

**Artificial Intelligence and Family
Medicine**
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EXPLORE
 HEALTHCARE SUMMIT

Disclosures and Learning Objectives

- I have no financial disclosures
- Learning objective 1: Understand basic AI techniques and terminology
- Learning objective 2: review applications of AI in medicine that are commercially available
- Learning objective 3: describe high level goals of future AI technologies in medicine and particularly primary care

Outline

- Introduction to AI
- Review of currently available tools
- Potential problems and bias
- Future of AI

Introduction to Artificial Intelligence

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Some basic terminology

AI: Artificial intelligence

- "The science and art of making intelligent machines" - John McCarthy
- "A branch of computer science that uses algorithms, data, and computational power to enable machines to perform tasks that normally require human intelligence" - ChatGPT

ML: Machine Learning

- Computer systems that are able to learn and adapt without following explicit instructions, by using algorithms and statistical models to analyze and draw inferences from patterns in data



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Some basic terminology

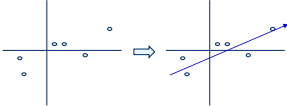
- NLP: Natural language processing
 - Subfield of AI specifically related to processing of spoken or written language
- LLM: Large language model
 - An algorithm for understanding, interpreting, and responding to human language built on an extremely large dataset
- GPT: Generative pre-trained Transformer
 - A type of LLM

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Okay but what is AI really?

- AI is just another form of automation
 - Data input → answer output
 - Data input → unsupervised tasks
- Never forget: garbage in = garbage out

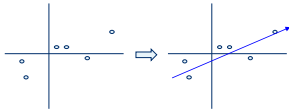
Is linear regression AI?



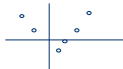
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Is linear regression AI?

- Takes input as some set of points
- Gives output that "summarizes" the information



What if there is no linear cohesion?



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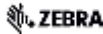
Currently available tools

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Image processing

- GE Quality care suite - image processing and "diagnostic tools"
- Siemens YSIO
- Zebra medical vision

- Long story short - the tech just isn't there yet for PCPs.
 - Diagnostic sensitivity, bias, liability



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Corporate and Administrative tools

- Automated patient message responses
 - actively undergoing clinical trials
- Large scale text processing
 - Anticipate clinical reviews to be incorporating AI



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The real deal: AI scribes

- Ultimate use case:
 - enable microphone
 - talk with patient
 - exit room with note and orders drafted
- DAX copilot from Dragon/Nuance
- DeepScribe partnering with EPIC
- Many others using "copy/paste"



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AI Scribes: Issues and considerations

- Are patient encounters stored?
- Who owns any recorded and transcribed data?
- Are any recordings subject to subpoena, or just the edited transcripts?
- Do you need to use informed consent?



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AI Scribes: The bottom line

- You should be paying attention to these technologies
- Represent most promising use of AI for primary care
- A note of caution: would you trust a radiologist who doesn't understand how a CT machine works?



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ChatGPT: what is it?

- Freely available website: chat.openai.com
- Generative Pretrained Transformer
 - generates text based on inputs
 - "trained" on ~500 GB of data
 - sequence-predicting chatbot
- Built on LLM, essentially a "very large" artificial neural network



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ChatGPT: what can it do?

- Take in small amount of text (the prompt)
- Produce excellent, well structured output

Small input: write a differential for an 83 year old patient with chest pain



ChatGPT: what can it do?

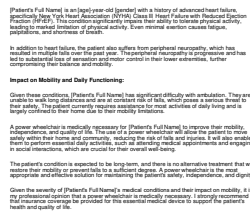
- Contextual power:
 - knowledge of entire conversation so far

"Okay, now rewrite the differential with the knowledge that the patient is a 50 year smoker and has a history of abdominal aortic aneurysm"



ChatGPT: some specific use cases

write a letter of medical necessity as if you were the primary care physician for a patient who needs a power wheelchair. They have a history of multiple falls due to peripheral neuropathy and nyha class 3 HFREF



ChatGPT: some specific use cases

write a letter appealing an insurance denial of a referral to MD anderson oncology. The patient has metastatic melanoma and is seeking a second opinion after initial consultation at Stephenson Cancer Center

I am writing to formally request the reconsideration of the patient referred to MD Anderson Cancer Center for a second opinion regarding the management of his metastatic melanoma.

Patient Background:
The patient is a 68-year-old male with a history of melanoma. He was diagnosed with metastatic melanoma in 2018. He has undergone two courses of immunotherapy (ipilimumab and nivolumab) with partial response. He is currently on surveillance. He is seeking a second opinion from MD Anderson Cancer Center for a second opinion on his treatment plan.

Request for Referral to MD Anderson Cancer Center:
MD Anderson Cancer Center is recognized as one of the premier oncology centers in the world. I am requesting a referral to MD Anderson for a second opinion on the management of the patient's metastatic melanoma. I believe that the expertise and resources of MD Anderson Cancer Center are critical for optimizing the treatment plan.

References: The patient has a confirmed to have additional metastatic melanoma which the patient's physician, a board-certified medical oncologist, has advised. There is a strong need for a second opinion at a center with extensive experience in complex melanoma cases.

