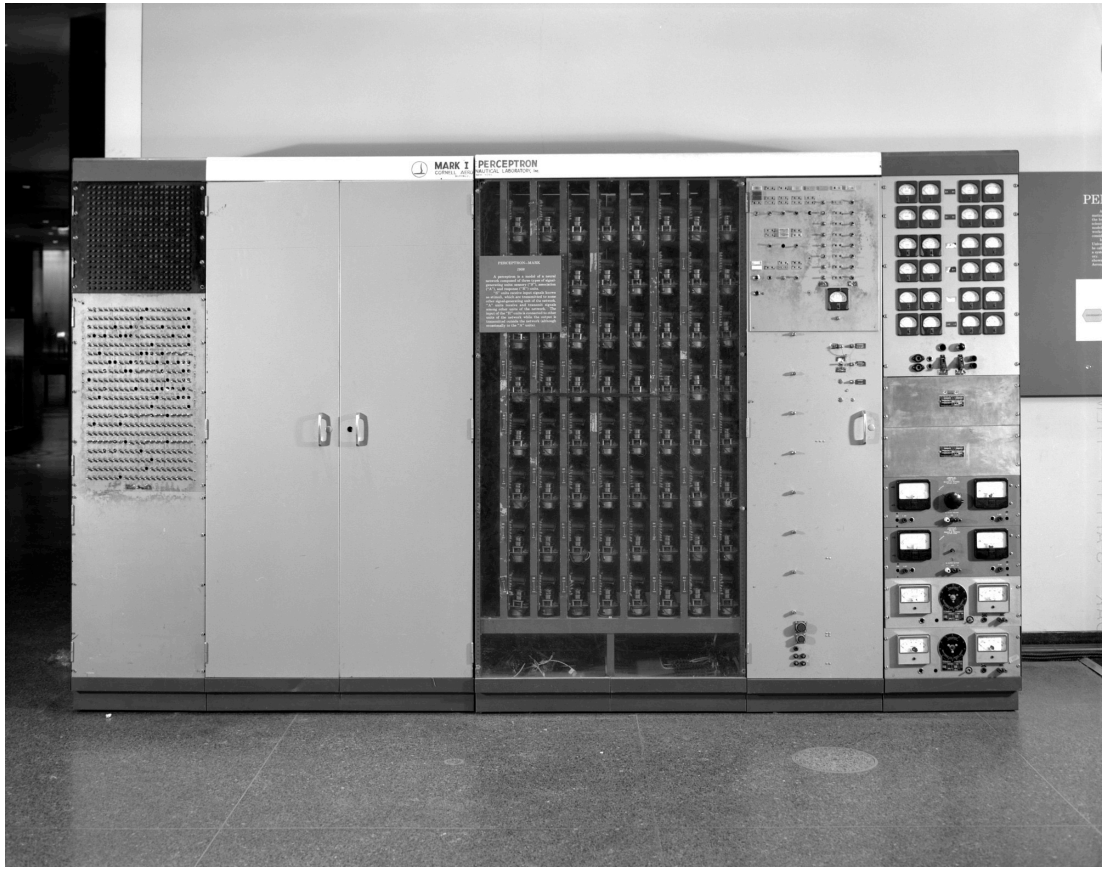
Cell Body = Signal Summation
The neuron **sums all the incoming excitatory and inhibitory signals**. If the total signal is strong enough, it crosses a threshold.

Action Potential = Binary Output
If the neuron fires, it releases **dopamine** into the striatum. This signals the motor system:
"Initiate movement!"

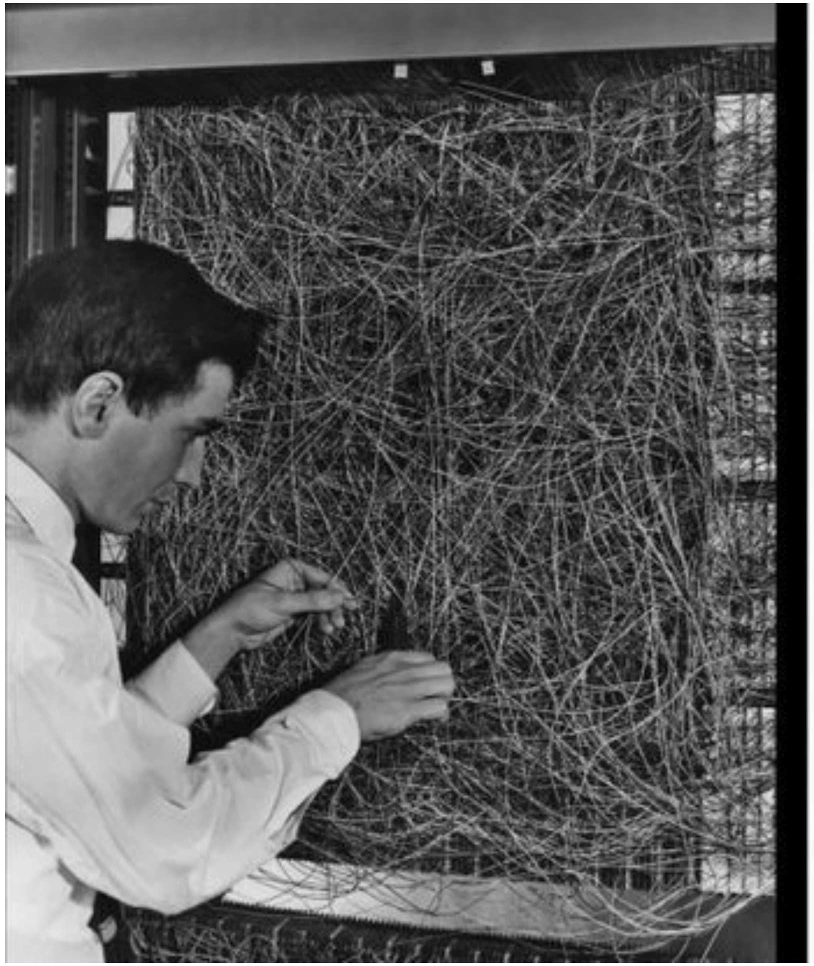
MARK I PERCEPTRON – 1958 – FRANK ROSENBLATT

