

Documentation

Documentation: Weather & Wine Recommendation System

Overview

This project fetches weather and wine data, merges them, stores them in a PostgreSQL database, uses OpenAI's GPT to generate wine recommendations based on current weather, and exposes the functionality through a FastAPI backend.

Modules Breakdown

`wine_fetch.py` – Fetch Wine Descriptions

- **Purpose:** Uses the Spoonacular API to fetch wine descriptions for a predefined list of wines.
- **Why:** Descriptive metadata about each wine helps the language model make more context-aware recommendations.
- **Key Features:**
 - Asynchronous API calls using `aiohttp`.
 - Saves data to `Wine_train.json`

`data_fetch.py` – Weather Data Collection

- **Purpose:** Uses the OpenWeather API to fetch **current weather data** for a predefined list of cities.
- **Why:** Weather conditions (e.g. temperature, feels-like temperature) influence wine preferences (e.g. bold reds vs. light whites). Supplying weather data helps the language model make **contextual and personalized wine recommendations**.

- **Key Features:**

- Asynchronous weather data fetching using `aiohttp` for efficient parallel API calls.
- Extracts relevant metrics such as temperature and feels-like temperature in both Celsius and Fahrenheit.
- Saves:
 - Raw weather data to `Weather_train.json`
 - Cleaned and structured data to `weather_cleaned.json`

`merge_data.py` – Merge Weather and Wine Data

- **Purpose:** Merges weather data and wine descriptions into a single JSON file (`merged_data.json`).
- **Why:** Centralizing the data allows the LLM module to access and reason over a unified structure.
- **Key Features:**
 - Asynchronous file I/O using `aiofiles`.
 - Structure ensures the merged output includes keys `"weather"` and `"wine"` for easy parsing downstream.

`Database.py` – Store Merged Data in PostgreSQL

- **Purpose:** Inserts the content of `merged_data.json` into a PostgreSQL table (`merged_data`).
- **Why:** Persistent storage ensures data availability across sessions and scales better than keeping everything in memory.
- **Key Features:**
 - Auto-creates table if it doesn't exist.
 - Stores entire JSON blob for flexibility in future querying or auditing.

llm.py – Generate LLM-Based Wine Recommendations

- **Purpose:** Uses OpenAI's GPT to generate summaries that recommend a wine based on a user's weather-based query.
- **Why:** The power of LLMs allows for rich, contextual wine recommendations by interpreting temperature and wine features.
- **Key Features:**
 - Extracts the city from the query.
 - Looks up the weather for that city.
 - Constructs a natural-language prompt to GPT-4.
 - Stores unique summaries in the `analysis_summaries` table in PostgreSQL.
 - Avoids duplicate entries using a pre-check.

main.py – FastAPI Web Server

- **Purpose:** Hosts three API endpoints to interact with the system.
- **Why:** Provides an interface for external clients to use the system programmatically.
- **Endpoints:**
 - `POST /fetch_and_process` : Accepts a query like *"What's the weather in Paris and what wine suits it?"* Calls the LLM and stores result.
 - `GET /results` : Returns all LLM-generated recommendations, optionally filtered by city.
 - `GET /analysis` : Returns only the latest summary (or latest per city).

Data Flow Overview

1. `wine_fetch.py` + (external weather data source): Generate base JSONs.

2. `merge_data.py` : Combines both datasets into `merged_data.json` .
3. `Database.py` : Saves this merged data to the PostgreSQL database.
4. `llm.py` : Reads from the merged file, calls GPT, and stores summaries.
5. `main.py` : API interface to query the system and access summaries.

Files Summary

File	Role
<code>wine_fetch.py</code>	Fetch wine data from Spoonacular API
<code>merge_data.py</code>	Merge wine + weather JSON into unified format
<code>merged_data.json</code>	Output file from merge step (used throughout the system)
<code>Database.py</code>	Push merged data into PostgreSQL
<code>llm.py</code>	GPT logic to generate and store recommendations
<code>main.py</code>	FastAPI backend for querying and managing data
<code>.env</code>	Secure storage of API keys and DB credentials (not shared here)

Why Use GPT/LLM?

- The use of GPT enables **natural language interpretation** and **contextual wine pairing** that would be difficult to hardcode.
- By combining weather details (e.g., *"feels like 34°C"*) with nuanced wine descriptions, GPT provides thoughtful and dynamic recommendations.

Environment Variables

The system relies on a `.env` file with:

```
env
CopyEdit
POSTGRES_DB_URL=your_postgres_connection_url
```

```
OPENAI_API_KEY=your_openai_api_key
SPOONACULAR_API_KEY=your_spoonacular_api_key
```

Kindly use own api-keys

Open-Weather = ""

spoonacular= " "

Open_API_key = ""

PostgressSQL = ""

Why This Architecture?

- **Separation of concerns:** Each script handles one task (data fetching, merging, storing, generating, serving).
- **Scalability:** Modular design allows replacing components (e.g., new wine API or weather provider).
- **Efficiency:** Async operations for fetching and merging improve performance.
- **Reliability:** PostgreSQL provides durable storage, while LLM ensures rich content generation.

