Navigating Inclusive Tourism: An AI-Powered Guide for Non-Japanese Tourists

BACKGROUND

In 2023, the number of inbound visitors traveling to Japan amounted to approximately 25.07 million, recovering considerably compared to the previous year. However, there are several challenges for foreign tourists when they travel in Japan

Majority of tourists don't understand Japanese

Food ingredients might be different from tourists' country

➢ **Ingredient Confusion**
Unfamiliar ingredients make it hard to identify dietary restrictions

➢ **Allergen Alerts**
Identifying food allergies and intolerances is challenging

➢ **Hard to comply diet restriction based on religions**

Halal for Muslims	Kosher for Jews	Vegetarian for Hindus
No pork on non halal meat products, alcohol	Avoid pork	No meat, dairy, or animal products

AI Utilization | Food Classifier

1. User profiling
Users input their diet restriction and preferences

2. Capture Image
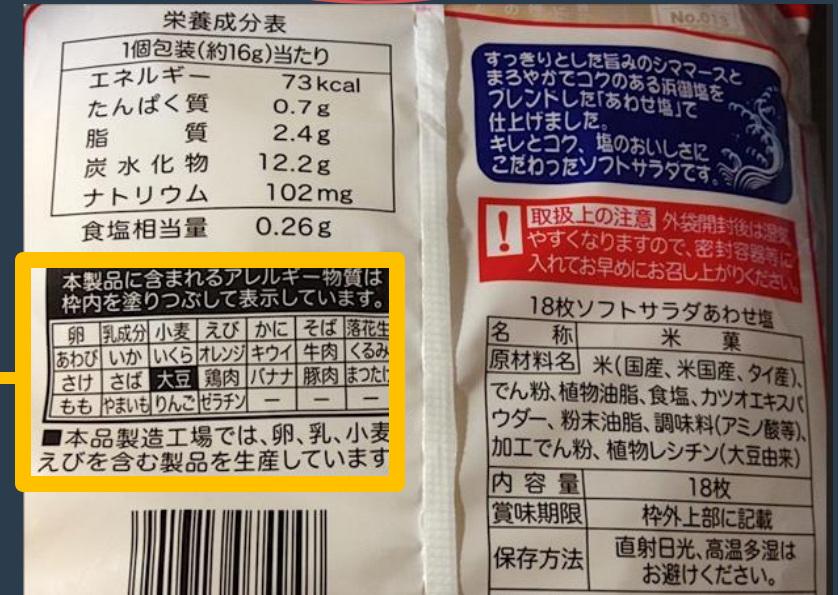Snap a photo of the ingredient's label

3. Image inference
Using multimodal-multilanguage LLM, we will analyze the captured image and the user profile information

