Scraps To Scrumptious

A RAG based chat tool for food saving and recipe curation

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Team

Our Team

Scraps2Scrumptious is the capstone project of a passionate team of data science master's students from UC Berkeley's MIDS program during the Summer 2024 semester. Our project embodies our dedication to merging technology and a passion for food to create a tool that enhances everyday cooking experiences.

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Scraps to Scrumptious

Our **Food Retrieval-Augmented Generation System** uses extensive recipe data to
tailor meals based on your pantry and dietary needs. This not only makes nutritious cooking easy and accessible but also helps in minimizing food waste.

Key Features:

- Personalized meal suggestions based on dietary restrictions and available ingredients.

- Ingredient substitutions to maximize pantry resources.

- Real-time ingredient integration with web-search agent.

- Dynamic suggestions prompting

Target User Group

Areas of Opportunity

Farms	Manufacturing	Consumer-facing businesses	Homes
17%	15%	20%	48%
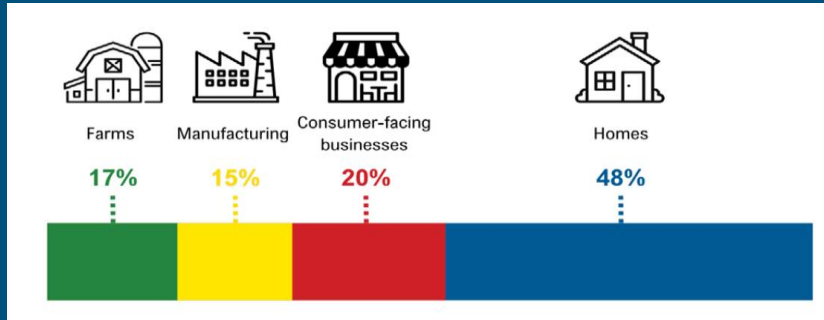
Quantifying the Potential

every household tossing **$1,500** into the wind

Scenarios of Use:

1

Allergy Check & Dietary Restrictions:

Whether you're allergic to peanuts or following a vegan diet, our system can suggest suitable recipes.

2

Ingredient Exclusion

If you want a chicken soup recipe without garlic, our system can provide one.

3

Cultural and Ethical Preferences:

Respect for your religious or ethical food preferences is a priority. Our system can suggest halal or beef-free recipes.

4

Healthy Options & Child-Friendly Recipes:

Whether you're on a low-carb diet or need a kid-friendly, egg-free snack, our system has you covered.
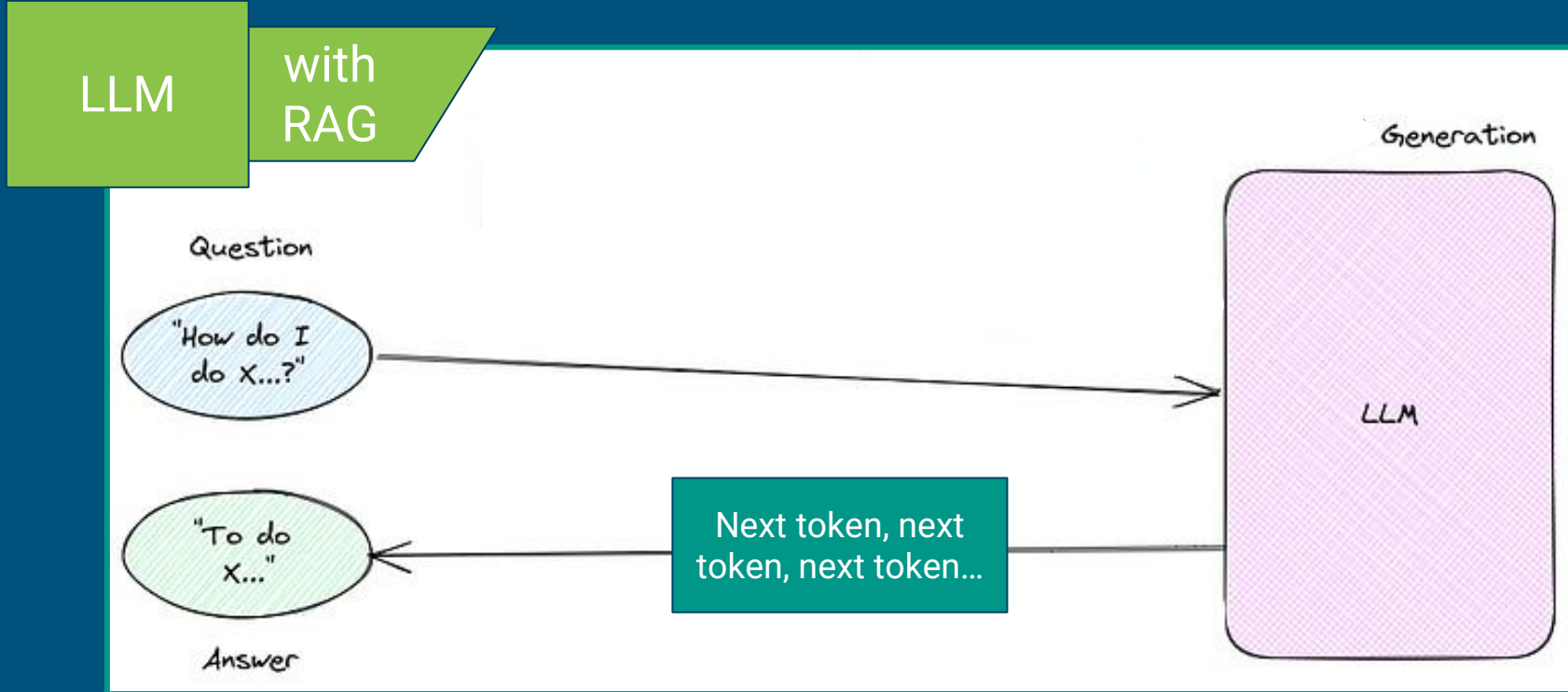
5

