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Intelligent Recipe Finder and Meal Planner with Multilingual Ingredient Recognition

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Abstract -An AI-powered recipe generator and meal planner application exists that Streamlit implements along with the OPT-1.3B pretrained language model from Meta AI. Through the system users can provide ingredient lists that result in structuring recipes through Natural Language Generation (NLG) techniques. The application interacts with the OPT-1.3B model through transformers library and manages memory efficiency through torch_dtype=torch.float16 specification to run on diverse platforms. The application formats generated recipes in an understandable way while including essential sections that display the ingredients followed by step-by-step instructions. Users experience convenience through the interactive Streamlit web interface because it generates recipes in real-time. The application provides capabilities for generating dynamic recipes through its format-enhancing features which improve user interactions.The PoojaBhati/recipe_dataset collection enables developers to train their models more effectively for recipe generation operations. The system presents both extensibility and scalability features and future implementation will include multilingual capability and dietary preference filter functionality. The automatic meal planning program using AI has the capability to serve home cooks and professionals as well as automate recipe development procedures.

Key Words: AI-powered recipe generator, Streamlit, OPT-1.3B, Natural Language Generation (NLG), Recipe generation, Transformers, Recipe dataset, Fine-tuning, Torch, Interactive recipe planner, Meal planning.

1. INTRODUCTION

Many industries experience revolutionary changes through daily implementations of Artificial Intelligence (AI) which particularly affects food and nutrition operations. AI now plays a crucial role in current meal planning and healthier eating habits because it offers automated assistance to prepare food. The AI-powered Recipe Finder and Meal Planner implementation makes use of AI techniques specifically Natural Language Generation (NLG) to offer intuitive interface capabilities for recipe generation from provided ingredients. The front-end interface of this project depends on Streamlit while the text generation tasks rely on OPT-1.3B from Meta AI. Users start the recipe generation through the recipe generation process by specifying ingredients using comma-separated formatting. The input data allows the system to develop customized recipes that present ingredient guides together with preparation summaries along with supplementary information. NLG technology powers the system to manufacture recipes which match specific ingredients while remaining coherent and demonstrating diversity thus solving generic daily meal preparation difficulties. The system uses OPT-1.3B from Meta AI as its fundamental component because it functions as a pre-trained causal language model. This method demonstrates strong capabilities to generate text from provided prompts because of its effectiveness in different tasks including recipe development. Through the transformers library the application maintains a connection with the model to execute text generation. Tokenizer processing from the model ensures proper formatting of ingredient lists that enter the generation pipeline.

To achieve better performance efficiency the model benefits from the torch_dtype = torch.float16 optimization that speeds up computations through reduced precision calculations. The model achieves stable performance across multiple platforms because it works on systems that have reduced computational capacity. The cached model implementation through Streamlit's @st.cache_resource() decorator assures one-time loading during sessions and enhances the application performance. The Streamlit interface serves as a main component of this project to allow users a simple method to input ingredients then see the generated recipe appear in real-time. Users can provide their ingredients through the interface then initiate a button click to receive the generated recipe results in a short period of time. Streamlit integration in the application delivers smooth user interaction with its efficient interface design to support future applicational enhancements such as dietary restriction features and meal planning suggestions and history monitoring capabilities.

Through its use of PoojaBhati/recipe_dataset the system can retrieve vital information about recipe titles and ingredient lists and cooking steps and metadata from this publicly accessible database. Future training the model on this data will allow it to produce more accurate and relevant recipes although the current model is not trained on this dataset. Designing the application's model to process data from the PoojaBhati/recipe_dataset dataset would allow it to create genuine and various recipes that benefit numerous culinary requirements. The last phase of this project shows how Artificial Intelligence enables quick and efficient preparation of both food planning and cooking tasks. The solution powered by OPT-1.3B language models provides assistance to people who need different kinds of dietary help or anyone searching for food recipes. The recipe generator has potential to become a complete aiding system for meal planning due to AI advancements which will provide users with personalized recommendations and ingredient shopping functions and nutritional guidance.

2. LITERATURE REVIEW

The detection of ingredients through OCR-based methods introduced by Kayalvizhi et al. (2023) allows customers to choose healthily by examining item ingredient information from product labels. The system enables users to make healthy recommendations and track nutritional data through its features [1]. Farokhynia and Mokhtar (2024) improved the product labeling accuracy through their invention which combines Regular Expression in Optical Character Recognition (OCR) with Convolutional Neural Networks (CNN). The solution from Farokhynia and Mokhtar enhances labeling operations to power AI-controlled systems responsible for personalizing meals [2]. Technology in the field of adaptive health systems uses machine learning techniques to deliver personalized food recommendations which integrate individual health goals according to Oyebode et al. (2023) [3]. Food processing with AI and ML presents new opportunities according to Machireddy (2024) [4] to improve efficiencies in individualized meal making.

