

Beyond the Textbook: Artificial Intelligence Powered Learning in Medicine

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Disclosures

The Study authors have no relevant financial disclosures to make

Outline

- Clinical Case
- AI Overview – How it works
- Challenges with AI
- Additional Cases
- Optimizing AI
- Societal Implications
- Conclusions

Poll 1: Which of the following logos do you recognize?



D. Multiple or all of the above

E. None of the above

Which of the following logos do you recognize?

A

0%

B

0%

C

0%

Multiple or all of the above

0%

None of the above

0%

Poll 2: I have used an AI platform.

- A. Yes, I use AI platform(s) daily or weekly
- B. Yes, but not routinely
- C. No, but I am excited to try one
- D. No, and I am apprehensive about them

I have used an AI platform

Yes, I use AI platform(s) daily or weekly

0%

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0%

No, and I am apprehensive about them

0%

Case 1

- 58 YOF presents after recent hospitalization
 - Cholecystectomy for cholecystitis
 - Post-op STEMI – distal vessel, managed medically
 - Started on appropriate medical therapies

- She asks: "Is it safe to SCUBA dive, and if so, when can I try to do it again?"

Poll 3: What would you do?

- A. Try to find a brief answer for the patient during the visit
- B. Offer to look up an answer later, and get back to her
- C. Ask her more questions about SCUBA, and why it is important to her
- D. Tell her to ask the cardiologist when she sees him/her
- E. Something else

What would you do?

Try to find a brief answer for the patient during the visit

0%

Offer to look up an answer later, and get back to her

0%

Ask her more questions about SCUBA, and why it is important to her

0%

Tell her to ask the cardiologist when she sees him/her

0%

Something else

0%

What did I do?

- "I am not sure, but let me get back to you"
- Challenges:
 - Most papers examine land-based sports participation
 - Time and effort
 - Spurious information or generalities
- At the time, I asked ChatGPT for help

Prompt:

I have a patient with coronary artery disease and a recent STEMI, managed medically given the distal nature of the occlusion, who wants to go SCUBA diving. What guidance can I offer?

Bottom line (clinician takeaway)

- Recent STEMI = no SCUBA diving
- Reconsider ≥ 6 months post-MI only if:
 - Asymptomatic
 - Preserved EF
 - High exercise capacity without ischemia
 - Stable rhythm
 - Off DAPT
- Clearance should be explicit, documented, and conservative

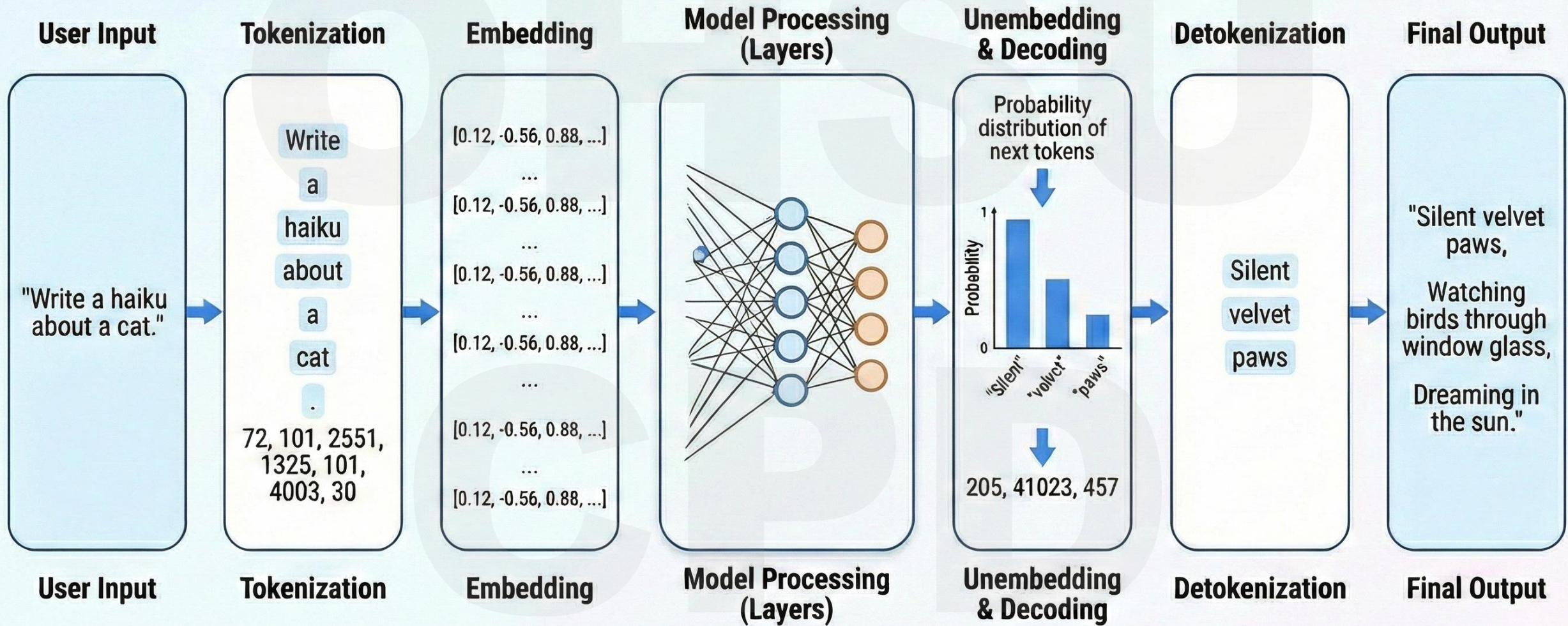
Initial thoughts?

