B.Tech.
Mid Term Review Project Presentation
A.Y. 2023-2024
Project Title: Culinary Curator- An AI Powered Recipe Assistant

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Roadmap

- Introduction
- Problem definition
- Literature Review / Market Survey (3 slides)
- Proposed System/ Algorithms/Architecture
- Design diagrams
- Implementation
- References

Introduction to the domain

- Within the field of Artificial Intelligence and Natural Language Processing applied to the culinary domain or food-related applications.
- The project's focus lies at the intersection of AI-NLP and culinary arts, as it aims to leverage advanced technologies to provide personalized and relevant recipe recommendations to users.
- By understanding user input, analysing recipe data, and employing recommendation algorithms, the project falls under the domain of AI-powered recipe generation and recommendation systems.

Problem Definition

- Design and develop an AI-powered recipe recommendation system that generates personalized and diverse recipe suggestions based on user input of available ingredients.
- The system should leverage NLP techniques to process user input, analyse a comprehensive dataset of Indian recipes, and employ advanced recommendation algorithms to offer users a curated list of recipes that suit their dietary preferences and the ingredients they have on hand.
- The project aims to simplify recipe discovery, inspire culinary creativity, and promote efficient meal planning for users to reduce food waste and user expenses.

Literature Survey

Paper Title	Approach	Research Gaps
RecipeGPT: Generative Pre-training Based Cooking Recipe Generation and Evaluation System (2020)	•GPT-2 fine-tuned on Recipe1M dataset. •Pre-processing involved filtering out non-ingredients, non-instructional sentences and lemmatizing nouns of ingredients	Non-deterministic model results, difficulty in evaluating machine-generated texts, and the adaptability of the model for novel inputs.
Personalized Recipe Recommendation with Graph Neural Networks (2022)	•Uses a GNN to learn the representations of the recipes, ingredients, and users. •The representations are then used to recommend recipes to the user that are tailored to their preferences.	Requires a large dataset of recipes and user interactions
Recipe Recommendation with Pre-Trained Language Models (2022)	•Uses the BERT pre-trained model to learn the representations of recipes VC •Then uses a simple recommendation algorithm to recommend recipes to the user.	Requires a large dataset of recipes.
Recipe Generation with Hierarchical Reinforcement Learning (2022)	•The model uses a hierarchical reinforcement learning algorithm to learn to generate recipes that satisfy the user preferences and are consistent with the real world.	Need for more research on how to train the model in a more efficient way.

Literature Survey

Paper Title	Approach	Research Gaps
Recipe Generation with Adversarial Learning and Knowledge Graph (2020)	•Uses an adversarial learning mechanism to generate more realistic and diverse recipes, and a knowledge graph to ensure that the generated recipes are accurate and consistent with the real world.	Need for more research on how to incorporate user preferences into the generated recipes.
Recipe Generation with Fine-Grained Control (2020)	•Proposes a hierarchical attention network with fine-grained control for recipe generation. •The model allows users to control the generation process by providing fine-grained feedback. •For example, users can specify the desired ingredients, cooking methods, and taste profile. The model then generates a recipe that satisfies the user's constraints.	Need for more research on how to generate recipes that are both accurate and creative.
Food Recipe Generation from Images with Attention (2016)	•Proposes a deep learning model with attention mechanism for recipe generation from images. •The model uses LSTM to learn the relationships between the different objects in the image and the corresponding cooking steps.	Need for more research on how to incorporate user preferences into the generated recipes.
Recipe Generation with T5 (2021)	•Proposes a recipe generation model with T5. •The model is trained on a large dataset of recipes and is able to generate recipes based on a variety of inputs, including ingredients, cooking methods, and dietary restrictions.	Need for more research on how to generate recipes that are both personalized and adaptable to user preferences.

