AI Travel Planner for Puerto Rico: AI-Driven Retrieval-Augmented Generation (RAG) System

Enhancing travel experiences with innovative AI solutions

by Larry W. Dávila

Agenda for Discussion

Project Objectives

Project Challenges & Solutions

Technologies and Classes Used

Project Implementation

Future Optimizations

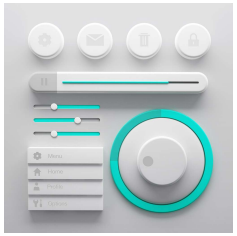
Conclusions

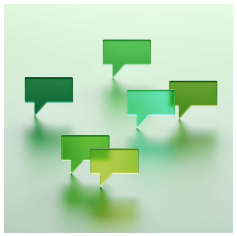
Project Objectives

Develop a Virtual Travel Assistant

Create an interactive virtual assistant to help users plan their trips to Puerto Rico efficiently and personally.

Enhance User Experience





An intuitive design ensures users can easily navigate and interact with the assistant, enhancing overall satisfaction.

Integrate Conversational Memory

Enable the assistant to remember user preferences and selections throughout the conversation to avoid redundancy and improve itinerary accuracy.

Project Challenges & Solutions

Data Collection & Cleaning

Challenges in Data Collection

Raw data contained HTML tags, special characters, and inconsistent formats.

Solutions:

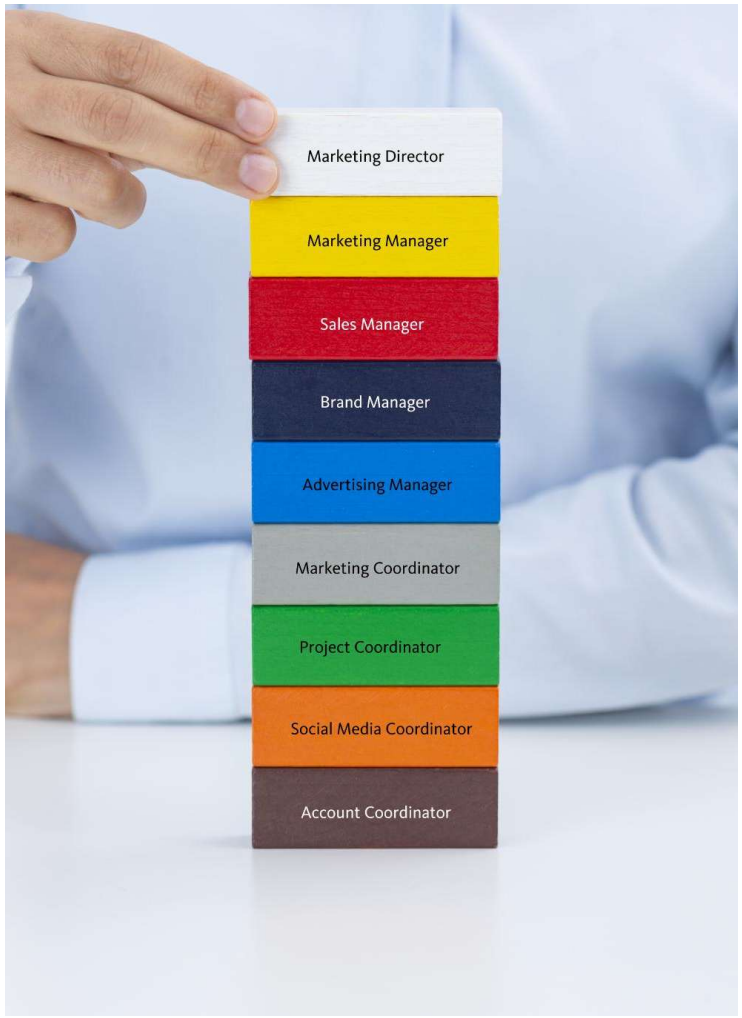
Implemented multi-step cleaning pipelines to extract meaningful text, standardize geospatial metadata, and assign categories based on keyword matching.

Geospatial Metadata Extraction

Challenges in Extraction

Coordinates were embedded in different formats across documents.

Solution: Developed a pattern-based extraction method to correctly structure latitude/longitude data and ensure proper mapping.



Category Assignment for Landmarks

Challenge on Classification System:

Landmarks could belong to multiple categories (e.g., "Outdoor", "Culture", "Extreme Adventure").

Solution:

Implemented a multi-category tagging system based on keyword detection, ensuring flexibility in search queries.

Relevant Links Filtering

Challenge:

Extracted links included non-relevant sources (e.g., archived pages, statistical reports).

Filtering Solution:

Filtered trusted sources (Wikipedia, DiscoverPuertoRico, etc.) and ensured English/Spanish consistency.