- Is this information trustworthy?
- Is it specific enough?
- What is the last statement about?

Artificial Intelligence -- Overview

- Definition: machines performing tasks that require human cognition
 - Reasoning
 - Decision making
 - Perception
- Large Language Models (LLM)
 - Most common type of AI
 - Trains on a data set, which reflects its "knowledge" base
 - Prediction, not comprehension

The LLM Data Flow: From Text to Meaning and Back



Challenges with AI

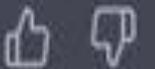
- Bias - trusting tech over ourselves
- Hallucinations and inaccurate references
- Computation time
- Data training set
 - Paywalls
 - Inaccurate information
 - Updates to guidelines/info
- Legalities

Example of a Hallucination

S what is the world record for crossing the english channel entirely on foot



The world record for crossing the English Channel entirely on foot is held by Christof Wandratsch of Germany, who completed the crossing in 14 hours and 51 minutes on August 14, 2020. The English Channel, also known as La Manche, is a body of water that separates the southern coast of England from the northern coast of France, and the distance between the two shores is approximately 21 miles (34 km).



Poll 4: I asked an AI to find evidence for a specific treatment. It gave me these two citations. Which one is the real study?

A) *“Effect of Empagliflozin on Cardiovascular Morbidity in Patients with Type 2 Diabetes.”*

- **Citation: Johnson, K.L. et al.** *New England Journal of Medicine.* 2024; 390(14): 1288-1299.

B) *“Empagliflozin, Cardiovascular Outcomes, and Mortality in Type 2 Diabetes.”*

- **Citation: Zinman, B. et al.** *New England Journal of Medicine.* 2015; 373(22): 2117-2128.

Which one is the real study?

“Effect of Empagliflozin on Cardiovascular Morbidity in Patients with Type 2 Diabetes.”

0%

“Empagliflozin, Cardiovascular Outcomes, and Mortality in Type 2 Diabetes.”

