Personalized Diet plan for Covid 19 Recovery using virtual reality and fine-tuning mechanisms

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1 Introduction

Our goal is to provide reliable and personalized COVID-19 diet plans to help individuals effectively manage their health and recovery while adhering to medical guidelines. By fine-tuning a language model with a dedicated COVID-19 diet dataset, we aim to understand patient conditions and deliver precise dietary recommendations. The COVID Coach app will integrate mental health considerations, suggesting foods that promote mood balance and stress reduction. Additionally, we plan to incorporate VR and AR technology to create immersive experiences that address anxiety and loneliness, allowing users to input dietary preferences and health goals in a virtual environment. This holistic approach, informed by the COVID-19 Healthy Diet Dataset, will enhance our ability to support users globally in improving their health outcomes during recovery.The process of fine-tuning a language model for generating COVID-19 diet plans involves several key steps. First, a diverse dataset is collected, including medical articles, dietary guidelines, patient case studies, and tailored recipes. The data is then cleaned and pre processed to ensure relevance and clarity. Fine-tuning can be approached through transfer learning or training from scratch, with careful selection of hyper parameters such as learning rate, batch size, and epochs. Once trained, the model's performance is evaluated using a validation set to ensure it produces accurate and relevant dietary recommendations. An example prompt might involve generating a diet plan for a COVID-19 patient with diabetes, emphasizing balanced nutrition and professional consultation. This process aims to equip the LLM to effectively assist individuals in their dietary recovery from COVID-19.

1.1 Statement Of Problem

How can an LLM be fine-tuned to effectively generate personalized COVID-19 diet plans that are accurate, relevant, and safe for individuals with varying health conditions and dietary needs? This problem statement outlines the specific goals of the fine-tuning process, emphasizing the importance of accuracy, relevance, and safety in the generated diet plans. It also acknowledges the need

to cater to individuals with diverse health conditions and dietary preferences. The development of a robust and reliable LLM capable of generating personalized COVID-19 diet plans presents several challenges. These include:

- Data Quality and Quantity: Acquiring a diverse and high-quality dataset that accurately represents the wide range of COVID-19 cases, dietary needs, and health conditions is crucial.
- Model Architecture and Hyper parameters: Selecting the appropriate LLM architecture and fine-tuning hyper parameters to ensure optimal performance and avoid biases in the generated diet plans.
- Contextual Understanding: Enabling the LLM to understand the nuances of individual health conditions, dietary preferences, and cultural factors that may influence dietary choices.
- Ethical Considerations: Addressing ethical concerns related to the generation of medical advice, ensuring the LLM avoids providing harmful or misleading information.
- Continuous Learning and Adaptation: Developing a system that can adapt to evolving medical knowledge and dietary recommendations related to COVID-19.

Specific Challenges:

- Handling Complex Medical Conditions: The LLM must be able to accurately incorporate information about underlying health conditions (e.g., diabetes, heart disease, allergies) into the generated diet plans.
- Addressing Dietary Restrictions: The LLM should be able to accommodate various dietary restrictions (e.g., vegetarian, vegan, gluten-free) and preferences.
- Cultural Sensitivity: The generated diet plans should be culturally appropriate and consider regional food preferences and dietary practices.
- Avoiding Misinformation: The LLM must be trained to avoid spreading misinformation about COVID-19 and its treatment.

Overall Goal: The goal is to develop an LLM with Virtual Reality Integration that can provide reliable and personalized COVID-19 diet plans, helping individuals manage their health and recovery effectively while adhering to medical guidelines and individual needs.

2 Review of Literature

The COVID-19 pandemic has underscored the importance of personalized healthcare, including dietary recommendations. Large Language Models (LLM's) offer a promising avenue for generating tailored diet plans based on individual

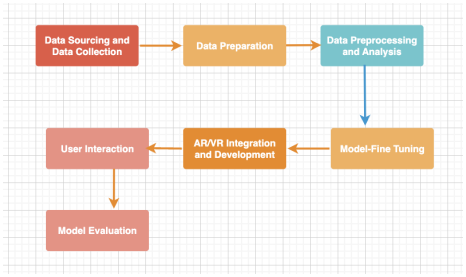

Figure 1: System Architecture

health conditions, dietary preferences, and cultural factors. This literature review explores existing research on fine-tuning LLM's for medical applications, specifically focusing on diet recommendations, and highlights the challenges and opportunities in developing LLM's for COVID-19 diet plans with Virtual Reality using VR/AR.Fine-tuning LLM's for COVID-19 diet plans presents both challenges and opportunities. By addressing the limitations and leveraging advancements in natural language processing, researchers can develop valuable tools to support individuals in their recovery and long-term health. Future research should focus on improving the accuracy, relevance, and ethical implications of using LLM's in this context.

3 Objectives of the Study

This project aims to enhance the existing idea of creating a COVID-19 diet plan dependent on the patient's condition. This enhanced the covid coach which concentrates on the person's mental health.LLM is used to create and dedicate daily plans by knowing the patient's condition, symptoms, preferences.This model helps give meal suggestions.As the patient's condition improves, the model updates the dight plan accordingly.Fine-tuning helps the LLM to handle the covid diet plan dataset. This helped the project to understand the patient's condition, and appropriate dietary responses to make it as perfect and precise as possible.The present COVID coach app is focused on mental health, and we are working to initiate a perfect diet plan to provide holistic care. The LLM that we are planning to use will consider the patient's mental health as input using virtual Reality as environment and suggest some foods that might help in balancing the person's mood and reducing stress.

