

Unlocking the Power of NLP in Healthcare: The Promise and Perils of Large Language Models

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Outline

- Introduction to Natural Language Processing (NLP)
- Motivation
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- Risks of using LLMs in healthcare
- Case Study: Message Recommendation

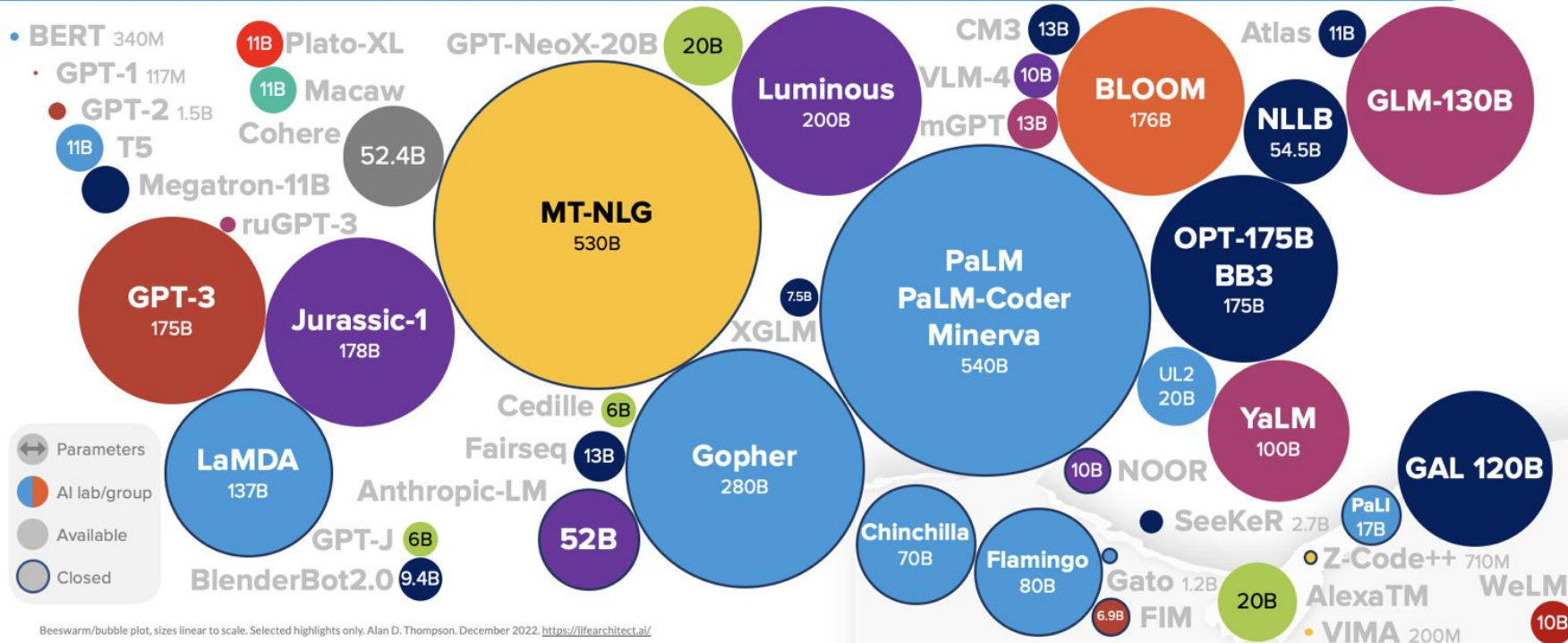


Introduction

- **NLP Overview:** Natural Language Processing (NLP) is the subfield of AI that enables computers to understand, interpret, and generate human language.
- **Large Language Models:** Large language models are advanced AI systems trained on vast amounts of text data, making them capable of understanding and generating human-like responses.