CORNELL AERONAUTICAL LAB IN BUFFALO, NY





THE GUTS



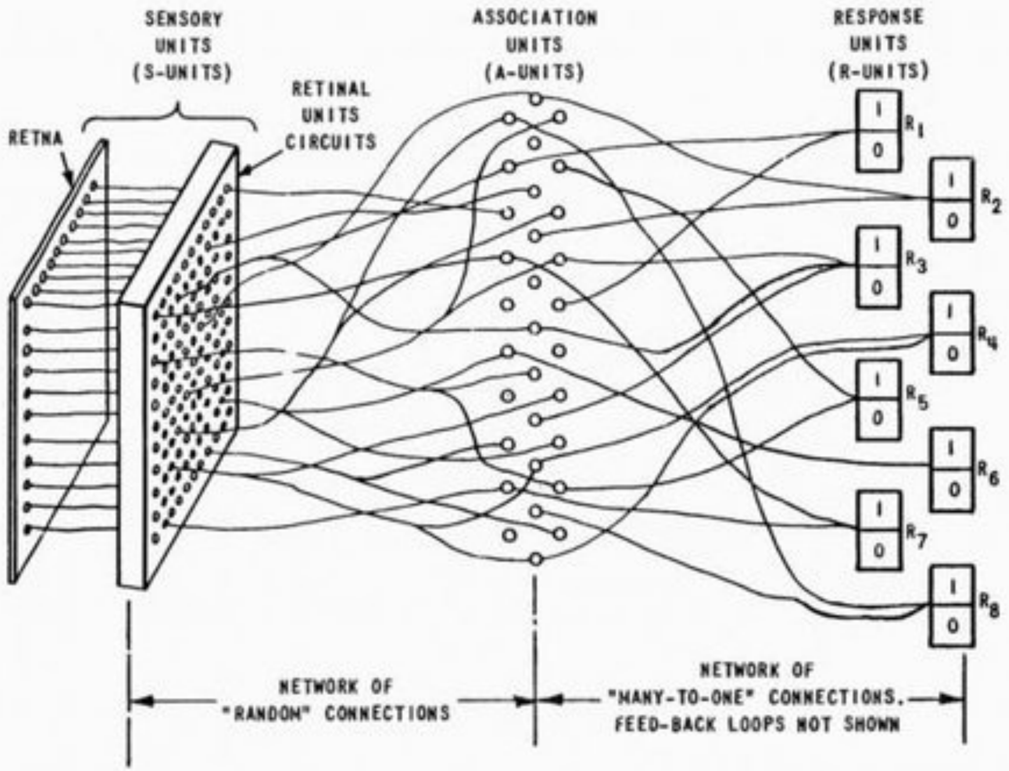
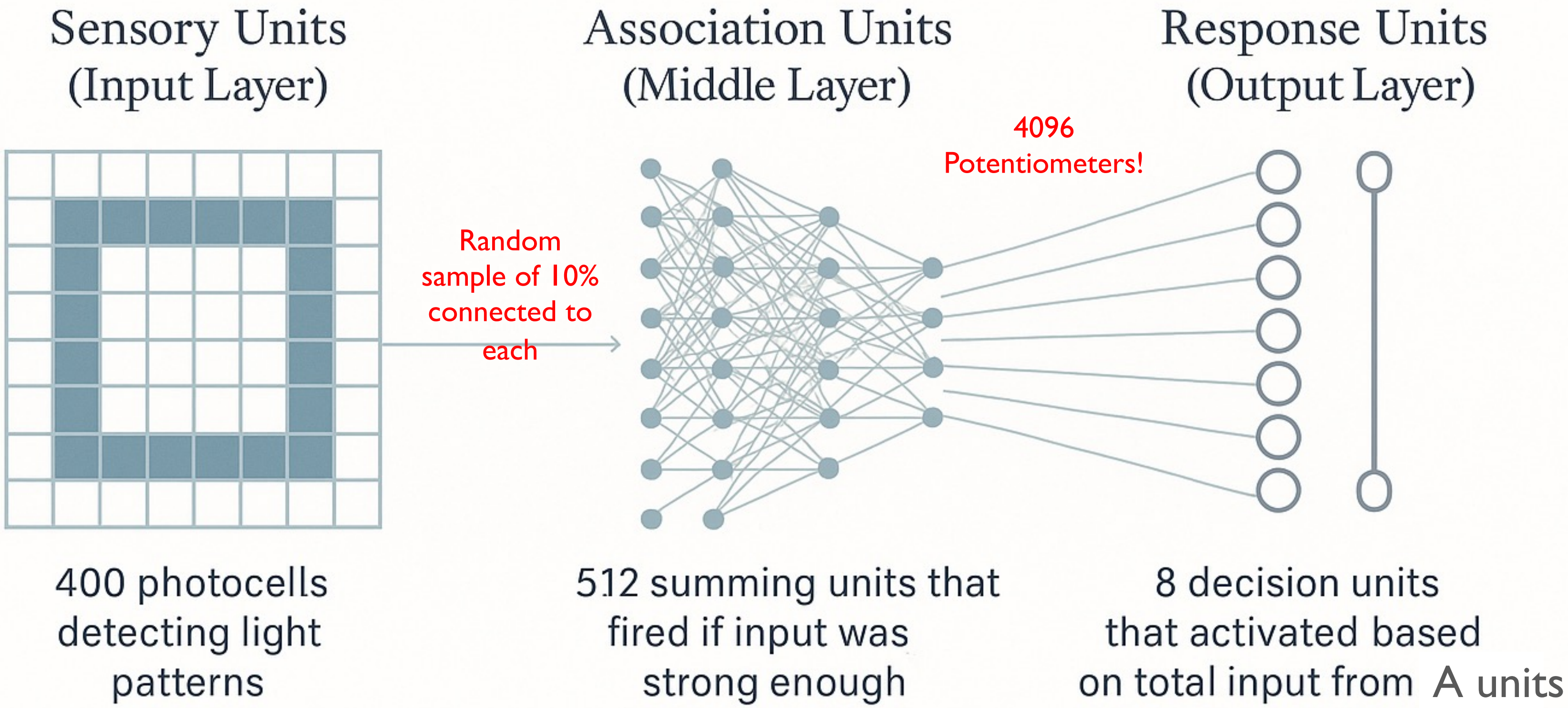