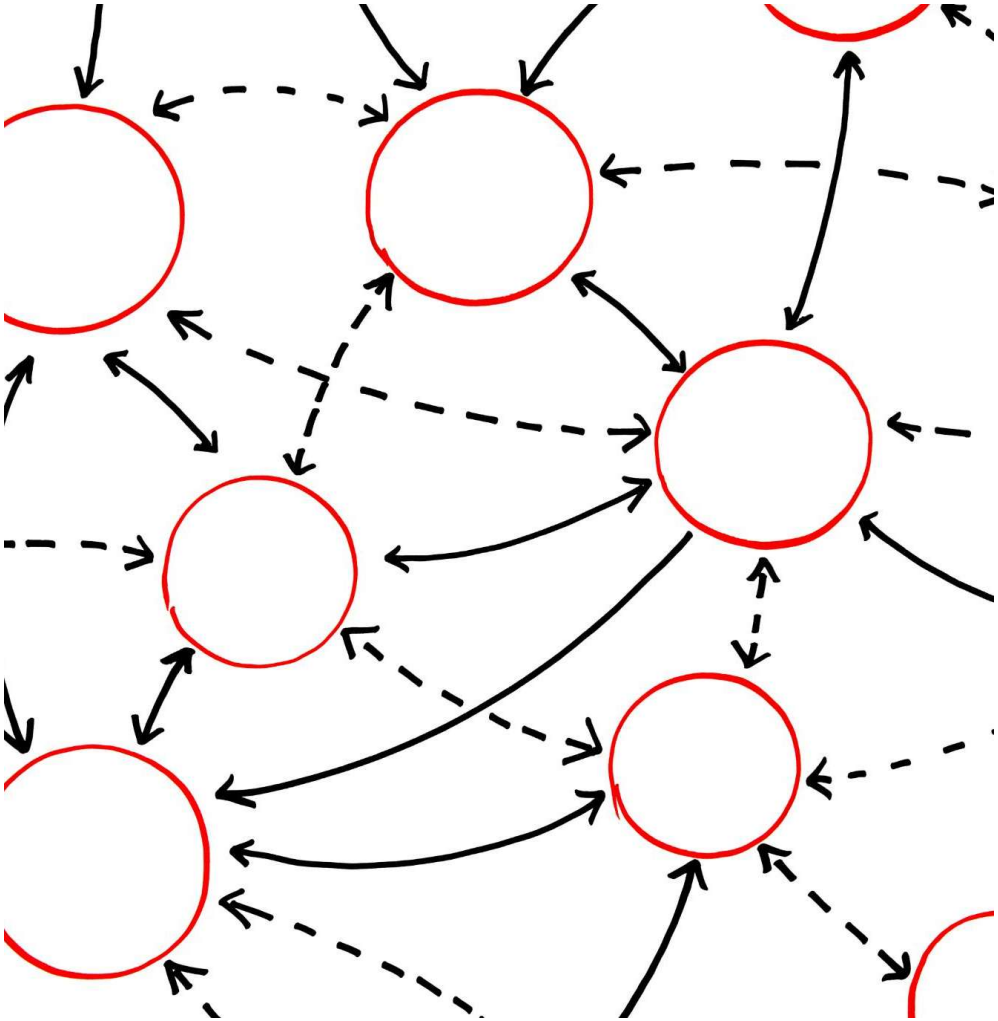
RAG Retrieval & Evaluation

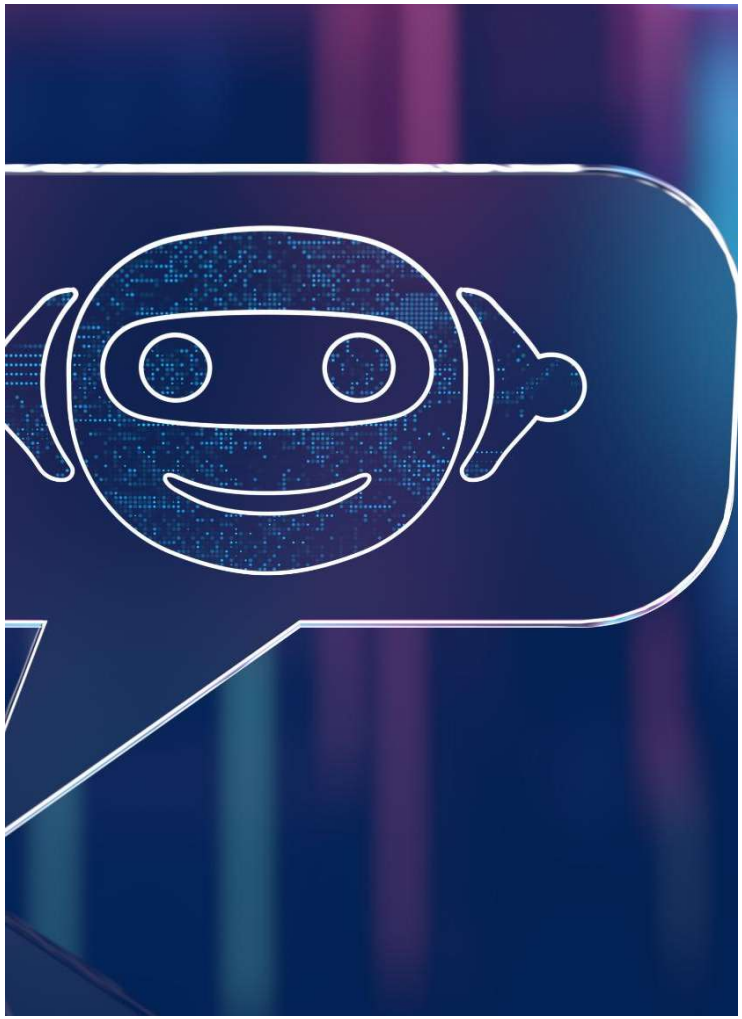
Challenge:

Evaluating retrieval effectiveness and ensuring high-quality AI-generated responses.

Solutions:

Implemented BLEU, ROUGE, and METEOR scores to measure retrieval quality. Although accurate results were not achieved, the structure provided a robust framework for assessment. Additionally, CPU vs. latency trade-offs were tested for optimization.





