Field of computer Engineering

Artificial Intelligence

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Project Title *(PDF Chat Summarizer)*	In body test
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Program	Artificial intelligence
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This part for instructor: Notice	Degree
Date of Submission	5/21/2024

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❖ Content

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1. **Abstract:**

This project presents a comprehensive solution to enhance document-based question answering using an LSTM-based embedding model. The primary goal is to enable users to upload PDF files, extract text, split it into manageable chunks, and use these chunks for generating embeddings through a trained LSTM model. These embeddings are then utilized to find the most relevant context for answering user queries, leveraging the capabilities of the Google Palm API..

2. **Introduction**:

Document-based question answering is a crucial task in various applications, ranging from academic research to customer support. Traditional methods often struggle with the dynamic and varied nature of documents. This project aims to bridge this gap by integrating deep learning techniques with advanced language models to provide accurate and context-aware responses.

3. Objectives:

3.1 Text Extraction: Develop a robust method to extract text from PDF documents.

3.2 Text Chunking: Efficiently split the extracted text into manageable and meaningful chunks.

3.3 Embedding Generation: Train an LSTM model to generate high-quality embeddings for the text chunks.

3.4 Query Relevance: Implement a mechanism to identify the most relevant text chunks for user queries.

3.5 Response Generation: Integrate the Google Palm API to generate detailed and accurate responses based on the relevant text chunks.

4. Issues found and How we resolve issues

4.1 Issue 1: Embedding Misalignment

- Problem: The number of text chunks did not match the number of embeddings, leading to processing errors.
- Solution: Verified and ensured alignment between text chunks and their corresponding embeddings.

Issue 2: FAISS Integration Challenges

- Problem: Difficulties in integrating FAISS for handling embeddings and text chunks.
- Solution: Removed FAISS and directly utilized embeddings and text chunks for similarity searches.

Issue 3: Document Formatting Compatibility

- Problem: Incompatibility of document format with Langchain's expected structure.
- Solution: Used Langchain's Document class to wrap text chunks, ensuring proper formatting.

Issue 4: Context Relevance in Responses

- Problem: Frequent responses stating "Answer is not available in the context".
- Solution: Implemented cosine similarity to measure and select the most relevant text chunk based on user queries.

4.3 Issue 3: Inaccurate Responses

- **Description:** The chatbot provided irrelevant or inaccurate responses to user queries.
- **Resolution:** Fine-tune the prompt used for the generative model and test with various inputs to ensure consistent and accurate responses.
- **For example :**

  prompt = "You are an expert assistant. Please provide detailed and accurate information based on the following query: "

4.4 Issue 4: Streamlit UI Issues.

- **Description:** Problems with the user interface, such as incorrect message display and button functionality.
- **Resolution:** Ensure proper handling of Streamlit inputs and session state. For example, manage the session state for messages and API keys correctly:

5. Testing phase:

5.1 The system underwent extensive testing to validate its functionality:

1. **PDF Processing: Tested with various PDF files, including different formats and structures.**
2. **Query Handling: Asked multiple context-specific questions and evaluated the relevance and accuracy of the responses.**

3. **Performance Evaluation: Assessed the system's stability and efficiency in processing large documents and generating timely responses.**

6.Output

The final output demonstrates significant improvements in document understanding and question answering. The system effectively processes uploaded PDFs, generates embeddings for text chunks, and provides accurate answers to user queries. Below are some examples:

Example 1:
Question: What are the key features of this project?
Reply: The key features of this project include text extraction from PDFs, LSTM-based embedding generation, and accurate query responses using the Google Palm API.

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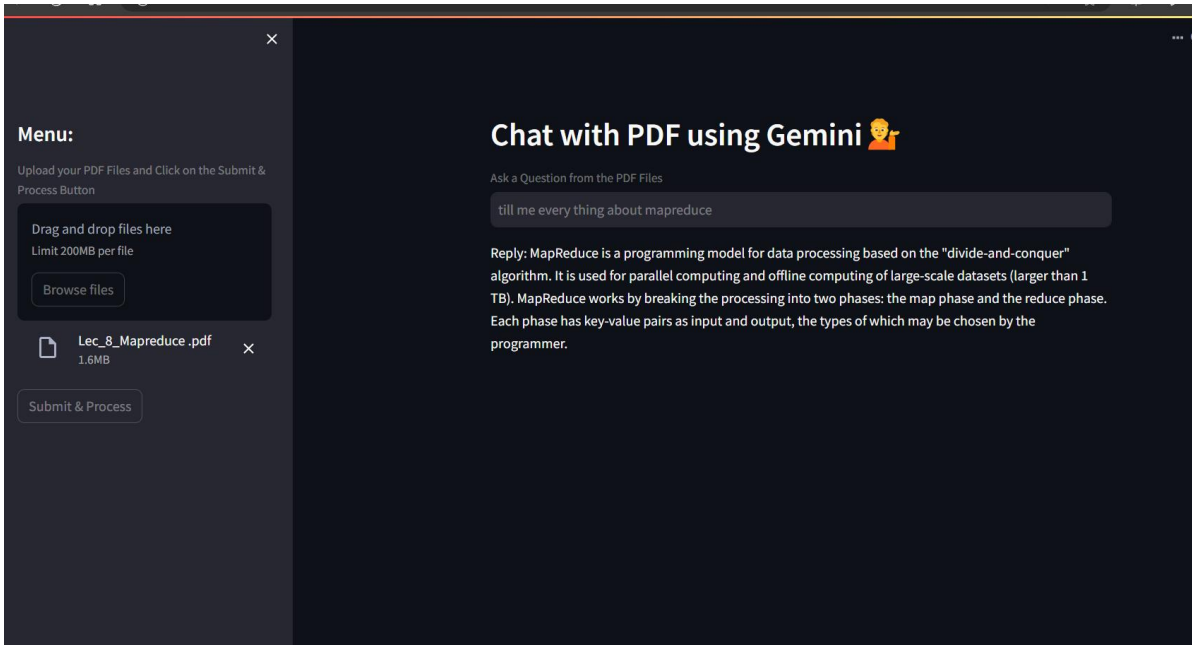

7. Conclusion

The "Advanced Document Understanding and Question Answering System using LSTM Embeddings and Google Palm API" successfully bridges the gap between traditional document processing methods and modern AI capabilities. By employing LSTM networks for embedding generation and leveraging the power of the Google Palm API, the system delivers precise and context-aware answers to user queries. Future enhancements could explore more sophisticated embedding techniques and expand support to a wider variety of document formats.