

BRIDGING THE DIGITAL DIVIDE IN ONCOLOGY: CLOUD TO BENCH TO BEDSIDE TO COMMUNITY

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Professor

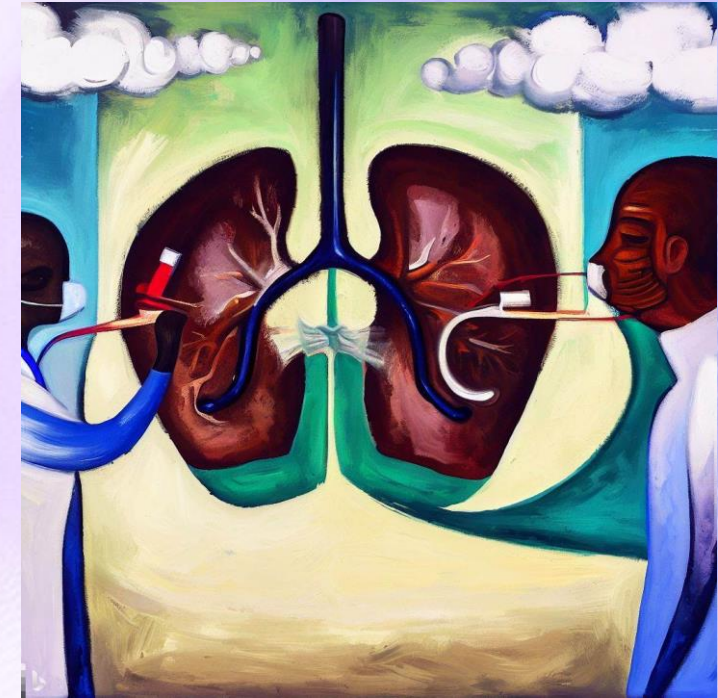
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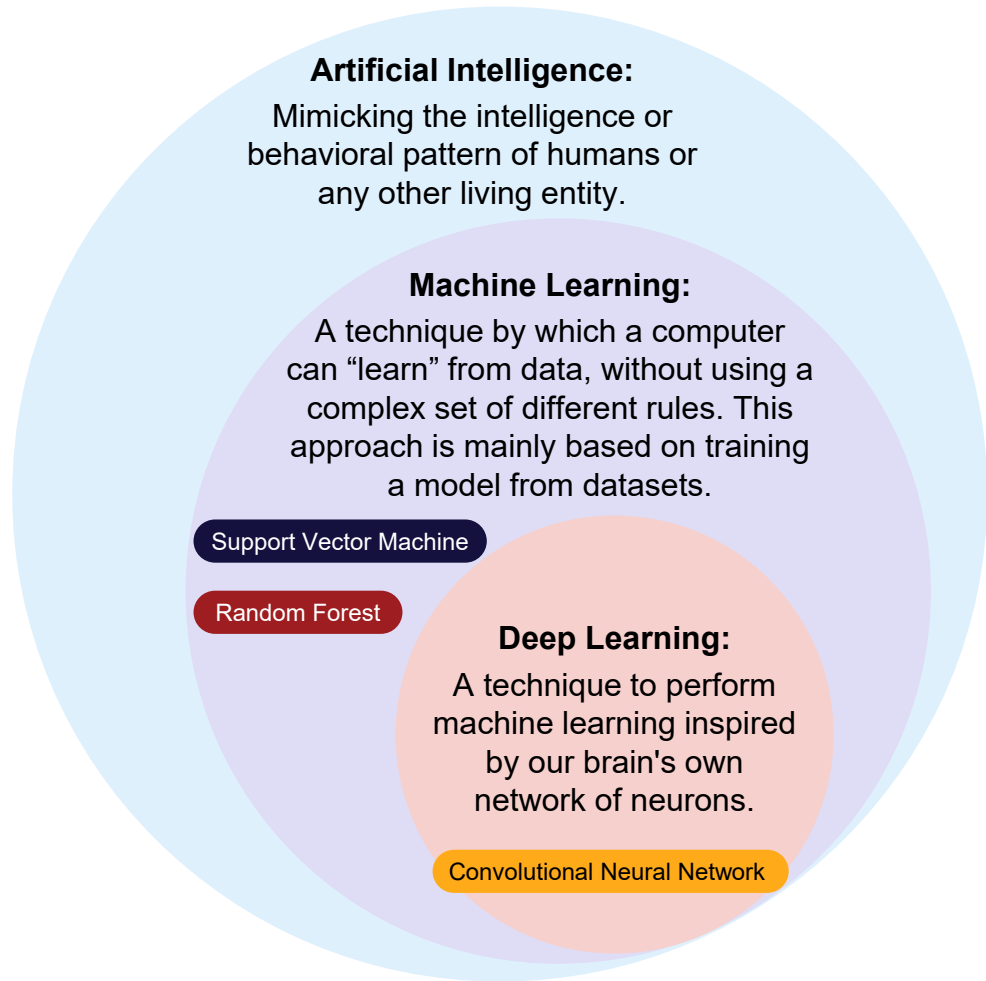
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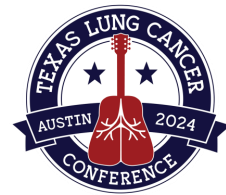


