COSE474-2024F: Final Project Proposal
Personalized Recipe Generation Based on User Preferences

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1. Introduction

1.1. Motivation & Problem Definition

Personalized nutrition and "meal prep" have gained traction recently, as individuals are more health conscious, adopting diverse dietary preferences—from health-focused diets like low-carb or high-protein to ethical ones like veganism. However, adapting recipes to meet these specific needs is often cumbersome and time-consuming. This project aims to create a generative AI model that produces recipes based on inputs, adapting to the user's needs while maintaining culinary integrity.

1.2. Challenges

The challenge lies in balancing user-defined constraints with the creation of realistic and delicious recipes. The model must understand cooking techniques, ingredient compatibility, and sequencing to ensure practical, usable outputs. Additionally, adapting recipes to meet dietary needs, like vegan or gluten-free, requires finding suitable substitutions without compromising flavor.

1.3. Related Works

RecipeGPT, based on GPT-2 and fine-tuned with Recipe1M, generates recipes from titles or ingredient lists, using top-k sampling for diversity (Lee et al., 2020). RecipeMC builds on this with Monte Carlo Tree Search (MCTS) for more precise alignment with user-specified ingredients, offering better control over content (Taneja, Segal, Goodwin, 2024). These models highlight different strategies for balancing flexibility and specificity in recipe generation.

2. Datasets

The Recipe1M+ dataset, containing over 1 million recipes with detailed ingredient lists and instructions, serves as the primary dataset for training the model, providing a diverse range of cuisines for generating varied recipes. Food-101 can also be combined with Recipe1M+ to enhance the model's understanding of dish types, contributing to more descriptive recipe outputs.

3. Goals

The project's goals include fine-tuning pre-trained language models like GPT-4 or Llama using the Recipe1M+ dataset to generate accurate and structured recipes based on user inputs. It will also explore prompt engineering techniques to ensure the model effectively understands and responds to user preferences.

4. Schedule

- Week 7-8: Research and Data Preparation
- Week 9-10: Model Fine-Tuning and Prompt Engineering
- Week 11-12: Testing, Evaluation, and Optimization
- Week 13-14: Integrate Nutritional Data
- Week 15-16: Final Testing and Report Writing

5. Comparison with SOTA

State-of-the-art recipe generation models blend multi-modal learning and fine-tuning. BLIP and Flamingo combine visual understanding with text generation, making them suitable for generating recipes that align with food images. Meanwhile, CookGPT is fine-tuned for culinary data, focusing on traditional recipe structures, and DietGPT tailors recipes to dietary needs. These models span from visually-driven approaches to text-based solutions for specific dietary requirements.

References

1. H. Lee, H., Shu, K., Achananuparp, P., Prasetyo, P. K., Liu, Y., Lim, E. P., Varshney, L. R. (2020, April). RecipeGPT: Generative pre-training based cooking recipe generation and evaluation system. In Companion Proceedings of the Web Conference 2020 (pp. 181-184).

2. Taneja, K., Segal, R., Goodwin, R. (2024). Monte Carlo tree search for recipe generation using GPT-2. arXiv preprint arXiv:2401.05199.