Implementing a Large Language Model Chat Interface for Epilepsy Patient Care

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Background

- The integration of AI into healthcare has the potential to improve the delivery of care, especially for chronic conditions like epilepsy that require continuous monitoring and support[1].
- Contemporary research leveraging large language models (LLMs) predominantly focuses on enhancing diagnostic capabilities and supporting clinical decision-making.
- Direct patient-LLM communication in clinical environments has promising benefits for both patients and caregivers, yet remains largely unexplored[2].
- Challenges for this effort include ensuring the safety and constraint of LLM responses, protecting sensitive patient data, integrating with hospital networks, and navigating the complex review and approval processes in health systems[3].
- **This project details progress toward the development and deployment of a real-time LLM chat interface for patients in the epilepsy monitoring unit.**

Methods

Chat Interface

- The chat interface is designed for use on a tablet at the patient's bedside, enabling them to communicate with the LLM via text or voice input.
- The LLM actively guides conversations, prompting patients for information relevant to their day-to-day care and responding to inquiries.
- A detailed system prompt sets the LLM's behavioral characteristics.
- Content moderation and topic classification ensure the safety of messages and constrain conversations to epilepsy-related topics.
  - Only messages classified as safe and on-topic are passed to the LLM.
- Chat message histories are stored in a database for post-hoc analysis and synchronization with recorded physiology, medications, and medical notes.
- All aspects of this project are built and hosted on institution-managed cloud resources.

Language Models

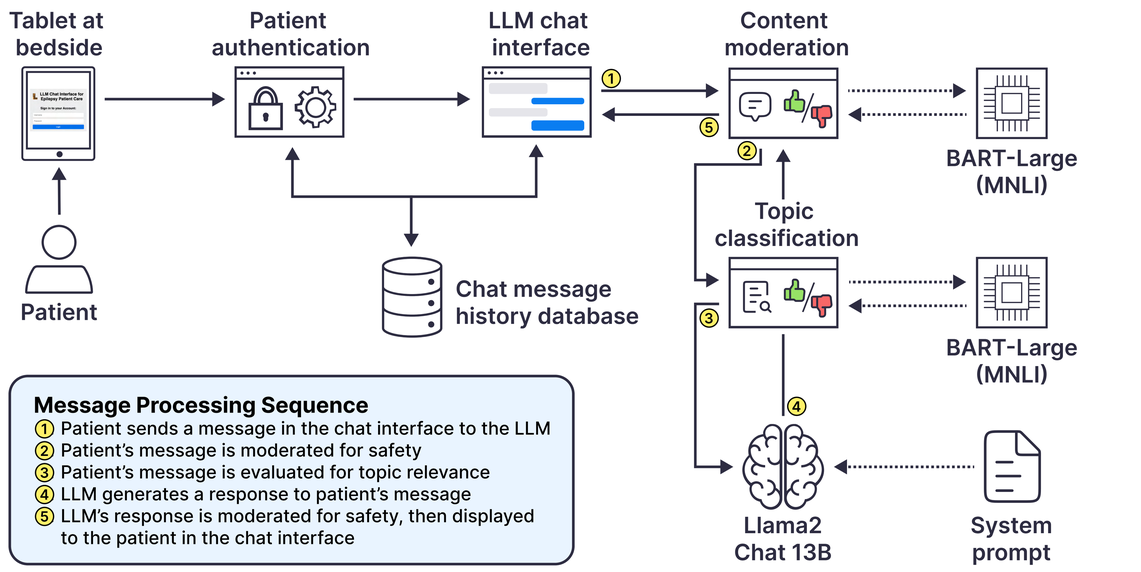
- **Llama2-Chat 13B (self-hosted):** used as the LLM for the chat interface.
- **BART-Large (MNLI):** used for zero-shot classification on message content.

LLM Behavioral Evaluation + Simulated Patient Scenarios

Ensure the LLM behaves as intended when interacting with patients

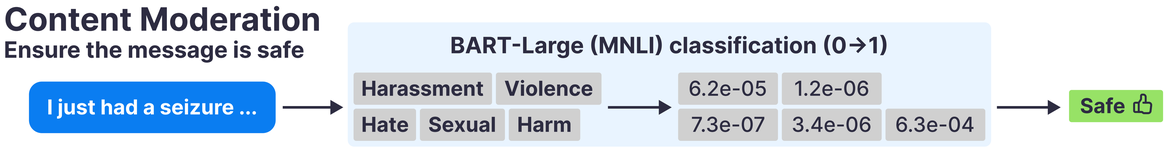
System Architecture

Patient-LLM interaction and message processing



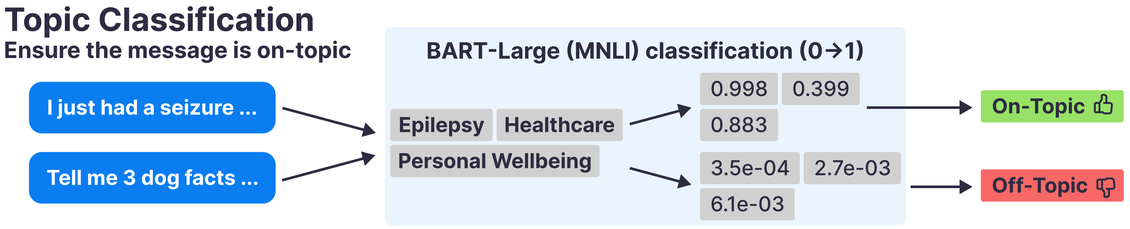
Content Moderation

Ensure the message is safe



Topic Classification

Ensure the message is on-topic



Results

- The system prompt alone is not sufficient to constrain Llama2-Chat 13B responses to only epilepsy-related topics.
- However, when paired with message filtering using BART-Large (MNLI), the LLM consistently maintains topic relevance even when challenged with prompts intended to diverge the conversation.
- BART-Large (MNLI) is effective in both message content moderation and topic classification.
- The LLM demonstrates contextual understanding throughout conversations in simulated patient scenarios.
- The system functions seamlessly across multiple simulated patients and yields a timestamped conversation history for each patient.
- The cloud architecture of this system was comprehensively reviewed by the information security department for robustness, adherence to hospital security protocols, and patient data management best practices.
- These results, although preliminary, support the feasibility of deploying this LLM chat interface in the epilepsy monitoring unit.

Conclusion

- LLMs, while promising for patient-centric communication and care delivery, require robust safety and contextual alignment mechanisms before clinical implementation.
- The chat interface detailed here aims to addresses these challenges and provide a practical system ready for deployment in patient care.
- Future work will explore the integration of metrics derived from real-time electrophysiological recordings and the automated creation of annotations in the clinical record.
- As this initiative progresses, it may serve as a model for translational AI research in managing chronic conditions that can be adopted in a broader range of healthcare domains.

References

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