Cloud: The Alphabet Soup of AI, ML, DL



Alan Turing, 1928

Zhao, Krauze. Gliomas 2021



Bedside: UCSD Study on “Webside Manner”: ChatGPT for Epic Messages

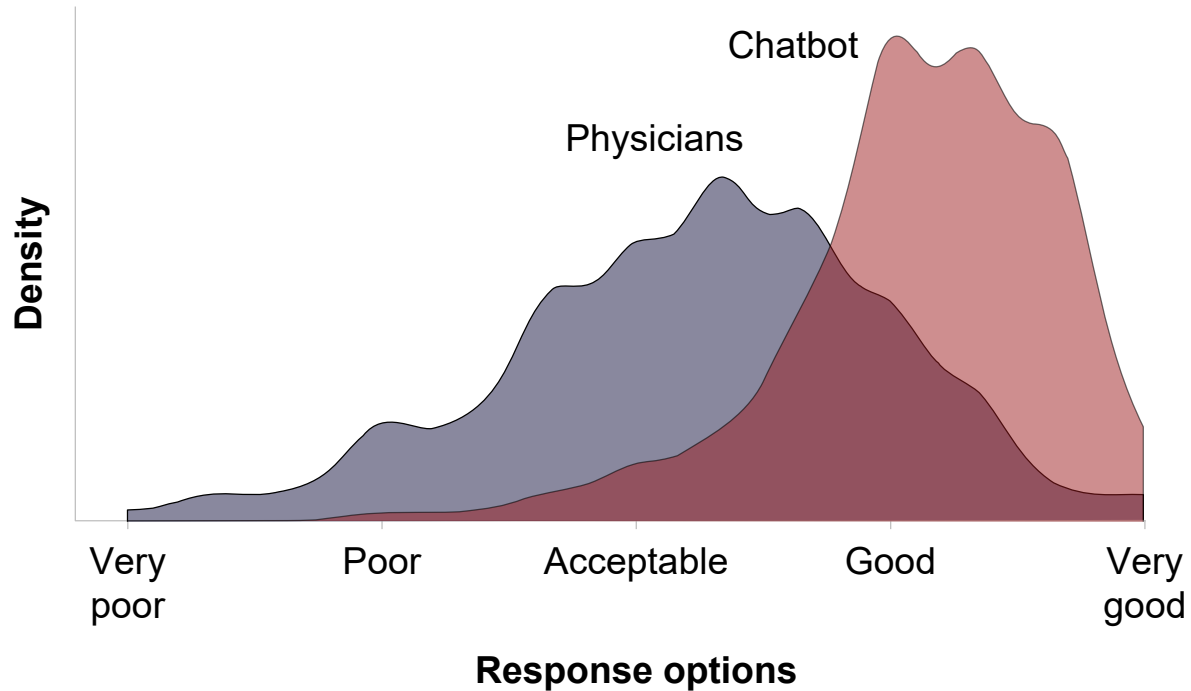


Ayers JAMA IM 2023

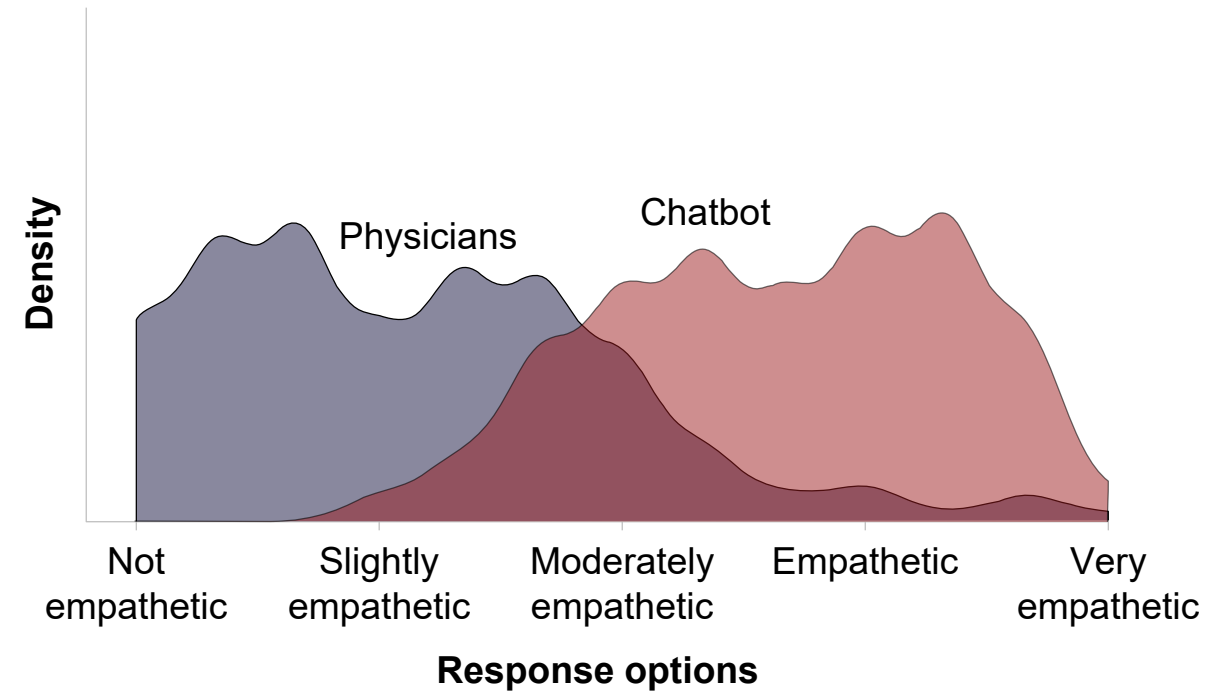
Bedside: Comparing Physician and Artificial Intelligence Chatbot Responses to Patient Questions Posted to a Public Social Media Forum



A. Quality ratings



B. Empathy ratings



Distribution of Average Quality and Empathy Ratings for Chatbot and Physician Responses to Patient Questions Kernel density plots are shown for the average across 3 independent licensed health care professional evaluators using principles of crowd evaluation. A, The overall quality metric is shown. B, The overall empathy metric is shown.



Ayers JAMA Intern Med. 2023;183(6):589-596. doi:10.1001/jamainternmed.2023.1838

How to keep patients safe on IO: EMR Alerts, Wallet Cards



Patient Safety Item (1 Advisory)

PATIENT HAS RECEIVED IMMUNE-BASED THERAPY

This patient has had an active order for an immune-based therapy in the past 12 weeks.

The toxicity from these medications may be subtle and in some cases ***life-threatening***. Diarrhea, rash, fatigue, cough can be signs of a more serious autoimmune reaction while on treatment.

The treating medical oncologist or on-call oncologist should be contacted to discuss potential steroid therapy in the setting of autoimmune side effects.

Please click here for more information on the proper work-up and screening of these patients:

Patient has received ***cellular therapy in the last 6 months** Administration of corticosteroids is **STRONGLY discouraged**

Up to 25% of patients receiving CAR T-cells may experience life-threatening ***cytokine release syndrome (sCRS)***, which manifests as fever, malaise, fatigue, anorexia, myalgia, arthralgia, nausea, vomiting, and/or headaches.

More severe manifestations include azotemia, hypofibrinogenemia with or without bleeding, transaminitis/hyperbilirubinemia, tachycardia, hypotension, and increased, followed by decreased, cardiac output

If you suspect sCRS, contact the patient's primary oncologist or inpatient BMT attending.

Click here for NCCN guidelines for treatment of sCRS:

--Placeholder for link--

***Cellular therapy = chimeric antigen receptor (CAR) T-cells, tumor-infiltrating lymphocytes (TILS), natural killer (NK) cells, or blinatumomab (BLINCYTO).**

IMMUNOTHERAPY WALLET CARD

NAME: _____

CANCER DX: _____

I-O AGENTS RCVD: CHECKPOINT INHIBITOR(S)

CAR-T VACCINES ONCOLYTIC VIRAL THERAPY MONOCLONAL ANTIBODIES

DRUG NAME(S): _____

IMMUNOTHERAPY TX START DATE: _____

OTHER CANCER MEDICATIONS: _____

NOTE: IMMUNOTHERAPY AGENTS ARE **NOT** CHEMOTHERAPY AND SIDE EFFECTS MUST BE MANAGED DIFFERENTLY. (SEE BACK)



IMMUNOTHERAPY CARD

IMMUNE-MEDIATED SIDE EFFECTS*, COMMON WITH CHECKPOINT INHIBITORS VARY IN SEVERITY AND MAY REQUIRE REFERRAL AND STEROIDS. PATIENTS HAVE A LIFETIME RISK OF IMMUNE-RELATED SIDE EFFECTS.