Figure I ORGANIZATION OF THE MARK I PERCEPTRON

How the Mark I Perceptron Functioned



Learning: Adjusted potentiometers to reinforce correct decisions

Wiring: Fixed between S and A; adjustable between A and R

MACHINE LEARNING AND NEURAL NETWORKS

Machine Learning

Like saying "antibiotics"

Works great for tabular data

- Linear regression
- Logistic regression
- Decision trees
- Random forests
- Support Vector Machines (SVMs)
- Naive Bayes
- K-means clustering

Neural Network

Like saying "penicillin"

Excels at image, signal, and text data

- Neural networks excel at learning **complex, nonlinear relationships**
- Can be **shallow** (1 hidden layer) or **deep** (many layers = deep learning)
- Most **modern AI breakthroughs** (e.g., image and language understanding) use neural networks

DEEP LEARNING VS NEURAL NETWORKS

🩺 **Clinical Scenario:**

You want to build a model that classifies whether a patient is likely to have **sepsis** based on:

- Temperature
- Heart rate
- Respiratory rate
- White blood cell count

🧮 **Model Structure:**

- **Input layer**: 4 features
- **1 hidden layer**: Maybe 5–10 neurons
- **Output layer**: Binary output (sepsis: yes/no)

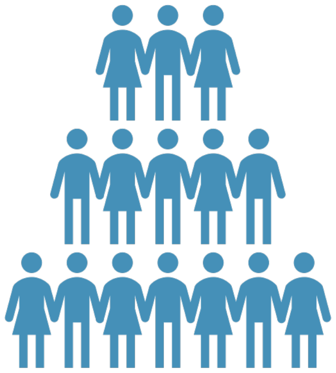
✅ This **is** a neural network

❌ This **is not** considered deep learning as it has **only one hidden layer**

Term	Explanation
Algorithm	A step-by-step set of rules the computer follows to solve a problem or make a decision.
Training	The process of teaching an AI model using example data.
Inference	When the trained model makes predictions or decisions using new data.
Supervised Learning	A type of learning where the model is trained on labeled data.
Unsupervised Learning	The model finds patterns in data without labels.
Feature	An individual variable or input used by the model (e.g., age, lab result).
Overfitting	When a model performs well on training data but poorly on new data due to memorizing noise.
Bias	Errors introduced by assumptions in the model or imbalanced training data.
Black Box	A model whose internal workings are not easily understood.
Explainability	How well a human can understand the model's reasoning or output.

Key Drivers: Data Digitization, Redefining Health Understanding, and Research Translation.

26 – 29 B



Adoption ~70%

200 – 600B

by 2030

https://www.bvp.com/atlas/roadmap-healthcare-ai
https://www.fortunebusinessinsights.com/industry-reports/artificial-intelligence-in-healthcare-market-100534
https://www.mckinsey.com/industries/healthcare/our-insights/generative-ai-in-healthcare-adoption-trends-and-whats-next

MARKET (DIAGNOSTICS, ADMINISTRATIVE TASKS, PERSONALIZED MEDICINE)

US HEALTH SYSTEMS (N = 43)

Category	Use Case	Pilot or Deployed	Degree of Success
Clinical Documentation	Ambient Notes	100% (43/43)	53% (21/40)
Clinical Risk Stratification	Early Detection of Sepsis	88% (38/43)	38% (13/34
Diagnosis	Imaging and Radiology Medical Coding	95% (41/43)	19% (5/26)
Revenue Cycle	Medical Coding	83% (36/43)	23% (7/30)


Journal of the American Medical Informatics Association, 2025, 1–8
https://doi.org/10.1093/jamia/ocaf065
Research and Applications

Research and Applications

Adoption of artificial intelligence in healthcare: survey of health system priorities, successes, and challenges

Eric G. Poon, MD, MPH[1,2,3,*], Christy Harris Lemak, PhD[4,5], Juan C. Rojas, MD, MS[6], Janet Guptill, MPH[5], David Classen, MD, MS[7]

Barriers such as immature AI tools (77% of respondents), financial concerns (47%), and regulatory uncertainty (40%) noted as significant challenges.