Chatbot Integration & Response Generation

Technical Challenges:

- Integrating chatbot functionality involves overcoming various technical challenges related to interaction and response generation.
- Ensuring AI-generated responses are relevant and fact-based.
- Maintain in memory the user selections

Solution:

- Developing an LLM-based chatbot that retrieves from validated sources before generating responses.
- Implement the use ConversationBufferMemory

Technologies and Classes Used

Streamlit

User Interface Development

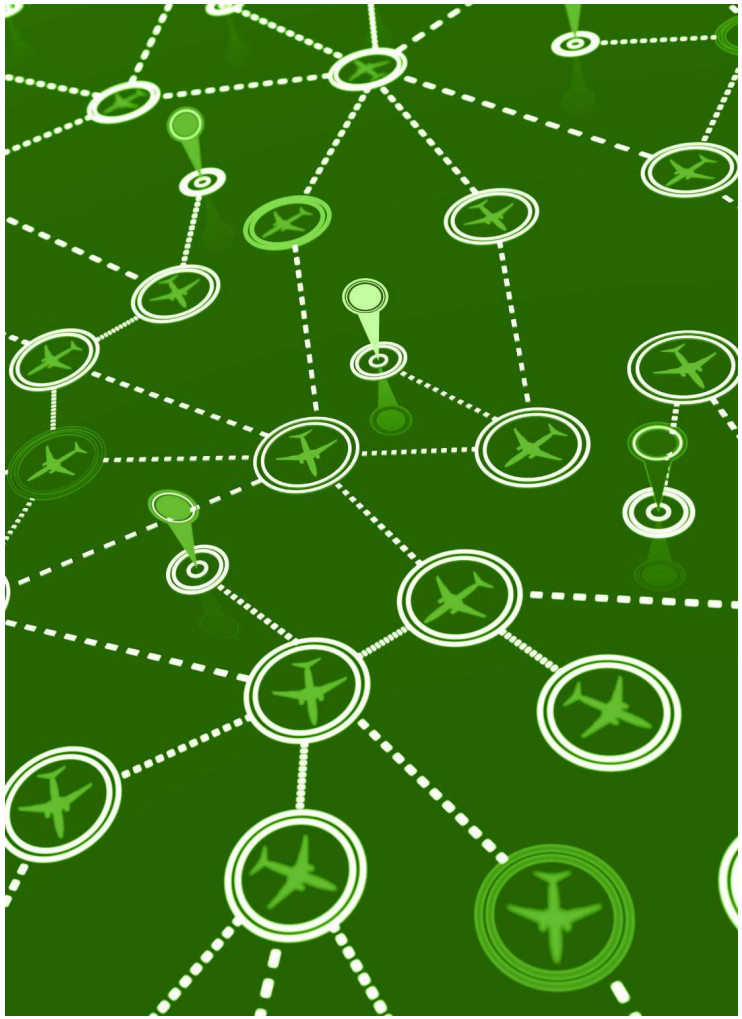
Streamlit enables rapid development of user interfaces, making it easy to create interactive web applications.

Enhancing User Engagement

The ability to build interactive applications significantly enhances user engagement and experience.

Efficient Application Building

Streamlit streamlines the process of building web applications, saving time and resources while maintaining quality.



LangChain

Managing Language Models

LangChain effectively manages various language models to ensure smooth operation and communication within the AI travel planner.

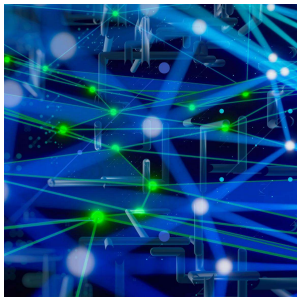
Orchestrating AI Components

It orchestrates different AI components, enabling seamless integration and collaboration among them for enhanced functionality.

AI Travel Planner

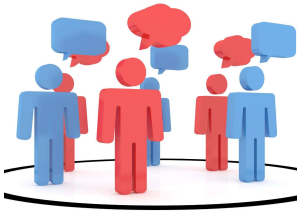
LangChain supports the AI travel planner by ensuring that various elements work together efficiently to enhance user experience.

ConversationalRetrievalChain



Effective Retrieval Mechanisms

The component enables the integration of sophisticated retrieval mechanisms tailored for conversational applications.