Ingredient Availability:

Even if you have only tomatoes and eggs, our system can suggest recipes with these ingredients.

6

Medical Conditions:

Our system can suggest dessert recipes suitable for diabetics or heart-healthy dinner recipes for those with high cholesterol.

LLMs work better with RAG!

Data pipeline part 1

Data set

Create vector database using recipe info:

- **Food.com recipes via Kaggle**
  - **17 million monthly visitors**
- **541,383 unique recipes**
- **28 columns**
- **Collected from 1999-2020**

1. RecipeName
2. Description
3. RecipeCategory
4. Keywords
5. RecipeIngredients
6. RecipeIngredientQuantities
7. Nutrition Information
8. CookingTime
9. RecipeServings
10. RecipeInstructions

Data pipeline part 2:
Base RAG system

Query ➤ **Retrieval** ➤ **Added context for generation**

"I want a recipe for a refreshing lemonade, maybe with some strawberries!"

Query has high cosine similarity with
1. Recipe 1460: Strawberry Lemonade

1. Recipe 2942: Strawberry Punch

1. Recipe 6916: Low Calorie Lemonade

1. Recipe 11913: Lemonade Pie

uctions:
ter, strawberries & sugar in a blender; cover & blend until

ished with lemon if desired.

ar, Lemon Juice, Lemon

Calories - 100.0, Fat - 0.3, SaturatedFat - 0, Cholesterol - 0, Sodium - 0, Carbohydrate - 25.9, Fiber - 1.5, Sugar - 22.8, Protein - 0.6

How to improve?
Add additional layers to filter the examples!