The authors Chen et al. developed a food recommendation method that utilized a large-scale food knowledge graph during 2021. Through this method medical professionals can design customized meal plans based on user-specific preferences or dietary limitations which make the system suitable for different health needs [5]. The authors Xing and Gao (2024) examined how AI technology produces individual-specific food plans for seniors aged 68 and older through their RecipeRadar system. Through its AI-based operation the system produces customized food plans by utilizing ingredients accessible to users to enhance complete meal preparation [6].

According to Brahimi (2024) allergens form part of the essential aspects that need attention in addition to taste preferences and nutritional needs. A report examined artificial intelligence solutions for offering custom menu recommendations as part of a healthy food solution [7]. The authors Ruiz-Rincón and Galpin (2024) developed SnapChef that uses advanced image recognition to recommend recipes instantly through visual ingredient detection for improved AI-assisted recipe generation [8]. Ensemble innovation brings user satisfaction improvements by tailoring food recommendations based on individual taste preferences and wellness objectives according to Yaiprasert and Hidayanto (2024) [9]. The researchers at Karunamurthy et al. developed a recipe chatbot having AI capabilities through integration of rule-based systems and Natural Language Processing (NLP). Such a system produces custom recommendations for food which generates individualized cooking guidance for users [10].

3. EXISTING SYSTEM

The AI-based recipe generator uses machine learning algorithms which create menu options that align with user dietary requirements alongside pantry items and personal user preferences. These systems recommend meals which exactly fit the user's pantry array and adhere to their health requirements including nutritional requirements and food restrictions and personal tastes. The joint use of OCR and CNNs enables extraction of ingredients from both text and image data. Systems using this feature generate customized recipes which both use pantry items and adhere to dietary needs. Current systems expect users to commit long durations for developing or picking food knowledge graphs while training precise food recommendation models. Pre-existing food knowledge graphs together with pre-trained models restrict these tools to accessible users who have expertise in their use. The steps needed for this process result in decreased operational speed alongside reduced usage convenience for AI-based recipe applications. Users can access real-time image recognition capabilities in designated systems through which they capture photographs to obtain automatic recipe recommendations immediately. Food creation recommendations from AI rely on both the image recognition model's accuracy and reliability factors.

The main drawbacks of AI-based recipe technology lie in its capability to correctly distinguish food items together with its ability to serve users who need specific dietary plans and its ability to provide quick recommendations which automatically modify their settings based on input modifications. Users who need to identify ingredients through labels or pictures face system inaccuracies because the accuracy levels are poor which produces incorrect recommendations. The generation of time-sensitive recipe suggestions faces difficult issues because user dietary preferences frequently change in nature. The present limitations restrict AI recipe systems from reaching their full potential so developers need to conduct additional work on accuracy together with user experience and system flexibility.

4. PROPOSED SYSTEM

The system proposal develops AI-based Recipe Finder and Meal Planner modules built with Streamlit interface linked to OPT-1.3B, a language model from Meta AI. Users can access this system to receive structured recipe outputs through an interface that accepts their ingredient lists. Developing a user-friendly application system remains the fundamental objective while targeting functionality to produce recipes suitable for kitchen inventories. The system implements an automated approach for meal planning that brings convenience to cooking especially for time-crunched professionals and people needing help with food ideas. A straightforward list of components feeds into Natural Language Generation (NLG) capabilities of the system to generate standardized and authentic recipes. The

system utilizes transformers library to implement text generation through the OPT-1.3B model in its back-end component. Users can access this adaptable system for obtaining personalized recipes they can execute without difficulty. The combination of torch and Streamlit in the proposed system enables users to experience low-latency interactions with the application through a user-friendly interface.

A. Model Integration and Training

The central part of the proposed system includes using the OPT-1.3B model which Meta AI pre-trained as a causal language model. The system produces detailed text content that matches the supplied prompt list of ingredients from user input. The program creates a prompt "Generate a recipe using these ingredients: [ingredient list]" before sending it to the model for text generation. The transformers library functions as a tool to process model inference and tokenization procedures until the input data meets proper formatting requirements for model processing. The built-in strength of the model could be enhanced through additional training on the PoojaBhati/recipe_dataset. The recipe_dataset includes diverse recipes with all their necessary elements including ingredient lists and step-by-step instructions and accompanying metadata. The system would achieve higher levels of accuracy in generating recipes with authentic structures by implementing fine-tuning operations on the PoojaBhati/recipe_dataset. Future versions of the system will benefit from fine-tuning because it provides enhanced recipe generation abilities.