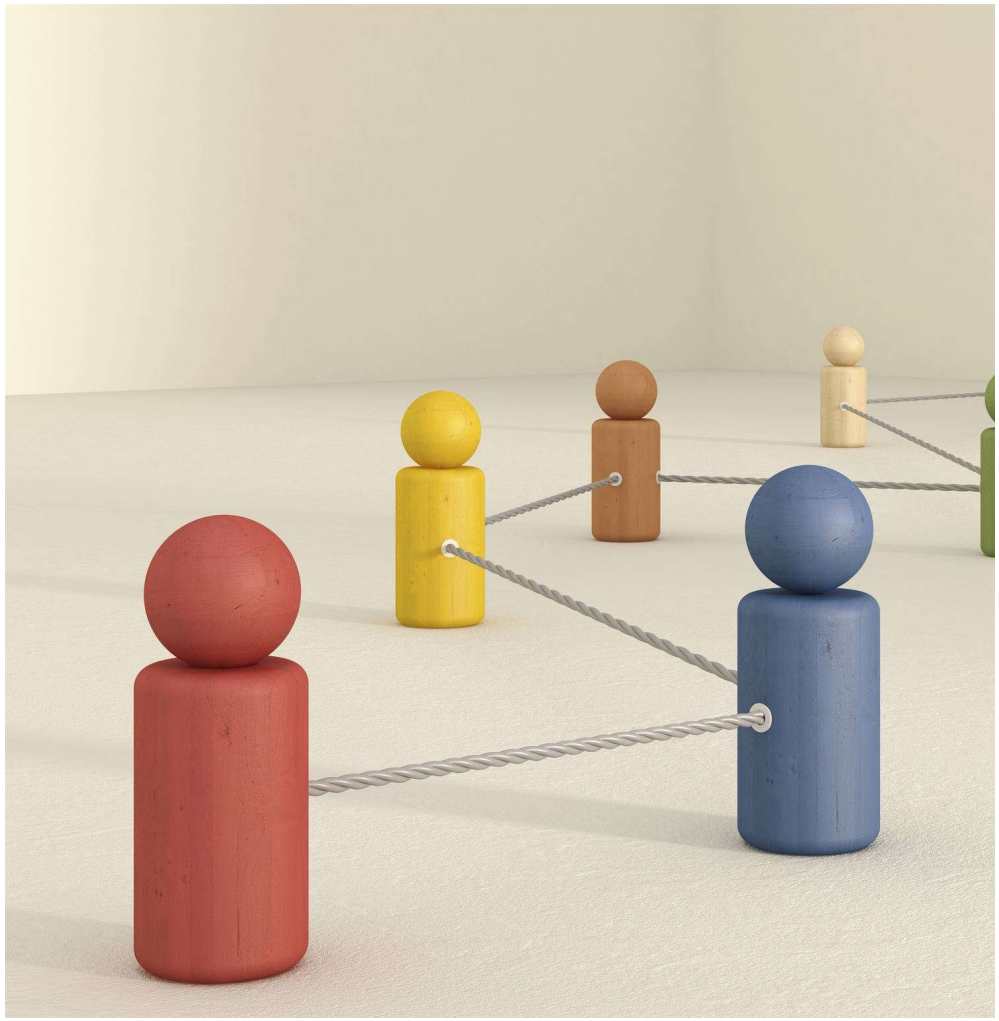


Conversational Contexts

Retrieval mechanisms are specifically designed to understand and respond accurately in conversational contexts, enhancing user interaction.

Relevance of Retrieved Data

By improving the relevance of data retrieved, users experience more accurate and meaningful interactions.



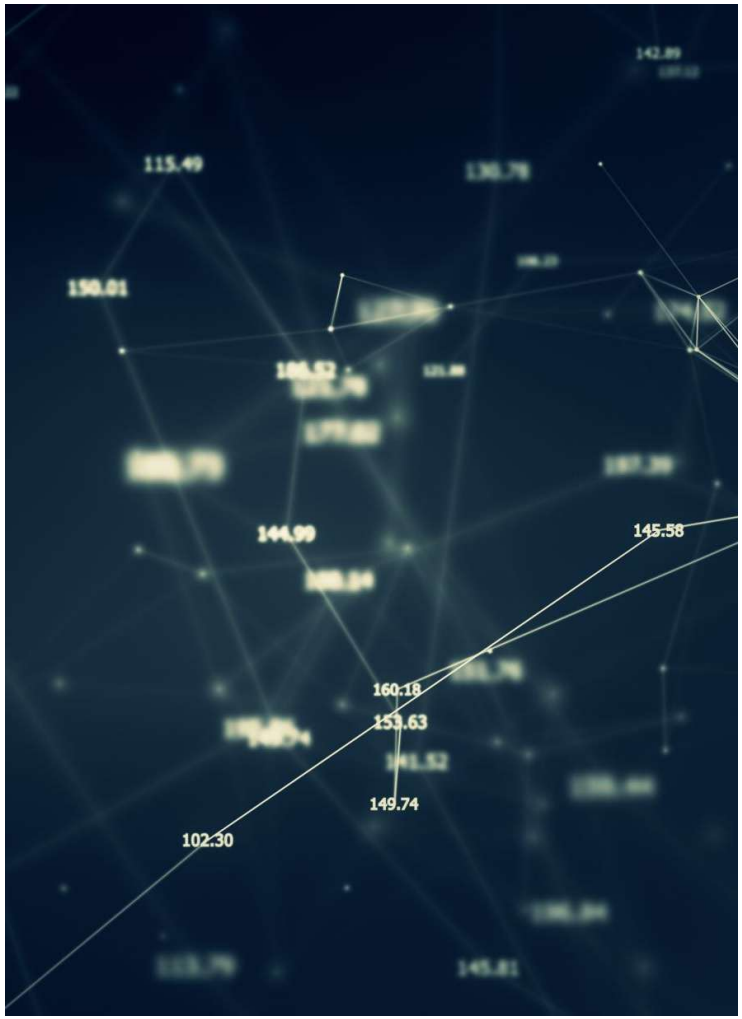
ConversationBufferMemory

Context Tracking

ConversationBufferMemory helps the system track ongoing conversations, maintaining relevant context for user interactions.

User Interaction Continuity

This memory mechanism ensures continuity in user interactions, allowing for a smoother conversation experience.



OpenAIEmbeddings

Semantic Understanding

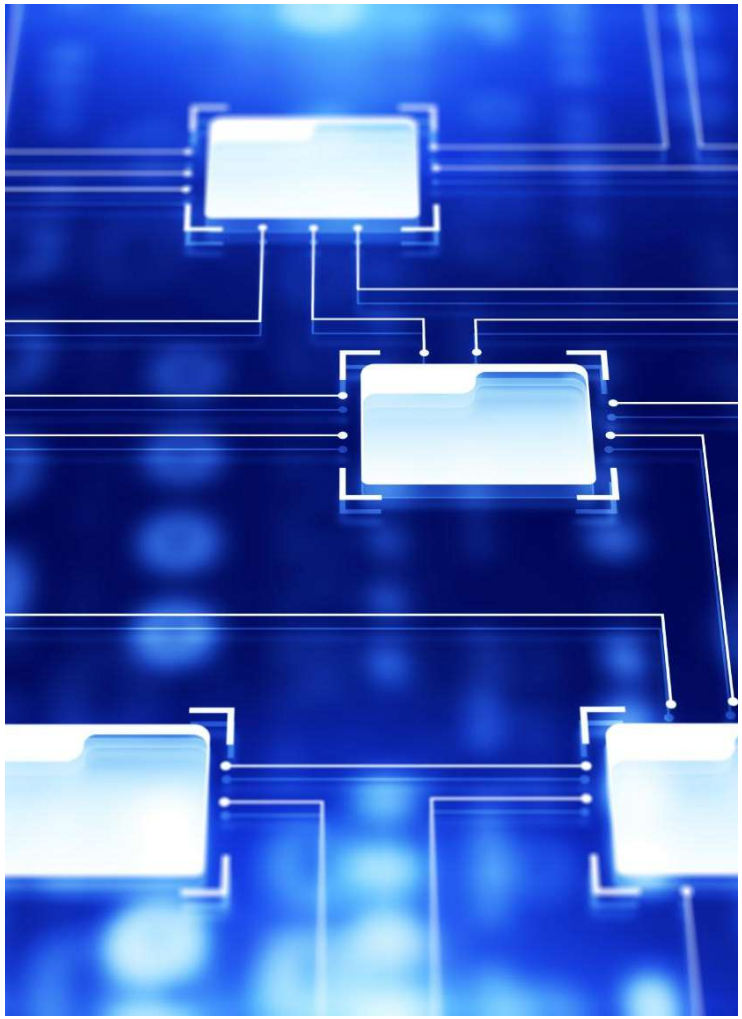
OpenAIEmbeddings enhance the ability of systems to understand context and meaning in language, leading to more accurate responses.