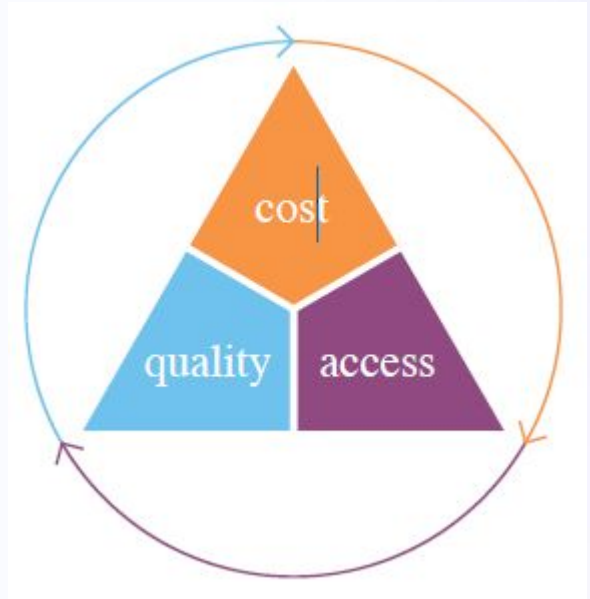
LANGUAGE MODEL SIZES TO DEC/2022





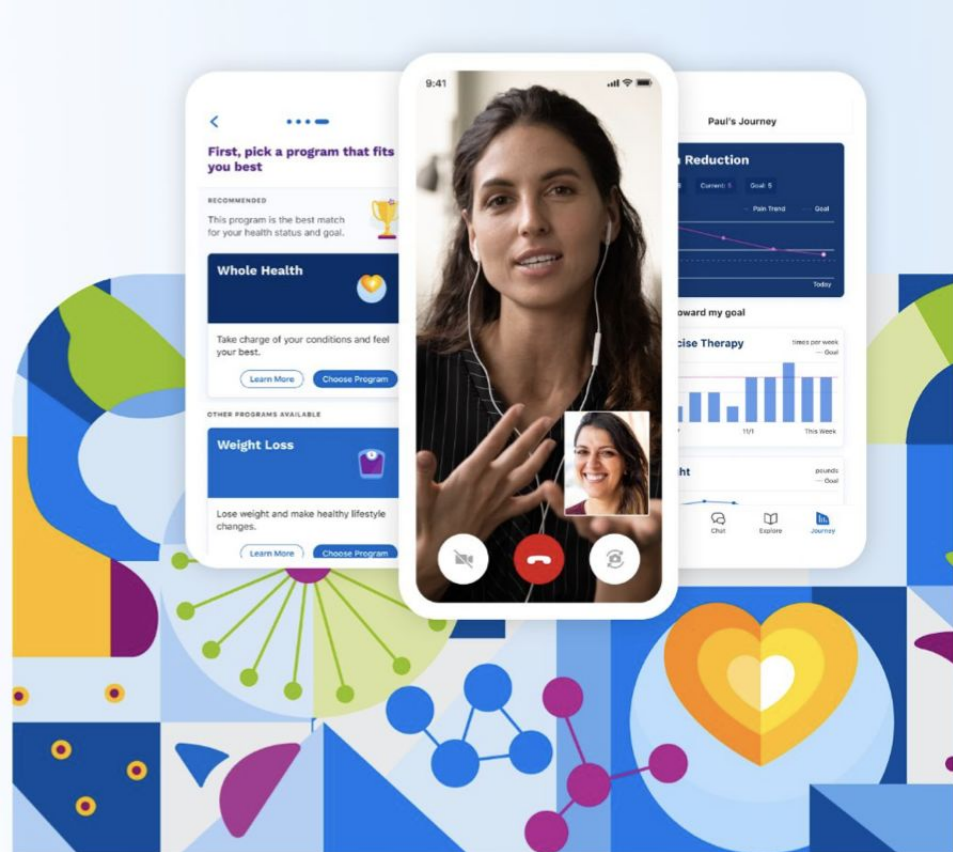
Access, Cost, and Quality in Healthcare - The Need for AI

- **Access to Healthcare:** Limited availability of healthcare services in certain areas and disparities in access to care create challenges for patients.
- **Healthcare Costs:** Rising costs in healthcare can hinder treatment affordability and strain medical resources.
- **Quality of Care:** Ensuring consistent, high-quality care across all patient populations is essential for optimal health outcomes.
- **Role of AI:** AI, including large language models, can help address these challenges by improving efficiency, reducing costs, and enhancing the quality of care.



Vida Health: A Leading Digital Health Company

- **Vida Health** is a digital health company focused on providing personalized care for a range of health conditions using cutting-edge technology.
- **AI Integration:** Vida Health leverages AI, including large language models, to enhance the effectiveness and efficiency of its services.