Layered RAG Approach

| Search Stage	Query Type	Purpose
Coarse	Maximum Marginal Relevance	Balance high similarity score and diversity
Validation	Self-Query LLM Structured Response	Semantic Filter
Fine	Reranker	Select most appropriate answer
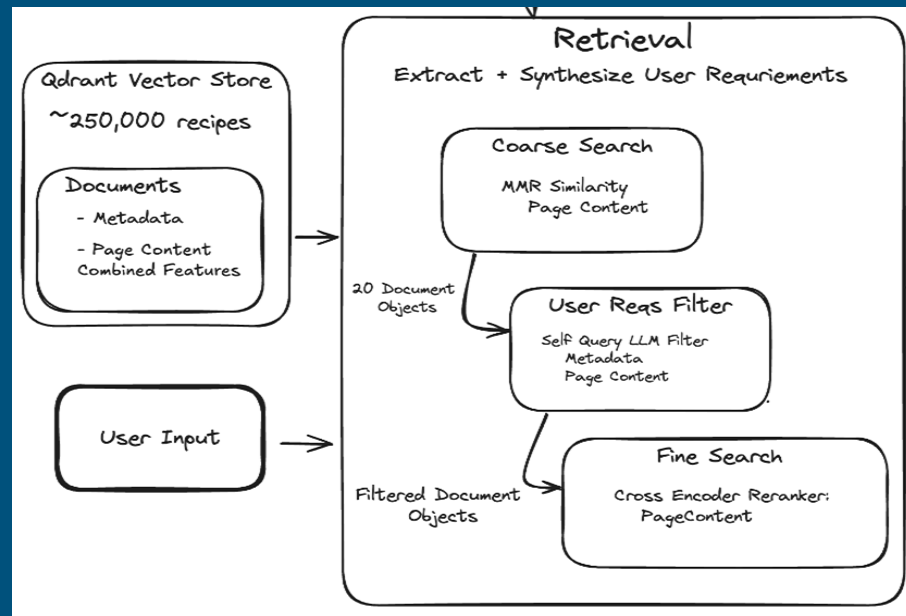
Provide Tool Calls to the LLM

Agent Handler
- Prompt Augmentation
- Web-Search

Validation

Next issue - this system doesn't allow for user modifications
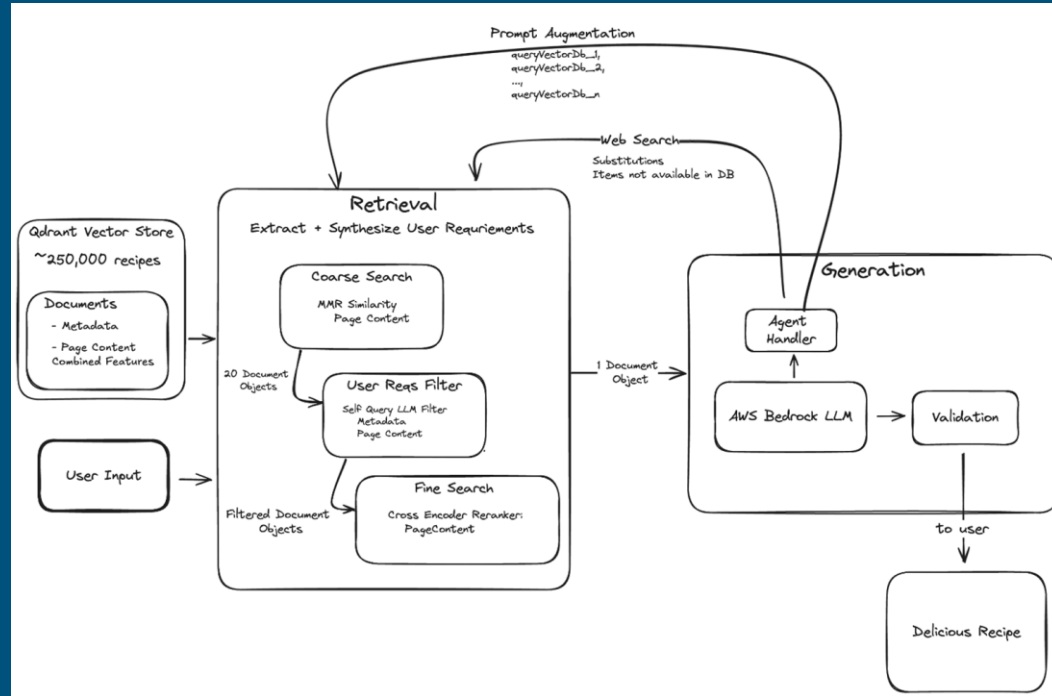
User Engagement

"Margherita pizza"

"Healthy dessert"

"Easy breakfast meal"

Make it interactive:

- Provide suggestions dynamically

- Retain Chat History and incorporate it into the context window

Application Demo

Try it yourself:

https://scraps2scrumptious.com

Key features:

- Continuous dialogue accommodates for specific requirements and dietary needs

- Context aware prompt refinement provide easy to use suggestions

- Thread based chat opens a new context window with the model

Application Demo

What's going on underneath?