Similarity Matching

These embeddings allow for effective similarity matching, improving the relevance of information retrieval and recommendations.

Overall Performance Enhancement

The integration of OpenAIEmbeddings significantly boosts the assistant's performance, making interactions more intuitive and effective.



Chromadb

Data Management

Chroma efficiently manages and organizes large volumes of data for easy access and retrieval.

Indexing Data

Chroma indexes data to enhance search capabilities, making it quicker to locate information.

Efficient Search Operations

With Chroma, users can perform efficient search and retrieval operations, improving productivity.

Benefits

Scalability through cloud services,

OpenAI API

Natural Language Processing

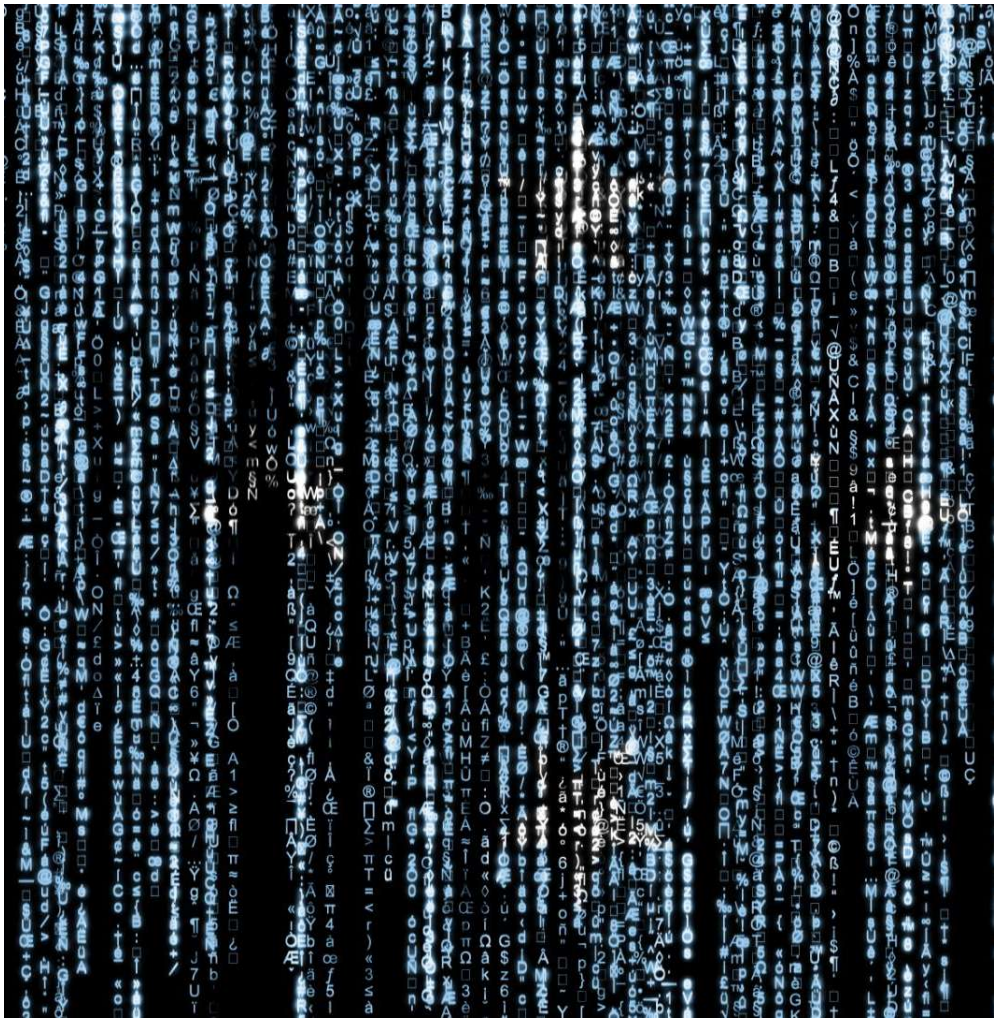
The OpenAI API facilitates advanced natural language processing, allowing applications to understand and generate human-like text.