COMMON USE CASES

- **Medical Imaging and Diagnostics Description**: AI analyzes medical images (e.g., X-rays, MRIs, CT scans) to detect conditions like cancer, fractures, or neurological disorders with high accuracy, often matching or surpassing radiologists.
- **Personalized Medicine Description**: AI uses patient data (genetics, lifestyle, medical history) to create tailored treatment plans, improving efficacy and reducing side effects.
- **Drug Discovery and Development Description**: AI analyzes biological and chemical data to identify drug candidates, predict efficacy, and reduce development costs.
- **Predictive Analytics for Patient Outcomes Description**: AI analyzes EHRs to predict risks like hospital readmissions or sepsis, enabling proactive care.
- **Robot-Assisted Surgery Description**: AI-powered surgical robots provide real-time data analysis for precision, reducing errors and improving outcomes.
- **Virtual Assistants and Chatbots Description**: AI-powered tools handle patient inquiries, schedule appointments, and provide triage support, improving accessibility.
- **Remote Patient Monitoring Description**: AI monitors vital signs via wearables and IoT devices, alerting providers to potential issues for early intervention.
- **Administrative Task Automation Description**: AI automates tasks like scheduling, billing, and data entry, reducing administrative burdens.

SPECIFIC USE CASES

- **Smart Stethoscope Detects Heart Failure Description:** An AI-powered stethoscope detects heart failure early, with accuracy comparable to echocardiograms, unaffected by age, sex, or race.
- **AI Identifies Heart Attacks in A&E Description:** AI, combined with blood tests, improves heart attack detection in emergency settings, particularly for women and older patients.
- **AI Predicts Cancer in Small Lung Nodules (5-15mm) Description:** AI predicts cancer risk in small lung nodules, outperforming traditional methods and reducing unnecessary CT scans.
- **AI Predicts Cancer in Large Lung Nodules (15-30mm) Description:** AI enhances cancer prediction accuracy for larger lung nodules, aiding timely clinical decisions.
- **AI Predicts Wet AMD in the Second Eye Description:** AI forecasts the development of wet age-related macular degeneration in the second eye, aiding resource allocation.
- **AI Predicts Flare-Ups in Ulcerative Colitis Description:** AI standardizes assessments and predicts inflammation in ulcerative colitis, matching pathologist accuracy.
- **AI Personalizes Lung Cancer Drug Combinations Description:** AI predicts drug sensitivity for lung cancer, enabling personalized treatment plans within days.
- **AI Predicts Emergency Bed Needs Description:** AI uses real-time data to forecast emergency bed requirements, outperforming traditional planning.

“generate a picture showing a doctor involved in a delicate balancing act where the fall will be dangerous”

IMPACT OF AI IN MEDICINE

A BALANCING ACT

Bioengineering (Basel). 2023 Dec 18;10(12):1435. doi: 10.3390/bioengineering10121435

How Artificial Intelligence Is Shaping Medical Imaging Technology: A Survey of Innovations and Applications

Luís Pinto-Coelho [1,2]

Editor: Seung Won Lee

Author information · Article notes · Copyright and License information

PMCID: PMC10740686 PMID: 38136026

RSNA News

The Future of Radiology: AI's Transformative Role in Medical Imaging

AI is paving the way to a reimagin… technology and human experti…

BY LYNN ANTONOPOULOS

Segmentation of anatomical structures of the left heart from echocardiographic images using deep learning

MHDJ Mortada, S Tomassini, H Anbar, M Morettini, L Burattini, A Sbrollini

Diagnostics, 2023 · mdpi.com

Knowledge about the anatomical structures of the left heart, specifically the atrium (LA) and ventricle (i.e., endocardium—Vendo—and epicardium—LVepi) is essential for the evaluation of cardiac functionality. Manual segmentation of cardiac structures from echocardiography is the baseline reference, but results are user-dependent and time-consuming. With the aim of supporting clinical practice, this paper presents a new deep-…

Automated bone marrow cytology using deep learning to generate a histogram of cell types

RM Tayebi, Y Mu, T Dehkharghanian, C Ross, M Sur, R Foley, HR Tizhoosh, CJV Campbell

Communications medicine, 2022 · nature.com

Background

Bone marrow cytology is required to make a hematological diagnosis, influencing critical clinical decision points in hematology. However, bone marrow cytology is tedious, limited to experienced reference centers and associated with inter-observer variability. This may lead to a delayed or incorrect diagnosis, leaving an unmet need for innovative supporting technologies.

- **Lung Cancer**: AI flags suspicious nodules in CT scans for early diagnosis.
- **Diabetic Retinopathy**: AI analyzes retinal images to detect early signs of this vision-threatening condition.
- **Cardiac Diseases**: AI interprets echocardiograms and CT scans to identify heart conditions like coronary artery disease.
- **Breast Cancer**: AI enhances mammography to improve early detection and reduce false negatives.

