Developing A Question-Answering System for Community-Centric Disaster Preparedness

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Project Description

In times of disaster, the availability of precise and locally-tailored information can be the difference between safety and peril. One fundamental problem communities face is obtaining up-to-the-minute, relevant information specific to their needs. Traditional question-answering systems excel at drawing from extensive databases but often fall short when asked for detailed local data, such as the location of the nearest emergency shelter in a particular town during a crisis. This deficit can render the guidance provided not only unhelpful but potentially hazardous in an emergency situation.

Our proposal offers a novel solution: a question-answering system that leverages advanced computational tools, known as large language models (LLMs), to deliver not just correct but contextually appropriate information to users. These LLMs are akin to sophisticated software that can comprehend human language and generate responses as a person might. However, LLMs, despite their intelligence, are prone to a critical limitation—they may generate plausible but false information when faced with queries beyond their training scope, a phenomenon known as 'hallucination'. In the context of disaster response, such misinformation could lead to dire consequences.

To mitigate the risk of misinformation, we plan to integrate a curated database filled with verified local documents into our system. This database will contain emergency contact numbers, government evacuation plans, and detailed regional hazard profiles. By referencing this local data when responding to queries, the system is empowered to deliver information that is both accurate and actionable. This innovative combination of LLMs with a specialized document repository represents a significant stride forward in providing reliable, localized information during emergencies.

Implementing our solution involves two sophisticated strategies: retrieval-augmented generation (RAG) and prompt engineering. RAG combines the comprehensive understanding of a large language model with the specificity of a search engine, pulling in up-to-date information from the local document database to inform its responses. This process ensures our system's replies are rooted in the latest and most relevant data. Concurrently, prompt engineering entails the careful design of queries and instructions to the AI, ensuring it understands and addresses the user's needs accurately. It's the science of telling our intelligent system exactly what to look for and how to present its findings. Together, these frameworks will allow our system to generate responses that are not only precise and relevant but also communicated in a way that is clear and understandable to the user.

Our initiative aspires to harness the combined strengths of advanced AI and meticulous data curation

to create a dependable platform for disaster preparedness information. Tailored to meet the specific needs of individual communities, this system stands to become an invaluable resource in enhancing safety and resilience in the face of emergencies.

Project Objectives

The overarching goal of this project is to develop, deploy, and assess a sophisticated question-answering system that integrates LLMs with a comprehensive local information database, aiming to deliver precise and pertinent disaster preparedness information to specific communities. To address the critical need for timely and relevant data during emergencies, the project needs to accomplish the following objectives:

- To design a system that interprets questions and yields responses informed by a database of local emergency protocols, contact directories, and hazard information
- To integrate the RAG framework and prompt engineering techniques for improved access to local documents and enhanced accuracy for interpreting user questions
- To assess the system using precise metrics that gauge the accuracy, context relevance, and consistency of the answers it provides

Scope and Delimitation

The scope of this project is centered on creating a question-answering system, particularly engineered to provide local and precise disaster preparedness information. At its core, this system will unify the advanced understanding capabilities of an LLM with the specificity offered by the RAG framework. This integration will be achieved by using a curated database of documents that contains local emergency protocols, contact information, and hazard data pertinent to a specific community. The design is focused on interpreting and responding to text-based inquiries with detailed, community-specific information that plays a crucial role in enhancing individual and collective preparedness in the face of emergencies.

The project's delimitations are characterized by its current capabilities and boundaries. The system is tailored for text-based data. It lacks the capability to process and interpret visual content, such as maps or intricate graphical data, with high fidelity. Its dependability hinges on the regular curation and expansion of the document database, a process that may be influenced by practical, financial, or bureaucratic limitations. The efficacy of the system's responses is heavily dependent on the quality of prompt engineering. Instructions given to the LLM must be optimized to ensure the system's output remains relevant and accurate. Furthermore, the system is not currently equipped to handle live data feeds or provide instantaneous updates, which may be pivotal during fast-changing disaster events.