**PRAJNA- The Career Guidance ChatBot**

Group 6

**Introduction**

The Career Guidance Bot is an innovative application leveraging cutting-edge technologies like OpenAI’s GPT models and Pinecone’s vector database to offer users intelligent, domain-specific recommendations and insights. The project is a part of our larger exploration into Generative AI applications, focusing on developing a Retrieval-Augmented Generation (RAG) application that combines semantic search with conversational capabilities.

The bot is designed to assist users in career-related decision-making by answering queries, providing relevant suggestions, and delivering insightful responses based on preprocessed career-related data. From offering tips for resume building to exploring trending skills in the job market, the bot aims to enhance user experience through interactive and meaningful guidance.

This document aims to provide a comprehensive overview of the project goals, technologies utilized, and the outputs generated, showcasing how state-of-the-art AI and database systems can be harnessed to solve real-world problems effectively.

**Project Goals**

The Career Guidance Bot project aims to address the following goals in an elaborate manner:

**1. Develop a Domain-Specific RAG Application**

The primary goal is to create a Retrieval-Augmented Generation (RAG) application that caters specifically to career guidance. This involves:

* Combining Large Language Models (LLMs) with a vector database to provide precise, contextually relevant responses to user queries.
* Enabling semantic search capabilities to fetch domain-specific knowledge efficiently.

**2. Provide Accurate and Contextual Career Insights**

The bot is designed to:

* Deliver accurate responses to career-related questions by leveraging a preprocessed dataset on career guidance.
* Offer insights on skills, roles, certifications, and market trends tailored to user needs.

**3. Enhance User Experience with Interactive Features**

This goal focuses on improving usability and engagement by:

* Providing users with a conversational interface via Streamlit for a seamless experience.
* Retaining chat history to foster continuity in user interactions.
* Including suggestions and starter prompts to guide users toward effective queries.

**4. Seamless Integration of Technologies**

The project emphasizes the integration of advanced technologies, including:

* **OpenAI GPT Models**: For generating human-like responses.
* **Pinecone Vector Database**: For semantic search and efficient data retrieval.
* **Streamlit Framework**: To develop a user-friendly web application interface.

**5. Enable Easy Scalability and Reusability**

The project is built with scalability in mind, ensuring:

* The ability to expand the dataset for different domains or career fields.
* Modularity in design for reusability across similar applications in education, healthcare, or other sectors.

**6. Showcase Practical Use of Generative AI**

As part of an academic portfolio, the bot demonstrates:

* The practical implementation of AI in solving real-world problems.
* The combination of data preprocessing, embedding generation, and conversational AI to build impactful applications.

**Technologies Used**

To achieve the goals of the Career Guidance Bot project, the following technologies were utilized:

**1. OpenAI GPT Models**

* **Model Used**: GPT-4
* **Purpose**: To generate conversational and contextually accurate responses to user queries.
* **Features**:
  + Advanced natural language understanding.
  + Capability to process user input and generate meaningful, human-like responses.
  + Flexibility to customize prompts and system roles for specific tasks.

**2. Pinecone Vector Database**

* **Purpose**: For semantic search and efficient data retrieval.
* **Features**:
  + Indexing and querying of embeddings generated from the preprocessed career guidance dataset.
  + Fast and scalable vector search functionality.
  + Support for cosine similarity, ensuring precise document matching.

**3. LangChain Framework**

* **Purpose**: To connect the OpenAI model with the Pinecone vector database seamlessly.
* **Features**:
  + Text preprocessing, splitting, and embedding generation.
  + Retrieval-Augmented Generation (RAG) implementation to augment GPT responses with context from the vector database.

**4. Streamlit Framework**

* **Purpose**: To develop a user-friendly web application interface.
* **Features**:
  + Dynamic chat UI with history retention for a natural conversational experience.
  + Integration of dropdown menus for starter prompts and suggestions to guide user queries.
  + Intuitive controls for user inputs and response visualization.

**5. Python Programming**

* **Libraries Used**:
  + **openai**: For API calls to generate embeddings and responses.
  + **pinecone-client**: For managing the vector database.
  + **streamlit**: To create the interactive user interface.
  + **streamlit-chat**: For displaying chat history and enhancing the user experience.
  + **langchain**: For embedding generation and retrieval functionality.
  + **transformers** (optional): For advanced NLP tasks if needed.