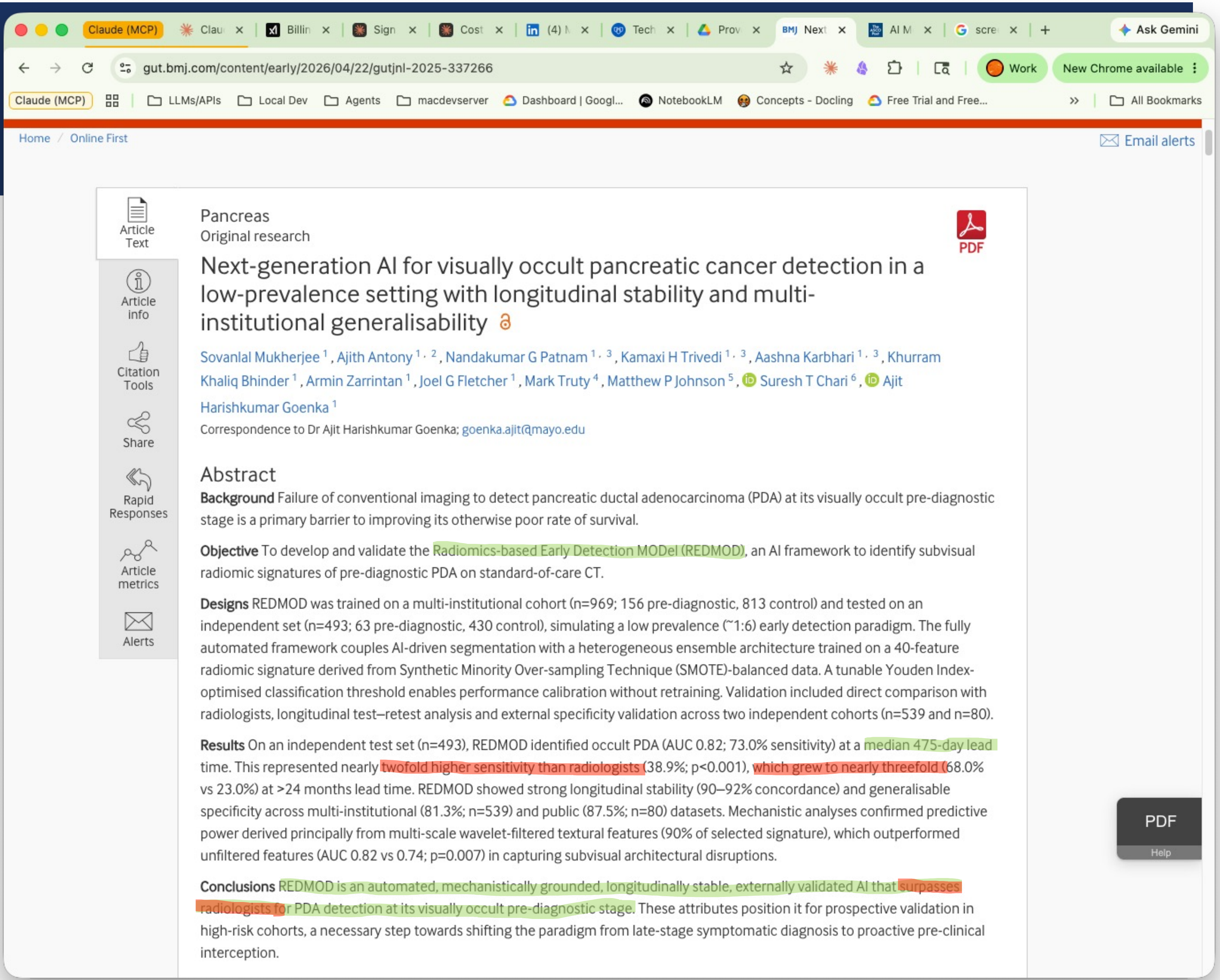
AI medical imaging market: $1.79 billion in 2025 to $26.23 billion by 2034

AI OR RADIOLOGIST?

REDMOD→ Pancreatic Ductal Adenocarcinoma

2x higher sensitivity becoming 3x >24 months

SURPASSES Radiologists!



gut.bmj.com/content/early/2026/04/22/gutjnl-2025-337266

Home / Online First

Pancreas
Original research

Next-generation AI for visually occult pancreatic cancer detection in a low-prevalence setting with longitudinal stability and multi-institutional generalisability

Sovanlal Mukherjee [1], Ajith Antony [1, 2], Nandakumar G Patnam [1, 3], Kamaxi H Trivedi [1, 3], Aashna Karbhari [1, 3], Khurram Khaliq Bhinder [1], Armin Zarrintan [1], Joel G Fletcher [1], Mark Truty [4], Matthew P Johnson [5], Suresh T Chari [6], Ajit Harishkumar Goenka [1]

Correspondence to Dr Ajit Harishkumar Goenka; goenka.ajit@mayo.edu

Abstract

Background Failure of conventional imaging to detect pancreatic ductal adenocarcinoma (PDA) at its visually occult pre-diagnostic stage is a primary barrier to improving its otherwise poor rate of survival.

Objective To develop and validate the Radiomics-based Early Detection MODel (REDMOD), an AI framework to identify subvisual radiomic signatures of pre-diagnostic PDA on standard-of-care CT.