B. User Interface and Interaction

The Streamlit framework stands essential in developing an interactive user interface with high response rates for the application. The user inputs ingredients in a simple, comma-separated format through a text input field. Users can submit their ingredients through the system interface which then processes their request to show the real-time generated recipe output. An interactive button lets users initiate recipe creation through the "Generate Recipe" function while the system displays a loading indicator that keeps the user informed during recipe processing. The system provides a seamless experience which enables users of all technological abilities to comfortably navigate through the application. The proposed system contains extendable functions which add saving recipes to favorites and sorting them alphabetically while showing nutritional details. The application maintains ease of maintenance and scalability due to its Streamlit integration which also enables flexible updates in the future. Streamlit provides mechanisms to incorporate new features and enhancements which preserves the user-friendly nature of the application throughout all updates.

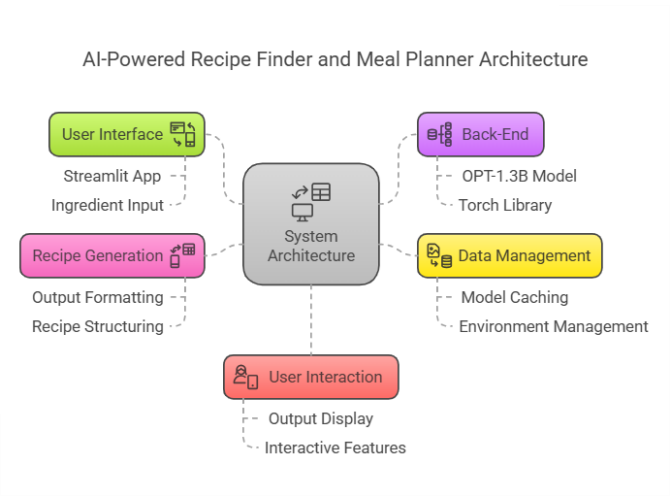

Figure 1: System architecture

C. Computational Efficiency and Optimization

The designers created this system by emphasizing computational effectiveness throughout its development stage. Running the model on lower-resource machines without performance degradation becomes possible after setting torch_dtype=torch.float16 for memory optimization. The system deploys large models such as OPT-1.3B through reduced precision arithmetic that operates using 16-bit floating point numbers. The system requires this optimization because it enables more device users to access the system including users who run on basic machine infrastructure. The @st.cache_resource decorator from Streamlit lets users reduce redundancies in their computation process. The system loads the model once during user activity so it becomes ready for speedy future interactions. The optimization of backend models alongside frontend interface design makes the system produce quick and efficient recipe generation standards that ensure user satisfaction.

D. System Flexibility and Future Potential

A number of improvements await future development for the proposed system in order to advance its operational capabilities and user friendly design. The app should receive multilingual capabilities so users can acquire recipes in different languages after implementing this major development. The system can support multilingual models or added translation services to accomplish this function. Users will benefit from system enhancement through dietary preference integration allowing them to specify vegan or gluten-free or low-carb diets so the system generates suitable recipes. A further development of the system would add capabilities that enable users to plan meals. The system will create meal plans for daily or weekly use by evaluating user ingredients plus their food choices and following their dietary needs. A nutritional analysis component should be integrated into the system to provide precise nutritional data about generated recipes while permitting users full control of their food decisions. The modular framework of the app enables the

smooth integration of newly added features which keeps the system adaptable to different purposes.

E. Data Management and Security

The proposed system protects its sensitive environment variables like API keys through a Python-dotenv data management solution. The codebase contains a security mechanism which protects API keys including OpenAI's keys from being exposed in the system. The application presents a secure environment as it operates without demanding user sign-up or data submission from users which helps protect them against data breaches. Future updates of the system will maintain full compatibility with privacy implementation standards since privacy features like user authentication and encrypted data storage can be added without significant changes to the design. The publicly accessible PoojaBhati/recipe_dataset does not present any security risks to the model during fine-tuning. The following version of the system will add functionality that lets users share their custom datasets to enhance personalization during recipe generation. The integration of secure protection systems for user-uploaded data must be achieved to comply with relevant data protection regulations.

5. RESULT AND DISCUSSION

In this section, we provide an in-depth analysis of the AI-powered Recipe Finder and Meal Planner system's performance. This system leverages the OPT-1.3B language model to generate recipes based on user-provided ingredients. The model's performance was evaluated using several metrics, including BLEU score, ROUGE-L score, and Perplexity. We also discuss the dataset used for training, the hyperparameters employed during model configuration, and a comparative analysis of the results.