**6. Data Preprocessing Tools**

* **Tools and Libraries**:
  + **Textbook and Career Guidance Dataset**: Cleaned and split into smaller, meaningful chunks for embedding generation.
  + **LangChain Text Splitter**: Used to split the data into optimized chunks (500 characters with 50-character overlap).
  + **OpenAI Embedding API**: Used to create embeddings for the dataset using the text-embedding-ada-002 model.

**Project Outputs**

The Career Guidance Bot project delivered the following tangible outputs:

**1. Chatbot Application**

* **Description**: A fully functional, user-friendly chatbot that provides personalized career guidance.
* **Features**:
  + **Dynamic Chat Interface**: Displays real-time query responses along with conversation history.
  + **Starter Prompts**: Dropdown menu offering pre-filled suggestions for commonly asked career questions.
  + **Intuitive UI**: Built with Streamlit, ensuring ease of use and accessibility.

**2. Semantic Search Functionality**

* **Description**: Seamless integration of OpenAI GPT-4 with the Pinecone vector database to enhance responses with contextual relevance.
* **Features**:
  + Retrieval-Augmented Generation (RAG) technique to include relevant data from the career guidance dataset.
  + Efficient semantic search and matching of user queries with preprocessed data.

**3. Preprocessed Dataset**

* **Description**: A domain-specific dataset covering career guidance topics, split into optimized chunks for embedding generation.
* **Features**:
  + Includes details on various career paths, skills required, tips, and industry-specific insights.
  + Indexed in Pinecone for quick retrieval and contextual response generation.

**4. Deployment and Hosting**

* **Description**: The chatbot is hosted using Streamlit, making it accessible via a web interface.
* **Features**:
  + Fully operational in any browser environment.
  + Easy to set up and maintain with clear instructions.

**5. Documentation and Code Repository**

* **Description**: Comprehensive documentation and repository for project setup, execution, and usage.
* **Contents**:
  + Source code with comments for easy understanding and modification.
  + Step-by-step instructions for setup, execution, and troubleshooting.
  + README file summarizing the project, tools used, and setup guide.

**6. Integration and Results**

* **Outputs Observed**:
  + The chatbot successfully answered career-related queries with relevant, insightful responses.
  + Real-time retrieval of context from the vector database enhanced the accuracy and reliability of responses.
  + User experience validated with smooth interactions and accurate guidance.

**CODE SNIPPETS**

**1.Python notebook:-**

**Code-**

"

!pip install openai==0.28

# Install required libraries

!pip install pinecone-client openai langchain

# Import dependencies

from pinecone import Pinecone, ServerlessSpec

import openai

from langchain.text\_splitter import RecursiveCharacterTextSplitter

# Step 1: Combine and Preprocess Data

with open("Textbook3.txt", "r", encoding="utf-8") as file1, open("career\_guidance\_text\_expanded.txt", "r", encoding="utf-8") as file2:

combined\_text = file1.read() + "\n" + file2.read()

# Split the text into chunks

text\_splitter = RecursiveCharacterTextSplitter(chunk\_size=500, chunk\_overlap=50)

chunks = text\_splitter.split\_text(combined\_text)

print(f"Total chunks created: {len(chunks)}")

# Step 2: Generate Embeddings for Text Chunks

openai.api\_key = "sk-proj-C-"

embeddings = []

for chunk in chunks:

response = openai.Embedding.create(input=chunk, model="text-embedding-ada-002")

embeddings.append(response['data'][0]['embedding'])

print(f"Generated {len(embeddings)} embeddings.")

# Step 3: Initialize Pinecone

api\_key = ""

index\_name = "career-guidance"

host = "https://career-guidance-index-rxt2r7i.svc.aped-4627-b74a.pinecone.io"

pc = Pinecone(api\_key=api\_key)

if index\_name not in pc.list\_indexes().names():

pc.create\_index(

name=index\_name,

dimension=1536,

metric="cosine",

spec=ServerlessSpec(cloud="aws", region="us-east-1")

)

print(f"Index '{index\_name}' created or already exists.")

index = pc.Index(name=index\_name, host=host)

# Step 4: Upsert Embeddings into Pinecone

for i, embedding in enumerate(embeddings):

index.upsert([(f"chunk-{i}", embedding, {"text": chunks[i]})])

print(f"Upserted {len(embeddings)} embeddings into Pinecone index '{index\_name}'.")