Designs REDMOD was trained on a multi-institutional cohort (n=969; 156 pre-diagnostic, 813 control) and tested on an independent set (n=493; 63 pre-diagnostic, 430 control), simulating a low prevalence (~1:6) early detection paradigm. The fully automated framework couples AI-driven segmentation with a heterogeneous ensemble architecture trained on a 40-feature radiomic signature derived from Synthetic Minority Over-sampling Technique (SMOTE)-balanced data. A tunable Youden Index-optimised classification threshold enables performance calibration without retraining. Validation included direct comparison with radiologists, longitudinal test–retest analysis and external specificity validation across two independent cohorts (n=539 and n=80).

Results On an independent test set (n=493), REDMOD identified occult PDA (AUC 0.82; 73.0% sensitivity) at a median 475-day lead time. This represented nearly twofold higher sensitivity than radiologists (38.9%; p<0.001), which grew to nearly threefold (68.0% vs 23.0%) at >24 months lead time. REDMOD showed strong longitudinal stability (90–92% concordance) and generalisable specificity across multi-institutional (81.3%; n=539) and public (87.5%; n=80) datasets. Mechanistic analyses confirmed predictive power derived principally from multi-scale wavelet-filtered textural features (90% of selected signature), which outperformed unfiltered features (AUC 0.82 vs 0.74; p=0.007) in capturing subvisual architectural disruptions.

Conclusions REDMOD is an automated, mechanistically grounded, longitudinally stable, externally validated AI that surpasses radiologists for PDA detection at its visually occult pre-diagnostic stage. These attributes position it for prospective validation in high-risk cohorts, a necessary step towards shifting the paradigm from late-stage symptomatic diagnosis to proactive pre-clinical interception.

COGNITIVE OFFLOADING: WHAT THE EVIDENCE SHOWS

The faster the answer comes, the less the mind works for it.

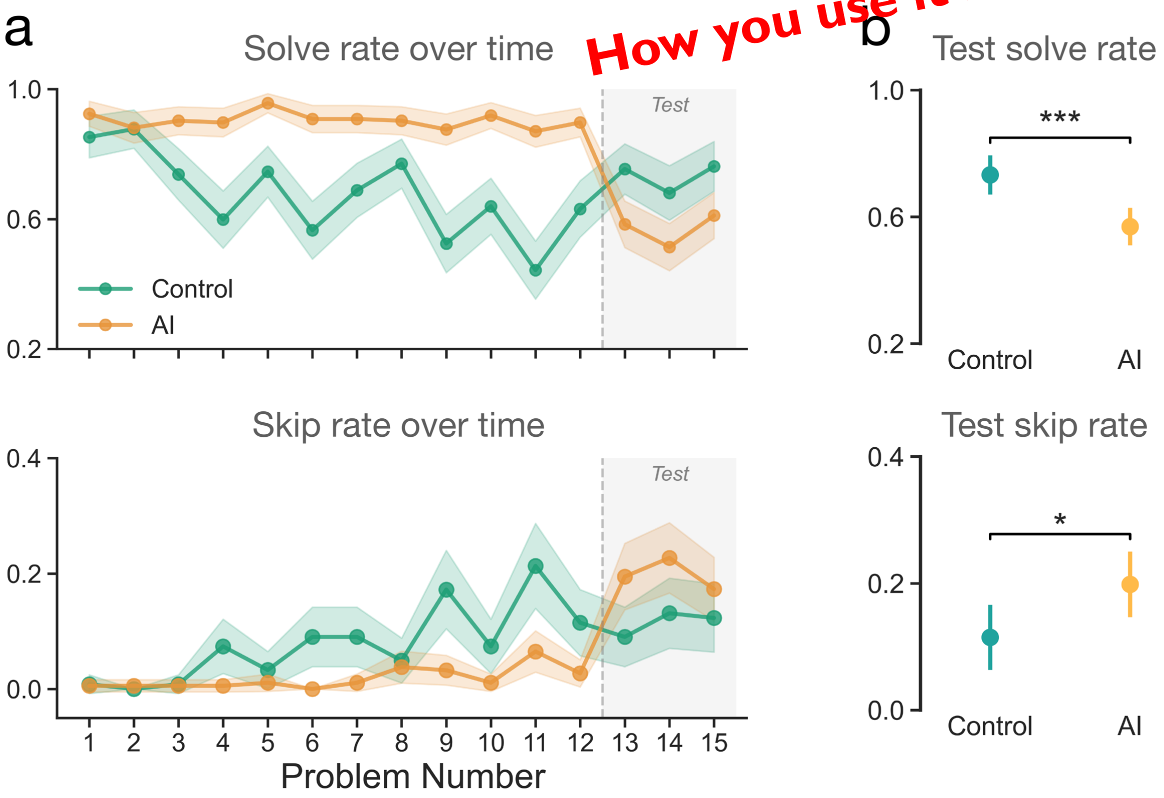
"generate a house of cards about to fall..."

- **Gerlich 2025 (n=666):** Frequent AI use = lower critical-thinking scores. Effect strongest in ages 17–25.
- **Lee et al., 2025 (n=319):** Higher confidence in GenAI → less critical thinking. Work shifts to verifying, integrating
- **Kosmyna et al.,2025 (n=54):** LLM users showed the weakest brain connectivity; >80% could not quote their own essays. "Cognitive debt."

1. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5082524
2. https://www.microsoft.com/en-us/research/publication/the-impact-of-generative-ai-on-critical-thinking-self-reported-reductions-in-cognitive-effort-and-confidence-effects-from-a-survey-of-knowledge-workers/
3. https://www.researchgate.net/publication/392560878_Your_Brain_on_ChatGPT_Accumulation_of_Cognitive_Debt_when_Using_an_AI_Assistant_for_Essay_Writing_Task

CAUSAL EVIDENCE: AI USE ERODES PERSISTENCE

How you use it matters more than whether you use it.



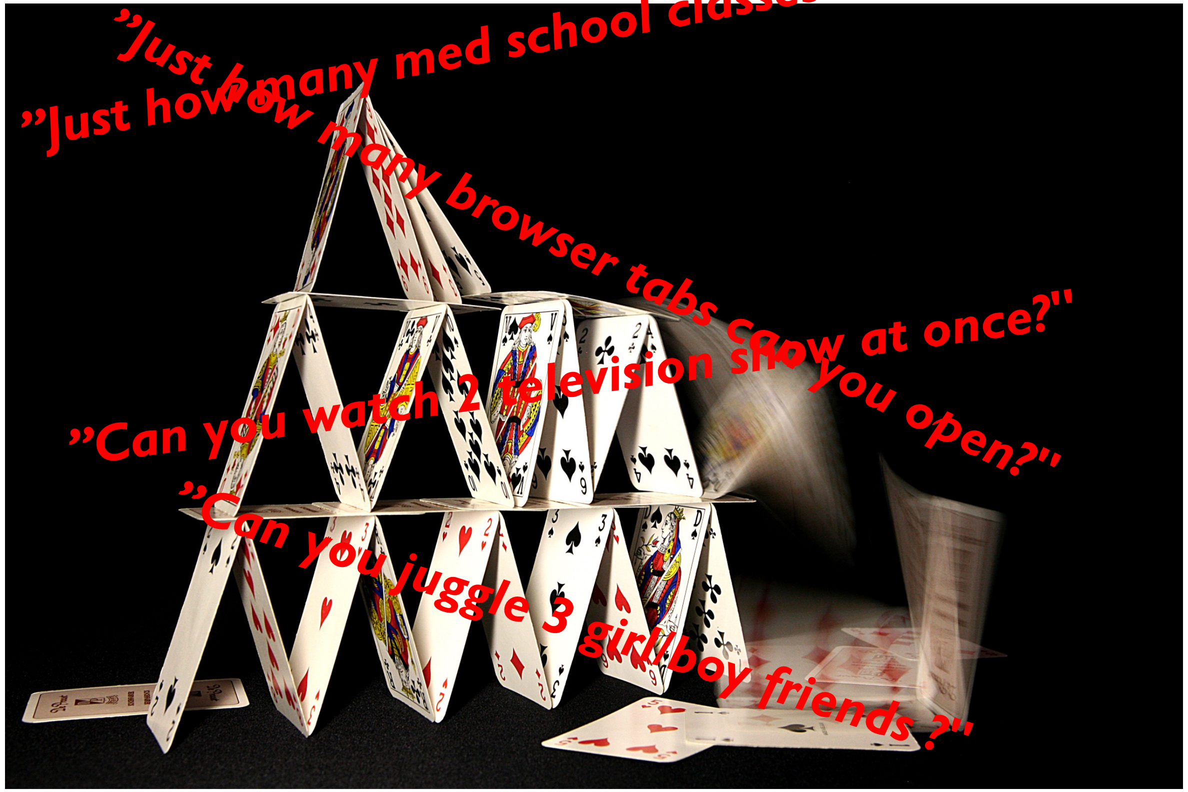
Liu et al., CMU/Oxford/MIT/UCLA — 3 RCTs (N=1,222)

Key Findings

- **AI assistance reduces persistence and impairs independent performance:** After brief AI-assisted sessions (~10 minutes), participants were significantly more likely to give up on problems and performed significantly worse once the AI was removed, compared to participants who never had AI assistance.
- **Effects are concentrated among users who seek direct solutions:** Persistence costs were concentrated among participants who prompted AI to solve tasks for them directly. Using AI for hints or clarifications did not produce significant impairments.
- **Effects generalize across domains:** Effects replicated across fraction arithmetic and reading comprehension, suggesting it is a general consequence of AI-assisted problem solving, not specific to any particular task.

ai-project-website.github.io/AI-assistance-reduces-persistence • arXiv:2604.04721

AND THE OTHER DIRECTION: "AI BRAIN FRY"



https://hbr.org/2026/03/when-using-ai-leads-to-brain-fry

HBR / BCG, March 2026 — n=1,488 US workers

-1,488 full-time U.S.-based workers (48% male vs 51% female; 58% independent contributors vs 41% leaders) at large companies across industries, roles, and levels.

-Asked about patterns and quantity of AI use, work experiences, and cognition and emotions.

- **Driver is oversight, not use:** high-oversight workers report 14% more mental effort, 19% more info overload. Productivity peaks at 3 tools, then declines. **Multitasking is notoriously unproductive.**
- **14% of AI users** report mental fatigue from oversight — "buzzing," fog, headaches, slower decisions.
- **Those affected:** 33% more decision fatigue, 39% more major errors, 39% higher intent to quit work.
- **Not burnout —** acute strain on attention, working memory, executive control. The early-adopter "high performers" are most affected.

SO WHAT — AS A RESIDENT?