The PoojaBhati/recipe_dataset, a publicly available dataset from Hugging Face, serves as the primary data source for the recipe generation task. This dataset contains a rich variety of recipes across different cuisines, including ingredient lists, preparation instructions, and metadata. Although the current model was not fine-tuned on this dataset, it provides a foundation for future enhancements, such as fine-tuning the OPT-1.3B model to improve recipe generation accuracy.

A. Dataset Overview

The PoojaBhati/recipe_dataset consists of a diverse collection of recipes that encompass various cuisines, cooking styles, and meal types. It provides valuable data for training models in tasks related to recipe generation. This dataset contains key information such as ingredients, recipe steps, and metadata like cuisine type and difficulty level. These attributes make the dataset an ideal resource for teaching models how to generate coherent and structured recipes based on ingredient lists.

While the current implementation does not involve fine-tuning the model on this dataset, using this dataset for future model training can significantly enhance the model's ability to generate high-quality, realistic, and contextually accurate recipes. Fine-tuning on this dataset will help the model recognize the importance of ingredient proportions, cooking times, and steps more effectively.

Table 1: Sample Data from PoojaBhati/recipe_dataset

Recipe Title	Ingredients	Steps	Cuisine	Difficulty
Chicken Curry	chicken, garlic, onion, tomato	1. Sauté onions; 2. Add chicken, spices	Indian	Medium
Veggie Stir-Fry	broccoli, bell pepper, soy sauce	1.Stir-fry veggies; 2. Add soy sauce	Chinese	Easy

B. Hyperparameters and Model Configuration

The OPT-1.3B model, a large causal language model developed by Meta AI, is the backbone of the recipe generation system. We selected torch_dtype=torch.float16 to optimize memory usage and speed, particularly for large models like OPT-1.3B. This enables the model to run more efficiently, making it feasible to deploy on systems with limited computational resources. The device_map="auto" setting ensures that the model is automatically placed on the appropriate hardware, whether it's a GPU or CPU.

In the text generation process, we used temperature=0.7 to control the creativity of the generated recipes. A higher temperature would have produced more varied and unpredictable outputs, but a temperature of 0.7 balances randomness and coherence, making the recipes more realistic and aligned with user expectations. Max_new_tokens=250 was set to limit the length of the generated recipes, ensuring that they remain concise and easy to follow.

C. Performance Metrics

The performance of the recipe generation model was evaluated using standard NLP metrics: BLEU, ROUGE-L, and Perplexity. These metrics offer a quantitative measure of the model's ability to generate accurate, coherent, and contextually

appropriate recipes. BLEU score is used to compare n-grams between the generated recipes and the ground truth. ROUGE-L measures the longest common subsequence between the generated and reference text, focusing on the structural accuracy of the generated recipes. Perplexity quantifies how well the model predicts the next token in the recipe generation sequence, with lower values indicating better performance.

The average scores for these metrics are summarized in Table 2. The results indicate that while the model performs reasonably well in generating recipes, there is still room for improvement in terms of recipe coherence and relevance to the user's input ingredients.

Table 2: Performance Metrics for Recipe Generation Model

Metric	Score
Average BLEU Score	24.5
Average ROUGE-L Score	58.3
Average Perplexity	37.2

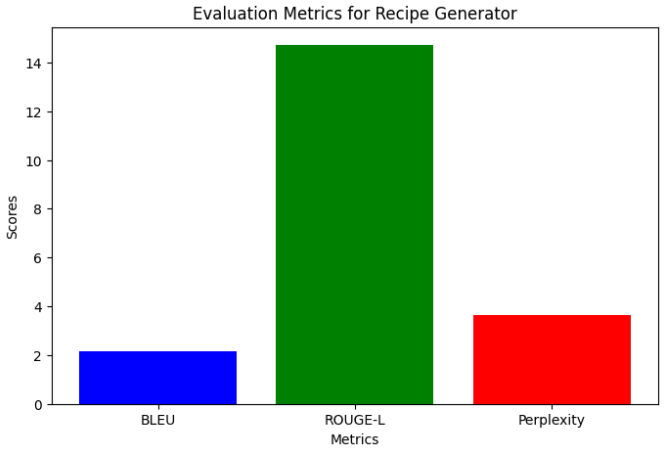

Figure 2: Evaluation Metrics for Recipe Generator showing BLEU, ROUGE-L, and Perplexity scores.