**MAY PRESENT AS RASH, DIARRHEA, ABDOMINAL PAIN, COUGH, FATIGUE, HEADACHES, VISION CHANGES, ETC. – CONFER WITH ONCOLOGY TEAM BEFORE CHANGING I-O REGIMEN OR STARTING SIDE EFFECT TREATMENT*

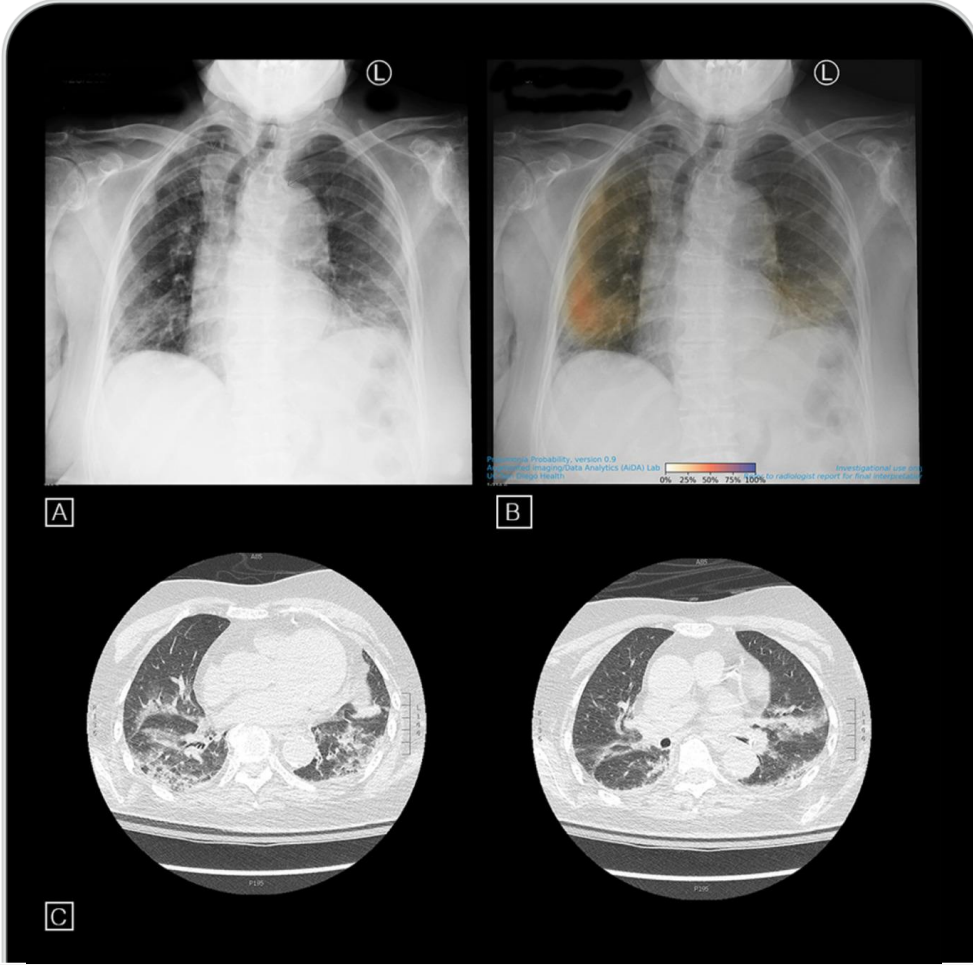
ONCOLOGY PROVIDER NAME: _____

ONCOLOGY PROVIDER NO: _____

EMERGENCY CONTACT: _____

CONTACT PHONE NO: _____

UCSD Deployment of artificial intelligence for radiographic diagnosis of COVID-19 pneumonia in the ER

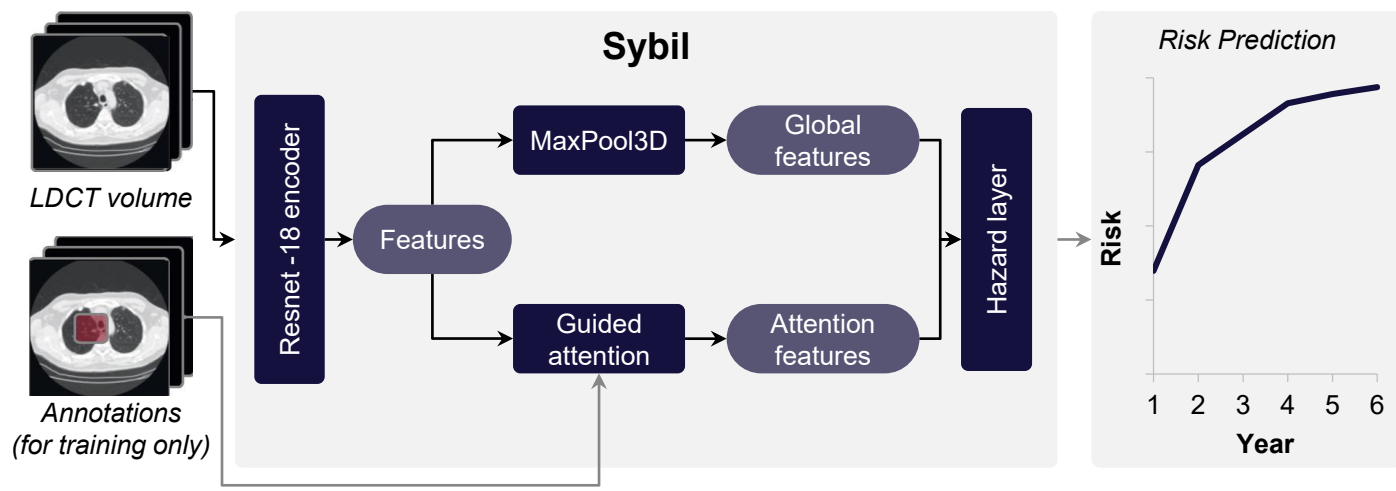


	Question 1: The AI-augmented overlay was easy to use in my existing workflow				
	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Overall cohort (n = 202)	150 (74%)	28 (14%)	15 (7%)	1 (0%)	8 (4%)
Resident cohort (n = 70)	61 (87%)	6 (9%)	3 (4%)	0 (0%)	0 (0%)
Attending cohort (n = 132)	89 (67%)	22 (17%)	12 (9%)	1 (1%)	8 (6%)