0%

Rates of Hallucination

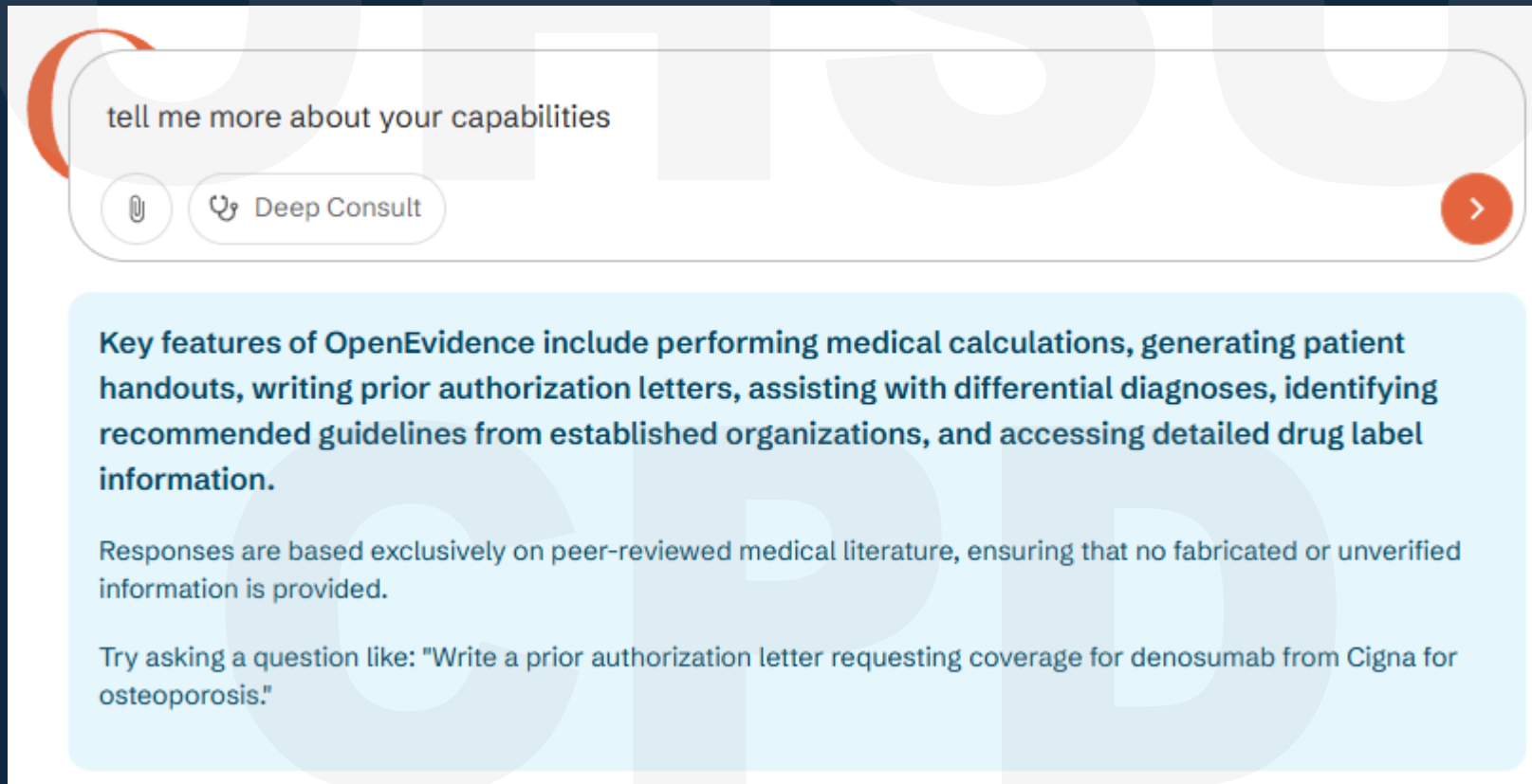
- Study: ask Chat-GPT to generate short lit reviews
 - Compare version 3.5 vs 4
 - 636 citations generated on 42 topics (84 total reviews)

	GPT-3.5	GPT-4
Percentage of cited works that are fabricated (and number of cited works, in parentheses)		
All works	55% (222)	18% (414)
Articles	73% (128)	18% (255)
Books	23% (78)	8% (126)
Chapters	70% (10)	70% (23)
Websites	50% (6)	10% (10)




What Data do These Models Train on?

- Most platforms do not fully disclose
- Information often includes the "full internet"
 - Message boards
 - Comments sections
 - Popular media
- Paywalls can be a barrier
 - Medical literature is often protected!
- Societal biases present in training data
 - Women
 - Minorities

Open Evidence – A Medical Oriented LLM



tell me more about your capabilities

  Deep Consult 

Key features of OpenEvidence include performing medical calculations, generating patient handouts, writing prior authorization letters, assisting with differential diagnoses, identifying recommended guidelines from established organizations, and accessing detailed drug label information.

Responses are based exclusively on peer-reviewed medical literature, ensuring that no fabricated or unverified information is provided.

Try asking a question like: "Write a prior authorization letter requesting coverage for denosumab from Cigna for osteoporosis."