4. Result
LLM will inform the users in English or their preferred language if they can eat the food or not
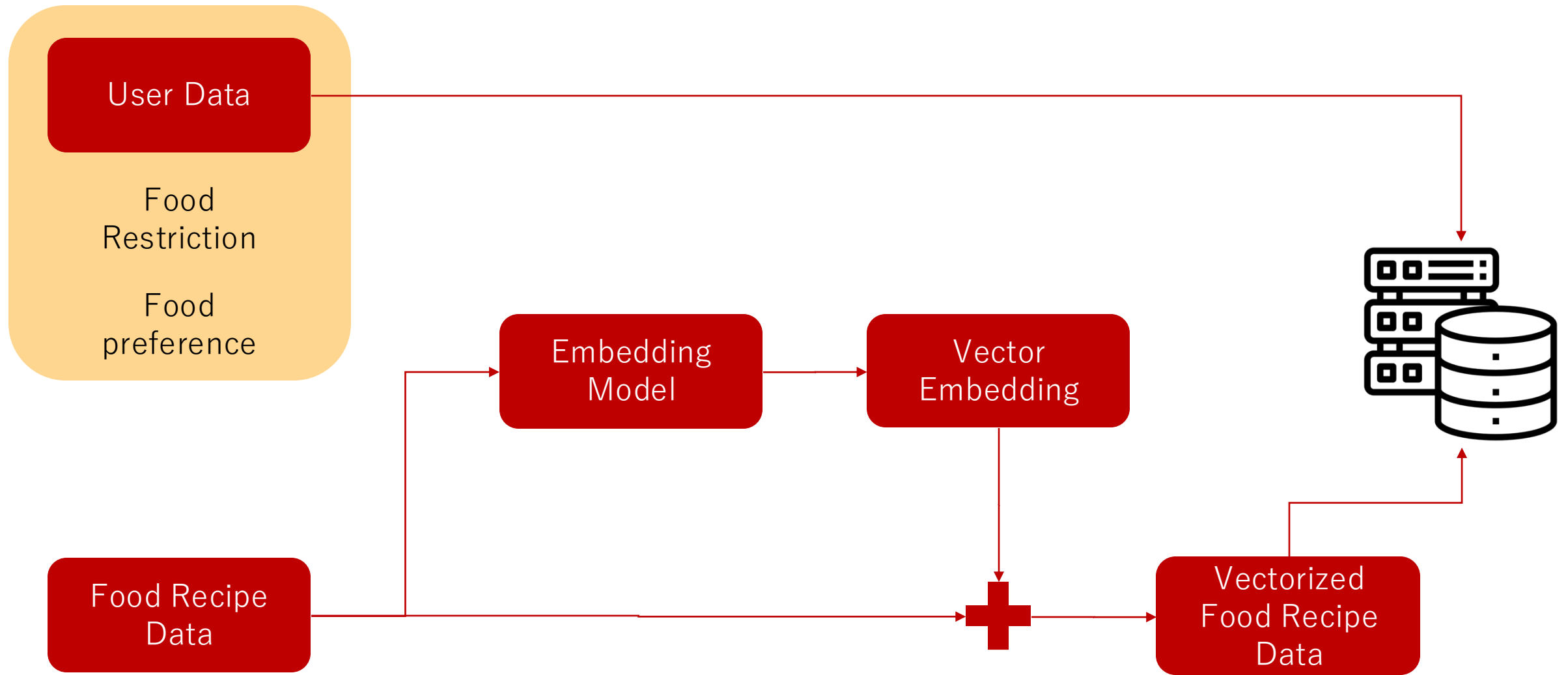
Example:

Ingredients

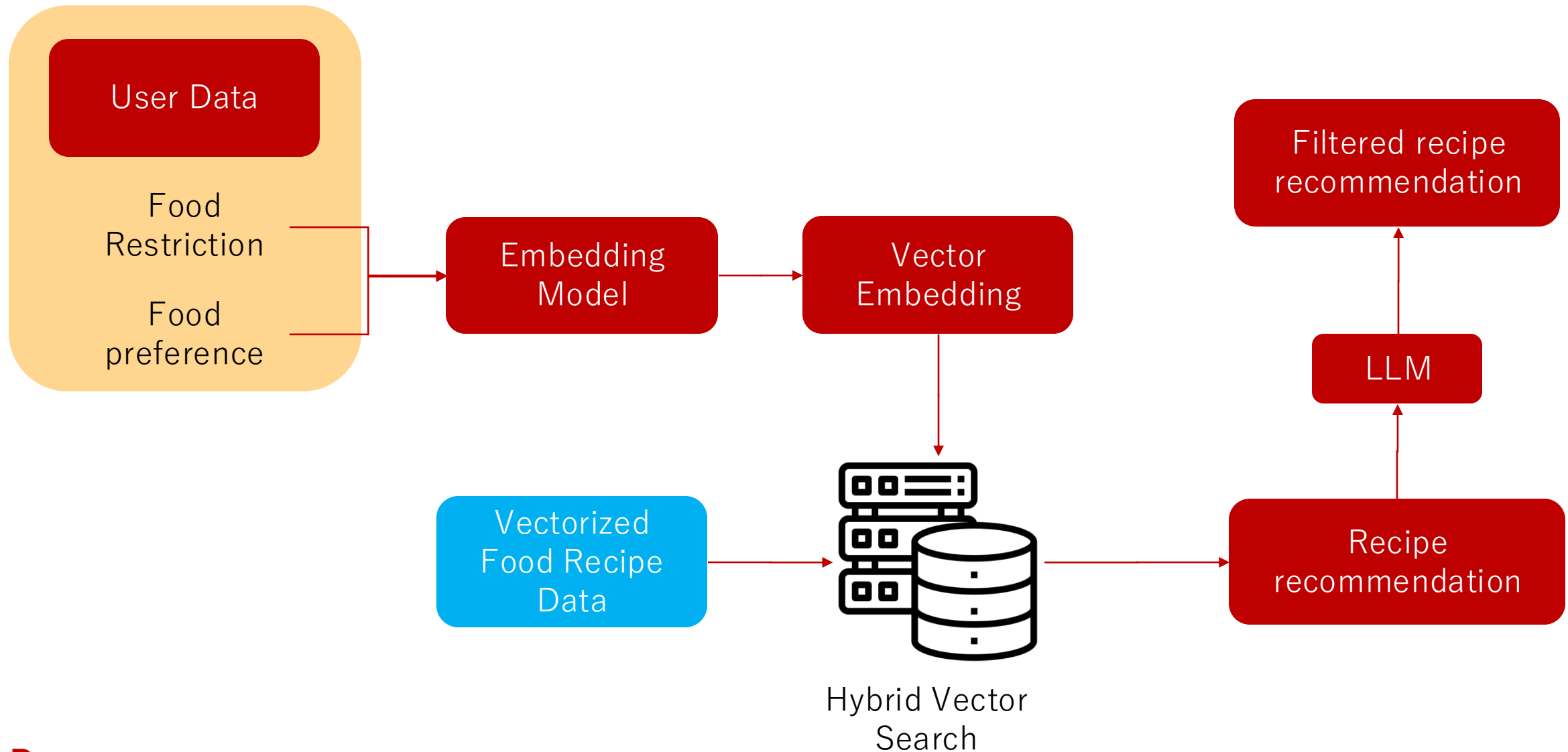|	
egg milk ingredients	soybeans
wheat	chicken meat
Shrimp	banana
Crab	pork
Soba	Matsutake
peanut	Peaches
Abalone Salmon	Yam
squid	apple
orange	gelatin
kiwi	
Beef	
Walnut	
Mackerel	

■This product manufacturing factory produces products containing eggs, milk, wheat, and shrimp.

✓ This product contains pork, gelatin and dairy product, so muslim cannot eat it

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AI-Utilization｜Recommender System｜Data Collection

User Data

Food Restriction

Food preference

Embedding Model

Vector Embedding

Food Recipe Data

Vectorized Food Recipe Data

AI-Utilization | Recommender System | Inference

Data Collection Methodology

Open source data:

@misc{shuyang_li_2019, title={Food.com Recipes and Interactions},
url={https://www.kaggle.com/dsv/783630},
DOI={10.34740/KAGGLE/DSV/783630}, publisher={Kaggle},
author={Shuyang Li}, year={2019} }

```python
recipe_data.head()
✓ 0.0s                                                                        Python
```
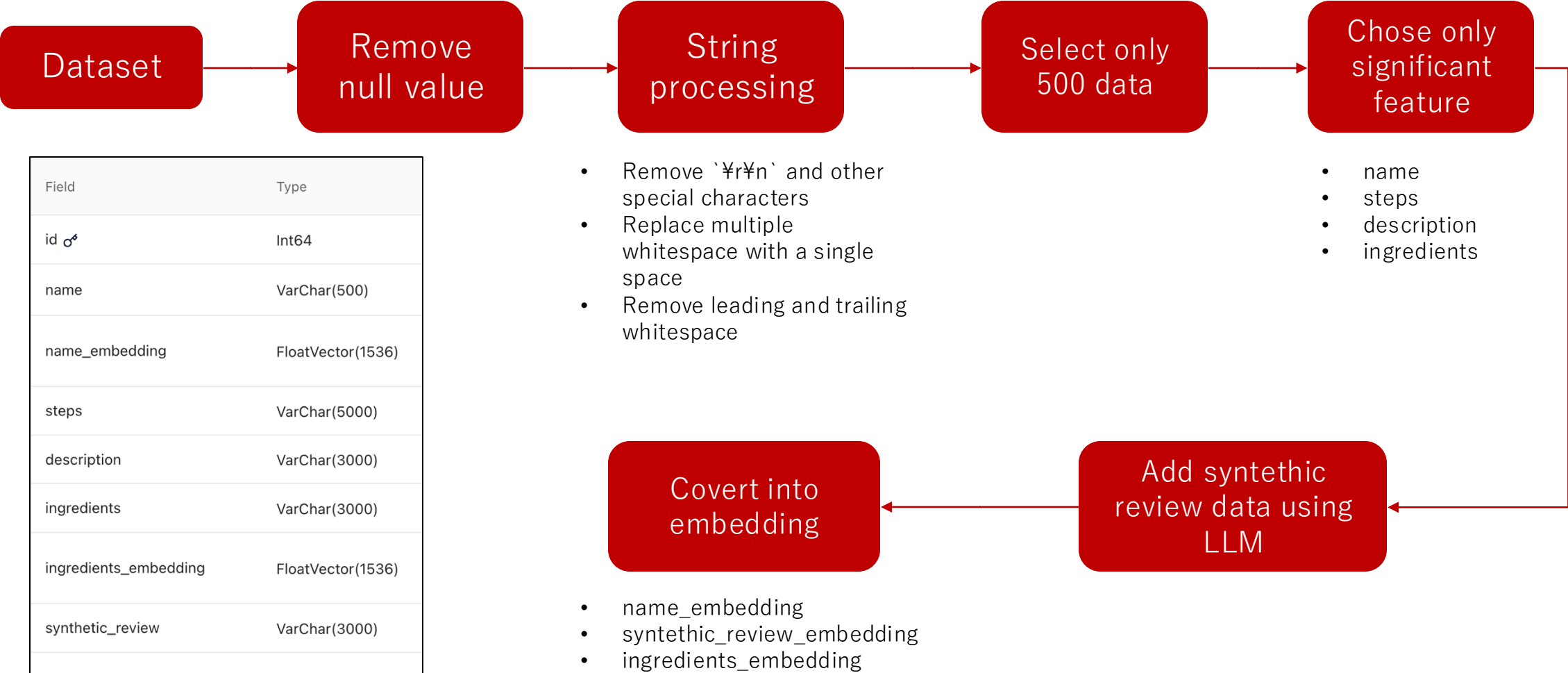
	name	id	minutes	contributor_id	submitted	tags	nutrition	n_steps	steps	description	ingredients	n_ingredients
0	arriba baked winter squash mexican style	137739	55	47892	2005-09-16	['60-minutes-or-less', 'time-to-make', 'course...	[51.5, 0.0, 13.0, 0.0, 2.0, 0.0, 4.0]	11	['make a choice and proceed with recipe', 'dep...	autumn is my favorite time of year to cook! th...	['winter squash', 'mexican seasoning', 'mixed ...	7
1	a bit different breakfast pizza	31490	30	26278	2002-06-17	['30-minutes-or-less', 'time-to-make', 'course...	[173.4, 18.0, 0.0, 17.0, 22.0, 35.0, 1.0]	9	['preheat oven to 425 degrees f', 'press dough...	this recipe calls for the crust to be prebaked...	['prepared pizza crust', 'sausage patty', 'egg...	6
2	all in the kitchen chili	112140	130	196586	2005-02-25	['time-to-make', 'course', 'preparation', 'mai...	[269.8, 22.0, 32.0, 48.0, 39.0, 27.0, 5.0]	6	['brown ground beef in large pot', 'add choppe...	this modified version of 'mom's' chili was a h...	['ground beef', 'yellow onions', 'diced tomato...	13

```python
recipe_data.info()
✓ 0.0s
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 231637 entries, 0 to 231636
Data columns (total 12 columns):
 #   Column          Non-Null Count   Dtype
---  ------          --------------   -----
 0   name            231636 non-null  object
 1   id              231637 non-null  int64
 2   minutes         231637 non-null  int64
 3   contributor_id  231637 non-null  int64
 4   submitted       231637 non-null  object
 5   tags            231637 non-null  object
 6   nutrition       231637 non-null  object
 7   n_steps         231637 non-null  int64
 8   steps           231637 non-null  object
 9   description     226658 non-null  object
 10  ingredients     231637 non-null  object
 11  n_ingredients   231637 non-null  int64
dtypes: int64(5), object(7)
```

