

Documentation for Code and Dataset

Predefined Functions

1. FuelConsumptionTool Class

- **Purpose:** The FuelConsumptionTool class is designed to analyze vehicle fuel consumption and emissions data from Canada. It includes various methods that help filter, process, and return data based on user queries.
- **Main Methods:**
 - **get_function_definition():**
 - **Description:** Provides the function metadata, including its name, expected input parameters, and outputs. This helps the LLM understand the structure of the function for integration.
 - **Usage:** Helps map user input to the function seamlessly within the LLM's tool use.
 - **get_name():**
 - **Description:** Returns the function's name for identification and mapping.
 - **Usage:** Ensures the LLM can recognize the function when calling it during user interactions.
 - **run_impl(params):**
 - **Description:** The main execution logic of the tool. Filters the dataset based on input parameters (e.g., year, make, model, fuel type) and returns the relevant vehicle data.
 - **Inputs:** User-provided parameters such as year, make, model, and fuel type.
 - **Outputs:** A filtered dataset containing information about the most fuel-efficient car(s).
 - **Detailed Implementation for Finding Most Fuel-Efficient Cars:**
 - Filters the dataset for the specified year.
 - Identifies the car(s) with the lowest Combined (L/100 km) fuel consumption value.
 - Returns details including Make, Model, Combined (L/100 km), and Fuel type:

python

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```
min_combined_consumption = year_data['Combined (L/100 km)'].min()
most_fuel_efficient = year_data[year_data['Combined (L/100 km)'] ==
min_combined_consumption]
car_info = most_fuel_efficient[['Make', 'Model', 'Combined (L/100 km)', 'Fuel
type']].to_dict(orient="records")
```

2. Groq Client Integration

- **Purpose:** Facilitates interaction between the application and the LLM to process user input and generate relevant responses.

- **Attributes and Methods:**
 - **Groq(api_key=API_KEY):**
 - **Description:** Initializes the client with an API key for authentication.
 - **client.chat.completions.create():**
 - **Description:** Sends conversation data to the LLM.
 - **Parameters:**
 - **model:** Specifies the LLM version used.
 - **messages:** Contains user and system prompts.
 - **tools:** Lists tools (e.g., FuelConsumptionTool) available to the LLM.
 - **tool_choice:** Specifies whether tool selection is automatic or manual.
 - **max_tokens:** Maximum token length for responses.

Dataset Description

fuel_data Dataset Overview: The fuel_consumption_canada.csv dataset comprises comprehensive data about vehicle fuel consumption and emissions in Canada. Below is an explanation of each column:

- **Model year:** Indicates the manufacturing year of the vehicle. This is useful for trend analysis and filtering data for specific years.
- **Make:** The manufacturer or brand of the vehicle (e.g., Acura, Audi). Allows users to filter or sort data by car brand.
- **Model:** The specific model of the car. Used to distinguish between different cars from the same manufacturer.
- **Vehicle class:** The classification of the vehicle (e.g., Subcompact, Compact, Two-seater). Helps users filter cars by type.
- **Engine size (L):** The engine displacement size in liters. Indicates the engine's capacity and can be relevant for performance analysis.
- **Cylinders:** The number of cylinders in the engine. Affects the vehicle's performance and fuel efficiency.
- **Transmission:** The type of transmission (e.g., A4 for 4-speed automatic, M5 for 5-speed manual). Helps analyze performance and fuel usage.
- **Fuel type:** The type of fuel the vehicle uses (e.g., X for regular gasoline, Z for premium gasoline). Important for understanding fuel consumption differences.
- **City (L/100 km):** The fuel consumption in liters per 100 km when driving in city conditions. Useful for comparing city-specific fuel efficiency.
- **Highway (L/100 km):** The fuel consumption in liters per 100 km on highways. Allows comparison of fuel efficiency on highways.
- **Combined (L/100 km):** The average of city and highway fuel consumption in liters per 100 km. A key metric for overall fuel efficiency.
- **Combined (mpg):** The combined fuel consumption in miles per gallon. Helps users familiar with mpg to understand fuel efficiency.

- **CO2 emissions (g/km):** The amount of CO2 emitted per kilometer. An essential metric for assessing environmental impact.

Use Cases:

- **Find the Most Fuel-Efficient Car(s):** Users can request data on vehicles with the lowest Combined (L/100 km).
- **Compare Vehicles by Make or Model:** Filter data to compare fuel consumption between different models or manufacturers.
- **Analyze Emissions:** Use the CO2 emissions (g/km) column to identify low-emission vehicles.
- **Trend Analysis by Year:** Track changes in fuel efficiency over time using the Model year column.

User Questions Answered by the Dataset:

- Which vehicle has the lowest combined fuel consumption for a given year?
- What are the fuel types used by vehicles with the highest efficiency?
- How does fuel efficiency compare across different manufacturers or models?
- What is the average fuel consumption for vehicles in a given year?