4 Research Design and Methodology

The problem statement is basically about the way to define the COVID-19 diet plan based on the patient's inputs like the symptoms and this was an update of the COVID COACH app which focuses on mental health etc

- The dataset is a CSV (comma-separated values) which consists of 5 datasets with all the country names and values, in addition to the list of values. Furthermore, the values have been cleaned and potential insights are handled graphically. Also, the dataset will be handled with machine learning and with the given models.

- LLM(Language Model): The LLM model was used in the meal plans to analyze patient conditions symptoms and preferences. Then the patient's inputs are understood and processed the inputs with the dight planes are been understated by the LLM and then provide the diet suggestions we can also take the data from the Covid Coach app and then we can get the inputs from the patient mental health and then we can handle the diet plan accordingly.

- Fine-tuning: To ensure accurate and customized suggestions, train the model on unique data from the dataset to improve its comprehension of dietary requirements and COVID-19-related health concerns.

- Once the model is ready, we will test the model with real-world patients and take feedback from their cases. Afterwards, we will validate the effectiveness of the diet plan and monitor how the patient's physical and mental health is impacted with the use of our model. We will take note of how their wellbeing benefits from the recommendations our model provides.

- Then the model has been continually updated based on the patient's new data, outcomes, and feedback. And we will make sure that the model will be flexible to change based on the feedback and work on it.

- Also, here we are including the Virtual reality VR/AR for mental health to implement activities related to anxiety, loneliness. To provide users with an immersive VR/AR experience that helps them plan, manage, and maintain a healthy diet during COVID-19.

- Users can input their dietary preferences, health conditions, and fitness goals in a virtual environment. The system provides customized meal plans and dietary advice based on their inputs.

- The COVID-19 Healthy Diet Dataset gives us the relationship between dietary habits and COVID-19 through different countries like food supply, COVID-19 statistics, and obesity

- Overall, Covid-19 had a significant impact globally around the world. By fine-tuning an LLM, we hope to provide reliable COVID-19 diet plans with health issues along with virtual reality and dietary restrictions taken into consideration. In our continuation of Covid Coach, we hope to utilize LLM and fine-tuning to further improve our model to benefit those looking to improve their symptoms at a faster rate

5 Dataset Description

The dataset chosen for this research project is from Kaggle. The data was collected from countries around the world. It carries "data for different food group supply quantities, nutrition values, obesity, and undernourished percentages," (Ren, 2020). Likewise, regarding Covid-19, the dataset includes the number of cases and deaths after testing positive. The sources of the statistics are derived from the Food and Agricultural Association of the United Nations, Population Bureau, choosemyplate.gov, and the Johns Hopkins Center for Systems Science and Engineering (Ren, 2020). In combination together, the metrics can be used to find the correlation between diets and Covid cases, to help us in the fine tuning of our model. This approach ensures the LLM can effectively provide diet plans suitable for COVID-19 patients, incorporating medical insights and dietary guidelines.

The COVID-19 Healthy Diet Dataset gives us the relationship between dietary habits and COVID-19 through different countries like food supply, COVID-19 statistics, and obesity. The dataset consists of 4 datasets

- FatSupplyQuantityData: It has the list of countries and the fat percentages from different with the list of food items around the world. In this column COVID-19 cases as percentages, obesity, and undernourished total population for comparison purposes.
- FoodSupplyQuantitykgData: This includes the food intakes in different countries. For comparison, the last two columns also include the percentages of the population that are obese, undernourished, and have COVID-19.
- FoodSupplykcalData: The percentage of energy intake (kcal) from various food kinds in various nations is included in this dataset. For comparison, the last two columns also include the percentages of the population that are obese, undernourished, and have COVID-19.
- ProteinSupplyQuantityData: This dataset contains the percentage of protein consumed from various dietary categories in various nations worldwide. For comparison, the last two columns also include the percentages of the population that are obese, undernourished, and have COVID-19.
- SupplyFoodDataDescriptions: The aforementioned datasets' food kinds are displayed for each category using this dataset, which was collected from FAO.org.

6 Individual Contributions

- **Kavya Parvathapuram** : Kavya helped in choosing the topic to research, choosing the dataset, and provided insight on how to perform our

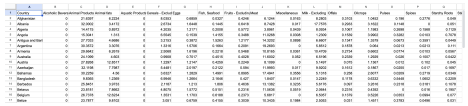

Figure 2: Sample Visual Representation Of CSV data

problem statement, AR/VR Analysis. She also submitted documents for the team.

- **Amina Khaja** : Amina helped with identifying and managing tasks to distribute among the team members. Additionally, she also helped with-reading articles in our area of research and sharing insights.

- **Vinay Daram**: Vinay helped to gather ideas to execute our problem statement with creating our model framework. Similarly, he also helped with coming up with ideas and choosing the dataset.

Together as a team, we have documented our research process thus far and have come together to create this project proposal to take steps towards beginning our project.

7 References

- Jaworski, B. K., Taylor, K., Ramsey, K. M., Heinz, A., Steinmetz, S., Pagano, I., Moraja, G., Owen, J. E. (2021, March 1). Exploring usage of Covid coach, a public mental health app designed for the COVID-19 pandemic: Evaluation of Analytics Data. Journal of medical Internet research.

- Author links open overlay panel Christopher Ball a 1, a, 1, b, c, Highlights UGT is applied to examine the use and adoption of VR devices during the pandemic.Buying VR during the pandemic is related to use for work, Abstract The coronavirus disease 2019 (COVID-19) pandemic has impacted all aspects of people's lives. (2021, October 13). Virtual reality adoption during the COVID-19 pandemic: A uses and Gratifications Perspective. Telematics and Informatics.

- Pallavicini, F., Pepe, A., Clerici, M., Mantovani, F. (2022, October 25). Virtual reality applications in medicine during the COVID-19 pandemic: Systematic review. JMIR serious games.