LLM Integration Overview

This is a visual representation of how the **LLM (Large Language Model)** integrates the weather and wine data:

- The **weather API** provides city-specific temperature and climate data.
- The **wine API** offers descriptive profiles of various wines.
- When a user asks, for example, *"What wine should I have in Paris?"*, the system:
 1. Looks up the **current weather** in Paris.
 2. Uses GPT to interpret both the **weather** and the **wine dataset**.
 3. Generates a personalized **wine recommendation**.

Adaptive Recommendations

The output varies based on city and weather. For example:

- In **Paris** with warm weather, it may suggest a light, crisp white wine like **Riesling**.
- In **Berlin** on a cooler day, it might recommend a bold red like **Cabernet Sauvignon**.

Illustration

This diagram shows the flow of data and logic between the components:

```
Problems Output Debug Console Terminal Ports
(pyenv) PS E:\Vengon\work\src> python .Vlm.py
Ask: what's the weather like in London and which wine suits it?
(pyenv) PS E:\Vengon\work\src> python .Vlm.py
The current temperature in London is 16.54°C and it feels like 15.71°C. Considering this mild temperature, a bottle of Pinot Noir would be a suitable choice. Pinot Noir is a light to medium-bodied red wine that is perfect for slightly cooler temperatures. It is not as heavy as other red wines like Cabernet Sauvignon or Malbec, making it a perfect balance for this kind of weather. Its diverse flavor profile, with notes of red fruit, spice, and earth, can also bring a comforting warmth to a slightly cool day.
Ask: what's the weather like in Sydney and which wine suits it?
The current temperature in Sydney is 20.97°C and it feels like 21.85°C. Given this temperature, a suitable wine could be Sauvignon Blanc. This is because Sauvignon Blanc is generally served chilled and is known for its refreshing and crisp qualities, making it a great choice for a relatively warm temperature. At around 20°C to 22°C, it's not too hot or too cold, which is a good temperature range for enjoying this type of white wine. It's also a versatile wine that can pair well with a variety of dishes.
(pyenv) PS E:\Vengon\work\src> python .Vlm.py
Ask: what's the weather like in Mumbai and which wine suits it?
The current temperature in Mumbai is 29.17°C but it feels like 34.15°C. Given this warm weather, a suitable wine would be Sauvignon Blanc. This is because Sauvignon Blanc is a light-bodied white wine that is often consumed chilled, and therefore can be refreshing in warmer weather. It also has a high acidity which can be very thirst-quenching in the heat. The tropical, grassy, and citrus flavors in Sauvignon Blanc can also complement the typical spicy and flavorful dishes in Mumbai's cuisine.
(pyenv) PS E:\Vengon\work\src> python .Vlm.py
Ask: what is the weather like in Berlin and which wine suits it?
The current temperature in Berlin is 19.58°C and it feels like 18.87°C. Given these temperatures, a nice bottle of Chardonnay would be a great choice. Chardonnay is a white wine that is typically served chilled, between 7-11°C, making it refreshing during milder weather. Additionally, Chardonnay has a crisp, fruity profile that pairs well with a variety of food, making it a versatile choice for an outdoor gathering or a meal. Its light and refreshing nature will complement the current temperature perfectly.
(pyenv) PS E:\Vengon\work\src> python .Vlm.py
Ask: what is the weather like in Tokyo and which wine suits it?
The current temperature in Tokyo is 13.36°C and it feels like 11.87°C. Given this temperature, Pinot Noir would be a suitable choice. Pinot Noir is a red wine that is lighter in body and served slightly cooler than other reds, typically around 12-16°C. This makes it versatile and easy to pair with a wide variety of foods. The current temperature in Tokyo falls within this range, so a Pinot Noir would be at just the right temperature to bring out its best flavors.
(pyenv) PS E:\Vengon\work\src> python .Vlm.py
Ask: what is the weather like in Paris and which wine suits it?
The current temperature in Paris is 20.89°C and it feels like 19.51°C. Given this moderate temperature, a medium-bodied red wine like a Pinot Noir would be most suitable. Pinot Noir is versatile and can be enjoyed at a range of temperatures, but it is often best served slightly cooler than room temperature, around 16-18°C. Serving this wine in the current weather will allow its complex flavors and aromas to be fully appreciated.
(pyenv) PS E:\Vengon\work\src> python .Vlm.py
Ask: what is the weather like in New York and which wine suits it?
The current temperature in New York is 17.40°C and it feels like 17.19°C. Given these moderate temperatures, a Pinot Noir would be a great choice. Pinot Noir is typically served at a slightly cooler room temperature, around 16°C to 18°C, which aligns well with the current weather. It is a medium-bodied red wine that isn't too heavy for a moderate temperature day. The light, fruity notes of a Pinot Noir can be quite refreshing, while its complexity can also provide a warming sensation if there's a slight chill in the air.
(pyenv) PS E:\Vengon\work\src>
```