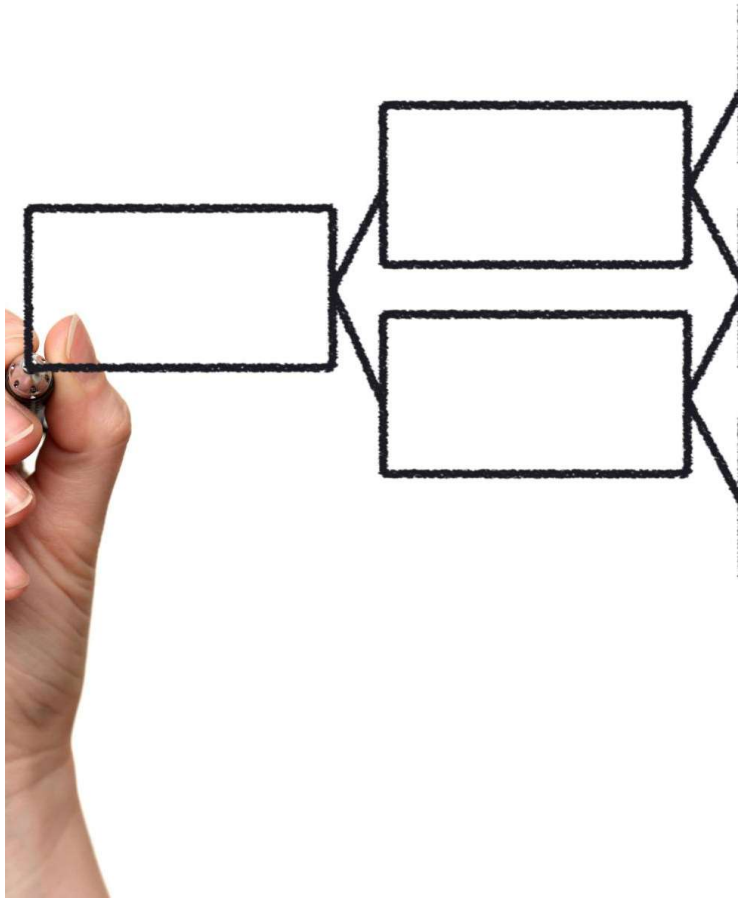
Coherent Responses

Using the API, the assistant can create coherent and contextually relevant responses, enhancing user interaction.

Model Used:

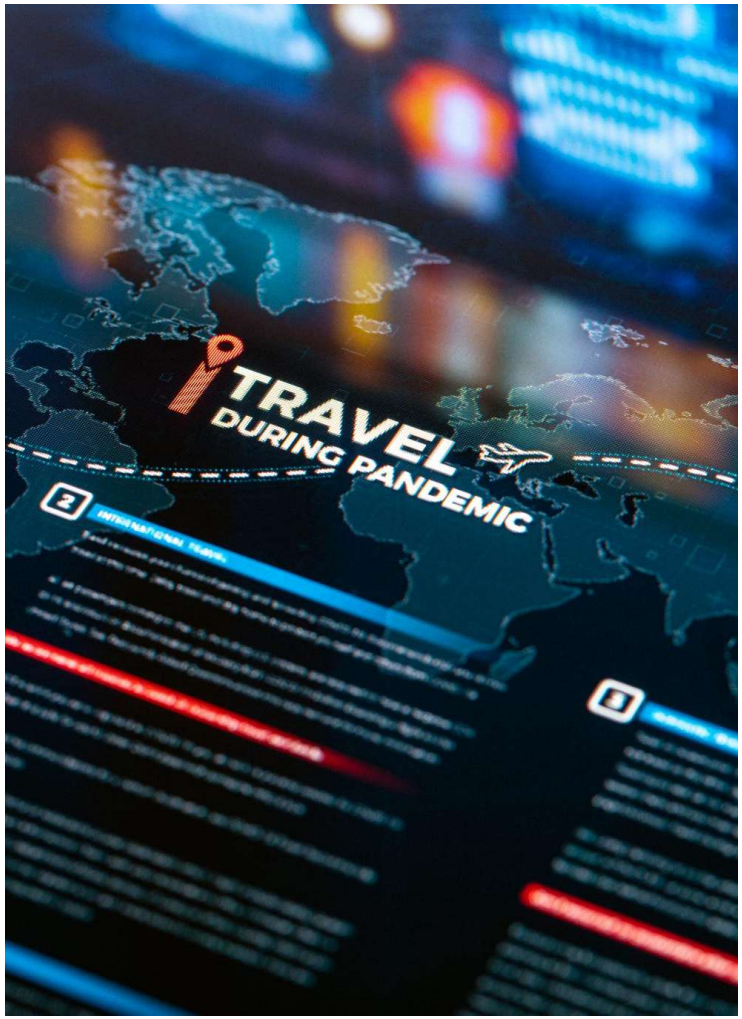
For llm => GPT-4-turbo
For Embeddings => text-embedding-ada-002





PromptTemplate

Class used to define custom question and answer templates for the virtual assistant.



ReportLab

Library used to generate PDF files with the final itineraries.