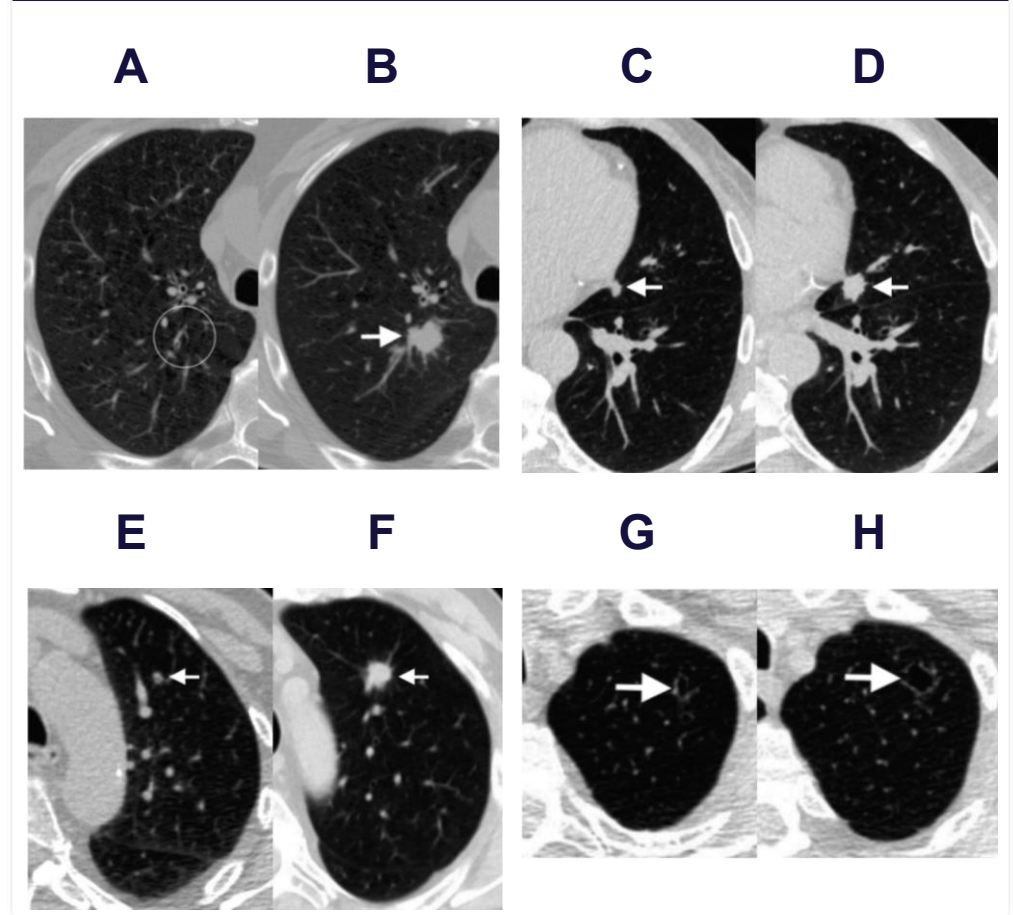
	Question 2: Did the AI-augmented overlay contribute to your medical decision making?	
	Yes	No
Overall cohort (n = 202)	41 (20%)	161 (80%)
Resident cohort (n = 70)	18 (26%)	52 (74%)
Attending cohort (n = 132)	23 (17%)	109 (83%)

Carlile et al. JACEP Open 2020

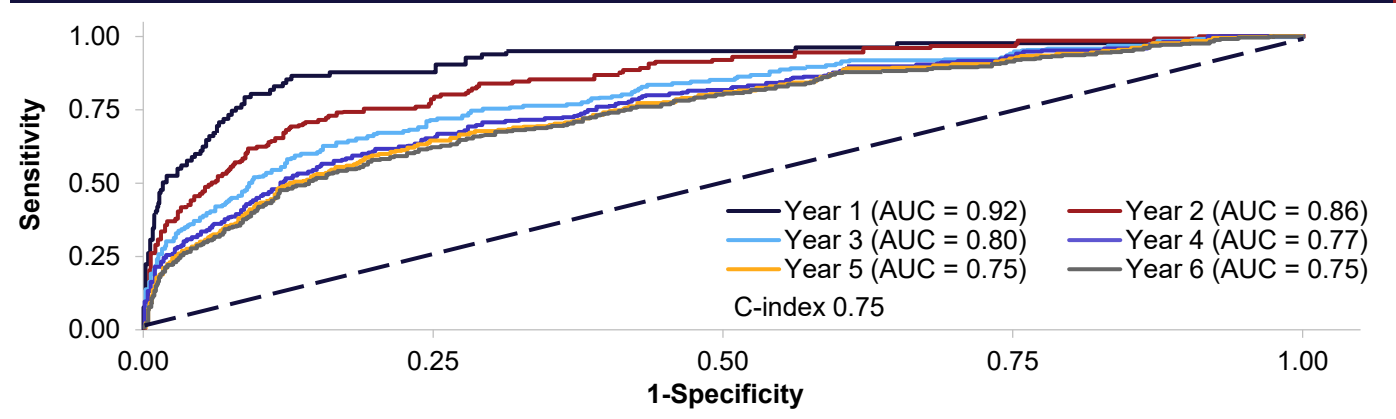
AI-Assisted LDCT for Lung Cancer Screening