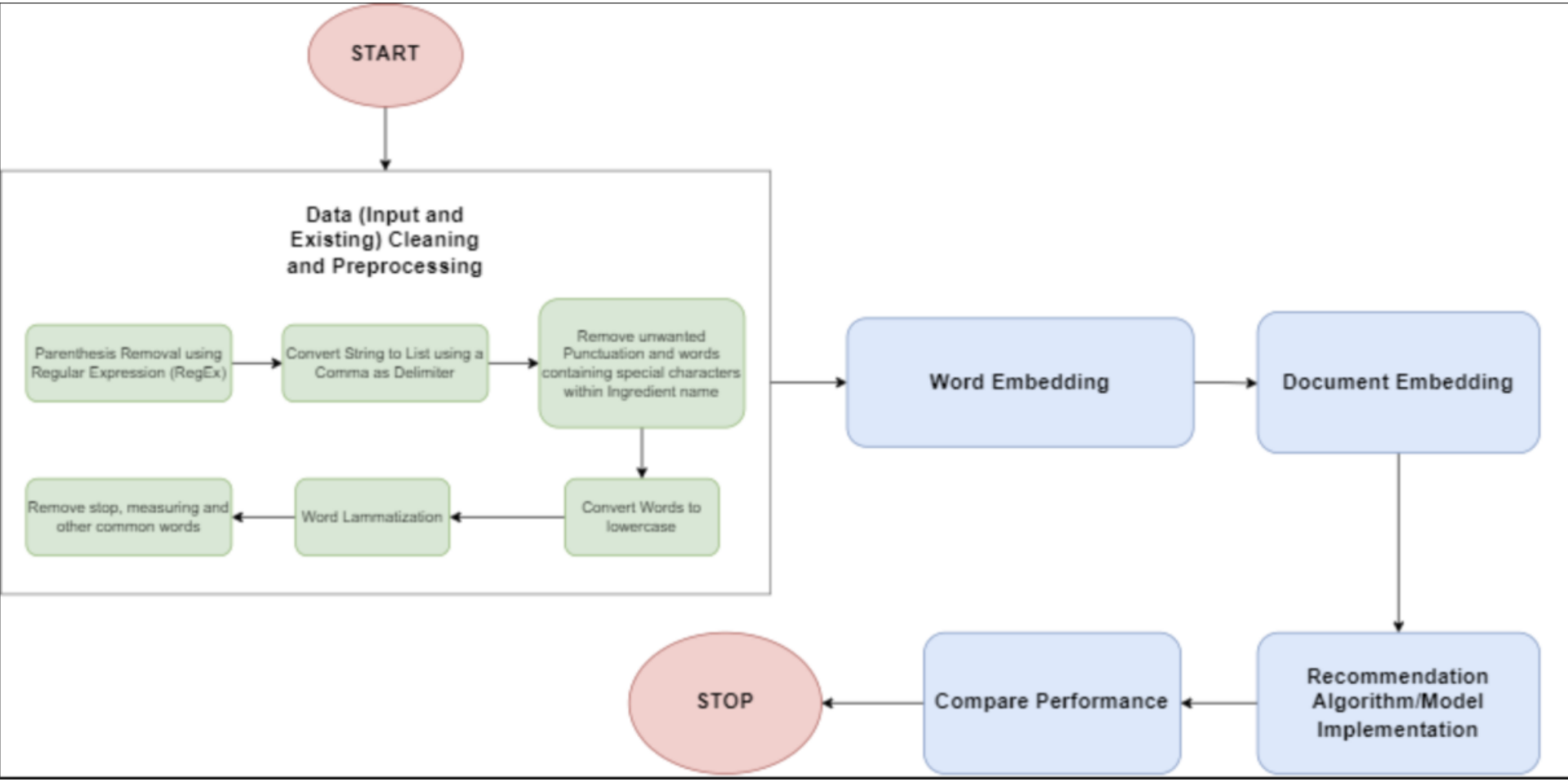
Literature Survey

Paper Title	Approach	Research Gaps
A Multi-Modal Recipe Recommendation System with Text and Image Features (2018)	•This paper proposes a recipe recommendation system that uses ResNet-50, a CNN model, to extract features from both food images and recipe descriptions to recommend recipes.	Requires a large dataset of food images and recipe descriptions, can be computationally expensive
Knowledge-aware Recipe Recommendation (2021)	•Uses the ConceptNet knowledge graph to encode the relationships between different food items. •Then uses a graph convolutional network to learn the representations of the recipes. •representations of the recipes are then used to recommend recipes to the user.	Requires a large knowledge graph of food
Personalized Recipe Recommendation with Graph Neural Networks (2022)	•Uses graph neural networks to model the relationships between recipes, ingredients, and users. •The system uses a graph neural network to learn the representations of the recipes, ingredients, and users. •The representations are then used to recommend recipes to the user that are tailored to their preferences.	Requires a large dataset of recipes and user interactions
Attentive Recipe Recommendation (2020)	•The system uses the RoBERTa pre-trained model to extract features from the recipe descriptions. •then uses attention mechanisms to focus on the important parts of the recipe descriptions, such as the ingredients, cooking instructions, and user reviews.	Requires a large dataset of user interactions

Market Research

Feature	Supercook	Yummly	SideChef	Cooked	RecipeGPT
Personalization	Limited	Moderate	Moderate	Moderate	Limited
Ingredient Utilization	Limited	Moderate	Moderate	Limited	Limited
Dietary Preferences	Limited	Moderate	Moderate	Limited	Limited
Recipe Diversity	Moderate	Moderate	Moderate	Limited	Moderate
Ingredient Matching	Limited	Moderate	Moderate	Limited	Limited
NLP Techniques	Limited	Moderate	Moderate	Limited	Limited
Nutritional Information	Limited	Limited	Limited	Limited	Limited
Sustainability Focus	Limited	Limited	Limited	Limited	Limited
User Reviews and Ratings	Yes	Yes	Yes	Yes	Limited
User-Friendly	Yes	Yes	Yes	Limited	Limited
Comprehensive Dataset	No	No	No	Limited	Limited

