

Retrieval Augmented Generation (RAG) Challenge

My Personal Librarian

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February 7, 2025

Introduction

Retrieval Augmented Generation (RAG) is a novel approach that combines the strengths of retrieval-based and generation-based models to provide accurate and contextually relevant responses. By leveraging a vector database to retrieve relevant documents and a large language model (LLM) to generate responses, RAG can significantly enhance the capabilities of applications in various domains such as customer support, knowledge management, and content creation.

Project Goals

Gain a comprehensive understanding of RAG's components and their integration through the process of dataset selection all the way through to connection to external artifacts (Vector DB, APIs)

About the Data

The dataset used for this project consists of over 34,000 consumer reviews of Amazon products, provided by Datafiniti's Product Database. It includes basic product information, rating, and review text for each rating.

(source:

<https://www.kaggle.com/datasets/datafiniti/consumer-reviews-of-amazon-products/data>)

Approach

A. Setup

a. Dataset Selection

- i. Evaluate various datasets (learning materials, news articles, product, reviews) to choose one of interest for the project.

b. Notebook Prep

- i. Load necessary libraries
- ii. Set up API keys and file paths.
- iii. Ensure all dependencies are properly initialized.

B. Data Cleaning

- a. Evaluation of columns, missing values, duplicate rows, etc.
- b. Removal of newlines, tabs, and excess whitespace

- [illegible]

a. Load pre-cleaned book text directly from a dataset

- #### D. Text Chunking Strategy

- ## E. Embedding Storage in ChromaDB

- ## F. Query Expansion & Document Retrieval

- a. Enhance user queries using GPT-4, to improve search accuracy
- b. Transform query into vector representation
- c. Perform semantic search, with ChromaDB retrieving the top-matching book chunks

G. Generating AI Responses

- a. Use ChromaDB search results to retrieve relevant book passages.
- b. Retrieved text is provided as context for GPT-4
- c. GPT-4 answers only based on retrieved information.

H. Evaluation with Benchmarking

- a. Compare expected vs generated answers.

Query	Expected Answer	Generated Answer	Evaluation
What is the capital of France?	Paris	Paris, France	I would score the response as a 4 . The generated answer does accurately identify the capital of France as Paris, which aligns with the expected answer. However, the addition of "France" is unnecessary as the question already indicates France as the country in question. Hence, the response could have been more concise, hence it's not a perfect 5.
What is the capital of France?	Paris	Paris, France	I would score this response a 4. The generated answer, "Paris, France," does correctly identify the capital of France as Paris. It just adds relevant but unnecessary information (France) to the answer. However, the addition does not distort the correctness of the answer.

- b. Rate responses from 1(poor) to 5(excellent) using GPT-4.
- c. Store evaluation results in a CSV file.