Clinically negative, but Sybil (MGH)+

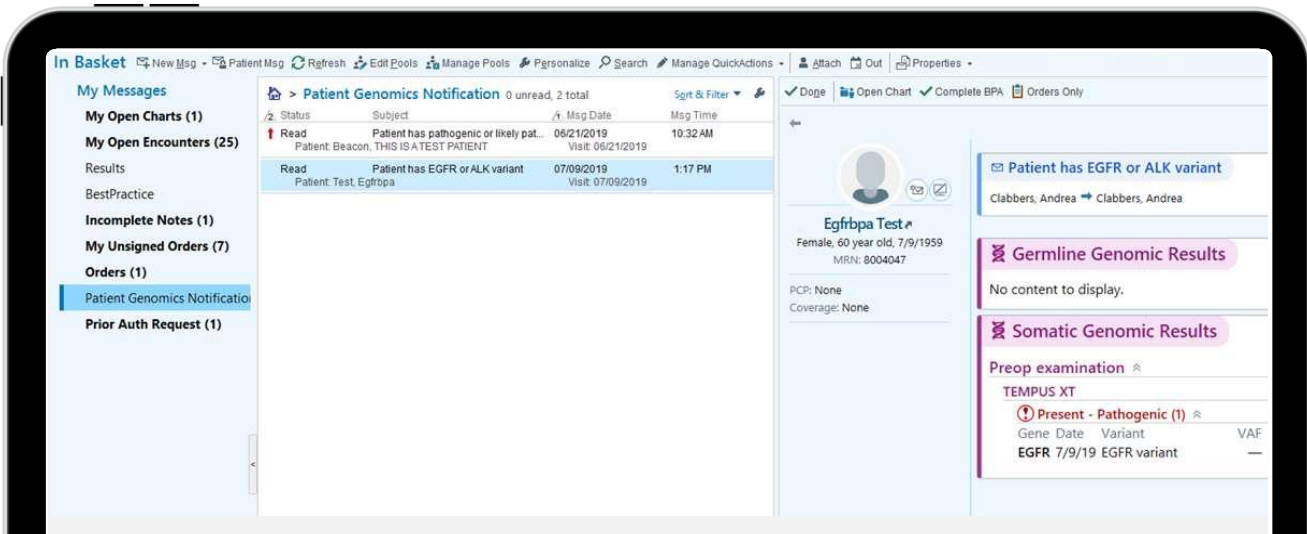


A. NLST

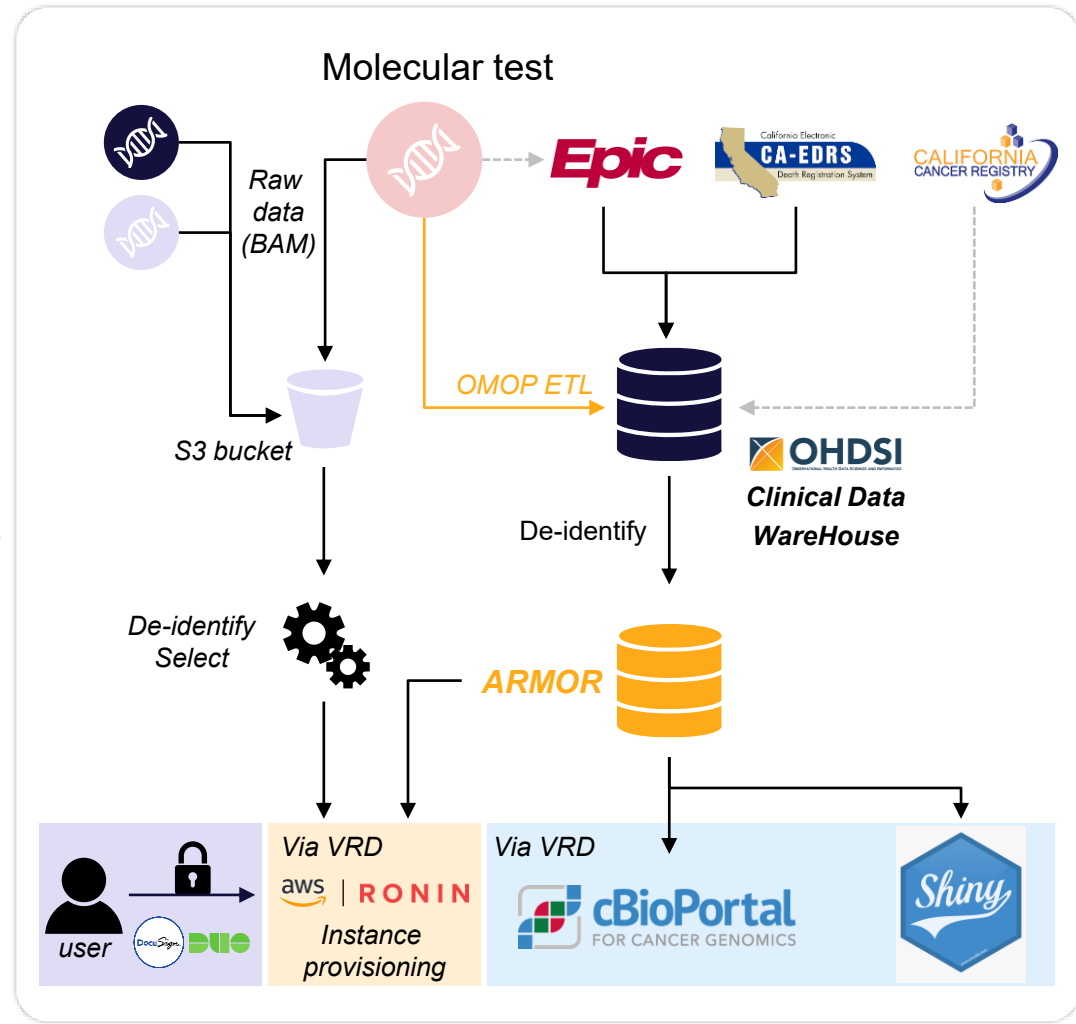


Mikhael et al. JCO 2023

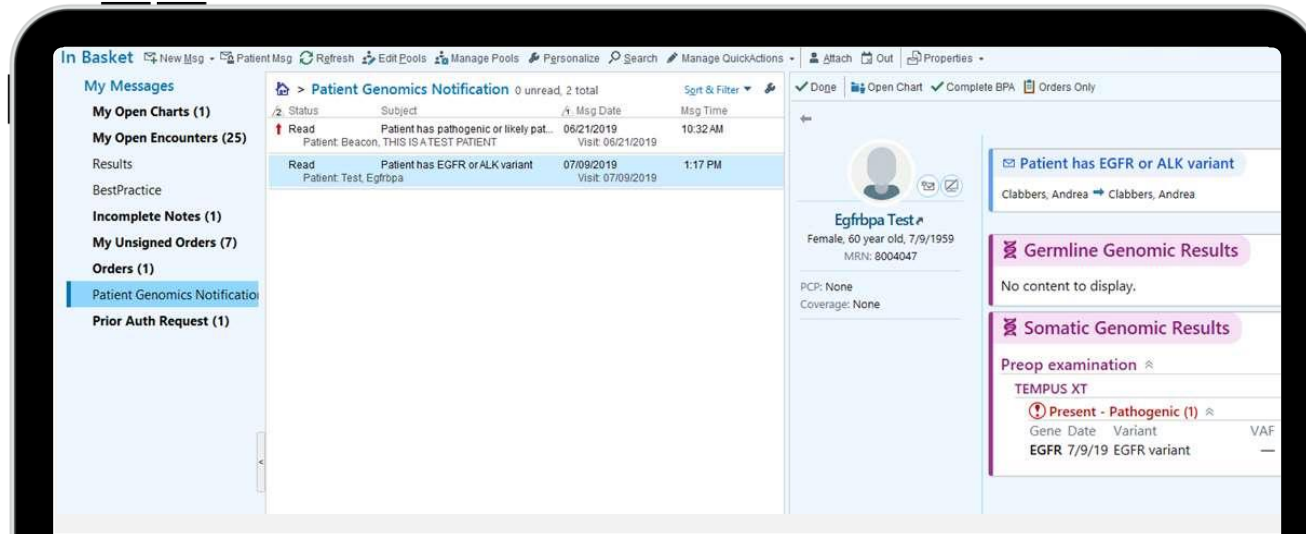
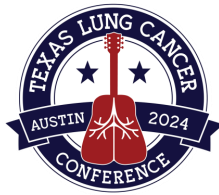
A path forward: Having the EMR work for you