Design Diagram



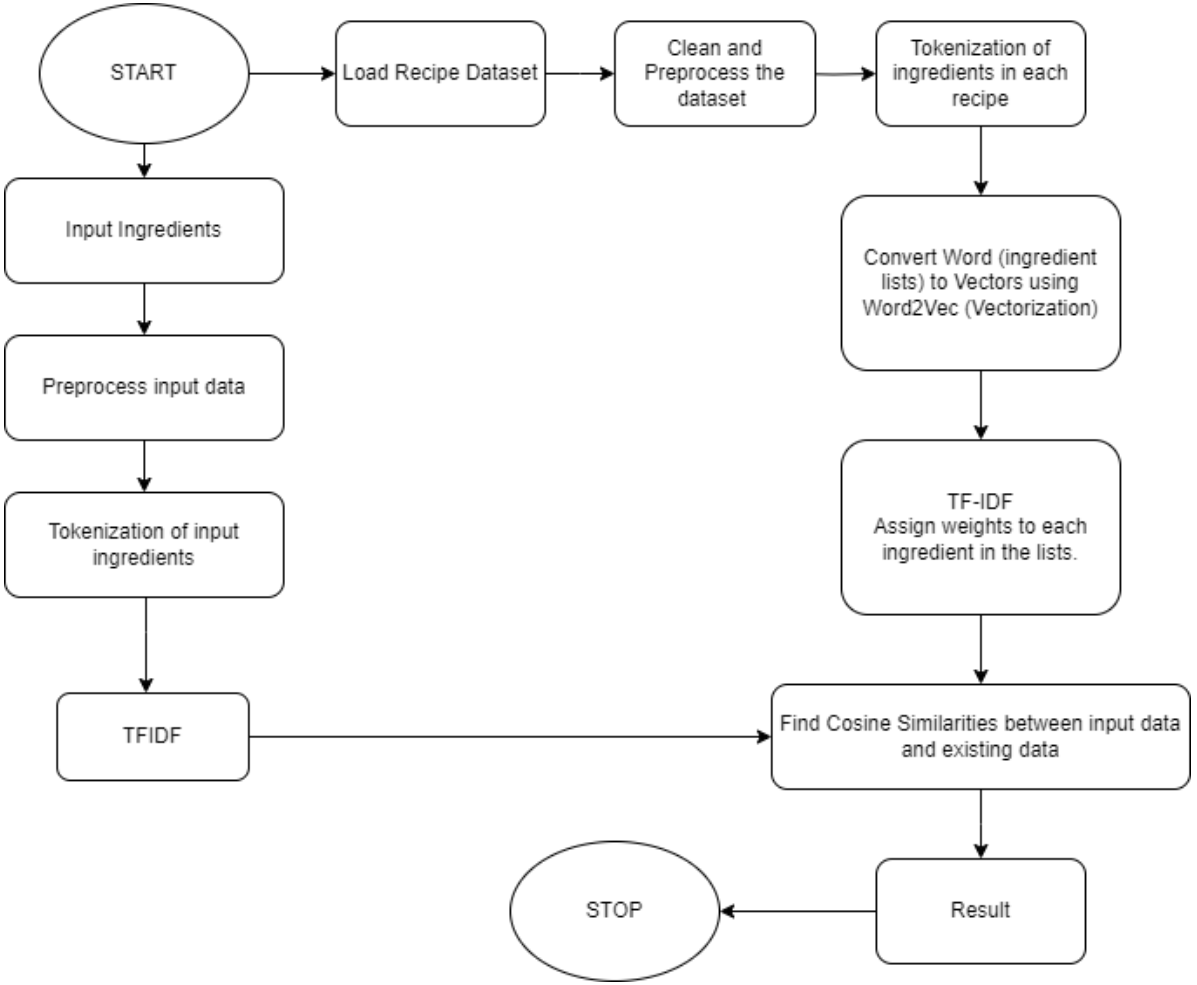
Algorithms: Word2Vec

TF-IDF (Term Frequency-Inverse Document Frequency): TF-IDF is a statistical measure used in NLP to evaluate the significance of words within documents. It determines the importance of a word in a document by considering both its frequency within that document (TF) and its uniqueness across a collection of documents (IDF).

Word2Vec: Word2Vec is a word embedding technique in NLP. It represents words as dense vectors in a continuous vector space. Word2Vec learns these vector representations by analyzing large text data and is based on the idea that words with similar meanings appear in similar contexts.

Cosine Similarity: Cosine Similarity is a metric used to measure the similarity between two vectors in a multi-dimensional space. Cosine Similarity measures the cosine of the angle between two vectors and provides a value between -1 and 1. Values closer to 1 indicate high similarity, while values closer to -1 indicate dissimilarity.

Design Diagram



Algorithms: BERT

BERT (Bidirectional Encoder Representations from Transformers): BERT is a pre-trained model for NLP. It has been trained on a vast amount of text data. BERT is known for its bidirectional context understanding, meaning it considers the context of a word by looking at both preceding and following words in a sentence. It's widely used for a variety of NLP tasks and has achieved remarkable performance on tasks like text classification, question answering, and more, often requiring only fine-tuning for specific applications.

Plan of Action

Month	Week	Task
August	Week 0-2	Setting up the programming environment, Recipe Data Collection, Cleaning & Preprocessing.
	Week 2-4	Implement NLP techniques for text processing and analysis of recipe descriptions.
September	Week 0-2	Begin building the recommendation system using suitable algorithms. Test basic version and implement advanced recommendation algorithms and filtering methods to improve the accuracy.
	Week 2-4	Introduce filtering methods and test different Machine Learning and Deep Learning Models recommendation models. Integrate user preferences and ingredients input with the recommendation systems.
October	Week 0-2	Explore options for incorporating images from which ingredients can be identified using Computer Vision. Explore nutritional data integration to provide nutritional information
	Week 2-4	Test the system thoroughly with a large set of users for performance evaluation. Address any issues, bugs, or user feedback and make necessary refinements.

References

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