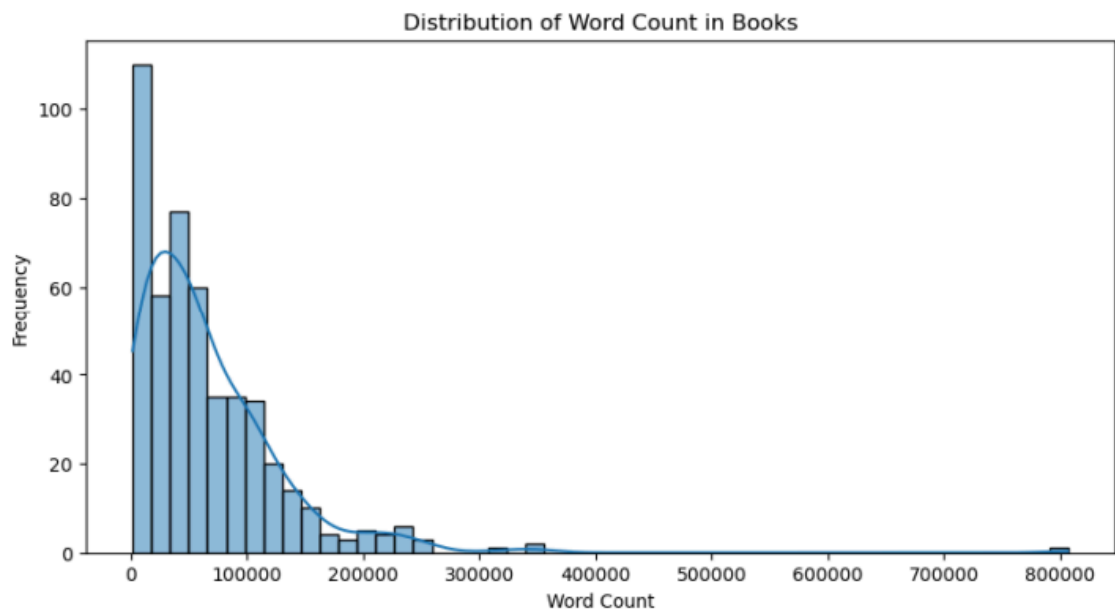
Results

A. EDA Findings

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RangeIndex: 500 entries, 0 to 499
Data columns (total 6 columns):
#   Column      Non-Null Count  Dtype
---  -
0   Title       500 non-null    object
1   Author      451 non-null    object
2   Link        500 non-null    object
3   ID          500 non-null    int64
4   Bookshelf   143 non-null    object
5   Text        482 non-null    object
dtypes: int64(1), object(5)
memory usage: 23.6+ KB
None
Total books: 494

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a. Evaluation with Benchmarking (5 books)

Query	Expected Response	Generated Response
Tell me about a pirate adventure story.	A classic pirate adventure involves sea battles, treasure hunts, and famous pirates like Blackbeard.	<p>In the story stated here, a group of pirates, while thoroughly preparing a meal, captured a man who was not willing to journey with them. This man was brought from Crete across the sea to Thoricus. The man, unable to bear the food served by these pirates, escaped secretly across the dark country to flee from his captors. In an attempt to evade being sold across the sea, he wandered alone.</p> <p>The adventure continued as certain strange events began to unfold. Wine flowed throughout their ship emitting a sweet, heavenly smell which seized all the crew with amazement. A vine sprawled across the top of the sail, brimming with many clusters and ivy twined around the mast, blossoming with flowers, and ripe berries. Garlands covered the thole-pins, adding to the bewilderment of the pirate crew.</p> <p>Suddenly a god, Dionysus, transformed into a dreadful lion aboard the ship, roaring and displaying his wonders. The god created a second creature, a shaggy bear, terrifying the crew. The scared sailors retreated to the stern and crowded around their righthanded helmsman, only for the lion to pounce on the ship's master. To escape, the sailors leapt overboard, whereupon they were transformed into dolphins.</p> <p>At this point, Dionysus had mercy on the helmsman and made him happy, revealing his true identity as the son of Zeus and Semele.</p> <p>This story ends by noting that Dionysus's mercy, even in the midst of calamity, restores joy, making this pirate adventure an eventful journey of transformation and mercy.</p>
What is a dystopian novel?	A dystopian novel explores a bleak future, often with oppressive governments or environmental disasters.	A dystopian novel is a type of book that presents a society that is the opposite of a utopia, typically featuring a future setting that has been rendered imperfect due to societal, political, or technological downfalls. These novels usually portray oppressive governments, environmental disasters, or other issues that lead to widespread suffering and injustice. Some well-known examples of dystopian novels include "1984" by George Orwell and "Brave New World" by Aldous Huxley. These narratives often serve as critiques of certain trends in the author's own society.
Who is Sherlock Holmes?	Sherlock Holmes is a fictional detective created by Arthur Conan Doyle, famous for his logical reasoning.	The provided text does not contain information on who Sherlock Holmes is.

b. Result Runs (500 books)