- Discrete genomics allows for triggering of EMR alerts
- Screening for molecularly-guided clinical trials
 - Pharmacogenomics for toxicity
- Parallel raw data allows for translational research
- University of California system-wide molecular database
 - Pan-UC



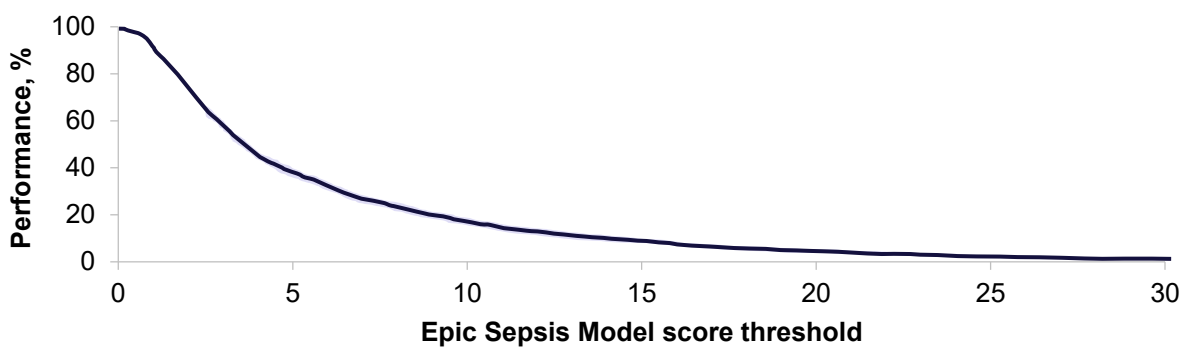
Genomics, Clinical Trials, and AI-assisted matching



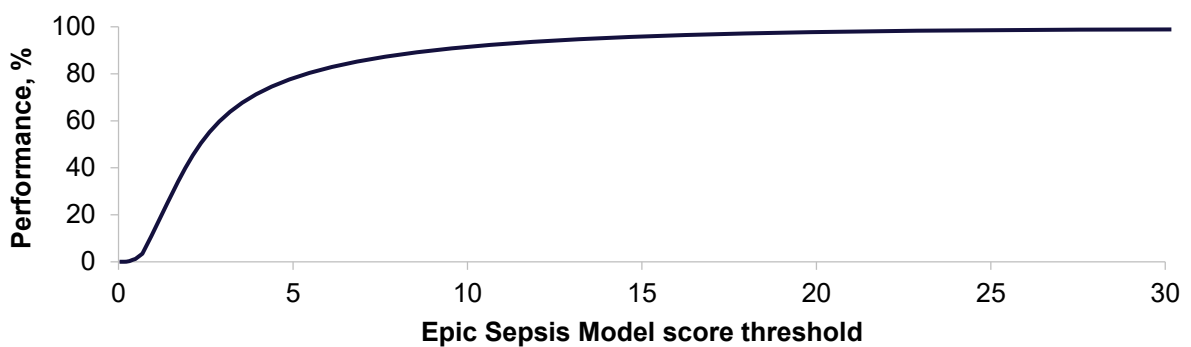


Widely deployed EMR Sepsis Algorithm Real World Performance

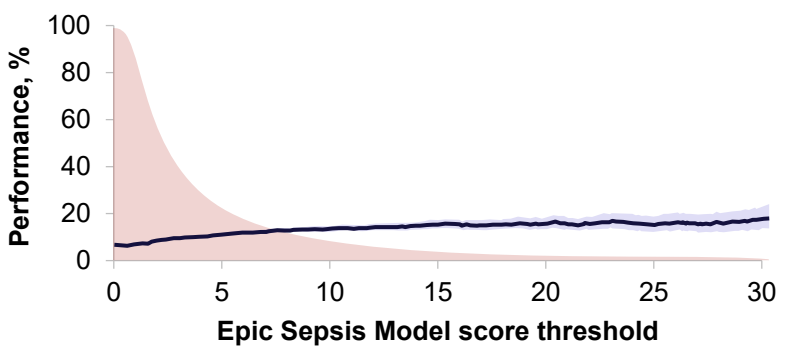
Sensitivity



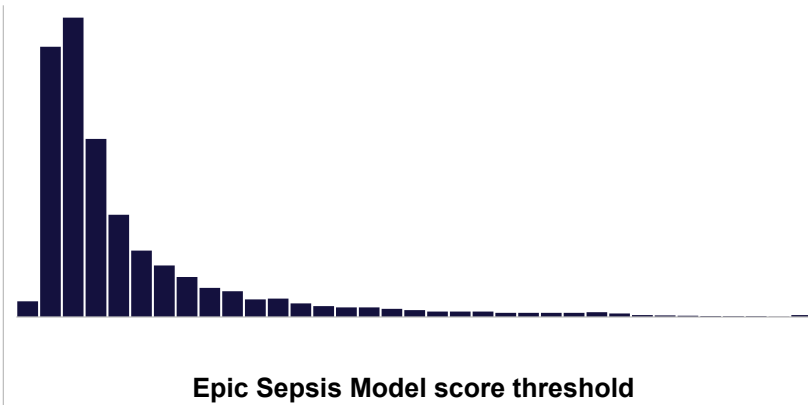
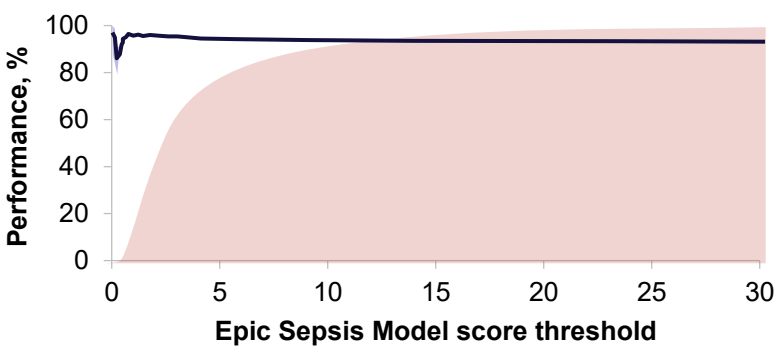
Specificity



PPV



NPV



...it identifies only 7% of patients with sepsis who were missed by a clinician (based on timely administration of antibiotics), highlighting the low sensitivity of the ESM in comparison with contemporary clinical practice.

