Gen AI Engineer / Machine Learning Engineer Assignment

Assignment – Part 2

Documentation: Interactive QA Bot Interface for Financial Data

Overview

Develop an interactive interface for the QA bot from Part 1, allowing users to upload PDF documents containing P&L tables and ask questions about the financial data. The interface should facilitate real-time queries and display retrieved information alongside generated responses.

Model Approach

The development of the financial QA bot involved the following steps:

a. Data Extraction:

- The application allows users to upload financial documents (PDFs). These documents are processed using **PDF parsing libraries** (e.g., pdfplumber) to extract text and tabular data into a structured CSV format.

- Preprocessing ensures that the data is cleaned and converted into a usable format for downstream tasks.

b. Indexing and Retrieval:

- The extracted data is embedded using **SentenceTransformers**, which generates vector representations of the text.
- These embeddings are stored in a **FAISS (Facebook AI Similarity Search)** index for efficient retrieval during question-answering tasks.

c. Question Answering:

A Retrieval-Augmented Generation (RAG) approach was used for answering financial queries:

- The query is embedded and compared with the stored FAISS index to retrieve the most relevant context from the document.
- The retrieved context is passed to a generative model to generate a natural language answer.

d. Frontend Deployment:

A user-friendly interface was built using **Gradio**, which supports two steps:

- Step 1: Upload the financial document and extract data into CSV.
- Step 2: Upload the extracted CSV file and ask financial questions.

Guide for Users

This provides step-by-step instructions on how to use the Financial QA Bot for extracting data from financial PDFs and querying the extracted data.

Step 1: Upload Documents and Extract Data

1. Navigate to the application interface.

2. Upload the financial PDF document in the 'Step 1: Upload and Extract PDF' section.

3. Click on the 'Extract Data' button to extract information from the uploaded file.

4. Once the extraction is complete, download the structured CSV file by clicking the provided link.

Screenshots illustrating these steps:

Fig.1

Fig.2

Step 2: Upload Extracted CSV and Ask Questions

1. Navigate to the 'Step 2: Upload CSV and Ask Questions' section.

2. Upload the extracted CSV file.

3. Enter your financial query in the input box (e.g., 'What is the profit?').

4. Click 'Analyze Question' to receive the bot's response. The answer will be displayed along with relevant context.

Screenshots illustrating this process:

Fig.3

Fig.4

Enter your financial question

what is the revenue of March 31, 2024?

Answer

Question: what is the revenue of March 31, 2024?

Answer:
Year ended March 31, 2024 and March 31, 2023:
(In ₹ crore)
Financial Retail (2) Communic Energy, Manufacturing Hi-Tech Life All other Total
Services (1)* ation (3) Utilities, Sciences (4) segments (5)
Particulars Resources
and Services
Revenue from operations 42,158 22,504 17,991 20,035 22,298 12,411 11,515 4,758 153,670
43,763 21,204 18,086 18,539 19,035 11,867 10,085 4,188 146,767
Identifiable operating expenses 24,782 11,704 11,071 10,838 14,596 7,232 6,716 2,938 89,877
24,990 10,892 11,101 9,923 12,493 6,959 5,834 2,801 84,993
Allocated expenses 8,052 3,918 3,232 3,674 3,505 2,026 1,901 1,060 27,368
7,930 3,916 3,226 3,461 3,429 1,949 1,685 1,048 26,644
Segment operating income 9,324 6,882 3,688 5,523 4,197 3,153 2,898 760 36,425
10,843 6,396 3,759 5,155 3,113 2,959 2,566 339 35,130
Unallocable expenses 4,678
4,225

Fig.5

Examples of Interactions

Below are some example queries:

- What are the total expenses for Q2 2023?
- Show the operating margin for the past 6 months.
- What is the net profit for the last fiscal year?
- How much revenue was generated in Q3 2023?
- What is the total tax expense for Q4 2023?

Deployment

The Financial QA Bot has been successfully deployed and is accessible online. You can access the application using the following link:

Financial QA Bot: https://huggingface.co/spaces/TGChandu/Financial-QA-Bot-2

The application allows users to interact with financial data in real-time, ensuring ease of use and efficient query handling.

Conclusion

The Financial QA Bot provides an intuitive and efficient solution for querying financial data from documents. By leveraging advanced techniques like Retrieval-Augmented Generation (RAG), FAISS indexing, and natural language processing, the application ensures accurate and contextually relevant responses to user queries. The streamlined two-step interface simplifies document processing and query answering, making it accessible to users with varying levels of technical expertise. Deployed on Hugging Face Spaces, the bot offers a reliable and scalable platform for financial analysis, addressing real-world challenges in data extraction, handling, and interpretation. This project demonstrates the practical integration of AI into financial data workflows, paving the way for enhanced decision-making and productivity.