Applications of LLMs at Vida

- **Consult Documentation:** NLP streamlines the process of generating, summarizing, and managing clinical notes and records.
- **Message Recommendation and Automation:** NLP enables intelligent message recommendation and automates communication for healthcare professionals and members.
- **Resource Recommendation:** NLP can suggest relevant medical instructions or contents based on specific patient cases or clinical scenarios.
- **Clinical Decision Support System:** NLP enhances clinical decision-making by providing data-driven insights and recommendations for diagnosis and treatment plans.



Consult Documentation

- **Generating Clinical Notes:** NLP automates the creation of clinical notes, reducing manual documentation efforts for healthcare professionals.
- **Summarizing Records:** NLP efficiently condenses lengthy medical records into concise summaries, enabling quicker access to essential patient information.
- **Managing Documentation:** NLP streamlines the organization and retrieval of patient records, improving the overall efficiency of healthcare workflows.



Message Recommendation and Automation

- **Personalized Communication:** NLP enables tailored message recommendations based on patient needs and preferences, enhancing patient engagement.
- **Automated Responses:** NLP helps automate routine patient queries, allowing healthcare professionals to focus on more complex cases.
- **Triage Support:** NLP assists in prioritizing incoming messages by identifying urgent cases, ensuring timely attention and care.



Resource Recommendation

- **Relevant Articles:** NLP identifies pertinent medical articles or research papers based on specific clinical scenarios or patient cases.
- **Guideline Suggestions:** NLP recommends appropriate clinical guidelines or best practices to aid healthcare professionals in decision-making.
- **Patient Education:** NLP curates tailored educational materials to help patients better understand their health conditions and treatment options.



Clinical Decision Support

- **Diagnosis Assistance:** NLP aids healthcare professionals in making accurate diagnoses by providing data-driven insights based on patient information.
- **Treatment Recommendations:** NLP offers evidence-based treatment suggestions, optimizing patient care and outcomes.
- **Depression Detection:** NLP analyzes written or spoken communication to identify signs of depression in patients, enabling early intervention.
- **Anxiety Detection:** NLP detects indicators of anxiety in patient communication, allowing healthcare providers to offer appropriate support and resources.



Potential Risks of Using Large Language Models in Healthcare

- **Hallucinations:** LLMs may generate inaccurate or nonsensical information, leading to potential misinterpretation or misdiagnosis.
- **Amplification of Social Biases:** LLMs can unintentionally perpetuate and amplify biases present in the training data, affecting patient care and outcomes.
- **Deficiencies in Reasoning Abilities:** Despite their advanced capabilities, LLMs may exhibit limitations in logical reasoning, which could impact the reliability of their outputs in healthcare applications.



Hallucinations in Large Language Models

- **Definition:** Hallucinations refer to instances when an NLP model generates inaccurate or nonsensical information, often due to limitations in its understanding of context or content.
- **Impact on Healthcare:** Hallucinations can lead to potential misinterpretation or misdiagnosis, affecting patient care and outcomes.
- **Mitigation Strategies:** Employing human oversight, refining training data, and using techniques like selective prediction can help minimize the occurrence of hallucinations in large language models.



Amplification of Social Biases in Large Language Models

- **Definition:** Social biases in NLP models refer to the unintentional perpetuation and amplification of existing biases present in the training data.
- **Impact on Healthcare:** Amplification of social biases can lead to unfair treatment, misdiagnosis, or unequal access to care for certain patient populations.
- **Mitigation Strategies:** Identifying and addressing biases in training data, ensuring diverse representation, and implementing fairness-aware algorithms can help reduce the impact of social biases in large language models.



Deficiencies in Reasoning Abilities of Large Language Models

- **Definition:** Despite their advanced capabilities, NLP models may exhibit limitations in logical reasoning or understanding complex scenarios.
- **Impact on Healthcare:** Deficiencies in reasoning abilities can affect the reliability of model outputs, potentially leading to suboptimal clinical decisions or misdiagnoses.
- **Mitigation Strategies:** Continual model refinement, incorporating expert knowledge, and combining AI with human oversight can help overcome reasoning limitations in large language models.



Case Study: Automated Message Responses

- **Repetitive Patient Questions:** A majority of patient queries are repetitive, allowing LLMs to efficiently respond based on their extensive knowledge and training.
- **Efficient Communication:** LLMs can quickly and accurately provide answers to common questions, enhancing patient engagement and reducing the workload of healthcare professionals.
- **Avoiding Low-Confidence Responses:** For more complex or nuanced questions, LLMs should withhold low-confidence responses to avoid potential misinformation.
- **Human Involvement:** Low-confidence responses can be forwarded to healthcare providers for review and follow-up, ensuring patients receive accurate and reliable information.