The ESM also did not identify 67% of patients with sepsis despite generating alerts on 18% of all hospitalized patients, thus creating a large burden of alert fatigue.

Wong et al. JAMA Intern Med. 2021

Husky vs Wolf Image Classifier

(a) Husky classified as wolf



(b) Explanation



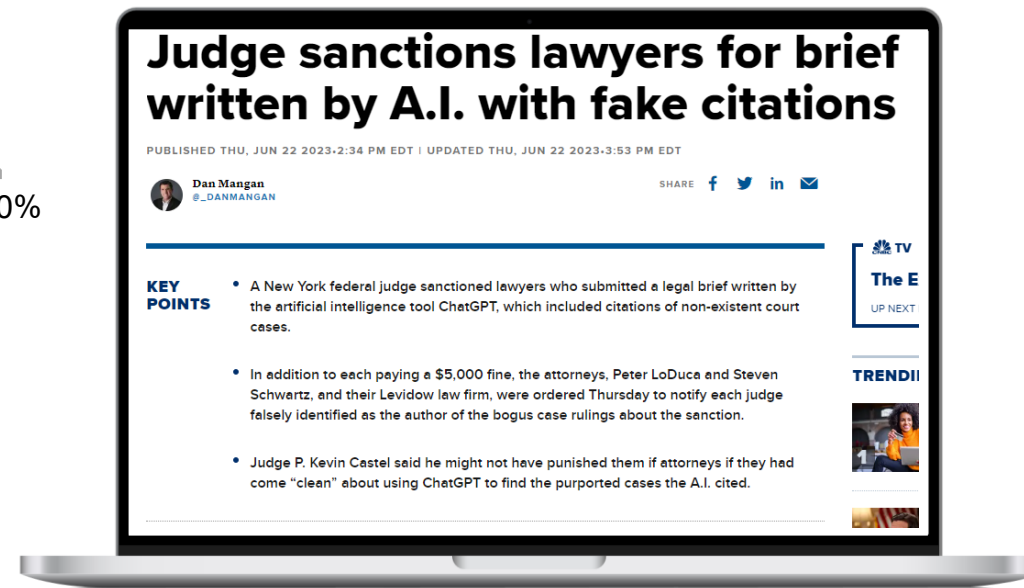
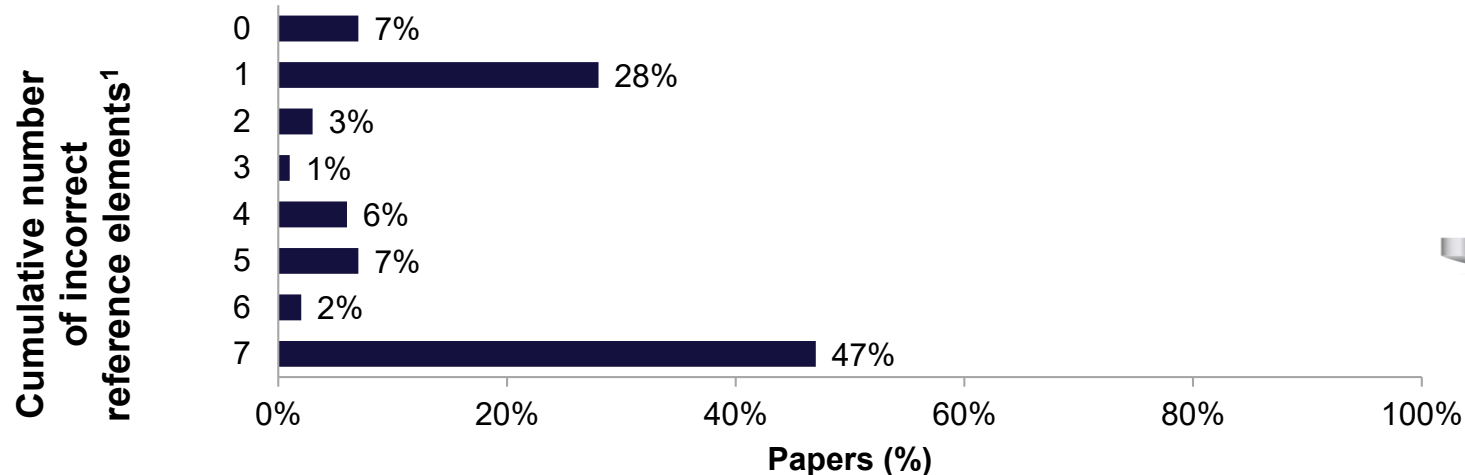
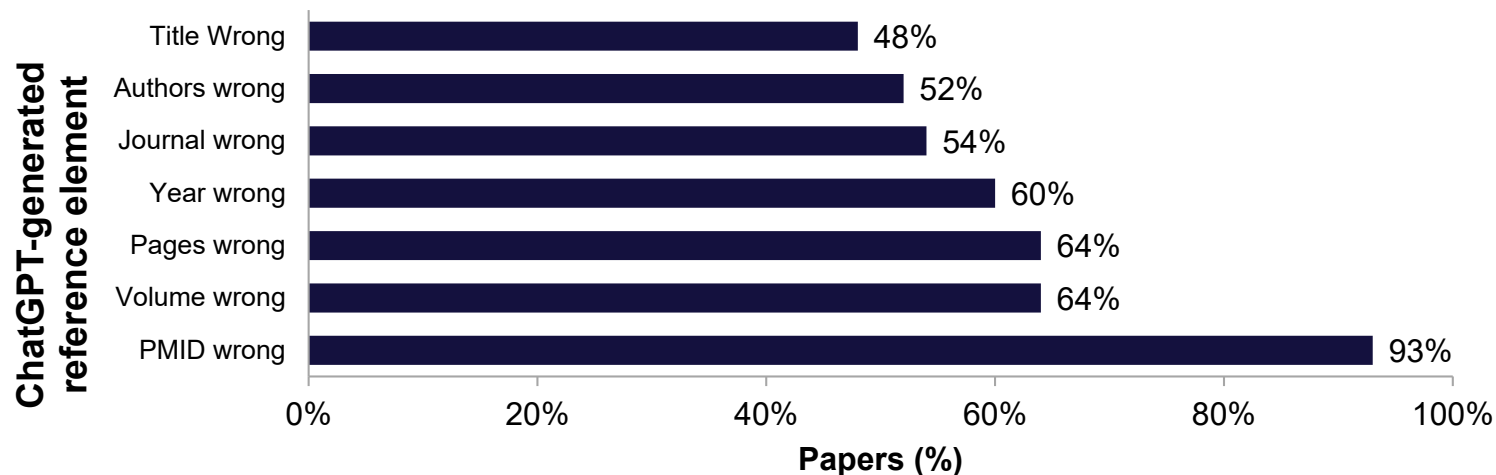
Figure 11: Raw data and explanation of a bad model’s prediction in the “Husky vs Wolf” task.