- Dynamically generated queries

- Agent based tool calling:

    - Query recipe vector db

    - Query google web search

I want to make a low carb pizza

{"queries":["low carb pizza recipe"]}
{"queries":"[\"low carb pizza crust tips\" \"low carb pizza healthy toppings\"]"}

Some of my family is vegan

{"queries":["vegan pizza recipe"]}
{"queries":"[\"vegan pizza crust tips\" \"vegan pizza cheese alternatives\"]"}

gluten-free option

{"queries":["gluten free pizza crust recipe"]}

{
"type": "text",
"text": "<search_quality_reflection>\nThe results from the recipe database provide several good options for low-carb pizza recipes using alternative crusts like tortillas, cheese, and egg-based mixtures. However, there are a few gaps in information that could be helpful to fully answer this query:\n\n1. Specific tips or techniques for making a low-carb pizza crust that has a texture and flavor close to traditional wheat-based pizza crust.\n\n2. Healthy low-carb topping ideas beyond just meats and cheeses.\n\n3. Nutritional information and exact carb counts for the different crust options to determine which is truly the lowest in carbs.\n\nTo supplement this, a quick Google search could provide some useful additional context around low-carb pizza crust alternatives and topping ideas.\n</search_quality_reflection>\n\n<search_quality_score>4</search_quality_score>"
},

Evaluation - What is a good Recipe?

- LLM as a Judge - Judge the quality of the response.

- LLM as a Gatekeeper - Making sure the system does not violate user's dietary restrictions

```
Model: func_call_rerank
User Query:
I have a peanut allergy but I like thai food. I also don't enjoy spicy food much, and want a meal with low carbs. G
ive a recipe with ingredients and instructions.

Recipe reviewed:
Thai Shrimp and Vegetable Curry

Score: 4

Reasoning:
1. Accuracy: The recipe closely matches the user's query, providing a Thai-inspired dish that is peanut-free and lo
w in carbs. The specified dietary restrictions and preferences are well-addressed.
2. Clarity: The instructions are clear and easy to follow, with precise cooking times and temperatures.
3. Creativity: The recipe demonstrates a creative approach by using shrimp and a variety of vegetables in a coconut
milk-based curry, which is a unique twist on a classic Thai dish.
4. Completeness: The recipe includes all necessary details, such as ingredient measurements, preparation steps, and
serving suggestions.
5. Healthiness: The recipe provides a balanced nutritional profile, with a focus on lean protein, vegetables, and h
ealthy fats from the coconut milk. It aligns well with the user's dietary considerations.
6. User Feedback: The recipe is likely to receive high ratings from users for its taste and ease of preparation, ma
king it an appealing option for those with peanut allergies and a preference for low-spice, low-carb meals.
========
```

```
Model: rerank
Yes, the response correctly follows the user's request. The generated recipe suggestions are peanut-free and appropriate for someone with a peanut aller
========
Model: rerank
Yes, the response correctly follows the user's request for a vegan breakfast recipe.
========
Model: rerank
Yes, the response correctly follows the user's request for a dairy-free pasta recipe.
========
```

Evaluation - Test configurations

LLM Temperature	LLM Top_P	LLM Top_K	Retriever Type
0.1	0.1	2	Coarse
0.5	0.9	10	Reranker
1.0			Self-Query Chain

Evaluation - Results

	Retriever Type	Temperature	Top P	Top K	LLM Gatekeeper Score	LLM Quality Score	Total Score
Baseline	N/A	0.1	0.9	2	0.916667	4.6	2.7583
1	Coarse	0.1	0.9	2	0.916667	5.0	2.958333
2	Coarse	0.5	0.9	2	0.958333	4.933333	2.958333
3	Coarse	0.1	0.1	10	0.958333	4.933333	2.958333
4	Coarse	0.5	0.1	10	0.916667	4.933333	2.925000
5	Coarse	1.0	0.1	2	0.916667	4.933333	2.925000
6	Self Query Chain	0.1	0.1	10	0.958333	4.933333	2.912500
7	Coarse	0.5	0.1	2	0.958333	4.866667	2.912500
8	Coarse	0.5	0.9	10	0.916667	4.866667	2.891667
9	Coarse	1.0	0.1	10	0.916667	4.866667	2.891667
10	Self Query chain	0.1	0.9	10	0.916667	4.866667	2.891667

Survey Results:

1. **Recipe Trials:** 38% of users have tried the suggested recipes, while 50% plan to try them soon.
2. **Recipe Accuracy:** 39% of users found the recipes to perfectly match their queries, while 50% found minor acceptable deviations.
3. **Recipe Creativity:** Users were split on the creativity of the recipes, with 35% finding them exceptionally creative and 28% finding them standard.
4. **Recipe Healthiness:** 13%of users found the recipes balanced, while 63% finding them generally healthy
5. **Improvements & Feedback:** Users suggested various improvements and provided additional feedback, which will be invaluable for future app enhancements.