Open Evidence – Positives and Negatives

- Positives

- Primarily trained on scholarly medical literature
- Offers citations for most questions
- Able to offer medically oriented services

- Negatives

- Does not have full access to all literature
- Not accessible at all workplaces
- Unclear if it will become monetized

Medical Legal Implications

- AI is not liable for decision making
- HIPAA still applies
 - Do not enter PHI into AI platforms unless you have an institutionally authorized platform
- Institutional Liabilities
 - Integration of AI platforms
 - Potential bias in allocation of care

Addressing AI challenges

- View AI as an assistant, not an equal
 - Your clinical judgment matters
 - Tech can be wrong
- Use AI tools sparingly, with specific goals in mind
- Understand the limitations of the tool you use
- Follow institutional guidance and medical laws

Back to Our First Case

Bottom line (clinician takeaway)

- Recent STEMI = no SCUBA diving
- Reconsider ≥ 6 months post-MI only if:
 - Asymptomatic
 - Preserved EF
 - High exercise capacity without ischemia
 - Stable rhythm
 - Off DAPT
- Clearance should be explicit, documented, and conservative

My Next Steps

- More specific information on exercise capacity
- Understanding the risks of DAPT
- Confirming veracity of information

Prompt:

can you find sources about the exact metabolic equivalents required to clear a patient on a stress test for scuba, and additionally a citation about the risk of dapt with scuba?

Response:

1) Metabolic Equivalents (METs) and SCUBA Clearance

Minimum METs & Exercise Capacity

A) RECOMMENDED MINIMUM EXERCISE CAPACITY

- Recreational SCUBA divers **should be able to maintain a minimum of about 6 METs** of continuous activity to be considered functionally fit for diving. PMC
- Achieving a higher peak aerobic capacity (~12–13 METs) without symptoms, ischemia, or arrhythmias is viewed by many dive medicine experts as **reassuring and indicative of good cardiovascular reserve**, though it's not universally mandated. PMC

Response:

2) Dual Antiplatelet Therapy (DAPT) and Diving Risk

SPUMS & Diving Medicine Guidance

- The **South Pacific Underwater Medicine Society (SPUMS)**—one of the commonly referenced clinical frameworks for diving medical risk—notes that **many cardiologists and diving physicians *would not allow diving while on dual antiplatelet therapy*** due to concerns about bleeding risk and the physiologic stresses of diving. PMC

Case 2 - Introduction

- Rare diseases afflict up to 1-in-10 Americans
- Average time to diagnosis is 6 years
- Challenges
 - Putting together disparate data
 - Recall/knowledge of disorders
 - Multi-organ involvement

Case 2 - Presentation

- 27 YOF presents after OOH VF cardiac arrest
 - Bystander CPR -> Defibrillation with EMS
 - Echo shows severe biventricular HF
 - Treatment for cardiogenic shock initiated
 - Cardiac cath, history, cardiomyopathy gene testing unrevealing
- Unable to transplant due to embolic CVA
- Discharged on inotrope with plan for repeat transplant evaluation
- PMHx:
 - Hypothalamic hypogonadism as teenager
 - Mild LFT elevation at that time, otherwise specialist workup unrevealing of etiology

Case 2 – Can AI Help with Diagnosing Etiology?

I have a 27 year old female in my ICU in cardiogenic shock from biventricular systolic heart failure. She has a history of hypothalamic hypogonadism without a clear etiology diagnosed, despite meeting a pediatric endocrinologist. At that time, she had mildly elevated LFTs. What could be the etiology of her heart failure?

1. Hereditary Hemochromatosis (including non-HFE variants) ★★★★★

Why it fits extremely well

- Hypogonadotropic hypogonadism → classic from iron deposition in the hypothalamus/pituitary
- Elevated LFTs → hepatic iron overload
- Dilated or restrictive cardiomyopathy → iron deposition in myocardium
- Can present young in non-HFE mutations (e.g., juvenile hemochromatosis)

Clues

- Amenorrhea or delayed puberty
- Diabetes or skin hyperpigmentation (may be absent)
- Cardiomyopathy can progress rapidly → cardiogenic shock

2. Wilson Disease ★★★★★

3. Mitochondrial Disease ★★★★★

Case 2 - Follow up

- Labs demonstrated:
 - A1c – 6.1 %
 - Ferritin – approximately 15,000 ng/mL
- Liver biopsy
 - Severe fibrosis without cirrhosis
- Therapeutics
 - Iron chelation
 - Transplantation 6 months later