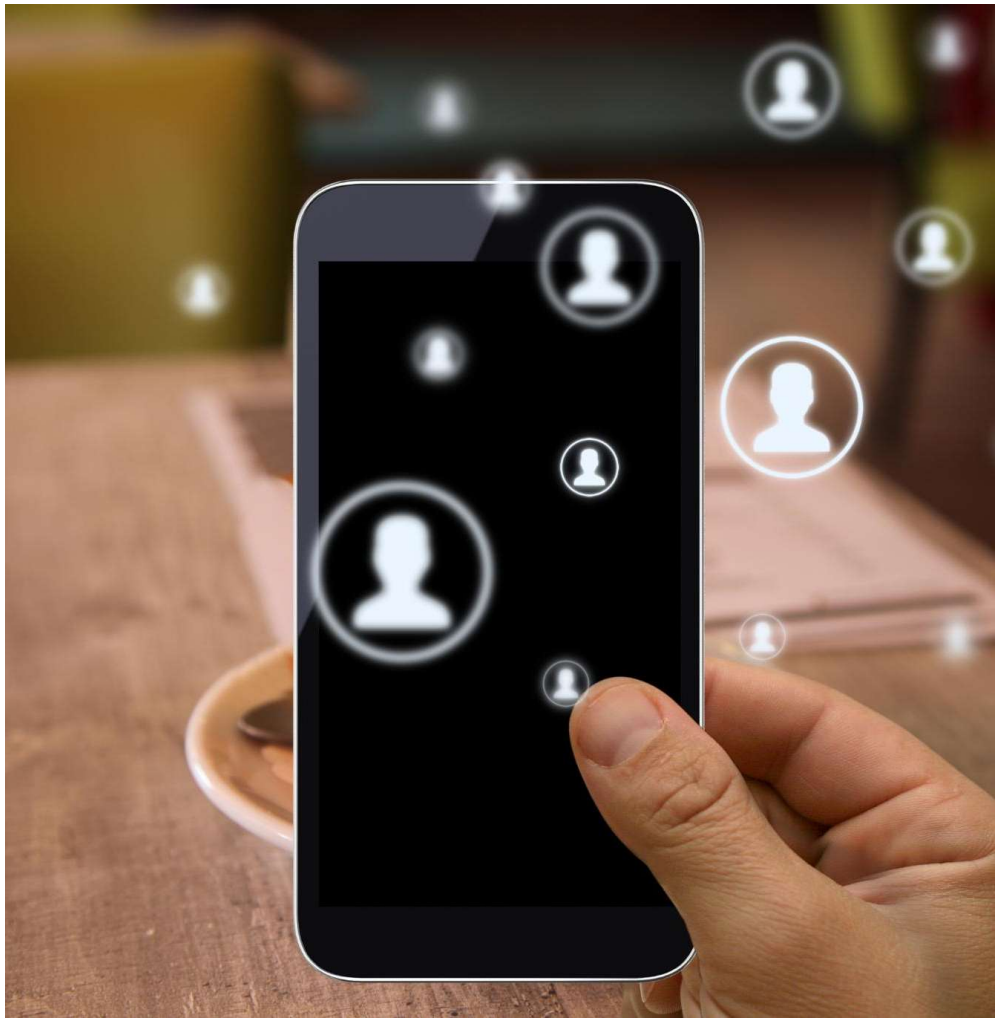
Puerto Rico Travel Itinerary

Day 1: El Yunque National Forest
Start your adventure in Puerto Rico by exploring El Yunque National Forest, the only tropical rainforest in the U.S. National Forest System. Begin early to enjoy the cool morning air and hike the popular trails like La Mina or El Yunque Trail to see beautiful waterfalls and panoramic views. Don't miss the Yokahú Tower for some breathtaking photos.
Lunch: After your hike, head to Luquillo and grab a bite at the famous Luquillo Food Kiosks. Try local specialties like "alcapurrias" or "bacalaitos".
Afternoon: Spend the rest of your day at Luquillo Beach, relaxing on the golden sands or swimming in the turquoise waters.
Dinner: For dinner, enjoy seafood at La Parrilla, located right in the kiosks area, offering fresh catches and delightful dishes.
Day 2: Toro Verde Adventure Park
Day two is all about thrill and excitement at Toro Verde Adventure Park in Orocovis. Known for "The Monster," one of the world's longest zip lines, you'll experience the beauty of Puerto Rico from above. Besides zip-lining, there are various other adventure activities like suspension bridges and rappelling.
Lunch: Eat at Toro Verde's own restaurant, which offers delicious local cuisine with a view of the lush landscape.
Afternoon: Continue your adventure in the park or explore the nearby town of Orocovis.
Dinner: Head back towards San Juan and dine at Casa Verde, a local favorite that serves traditional Puerto Rican dishes with a modern twist.
Day 3: Old San Juan
Dedicate your third day to exploring the historic Old San Juan. Walk through the colorful streets lined with Spanish colonial architecture, visit El Morro and San Cristobal Forts, and don't miss the Paseo de la Princesa for a scenic walk.
Lunch: Enjoy mofongo (a must-try Puerto Rican dish made from fried plantains) at Café El

Project Implementation

User Interface

The project includes an interactive user interface created with Streamlit, allowing users to initiate a new consultation, interact with the travel assistant, and download the final itinerary in PDF format.

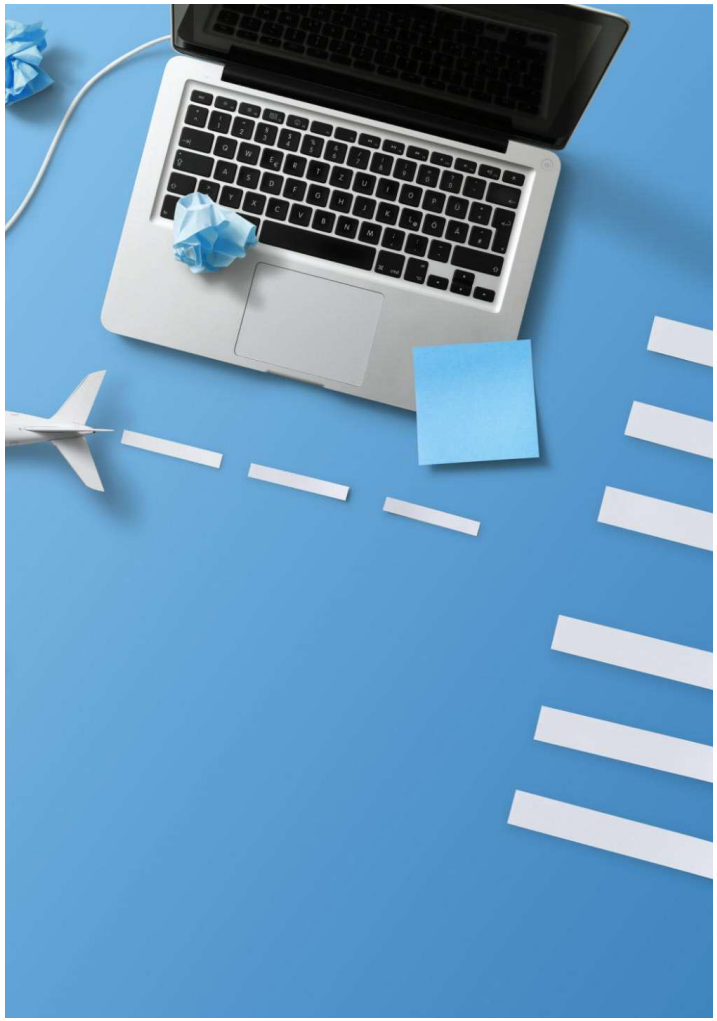


Conversational Memory

The assistant uses conversational memory to store and recall user preferences and selections during the interaction, enhancing relevance and accuracy in recommendations.