Query	Generated Response (as an assistant)	Generated Response (as a librarian)
What are the main themes in some of Victor Hugos works?	Victor Hugo's works often explore themes such as social and political issues, morality, love, and the human spirit. This is evident in "Les Misérables", which discusses issues of poverty, crime, and justice, and "The Hunchback of Notre-Dame", which about unrequited love and social isolation. He often depicted the struggles of marginalized groups and the harsh realities of society, examining the struggle between good and evil, and advocating for social reform. His later work "Actes et Paroles", from which the passage you provided comes, reflects on the power of words in political and social debates, along with ideas of progress and civilization.	Victor Hugo is known for addressing themes of social and political injustices, due process of law, tenderness and passion, romanticism, and the nature of love and forgiveness, among others. In his work "Actes et Paroles, Vol.I", which you mentioned, Hugo discusses the conflict between rights and laws and how civilization will progress when this dispute declines. He further speaks on the future society where the focus will shift from battles to discoveries, from warriors to workers. The work also emphasizes the importance of leading by evidence and ideal beauty, leaning towards a peaceful and just society ruled by intellect and creativity. Other examples from Hugo's catalogue include "Les Misérables", where he explores themes of law and religion, war, love and forgiveness. For example, he highlights social injustice by showing how the law treats people differently based on their social status - evident in the harsh punishment given to Jean Valjean for stealing a loaf of bread. The character's journey of redemption is also central to the story. In "The Hunchback of Notre Dame", he tenderly explores the themes of unrequited love, devotion and social ostracism. The tragically beautiful story of Quasimodo and his love for Esmeralda, despite his physical appearance, has captivated many readers over the years. Hugo's works have always pushed the boundaries, addressing the social and political issues of his time, despite the heavy censorship he endured. His passion for making a difference in society is clearly reflected in his diverse catalogue
Summarize a book by Zane Grey.	I'm sorry, but the provided text does not include any information about a book by Zane Grey. Zane Grey was an American author primarily known for his popular adventure novels and stories that presented an idealized image of the American frontier. If you provide me the title of a particular book by him, I'd be happy to give a summary of it.	The book "The U.P. Trail" by Zane Grey is a vivid description of the development of the railroad through the wild, uncharted terrain of the American West in the 1860s. The novel captures the tumultuous changes brought about by the railroad, with hollow, boisterous cities springing up and dying out as the constructions advanced further west. It encapsulates human elements of gold rush, lust, death, and the extremes of social differences. At the same time, the book paints a striking image of the harsh yet beautiful landscapes that the railway traverses, from the grassy plains of Nebraska to the barren land of Wyoming, then onto Utah's green valleys and Nevada's mountains, finally culminating

Query	Generated Response (as an assistant)	Generated Response (as a librarian)
		at the majestic Pacific. The story is enriched with vibrant depictions of local life and nature and the fraught encounters between settlers and Native American tribes, offering an expansive, multi-dimensional narrative that immortalizes the era and its overarching progress symbolised by the railroad.
Summarize some of Balzac's popular works.	It seems there may be some confusion. The text provided is related to the book "The Stones of Venice, Volume II" by John Ruskin, not the works of Honoré de Balzac. Balzac was a French novelist and playwright known for his series of novels and stories, "La Comédie Humaine," which presents a panorama of French society in the first half of the 19th century. Some of his popular works include "Père Goriot," "Lost Illusions," and "Eugénie Grandet." However, these are not discussed in the provided text. If you need information on Balzac's works, please provide the related texts.	As a librarian with intimate knowledge of this catalogue, it appears this particular excerpt focuses on Honoré de Balzac's "The Chouans". However, Balzac was a prolific writer best known for his series of novels and stories, "La Comédie Humaine", which presents a panorama of French society in the first half of the 19th century. Several popular works from this series include:1. "Eugenie Grandet": This is a meticulously observed tale of a provincial spinster whose life becomes filled with romantic despair upon the arrival of an attractive cousin.2. "Lost Illusions": In this three-part novel, Balzac explores the corrupting influence of society on an ambitious young poet, Lucien de Rubempré.3. "Père Goriot": This tale showcases the morally corrupt Parisian society through the tragic tale of two young women who use their elderly father to increase their own wealth and social standing.4. "Cousin Bette": A revenge tale in which an embittered spinster, Cousin Bette, destructively manipulates the lives of those around her.5. "A Harlot High and Low": This is the saga of a courtesan, Vautrin, and criminal mastermind determined to claw his way to the top of Parisian society.6. "The Wild Ass's Skin": Balzac weaves the story of a young man, Raphael de Valentin, who discovers a magical piece of shagreen that fulfills his every desire but shrinks with each wish and takes his life in the process. These, among other fascinating works, illustrate Balzac's deep understanding of humanity and his expert analysis of the social, political, and economical aspects of the time.
What are some of the works written by Anonymous in your catalogue?	As an AI, I don't have access to a catalogue. However, popular works credited to Anonymous include "Beowulf", "The Arabian Nights", and thousands of books on Project Gutenberg. For specifics, you might want to search for "Anonymous" on a library website or a book database.	This catalogue includes the book "The Lady's Album of Fancy Work for 1850" by Anonymous. This book contains various designs, patterns, and clear instructions for knitting, netting, crochet, braiding, and embroidery intended for the ladies of the United Kingdom in the 1850s. It includes items such as a front for a lady's cabinet, a cover for a cake-basket, an infant's bonnet, and lace for a pocket-handkerchief, among others.