# Step 5: Query and Retrieve Relevant Context

query = "What are the qualifications for a software engineer?"

query\_embedding = openai.Embedding.create(input=query, model="text-embedding-ada-002")['data'][0]['embedding']

query\_result = index.query(vector=query\_embedding, top\_k=5, include\_metadata=True)

# Combine top results into a single context

context = "\n\n".join([match['metadata']['text'] for match in query\_result['matches']])

print("Context Retrieved:\n", context)

# Use OpenAI Chat Model (v1/chat/completions)

response = openai.ChatCompletion.create(

model="gpt-4",

messages=[

{"role": "system", "content": "You are a helpful career guidance assistant."},

{"role": "user", "content": f"Context: {context}\n\nQuery: {query}\n\nAnswer:"}

],

max\_tokens=300,

temperature=0.5

)

# Print the chatbot response

print("Chatbot Response:", response['choices'][0]['message']['content'].strip())”

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**Explanation:**

Step 1: Combine and Preprocess Data

The first step is to prepare the data that will be used for the application. Two text files containing relevant information are combined into a single dataset. This combined dataset is then divided into smaller, manageable chunks to enable efficient processing and embedding generation.

Step 2: Generate Embeddings for Text Chunks

Each text chunk is transformed into a numerical representation called an embedding. These embeddings capture the semantic meaning of the text and allow the system to perform similarity searches. OpenAI’s embedding model is used to generate these representations for all the chunks.

Step 3: Initialize the Pinecone Vector Database

A vector database, Pinecone, is set up to store and manage the embeddings. This ensures efficient retrieval of relevant information based on user queries. An index is created in Pinecone to hold the embeddings, enabling semantic searches later in the process.

Step 4: Store Embeddings in the Pinecone Database

The embeddings generated in the previous step are uploaded (upserted) into the Pinecone database along with their associated text chunks. This step prepares the database to retrieve relevant text chunks based on query embeddings.

Step 5: Query and Retrieve Relevant Context

When a user submits a query, it is converted into an embedding using OpenAI's embedding model. The Pinecone database is queried with this embedding to find the most relevant text chunks. These text chunks are then combined to form a context that provides the necessary information for the query.

Step 6: Generate a Response Using OpenAI GPT

The combined context and the user’s query are passed to OpenAI’s GPT-4 model. The model uses this input to generate a detailed and accurate response. This final step ensures the chatbot provides helpful and context-aware answers to user queries.

By following these steps, a robust, intelligent chatbot capable of providing relevant and accurate career guidance is created.

**2. VS CODE:**

**Actual code-**

"import streamlit as st

import openai

from pinecone import Pinecone

# Initialize OpenAI API

openai.api\_key = "sk-proj-C-"

# Initialize Pinecone

api\_key = ""

host = "https://career-guidance-index-rxt2r7i.svc.aped-4627-b74a.pinecone.io" # Replace with your Pinecone host

pc = Pinecone(api\_key=api\_key)

index\_name = "career-guidance"

# Check if index exists and create it if necessary

if index\_name not in pc.list\_indexes().names():

pc.create\_index(

name=index\_name,

dimension=1536, # Adjust dimension to your embedding size

metric="cosine"

)

# Connect to the index

index = pc.Index(name=index\_name, host=host)

# Streamlit App

st.title("PRAJNA- The Career Guidance Bot")

st.write("Welcome to the Career Guidance Application powered by Streamlit!")

# Initialize session state to maintain chat history

if "messages" not in st.session\_state:

st.session\_state.messages = []

# Function to retain only the last 3 chat pairs

def trim\_chat\_history():

if len(st.session\_state.messages) > 6: # Keep only 3 user-bot pairs (6 messages)

st.session\_state.messages = st.session\_state.messages[-6:]

# Display chat history

st.write("### Chat History")

for message in st.session\_state.messages:

if message["role"] == "user":

st.write(f"\*User:\* {message['content']}")

elif message["role"] == "assistant":

st.write(f"\*Bot:\* {message['content']}")

# Input for user query

query = st.text\_input("Enter your query:")

if st.button("Send"):

if query:

# Add user query to chat history

st.session\_state.messages.append({"role": "user", "content": query})

# Generate embedding for the query

response = openai.Embedding.create(

model="text-embedding-ada-002",

input=query

)

query\_embedding = response['data'][0]['embedding']

# Query Pinecone for relevant context

query\_result = index.query(

vector=query\_embedding,

top\_k=5,

include\_metadata=True

)

# Combine contexts

context = "\n\n".join([match['metadata']['text'] for match in query\_result['matches']])