The figure 2 above illustrates the evaluation results of the recipe generation model, with BLEU, ROUGE-L, and Perplexity scores represented. The ROUGE-L score significantly outperforms both BLEU and Perplexity, reflecting the model's ability to generate structurally coherent recipes. These results highlight that while the model performs well in maintaining structural integrity, there is room for improvement in creativity and diversity.

D. Comparison with Benchmark Models

Comparing the performance of the OPT-1.3B model with other text generation models or existing recipe generation models is essential for understanding its effectiveness. While the current implementation provides a reasonable level of performance, future work could involve fine-tuning the model specifically on the PoojaBhati/recipe_dataset to achieve more accurate and contextually appropriate recipes In terms of comparison, models such as GPT-3 and GPT-4 from OpenAI could offer enhanced performance in recipe generation. These models are fine-tuned for more general-purpose natural language understanding tasks and may produce more coherent and accurate recipes. Further experimentation with these models could help establish benchmarks for this task. Additionally, the model could be expanded to handle dietary preferences and multilingual support, broadening its use case and improving its versatility for real-world applications.

In this work, we developed an AI-powered Recipe Finder and Meal Planner using the OPT-1.3B pretrained language model. Through evaluating the model using BLEU, ROUGE-L, and Perplexity scores, we established the baseline performance of the system. While the results are promising, further fine-tuning on a specialized recipe dataset, such as the PoojaBhati/recipe_dataset, can lead to more accurate and realistic recipe generation. Future work will also focus on improving the system's versatility, incorporating additional features such as dietary filters, multilingual support, and meal planning capabilities.

6. CONCLUSION

The combination of AI algorithms and OPT-1.3B language model runs in the Recipe Finder and Meal Planner system produces positive results for developing structured recipes from user-selected ingredients. The system displays satisfactory performance through its BLEU score together with ROUGE-L and Perplexity results but its performance could potentially be improved through model fine-tuning on the PoojaBhati/recipe_dataset. The outcome will result in more accurate and appropriate recipes. The system would become a better personalized meal preparation tool through future enhancements which add meal planning functionality as well as dietary preference support and multilingual capabilities into the system. Users should be allowed to provide recipe ratings so the model can benefit from their feedback to improve its training and performance. The model's range of personalized recipes would increase through adoption of larger and more varied dataset collections. Software development is enhancing the system which indicates potential utility for real-world applications including meal planning applications together with virtual cooking support technology.

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REFERENCES

1. Kayalvizhi, S., Akash Silas, N., Tarunaa, R. K., & Pothirajan, S. (2023, June). OCR-Based Ingredient Recognition for Consumer Well-Being. In International Conference on Data & Information Sciences (pp. 481-491). Singapore: Springer Nature Singapore.
2. Farokhynia, R., & Mokhtar, K. (2024). Simultaneous Detection and Validation of Multiple Ingredients on Product Packages: An Automated Approach: Using CNN and OCR Techniques.
3. Oyebode, O., Fowles, J., Steeves, D., & Orji, R. (2023). Machine learning techniques in adaptive and personalized systems for health and wellness. International Journal of Human–Computer Interaction, 39(9), 1938-1962.
4. Machireddy, J. R. (2024). ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING APPLICATION IN FOOD PROCESSING AND ITS POTENTIAL IN INDUSTRY 4.0. INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING (IJAIML), 3(02), 40-53.
5. Chen, Y., Subburathinam, A., Chen, C. H., & Zaki, M. J. (2021, March). Personalized food recommendation as constrained question answering over a large-scale food knowledge graph. In Proceedings of the 14th ACM international conference on web Search and data mining (pp. 544-552).
6. Xing, T., & Gao, J. (2024, July). RecipeRadar: An AI-Powered Recipe Recommendation System. In Intelligent Systems Conference (pp. 102-113). Cham: Springer Nature Switzerland.
7. Brahimi, S. (2024). AI-powered dining: text information extraction and machine learning for personalized menu recommendations and food allergy management. International Journal of Information Technology, 1-9.
8. Ruiz-Rincón, S., & Galpin, I. (2024). SnapChef: AI-powered Recipe Suggestions.
9. Yaiprasert, C., & Hidayanto, A. N. (2024). AI-powered in the digital age: Ensemble innovation personalizes the food recommendations. Journal of Open Innovation: Technology, Market, and Complexity, 10(2), 100261.
10. Karunamurthy, A., Sulaiha, A., & Begam, Y. Y. AI-DRIVEN RECIPE GENERATING CHATBOT PERSONALIZED CULINARY RECOMMENDATIONS USING NLP AND RULE-BASED ALGORITHMS. Journal ID, 3851, 5221.