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## Part 4: RAG, User Interface, and Web Analytics

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### User Interface

It is now the time to give your search engine a user interface (UI) and apply some web analytics to it. You are asked to provide a Web application for entering the search query, displaying the search results, and collecting usage statistics.

Use the simple Python web framework **Flask** that runs its own development web server (a project boilerplate will be created in class as a hands-on part of the Web Analytics seminar).

Project content:

1. **Search page:** Create a main web page with a central search box for users to enter a query and a button to execute the search.
2. **Search action:** When the button is clicked in the UI, the search text must be passed to this engine's search function.
3. **Search function in the engine:** Provide in your search engine a general "search" function that receives a string as a parameter. Add any other parameter you consider helpful for the implementation.
4. **The search algorithms:** The search function, in turn, must call the previously defined algorithms:
  - a. Now that you have a real use case, optimize your algorithms for the goal of retrieving the best results, faster, cleaner, and better suited to the user's information needs.
  - b. Structure your code in a way that can be used in a web application.
  - c. The document corpus will be the already provided E-commerce website database.
5. **The results page:** create a web page that displays the list of documents found for the query and in the calculated order/ranking.
  - a. Each result record must represent a document from the corpus, so it must have at least the following properties:
    - i. Title
    - ii. Description
    - iii. Selling\_price, discount
    - iv. Average\_rating
    - v. URL (used to link to the document on the original website)
    - vi. Other items you consider relevant for the results page.
6. **LLM summary on the results page:** add the results summarisation using 3rd third-party API to complete a RAG system based on a search in a custom database.
7. **The document details page:** a page to display the whole document's information.
  - a. Display other relevant properties present in the corpus for each document.

## RAG

You are given a basic Retrieval-Augmented Generation (RAG) pipeline that takes a query and retrieved product information from an e-commerce dataset to generate answer for user. While functional, the system is overly generic and leaves significant room for improvement.

**Task:** analyze the weaknesses of the baseline RAG and propose ways to improve it. You must suggest and implement two-three improvements (e.g., refined prompts, use of additional metadata, handling “no good products,” or alternative retrieval/generation methods). In your report, clearly describe each suggested improvement, explain why it should help (pros and cons), and demonstrate with examples how your improved version outperforms the baseline.

## Web Analytics

You are required to provide a robust mechanism for effective tracking and analyzing how people use your website and the search engine’s use.

As this is for educational purposes, you can store data in memory (the use of a database for long-term persistence is optional, and if used, it must be very well documented in order for teachers to reproduce it in their environments for evaluation).

1. **Data collection:** You can, for example, collect and store the following actions:
  1. For HTTP
    - Requests data
    - Clicks
    - HTTP Sessions data
  2. For queries: number of terms, order, etc.
  3. For results (documents)
    - clicks on documents.
    - to what query where related.
    - ranking of clicked documents.
    - dwell time: the time between clicks on a result document and coming back to the results page.
  4. For user context (visitor):
    - browser, OS/computer/mobile, time of the day, date
    - *IP address, country, city (optional bonus point)*
  5. *For sessions (optional bonus point)*
    - *time-based sessions: queries of a user in the same sit-down (physical session).*
    - *missions: a sequence of queries with the same goal (logical session); there can be multiple missions within a physical session.*
    - *Research missions span across multiple sit-downs, days, weeks, etc.*
  6. All other information that you find interesting (justify in your report)

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2. **Data storage:** Design a data model to store the information that you collect about the website usage that you collect from the above point. Consider a star schema, for example, with the following tables:
  - a. Session
  - b. Click
  - c. Request
3. **The analytics dashboard:** Create a web page that displays the usage statistics.
  - a. Define key indicators, metrics, and reports.
  - b. Show how people use your website and search engine.
  - c. Provide graphs with explanations of what is displayed.