75% of users are likely to recommend the app for suggesting tasty and reasonably easy to prepare recipes

Key Learnings

Implementation of a complex RAG system with additional layers for optimizing the LLM context window with relevant documents, LLM agents, and usage of LLM as a judge.

Implementation of the best offerings available within the GenAI field to enhance access to healthy and sustainable meal options. Our innovative chatbot curates personalized recipes, helping users make informed choices that reduce food waste and promote overall well-being.
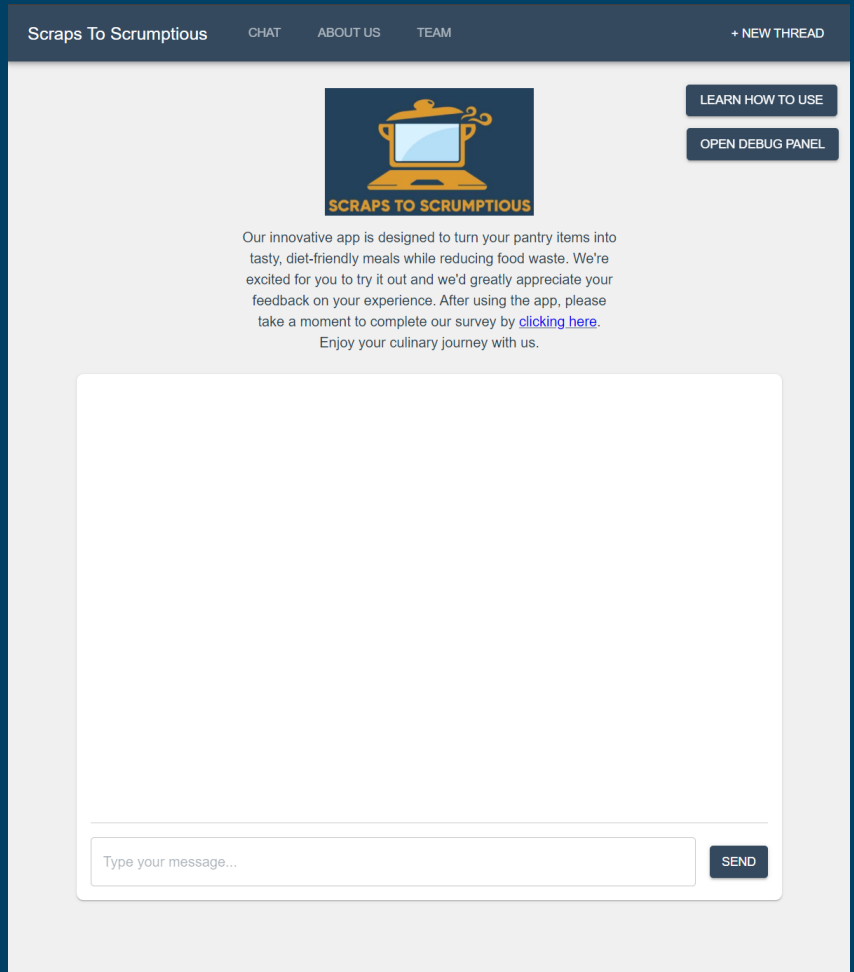
Roadmap

Phase 1 - Chat based RAG System

Phase 2 - Expand from static dataset to ingest from multiple sources

Phase 3 - Integrate with image classifier system that monitors available food

Mission

Help households turn overlooked ingredients into delicious meals, promoting health and sustainability one recipe at a time.

LEARN HOW TO USE

OPEN DEBUG PANEL

SCRAPS TO SCRUMPTIOUS

Our innovative app is designed to turn your pantry items into tasty, diet-friendly meals while reducing food waste. We're excited for you to try it out and we'd greatly appreciate your feedback on your experience. After using the app, please take a moment to complete our survey by clicking here. Enjoy your culinary journey with us.

Type your message...　　SEND