AI-Enhanced Information Retrieval System with Big Data Analytics and NLP Transformers

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MOTIVATION

As the volume of data continues to grow, obtaining relevant information from it becomes more challenging, particularly since not all parts of the data are equally important. Therefore, it is necessary to handle, filter, and process the data before modeling it to obtain better inferences. In this regard, Big Data Tools are essential, as they can efficiently process vast amounts of data and retrieve relevant information in a matter of seconds. To this end, various AI-based technologies such as ChatGPT and BARD have emerged, which can extract abstractive information from this massive amount of data.

In response to the challenge of extracting relevant information from large volumes of data, I developed an AI-based information retrieval system in this study. The system enables rapid access to pertinent data and performs specific tasks based on user specifications.

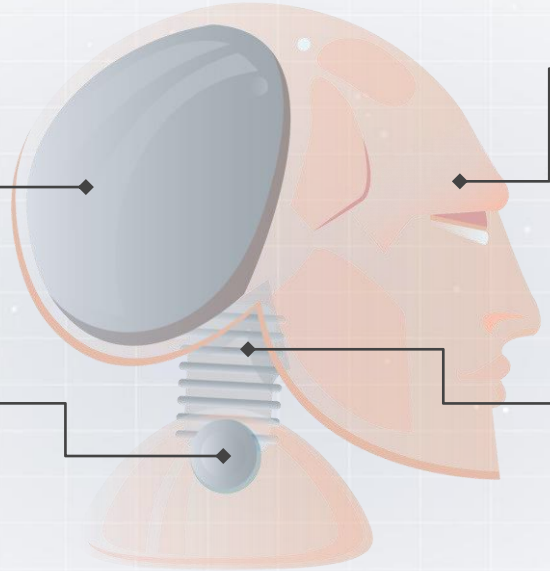
PROBLEM DESCRIPTION

NLU

Natural Language Understanding based on context

Q&A

Question answering from given passage



SIMILARITY

Identifying the most pertinent documents related to a query

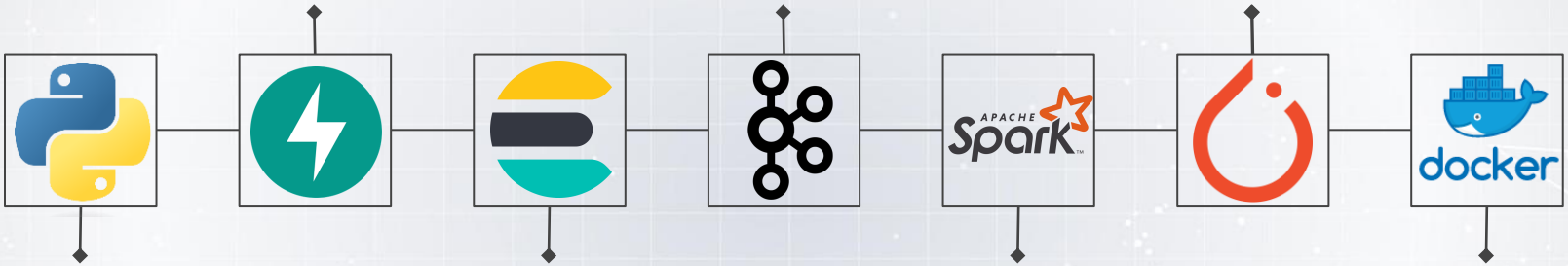
SUMMARIZE

Extraction of most informative sections from larger texts

01

TECHNOLOGIES

Languages, Tools and Frameworks



PYTHON
Language to logic implementaion

FASTAPI
HTTP requests for AI models

ELASTICSEARCH
Storing and indexing the documents

APACHE KAFKA
Data streaming and real-time data pipeline

APACHE SPARK
Real-time data processing and ETL

PYTORCH
Training and Finetuning the AI Models

DOCKER
Containerization and isolation of the applications

02

DESIGN SPECIFICATIONS

STAGES OF THE PIPELINE

01

ETL

The data is first preprocessed with Spark, then consumed from Kafka, before being utilized in Applications.

