Project Proposal

Project Track: development track

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Functions and Users

We are planning to develop a web-based recipe recommending system tailored to provide personalized recipe suggestions. This innovative platform will cater to users by allowing them to input their dietary preferences, restrictions, and available ingredients in natural language. The system will then recommend recipes that align with the users' inputs, focusing on relevance, variety, and adherence to dietary needs. In addition to that, we may want to add a feedback mechanism through which users can rate the recommendations for further refinement of the algorithm.

The target users are individuals seeking culinary inspiration that matches their specific dietary needs, available cooking ingredients, or desire to explore new recipes. This includes, but is not limited to, home cooks, individuals with dietary restrictions, and those looking to diversify their meals.

Significance

The proposed web-based recipe recommending system is a novel solution designed to enhance personal culinary experiences by addressing key pain points in current recipe discovery processes. Here's why this tool is significant and necessary:

1. Personalization: It directly caters to individual dietary preferences and restrictions, offering a tailored recipe selection that current platforms lack, thus solving the challenge of sifting through irrelevant options.
2. Efficiency and Waste Reduction: By suggesting recipes based on available ingredients, it promotes efficient use of resources, potentially reducing food waste and aiding in environmental sustainability.
3. Health and Dietary Support: The system supports health and wellness goals by ensuring that all recommended recipes align with users' dietary needs, contributing to better health outcomes.

In summary, this tool not only enhances the meal planning process for individuals with specific dietary needs but also contributes to broader societal goals of sustainability and wellness.

Approach

First, our group will preprocess the data by doing text normalization and tokenization, the original data come from Kaggle: https://www.kaggle.com/datasets/pes12017000148/food-ingredients-and-recipe-dataset-with-images/data. For text normalization, we will process the natural language inputs for dietary preferences, restrictions, and available ingredients by converting text to lowercase, removing punctuation, and correcting misspellings. For tokenization, we will break down users' inputs into tokens (words or phrases) to facilitate analysis.

Then our group will do the feature engineering including ingredient embeddings and recipe encoding. For ingredient embeddings, we will convert ingredients listed in recipes and user inputs into numerical vectors using techniques like TF-IDF or word embeddings (e.g.,

Word2Vec). This transformation enables quantitative analysis of textual data. For recipe encoding, we will encode recipes in a structured form that includes vector representations of ingredients, nutritional information, and categorical encoding of applicable dietary restrictions. After we get all the processed data, our group decides to use cosine similarity to measure the similarity between user profiles and recipes based on ingredient embeddings. This metric can help identify recipes that match users' dietary needs and ingredient preferences. For training models, our group will combine content-based and collaborative filtering methods for a more robust recommendation system. Machine learning models, such as neural networks, can integrate these inputs to predict user preferences for unseen recipes.

Evaluation

To assess the usefulness of our NLP-based food recommendation tool, we will conduct a comprehensive user-centered evaluation. This involves gathering a diverse group of participants to use our system in a controlled setting. Participants will be asked to input descriptions of their food preferences, dietary restrictions, or available ingredients using natural language. The system's recommendations will be evaluated based on relevance, variety, and how well they match the users' inputs. We plan to use surveys and interviews post-interaction to collect qualitative feedback on user satisfaction, perceived accuracy, and ease of use. This feedback will be instrumental in identifying areas for improvement and ensuring that our system meets the actual needs of our target users.

Quantitatively, we will evaluate our system using standard NLP metrics such as precision, recall, and F1 score. These metrics will help us measure the correctness of our implementation in terms of accurately understanding user inputs and providing relevant food recommendations. Precision will indicate the percentage of relevant recipes among the recommendations, recall will measure how many of the total relevant recipes were recommended, and the F1 score will provide a balance between precision and recall. Additionally, we will track the system's response time to ensure that our tool delivers recommendations efficiently.

Timeline

- Milestone 1: Finalize the project proposal, including objectives, scope, and expected outcomes. –Mar 31, 2024
- Milestone 2: Begin preliminary research on NLP techniques and existing food recommendation systems. –April 7, 2024
- Milestone 3: Collect a manageable set of recipes and related data for the prototype. –April 7, 2024
- Milestone 4: Start developing the basic NLP model for processing user inputs.–April 14, 2024
- Milestone 6: Develop a simple user interface for inputting preferences and displaying recommendations. –April 21, 2024
- Milestone 7: Conduct initial testing of the system with sample inputs to assess functionality.–April 21, 2024
- Milestone 8: Refine the NLP model and recommendation algorithm based on initial testing feedback.- April 28, 2024
- Milestone 9: Present the prototype to a small group for user feedback.- April 28, 2024
- Milestone 10: Iterate on the system based on feedback, focusing on improving user experience and recommendation accuracy. May 2, 2024
- Milestone 11: Conduct a final evaluation of the system, using both qualitative and quantitative metrics. May 2, 2024

- Milestone 12: Prepare and deliver the final project presentation, showcasing the development process, system functionality, evaluation results, and future work directions. May 5, 2024

Task division

- Zixiong Luo: Focuses on collecting and preprocessing the recipe data, ensuring it's clean and usable for the NLP model.
- Liam Li: Takes charge of developing and refining the NLP model, working closely with the data to understand user inputs.
- Lingge Wu: Leads the design and implementation of the user interface, ensuring it's user-friendly and effectively displays recommendations.
- Yifan Zhong: Coordinates the integration of the NLP model with the user interface and oversees testing and feedback collection to refine the system.
- Lin Guo: Help with user research, algorithm optimization. And help with interface if needed.