Optimizing AI Use – The Prompt Matters

- Persona-based Prompting: "Act as a nurse instructing a patient with low health literacy..."
- Break down the steps: "first, summarize the history. Second, give a differential. Third, rank the likelihood of diagnosis"
- Offer examples, if able: "Here is a copy of the formatting I like for these instructions"
- Give guidance: "Do not use medical jargon"
- Be specific and detailed in the prompt

Examples of Specific Prompts

Simple Prompt	Optimized Prompt
"What is the treatment for hypertension?"	"Summarize the 2024 JNC 8 guidelines for managing hypertension in a 75-year-old African American male with Stage 3 CKD. "
"Write a letter to insurance."	"Write a Prior Authorization appeal letter for Ozempic. Reference the attached clinic note proving the patient has failed Metformin and Sulfonylureas. Use a firm, professional tone. "

Case 3 – AI for Patient Communication

- Mr. M is a 58 YOM with ischemic cardiomyopathy
 - CABG x3 2 years ago
 - LVEF recovery from 30% to 45% post-operatively
 - Struggling to take medications consistently
 - Asks for instructions on meds

- AI can be useful to provide easy instructions for patients!

Case 3 – Prompt

My patient is a 58 year old male with a history of ischemic cardiomyopathy who underwent coronary artery bypass grafting approximately 2 years ago, and has a residual left ventricular ejection fraction of 45%, which is improved from a low of 30% prior to surgery. He is struggling with his medications. Can you generate instructions and a table for medication administration to help him keep track? He takes sacubitril-valsartan 49-51 mg BID, carvedilol 12.5 mg BID, empagliflozin 10 mg daily, spironolactone 25 mg daily, atorvastatin 80 mg, aspirin 81 mg daily, metformin 500 mg BID, and escitalopram 10 mg daily.

Your Daily Medications

This guide will help you understand your medications as prescribed by your doctor to protect your heart and improve your quality of life.

MORNING MEDICATIONS (Take with breakfast):

1. **Sacubitril-valsartan (Entresto) 49-51 mg - 1 tablet**
2. **Carvedilol 12.5 mg - 1 tablet**
3. **Empagliflozin (Jardiance) 10 mg - 1 tablet**
4. **Spirolactone 25 mg - 1 tablet**
5. **Atorvastatin (Lipitor) 80 mg - 1 tablet**
6. **Aspirin 81 mg - 1 tablet**
7. **Metformin 500 mg - 1 tablet**
8. **Escitalopram (Lexapro) 10 mg - 1 tablet**

EVENING MEDICATIONS (Take with dinner):

1. **Sacubitril-valsartan (Entresto) 49-51 mg - 1 tablet**
2. **Carvedilol 12.5 mg - 1 tablet**
3. **Metformin 500 mg - 1 tablet**

Take all of these medications together to protect your heart and improve your quality of life.

General Guidelines:

- Take your medications at the same times each day to help you remember
- You can take most of these medications with or without food, but taking them with meals may help prevent stomach upset

Spirolactone: This is a "water pill" that also protects your heart. Your doctor will check your potassium levels regularly while you're on this medication.

What to Watch For

Contact your doctor if you experience:

- Dizziness or lightheadedness when standing up
- Unusual fatigue or weakness
- Swelling in your legs or ankles
- Shortness of breath

Other Considerations – AI and Society

- Energy and water cost
- Effects on education
- Human labor replacement

AI Data Centers Are Sending Power Bills Soaring

Wholesale electricity costs as much as 267% more than it did five years ago in areas near data centers. That's being passed on to customers.

Their Water Taps Ran Dry When Meta Built Next Door

In the race to develop artificial intelligence, tech giants are building data centers that guzzle up water. That has led to problems for people who live nearby.

TECH

MIT study finds AI can already replace 11.7% of U.S. workforce

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Poll 5: Today, during/after this talk...

- A. I learned something new about AI
- B. I feel more comfortable about the role of AI in medical practice
- C. I plan on using AI in the near future for patient care
- D. Multiple/all of the above
- E. None of the above

Today, during/after this talk...

I learned something new about AI

0%

I feel more comfortable about the role of AI in medical practice

0%

I plan on using AI in the near future for patient care

0%

Multiple/all of the above

0%

None of the above

0%

Conclusions

- AI – technology performing human cognitive tasks
- View AI as an assistant, not a replacement
 - Trust your clinical judgment
- Review information carefully and check the work
- Be mindful institutional and legal guidance
- When used well, AI can improve patient care and clinician efficiency