Itinerary Generation

The assistant provides personalized recommendations based on user preferences and generates a PDF file with the final itinerary, which users can download and use during their trip.



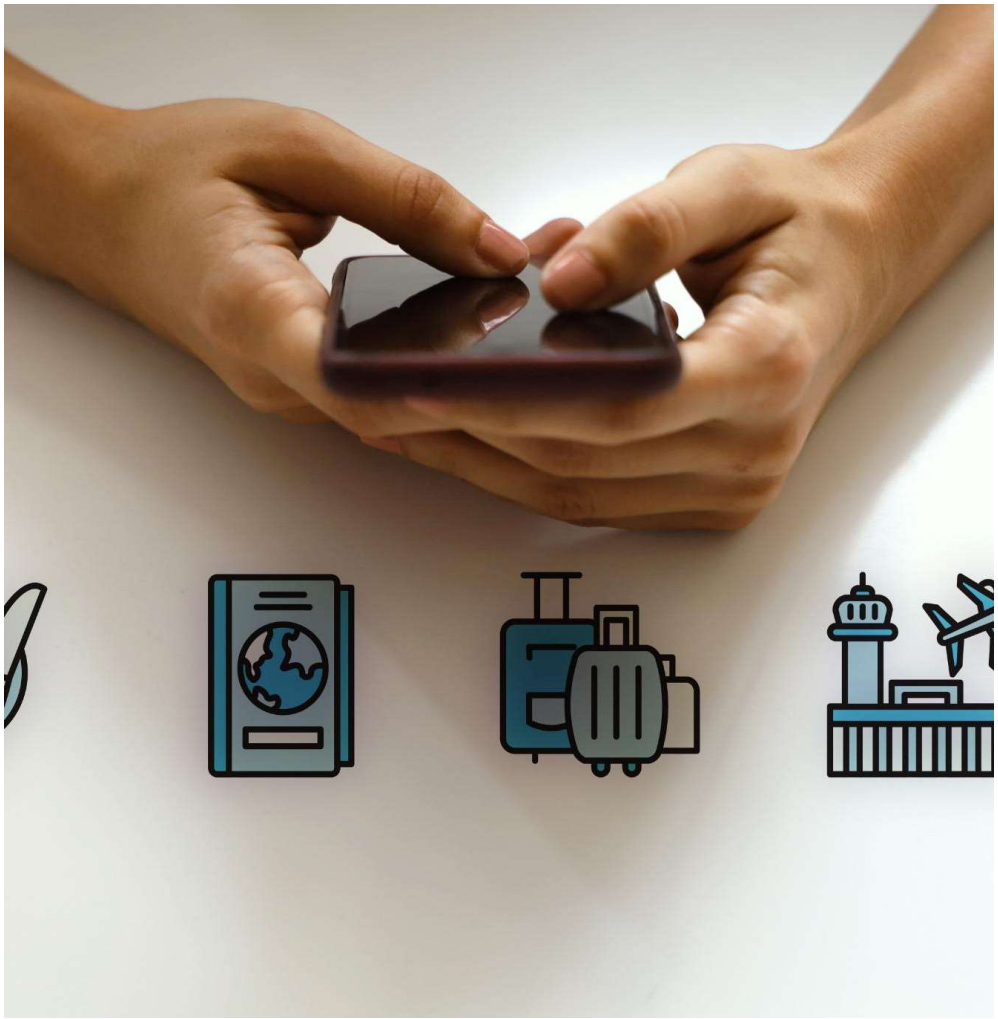
Future Optimizations

Enhanced Multi-Language Support

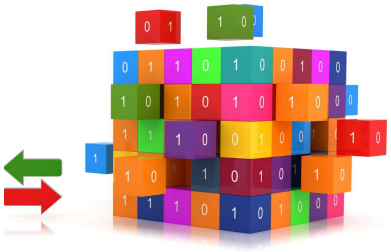
Improve multilingual capabilities to better serve users who speak different languages, including real-time translation.

Integration with Booking Systems

Enable users to book accommodations, tours, and activities directly through the chatbot interface.



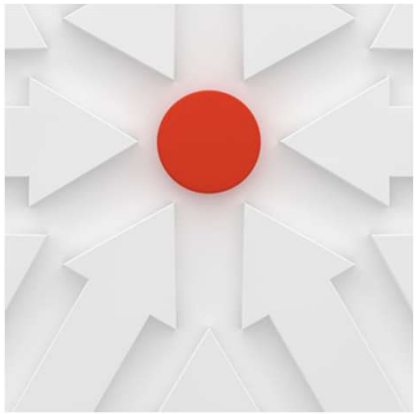
Expanded Data Sources



Richness of Information

Incorporating additional data sources allows for a more comprehensive understanding of user needs and information context.

User Feedback Loop



The integration of varied data sources significantly enhances the accuracy of the information shared with users.

Conclusion

The AI Travel Planner for Puerto Rico combines advanced natural language processing and information retrieval technologies to provide a personalized and efficient travel planning experience. The integration of conversational memory ensures a fluid and coherent interaction, enhancing user satisfaction and facilitating the creation of detailed and personalized itineraries.