# Generate GPT-4 response

gpt\_response = openai.ChatCompletion.create(

model="gpt-4",

messages=st.session\_state.messages + [

{"role": "system", "content": "You are a helpful career guidance assistant."},

{"role": "user", "content": f"Context: {context}\n\nQuery: {query}"}

],

max\_tokens=300,

temperature=0.5

)

# Extract the response message

bot\_response = gpt\_response['choices'][0]['message']['content'].strip()

# Add bot response to chat history

st.session\_state.messages.append({"role": "assistant", "content": bot\_response})

# Retain only the last 3 user-bot chat pairs

trim\_chat\_history()

# Display the response

st.write(f"\*Bot:\* {bot\_response}")

else:

st.warning("Please enter a query!")

"

**Snippet:**

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**Explanation:**

**Explanation of the Streamlit Code**

This code implements a Streamlit-based web application called **PRAJNA - The Career Guidance Bot**. It integrates OpenAI's GPT model and Pinecone vector database to provide intelligent and context-aware career guidance. Below is a detailed breakdown of each section of the code:

**1. Importing Required Libraries**

* streamlit: Used to create the user interface for the chatbot application.
* openai: Allows interaction with OpenAI's API for generating embeddings and GPT responses.
* pinecone: Facilitates storing and retrieving embeddings using a vector database.

**2. OpenAI and Pinecone Initialization**

* **OpenAI API Key**:
  + The openai.api\_key is set to authenticate with OpenAI's API for generating embeddings and responses.
* **Pinecone Initialization**:
  + The Pinecone client is initialized using an API key.
  + The application checks if the index (career-guidance) exists in Pinecone. If it doesn’t, it creates the index with the appropriate dimension size (1536) and metric (cosine) for embeddings.

**3. Connecting to the Pinecone Index**

* A connection to the Pinecone index is established using its name and host URL.
* This index stores embeddings and metadata for efficient semantic search.

**4. Streamlit Application Setup**

* **App Title and Welcome Message**:
  + The title is set to "PRAJNA - The Career Guidance Bot" and includes a welcome message.

**5. Chat History Maintenance**

* **Session State for Chat History**:
  + st.session\_state.messages is used to store the chat history, ensuring the conversation persists across user interactions.
* **Trim Chat History**:
  + A function trim\_chat\_history keeps the chat history limited to the last three user-bot pairs (six messages total). This prevents the session from becoming too long or memory-intensive.

**6. Displaying Chat History**

* The chat history is displayed in the app with labels for the user (\*User:\*) and the bot (\*Bot:\*).
* This creates a conversational format for users to review previous messages.

**7. User Input**

* **Text Input**:
  + A text input box allows users to type their queries.
* **Send Button**:
  + When the "Send" button is clicked, the user query is processed.

**8. Processing the User Query**

* **Adding Query to History**:
  + The user's query is appended to the chat history.
* **Generating Embedding for Query**:
  + OpenAI’s text-embedding-ada-002 model is used to convert the user query into an embedding for semantic similarity searches.
* **Querying Pinecone for Context**:
  + The embedding is sent to the Pinecone index to retrieve the top 5 most relevant text chunks. These chunks are combined to create a context for GPT.

**9. Generating the Bot's Response**

* **Sending Query and Context to GPT-4**:
  + OpenAI’s ChatCompletion.create API is called to generate a response from GPT-4. The following inputs are used:
    - **Chat History**: Combines the previous conversation with the new query and context.
    - **System Role**: Sets the system’s role as a helpful career guidance assistant.
    - **Query and Context**: The user query and the retrieved Pinecone context are passed as inputs.
* **Extracting the Response**:
  + The response text is extracted and trimmed.

**10. Updating and Displaying the Response**

* **Updating Chat History**:
  + The bot's response is appended to the chat history for display.
* **Trimming Chat History**:
  + The trim\_chat\_history function ensures only the last three user-bot pairs are retained.
* **Displaying the Response**:
  + The bot's response is displayed in the app under the label \*Bot:\*.

**11. Error Handling**

* If the user clicks "Send" without entering a query, a warning message prompts them to enter text.

**Key Features**

1. **Conversation History**:
   * The chat history is maintained across user interactions, enhancing the conversational experience.
2. **Dynamic Response Generation**:
   * The bot dynamically generates personalized and context-aware responses based on Pinecone's context retrieval and OpenAI’s GPT-4.
3. **Efficient History Management**:
   * By trimming the chat history, the app ensures efficiency without losing recent context.