Data Collection Methodology: Data Prerocessing

Dataset → **Remove null value** → **String processing** → **Select only 500 data** → **Chose only significant feature**

String processing:
- Remove `¥r¥n` and other special characters
- Replace multiple whitespace with a single space
- Remove leading and trailing whitespace

Chose only significant feature:
- name
- steps
- description
- ingredients

Covert into embedding ← **Add syntethic review data using LLM**

Covert into embedding:
- name_embedding
- syntethic_review_embedding
- ingredients_embedding

| Field	Type
id 🔑	Int64
name	VarChar(500)
name_embedding	FloatVector(1536)
steps	VarChar(5000)
description	VarChar(3000)
ingredients	VarChar(3000)
ingredients_embedding	FloatVector(1536)
synthetic_review	VarChar(3000)
synthetic_review_embedding	FloatVector(1536)

Further improvement point: Combine Neural Collaborative Filtering with Current System

Our approach: content based filtering -> uses item features to recommend other items similar to what the user likes

CF: In a broad sense, it is the process of filtering for information or patterns using techniques involving collaboration among multiple users, agents, and data sources.

Matrix Factorization

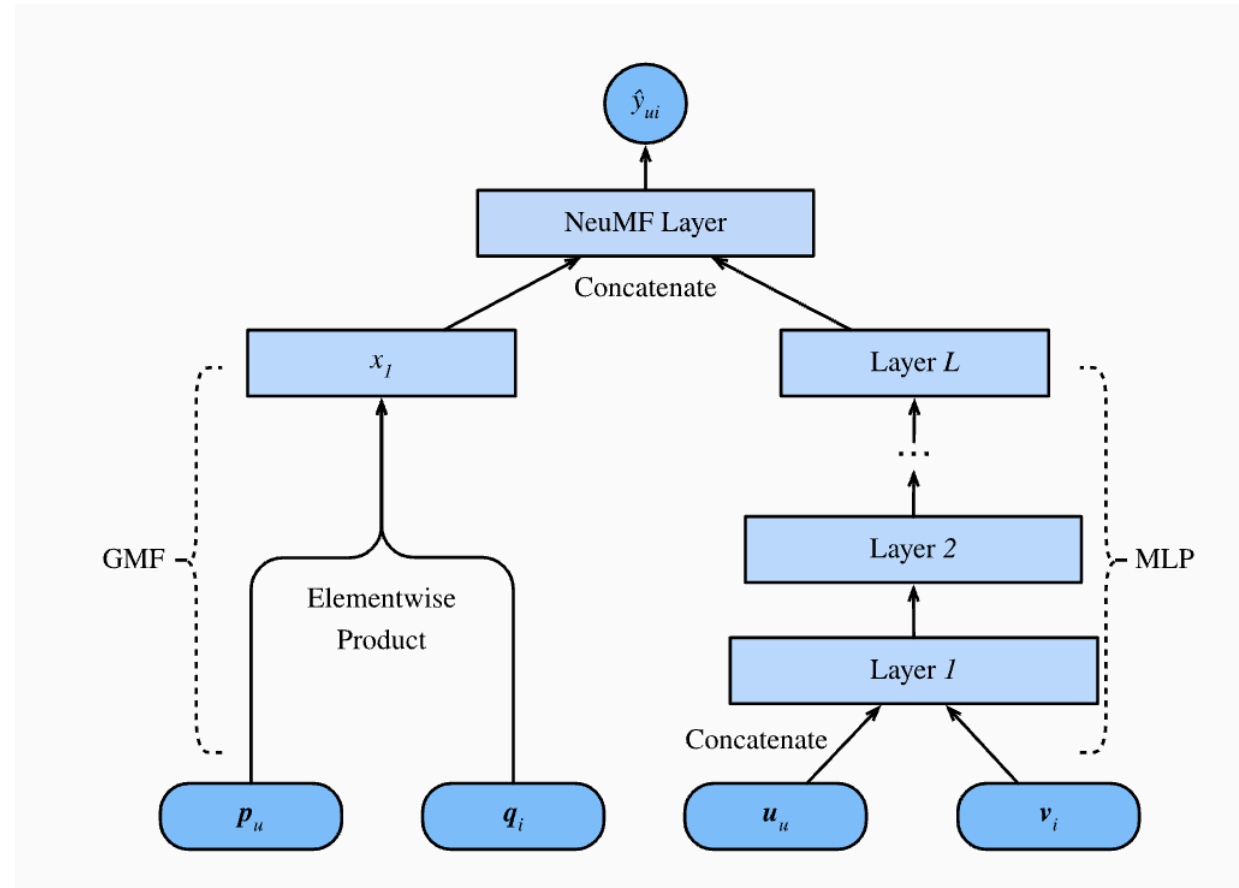User-Home Matrix ≈ User Matrix × Home Matrix
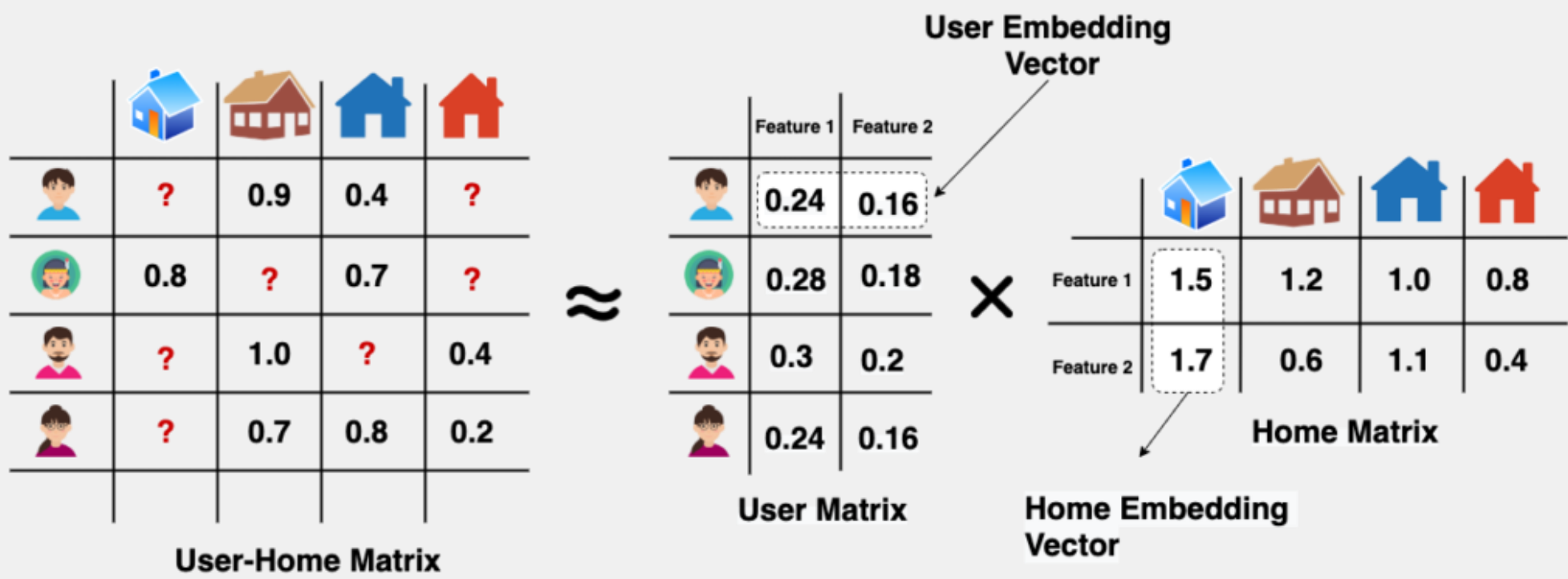
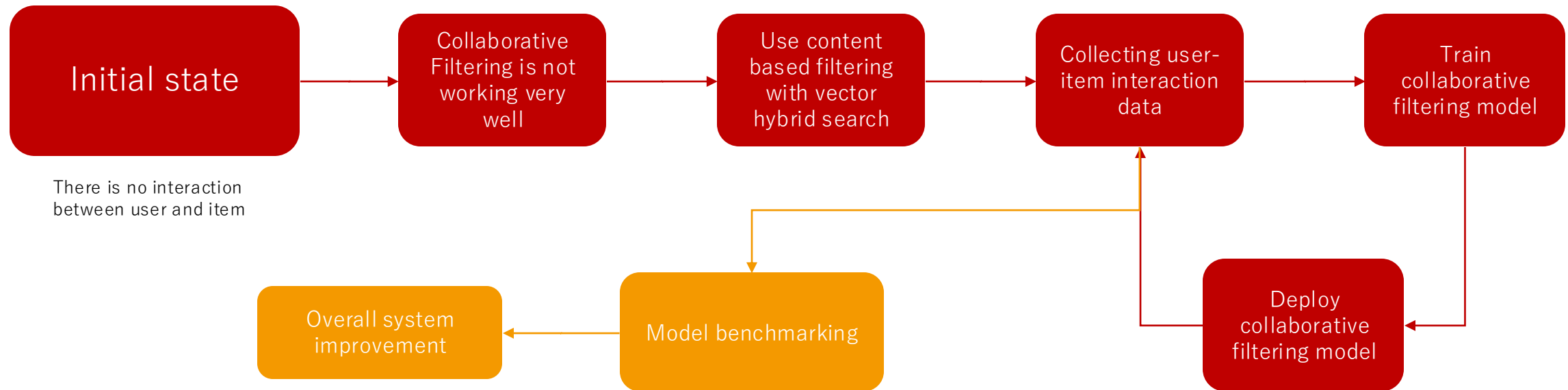# Further improvement point: Combine Neural Collaborative Filtering with Current System

Neural Collaborative Filtering: Combination of matrix factorization and neural network

Matrix factorization deficiency:
- Lack of expresiveness: The inner product, which simply combines the multiplication of latent features linearly, may not be sufficient to capture the complex structure of user interaction data.
- Only use explicit feedback ->cannot incorporate implicit feedback

Further improvement point: Combine Neural Collaborative Filtering with Current System

Initial state

There is no interaction between user and item

Collaborative Filtering is not working very well

Use content based filtering with vector hybrid search

Collecting user-item interaction data

Train collaborative filtering model

Deploy collaborative filtering model

Model benchmarking

Overall system improvement

References

1. https://medium.com/@rebirth4vali/implementing-matrix-factorization-technique-for-recommender-systems-from-scratch-7828c9166d3c
2. Dive deep into deep learning books
3. Icon: flaticon.com