Overtrain model:
Snow + Mountain = Wolf

	Before	After
Trusted the bad model	10 out of 27	3 out of 27
Snow as a potential feature	12 out of 27	25 out of 27

Table 2: “Husky vs Wolf” experiment results

Epistemology, Metacognition, and Fake Citations

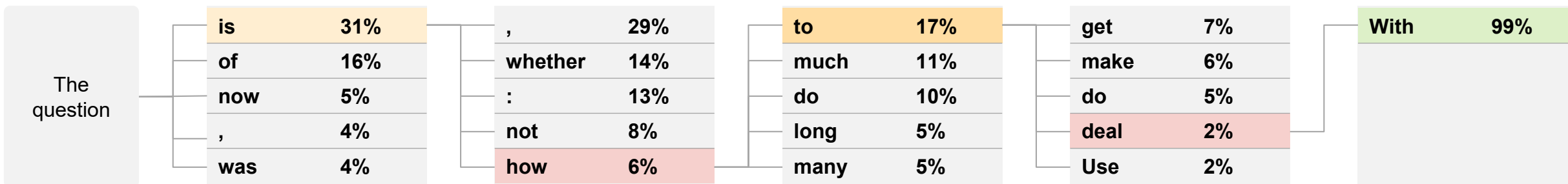


1. Bhattacharyya Cureus 2023



Language Modeling Errors

The question is how to deal with the issue



How many feet fit in a shoe ?

Shoe usually holds two feet, but it depends on the shoe. Some shoes hold up to four feet.

A ▶

How = 12.38%

A = 5.04%

The = 3.68%

What = 3.40%

I = 2.96%

One = 2.14%

There = 2.09%

If = 1.85%

It = 1.65%

This = 1.42%

Answer the question

Question: How many feet fit in a shoe ?

One = 8.76%

A = 6.26%

Dep = 4.62%

The = 4.17%

It = 3.24%

Two = 2.85%

If = 2.72%

I = 2.50%

None = 2.07%

10 = 1.93%

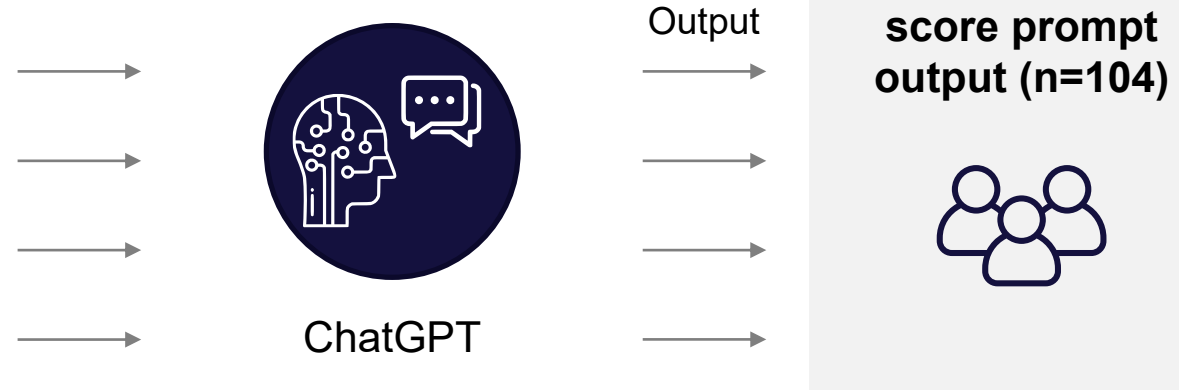
Answer: **One** ▶

LLM Only Concordant with NCCN Guidelines Only 1/3 The Time

Set of prompts for a given diagnosis description:

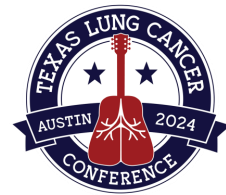
1. What is the treatment for stage I breast Cancer?
2. What is a recommended treatment for stage I breast cancer according to NCCN?
3. What is a recommended treatment for Stage I breast cancer?
4. How do you treat Stage I breast cancer?

× 26 diagnosis descriptions:
Cancer type ± extents of disease



“All outputs with a recommendation included at least 1 NCCN-concordant treatment, but 35 of 102 (34.3%) of these outputs also recommended 1 or more nonconcordant treatments.

Responses were hallucinated (ie, were not part of any recommended treatment) in 13 of 104 (12.5%) outputs. Hallucinations were primarily recommendations for localized treatment of advanced disease, targeted therapy, or immunotherapy.”



AI Hallucinations: The Drunk Model



What is the best cancer treatment for a metastatic lung cancer patient with an EGFR exon 19 deletion and PD-L1 score 90%

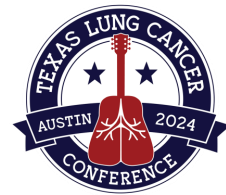


Regenerate draft  

The best cancer treatment for a metastatic lung cancer patient with an EGFR exon 19 deletion and PD-L1 score 90% is a combination of an EGFR-tyrosine kinase inhibitor (TKI) and an immune checkpoint inhibitor (ICI).

The EGFR-TKI will target the specific EGFR mutation in the patient's tumor cells, while the ICI will help the patient's immune system to attack and kill the tumor cells.

There are a few different combinations of EGFR-TKIs and ICIs that can be used for this patient population. One option is to use Osimertinib, an EGFR-TKI that is specifically designed to target EGFR exon 19 deletions, in combination with pembrolizumab, an ICI. This combination has been shown to be effective in clinical trials, with a median progression-free survival (PFS) of 18.9 months.



Summary

Artificial intelligence is a tool that can augment human intelligence

- Current “AI” systems are large language models – statistical language autocomplete

Hallucinations and errors with AI are common enough to preclude unsupervised use

Potential for AI to augment medical tasks

- Image detection
- Biomarker discovery and pathologic diagnosis
- Clinical support
- Clinical research support

AI-assisted prompting for human confirmation and execution most likely paradigm

Best is yet to come, but cannot let hype overtake reality

Questions?



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