Reference to a Second Opinion:
The patient is requesting a second opinion from MD Anderson Cancer Center. He is seeking a second opinion from MD Anderson Cancer Center regarding the management of his metastatic melanoma. A second opinion from MD Anderson Cancer Center will provide the patient with a second medical opinion and help him understand his options for further treatment.

Conclusion and Request for Reconsideration:
I respectfully request that you reconsider the denial of this patient. The patient is facing a life-threatening condition, and a second opinion from MD Anderson Cancer Center is critical for his long-term health. I am confident that a second opinion from MD Anderson Cancer Center will provide the patient with a second medical opinion and help him understand his options for further treatment.

Please feel free to contact me directly if you require further information or clarification regarding the patient's condition.

ChatGPT: some specific use cases

write a procedure note for a pap smear

Procedure Note: Pap Smear
Date of Examination: 08/15/2024
Patient Name: Jane Doe
Date of Birth: 01/15/1965
Physician: Dr. John Smith, MD
Location: Gynecology Clinic
Indication: Routine cervical cancer screening.
Procedure:
The patient was placed in the lithotomy position on the examination table. The genital area was cleaned and prepared aseptically. The external genitalia were examined and appeared normal. A bimanual examination was performed with the patient in the lithotomy position. The cervix was visualized and appeared normal. A speculum was used to collect cells from the ectocervix. A 5-mL vial of ThinPrep liquid-based cytology was used to collect the specimen. The cervix was inspected visually and appeared normal. The procedure was completed without difficulty or complications. No immediate concerns were noted. Final Pap cytology results will be discussed further management based on findings.

ChatGPT: other tasks

- "generate a handout of patient information for a new diagnosis of type II diabetes"
- "what are some ways a patient could reduce their cholesterol without medication?"
- "what are some topics that I should cover when making a presentation on AI in primary care?"
- "summarize this article for me"

ChatGPT: some words of caution

- Hallucination (or confabulation)
- No guarantee of real-time updates
- Patient data security
- Bias



Issues with AI

Liability and Ethics

- Diagnostic errors
- Deviation from standard of care
- Difficult to understand/extract AI rationale
- Is informed consent necessary?
- Should patients be able to opt out?



Ownership of data

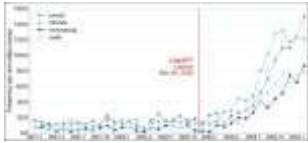
- Who owns patient data?
- Tremendous value of data of any kind
- Do you trust your institution (or EHR vendor) to safeguard any data being used?



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Bias: what is it?

- Algorithms are **very** dependent on their training dataset
- Bias = more likely to decide upon one outcome or diagnosis based on their *construction* rather than the clinical case
- Example: crackles on lung exam
- Example: "pivotal, intricate, showcasing, realm"



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Bias: A case study

Measuring the impact of AI in the diagnosis of hospitalized patients

Authors: Sarah Jabbour et al, JAMA. 2023

Goal: evaluate how clinicians perform when given an AI tool that is systematically biased

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Study Design

- Present clinicians with several clinical vignettes: patient with AHRF, labs, physical, and chest xray
- Then asked to differentiate between possible diagnosis: pneumonia, heart failure, or COPD
- Then clinicians were given several more vignettes along with AI-based interpretation of the xray



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Study Design: The ole bait and switch

- Some participants were randomized to get AI models which had some inherent bias
- Essentially, much more likely to predict heart failure than the other diagnoses based on training data (and other bias mechanisms)



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Study Design: The ole bait and switch...?

- Importantly, all clinicians were primed and told that some of the models **may have bias**
- Some were even given a display that showed what portions of the xray the AI model was using to base its prediction on



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Results

Setting	Average Marginal Effect
Clinician + Standard Model	2.9
Clinician + Standard Model + Explainable	4.4
Clinician + Systematically Biased Model	-11.3
Clinician + Systematically Biased Model + Explainable	-6.1
Clinician + Clinical Consult	8.1

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What to make of all this?

- Automation bias
 - People are more likely to trust information that is given to them
 - Essentially when given a tool, people need a reason to mistrust the output of that tool

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What to make of all this?

- I am not saying you should never trust any AI-based clinical tool
- Sometimes sensitivity is preferred in diagnostics
- Bias is present in many clinical situations, not just AI

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Future Directions and Other Miscellany

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Promising applications of AI

- Virtual therapists
- Genomic medicine
- Drug interaction and novel drug development
- Integration with wearables
- Population and resource management
- Institutional monitoring



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A note on in-house AI

- It's really hard to make an AI tool integrate into your EMR
- FDA approval is required
- The location of your data matters



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Other miscellaneous AI applications

- Image generation - DALLE
- Scientific inquiry - elicit.com
- Medical education
 - your students are already using ChatGPT
- Virtual reality-based trainings

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Final Thoughts

- You should use ChatGPT
- Be cautiously optimistic about AI scribing tech
- Be wary of any diagnostic support tools
- AI is here to stay.

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Thank you

Questions?