⚠ THE TRAP

- Confidence in AI rises — your own thinking quietly fades.
- Time pressure + AI suggestion = highest risk of automation bias or cognitive offloading.
- The less you know an area, the more the AI sways you — exactly when you most need to push back.*
- Outputs converge: everyone using the same tool starts thinking the same way.

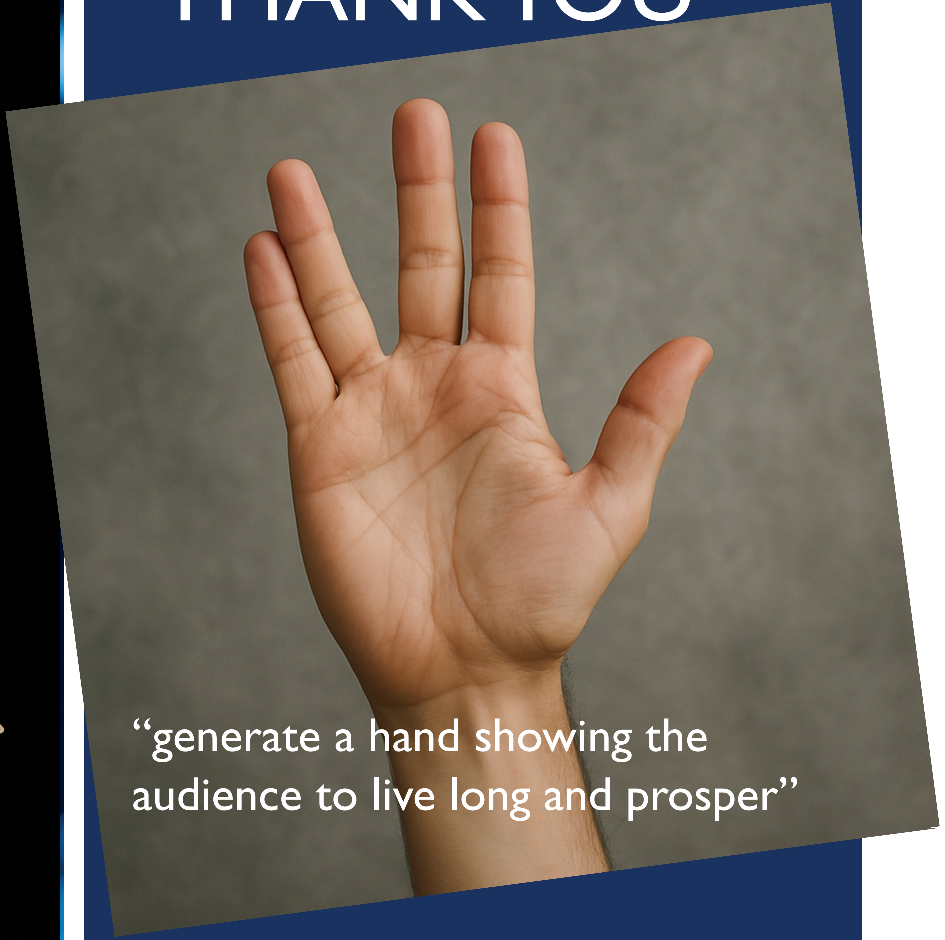
✓ THE HABIT

- **Commit first.** Form your own assessment before reading the AI's.
- **Verify, don't validate.** Ask what's missing, not just what's there.
- **Disagree on purpose.** Argue against the AI on every case.
- **Protect the reps.** Residency builds the brain you'll use for 30 years.

Use AI as a colleague, not a crutch.

*Wound Care/CDSS: https://pubmed.ncbi.nlm.nih.gov/39234734/

THANK YOU



Troy.Sybert@VA.gov

REFERENCES: SPECIFIC USE CASES

- Point-of-care screening for heart failure with reduced ejection fraction using artificial intelligence during ECG-enabled stethoscope examination in London, UK: a prospective, observational, multicentre study
  - https://www.sciencedirect.com/science/article/pii/S2589750021002569?via%3Dihub
- External validation of a convolutional neural network artificial intelligence tool to predict malignancy in pulmonary nodules
  - https://thorax.bmj.com/content/75/4/306
- Machine learning for diagnosis of myocardial infarction using cardiac troponin concentrations
  - https://www.nature.com/articles/s41591-023-02325-4
- A radiomics-based decision support tool improves lung cancer diagnosis in combination with the Herder score in large lung nodules
  - https://www.thelancet.com/journals/ebiom/article/PIIS2352-3964(22)00526-6/fulltext
- Predicting conversion to wet age-related macular degeneration using deep learning
  - https://www.nature.com/articles/s41591-020-0867-7
- Artificial Intelligence Enabled Histological Prediction of Remission or Activity and Clinical Outcomes in Ulcerative Colitis
  - https://www.gastrojournal.org/article/S0016-5085(23)00216-0/fulltext?referrer=https%3A%2F%2Fpubmed.ncbi.nlm.nih.gov%2F
- Individualized Prediction of Drug Response and Rational Combination Therapy in NSCLC Using Artificial Intelligence–Enabled Studies of Acute Phosphoproteomic Changes
  - https://aacrjournals.org/mct/article/21/6/1020/699199/Individualized-Prediction-of-Drug-Response-and
- Machine learning for real-time aggregated prediction of hospital admission for emergency patients
  - https://www.nature.com/articles/s41746-022-00649-y#author-information