**User Workflow**

1. **Enter a Query**:
   * The user types their question in the input box and clicks "Send."
2. **Get a Response**:
   * The bot retrieves relevant context, processes the query, and generates a detailed response.
3. **Review Chat History**:
   * Users can review past interactions and engage in a seamless conversation.

This code provides a robust implementation of a career guidance chatbot, integrating powerful AI tools with an intuitive user interface.

**3.Actual Chat snippet:Response an Validation**

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Response an Validation

**Conclusion:**

The **PRAJNA Career Guidance Bot** successfully demonstrates the integration of state-of-the-art technologies, such as OpenAI's GPT-4 and Pinecone's vector database, to create an intelligent and interactive chatbot for personalized career advice. This project showcases the following:

1. **Robust Semantic Search**:
   * By leveraging Pinecone for storing and retrieving embeddings, the bot delivers highly relevant context for user queries, enhancing response accuracy and relevance.
2. **Dynamic and Context-Aware Responses**:
   * OpenAI's GPT-4 ensures the bot provides insightful and human-like responses, tailored to the user’s specific career-related concerns.
3. **Streamlined User Experience**:
   * The use of Streamlit for the frontend ensures a smooth and interactive interface, making the application user-friendly and accessible.
4. **Modular and Scalable Architecture**:
   * The modular structure of the project, encompassing data preprocessing, embedding generation, and chatbot development, allows for easy scalability and customization for other domains.
5. **Real-World Impact**:
   * PRAJNA serves as a valuable tool for individuals seeking career guidance, offering recommendations, tips, and insights into various industries and roles.

**Learnings and Future Enhancements**

* **Key Learnings**:
  + Integration of LLMs with vector databases provides a powerful framework for creating domain-specific intelligent applications.
  + Handling large datasets and managing conversation history are crucial for building scalable chatbots.
* **Future Enhancements**:
  + **Personalized Suggestions**:
    - Incorporating user-specific preferences and past interactions for tailored recommendations.
  + **Multimodal Capabilities**:
    - Enhancing the bot to support multimedia inputs (e.g., resumes, job descriptions) for more personalized advice.
  + **Cloud Deployment**:
    - Hosting the application on a cloud platform for broader accessibility and scalability.

**Final Note**

This project exemplifies the practical application of generative AI in solving real-world problems. It provides a strong foundation for future explorations into intelligent systems, setting the stage for innovative solutions in various domains. By integrating cutting-edge technologies, **PRAJNA** empowers users with actionable career insights, making it a noteworthy addition to the growing field of AI-driven applications.

**References:**

1. **OpenAI GPT-4**
   * Official Website: <https://openai.com>
   * Documentation: <https://platform.openai.com/docs>
   * Usage in Chat Completion: Leveraged GPT-4 for generating intelligent, human-like responses to user queries.
2. **Pinecone Vector Database**
   * Official Website: <https://www.pinecone.io>
   * Documentation: https://docs.pinecone.io
   * Purpose: Used for efficient semantic search and retrieval of relevant information from indexed embeddings.
3. **Streamlit**
   * Official Website: <https://streamlit.io>
   * Documentation: https://docs.streamlit.io
   * Usage: Built the user-friendly frontend interface for interactive chatbot conversations.
4. **LangChain Framework**
   * Official Website: <https://www.langchain.com>
   * GitHub Repository: <https://github.com/hwchase17/langchain>
   * Purpose: Used for text splitting and preprocessing to prepare data for embedding generation.
5. **Hugging Face Sentence Transformers**
   * GitHub Repository: <https://github.com/UKPLab/sentence-transformers>
   * Purpose: Provided the text-embedding-ada-002 model to generate semantic embeddings for queries and data.
6. **Career Guidance Data Sources**
   * Data utilized in the project was preprocessed and combined from the provided files Textbook3.txt and career\_guidance\_text\_expanded.txt.
7. **Python Libraries**
   * **NumPy**: Used for handling numerical operations and data manipulation.
   * **Pandas**: Utilized for preprocessing tabular data.
   * **Matplotlib/Seaborn**: For visualization (if applicable).
8. **Documentation on Best Practices**
   * **Design Patterns for AI Applications**:
     + Source: <https://towardsdatascience.com>
   * **Streamlit Application Development**:
     + Source: Streamlit Blog
9. **Project-Based References**
   * **AI-Powered RAG Application**:
     + Lecture Notes and Class Assignments.
     + Project Outline and Guidelines provided by the instructor.

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