Mitigating Hallucination with Selective Prediction

- **Selective Prediction:** An approach that measures a model's uncertainty and withholds answers when the model is not appropriately confident.
- **Reducing Hallucinations:** By using selective prediction, the likelihood of generating inaccurate or nonsensical information is minimized.
- **Enhancing Reliability:** Implementing selective prediction in large language models improves the trustworthiness and dependability of their outputs in healthcare applications.



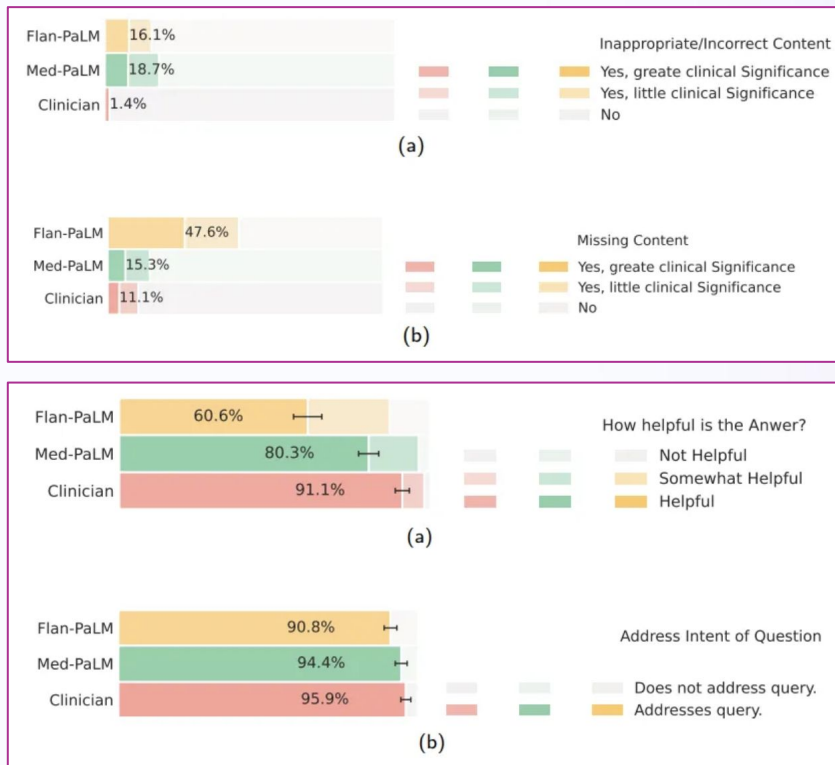
Mitigating Hallucination with Selective Prediction

- **Self-Consistency:** Evaluating the model's confidence by measuring the consistency of its outputs across multiple decodes.
- **Chain-of-Thought Prompting:** Encouraging the model to generate reasoning steps in addition to its final answer, providing a better understanding of the model's thought process.
- **Confidence Threshold:** Establishing a confidence threshold to determine when the model should withhold its answer due to insufficient confidence.



Can the Current LLMs Replace Medical Expertise?

- **Different Metrics to Evaluate:**
 - Scientific consensus
 - Helpfulness of the answers
 - Addressing the intent of question
 - Relevance of the contents
 - Etc
- The current state of the art models still not at the clinicians level, but they are promising





The Future of Large Language Models in Healthcare

- **Personalized Care:** Large language models can further enhance the personalization of healthcare services, improving patient experiences and outcomes.
- **Interdisciplinary Collaboration:** As NLP models advance, the potential for collaboration between AI developers, healthcare professionals, and regulators will grow, driving innovation.
- **Ethical AI Development:** The future of large language models in healthcare will increasingly emphasize ethical considerations, ensuring fair, transparent, and accountable AI applications.



Conclusion

- **Transformative Potential:** Large language models hold the potential to revolutionize healthcare by improving efficiency, accuracy, and personalization of care.
- **Balancing Benefits and Risks:** It's crucial to address ethical concerns and potential risks associated with using large language models in healthcare applications.
- **Ongoing Innovation:** The future of NLP in healthcare will involve interdisciplinary collaboration and ethical AI development, ultimately enhancing patient care and outcomes.



Thanks