2024 AI Challenge

Neph.ai

Product

Problem

Chronic kidney disease (CKD) is becoming a more prevalent condition around the globe. Learning to live with CKD can be extremely stressful for both patients and their loved ones, since much of its treatment involves management which is very complex since CKD is coupled with many other contributing and causative conditions. Also CKD management is different for each patient depending on the stage of the disease, the results of regular monitoring tests and other variable factors which makes management plans hyper-specific to each individual.

Solution

Neph.ai aims to tackle the challenge of CKD management in interpreting medical test reports and symptom management by using Generative AI which uses accurate biomedical information to help them interpret their results and allow for easier management of their CKD.

Features

- Ask specific questions about dialysis and other routes: Gain clear, concise, and non-technical answers about report details, implications, and potential next steps on how to proceed.
- Input medical test report details: Enter specific results obtained in CKD and renal health tests to get a better idea of what this means for your health.
- Receive personalized recommendations for ietary and lifestyle modifications: Manage conditions through diet, exercise, and stress management based on individual needs.
- Potential medications: Learn about classes of medications used for specific conditions, their potential benefits and side effects (disclaimer: emphasizes consulting professionals for diagnosis and treatment plans).

Target Audience

This solution targets patients at all stages; pre-CKD and all other stages including end-stage (patients on dialysis). The target users are idividuals who have undergone medical tests related to kidney function or are getting them on a regular basis to gain a better understanding of their results to help manage their diet and symptoms.

Engineering

High-Level Design

- Training: RAG model is trained on medical textbooks and specialised books on how to deal and manage life with CKD and dialysis.
- Data Acquisition: Run software locally with ease so that no data is collected, thus no need for data privacy concerns and anonymising confidential medical information and corresponding diagnoses and treatment information (with appropriate consent and ethical approval).
- Pre-processing and Training: Apply natural language processing (NLP) techniques to clean and pre-process the data. Use BoMistral to focus on tasks like information extraction, question answering, and text summarization.
- Development: Develop a user-friendly interface (web or mobile app) that allows users to ask questions about the report using natural language and access personalized recommendations and resources.

Role of Generative AI

BioMistral plays a central role in understanding the user's intent from their questions and medical reports. It generates informative and personalized responses by leveraging its knowledge base of medical information combined with the user's specific data. Neph.ai also uses Generative AI to assist in suggesting potential interventions based on learned patterns and correlations within the training data.

Technologies

- Pre-trained language model (LLM): BioMistral 7B
- Embedding Model: PubMedBert
- LangChain. Llama CPP
- Vector Database: Qdrant

Results and Analysis

We conducted user testing to evaluate the accuracy, clarity, and helpfulness of the LLM's responses and compared and tested same prompts with other available LLMs and especially medical-domain based LLMs. Neph.ai was able to provide more knowledgeable responses specific to the questions asked and there was a lack of hallucination seen in Neph.ai due to the RAG implementation.

Going Forward

We will continuously refine the Neph.ai through additional training and user feedback and add more data to the RAG model to further improve its results. We will also add functionality to be able to take PDF files of lab reports for the model to analyze and give a user a detailed breakdown of their results and what dietary and medicinal measures to take. Furthermore, we could add a history feature which stores results from the users previous reports to give a historic view of health.

Citations

1. Textbook of Medical Physiology - Guyton and Hall (Unit 5)
2. Dialysis without Fear; A Guide to Living Well on Dialysis for Patients and Their Families - Daniel Offer, Marjorie Kaiz Offer, and Susan Offer Szafir
3. D'Alessandro, C., Piccoli, G.B., Calella, P. *et al.* "Dietaly": practical issues for the nutritional management of CKD patients in Italy. *BMC Nephrol* 17, 102 (2016). https://doi.org/10.1186/s12882-016-0296-5
4. Kim SM, Jung JY. Nutritional management in patients with chronic kidney disease. Korean J Intern Med. 2020 Nov;35(6):1279-1290. doi: 10.3904/kjim.2020.408. Epub 2020 Sep 23. PMID: 32872726; PMCID: PMC7652660.
5. Diet and Chronic Kidney Disease - Division of Nephrology