02

QUERY

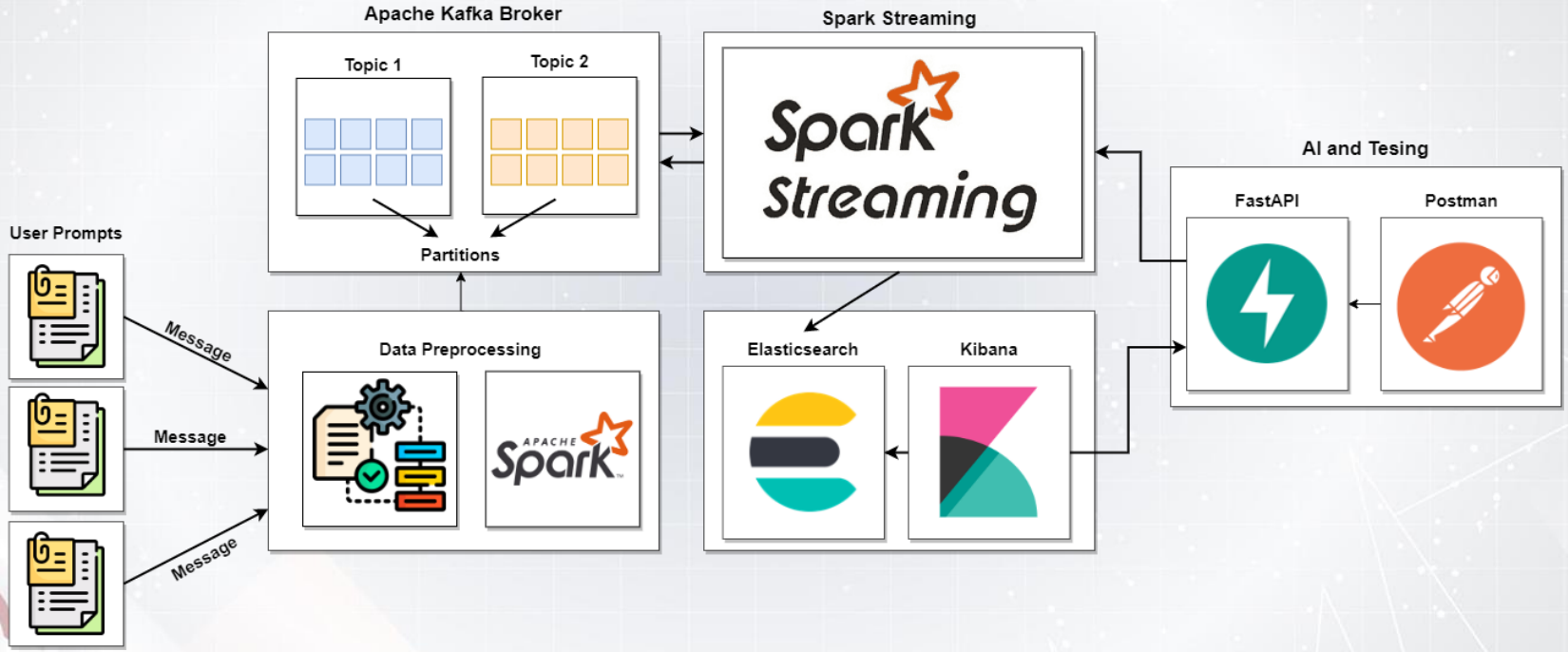
Prompt a query and send a HTTP request to trigger a particular operation

03

RETRIEVE

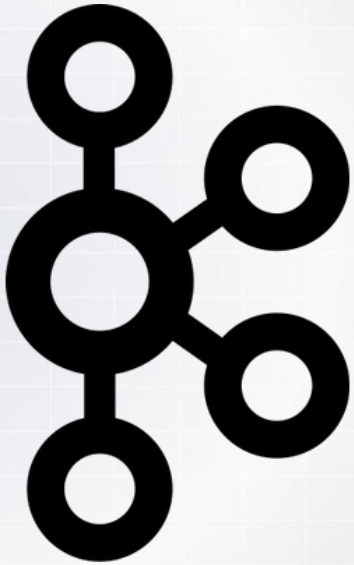
Retrieve relevant data from the database and perform specific actions based on the query.

DATA INGESTION PIPELINE



DATA STREAMING

Data is continuously streamed into Kafka in real-time, making it readily available for consumption by all applications.



DATA WRANGLING

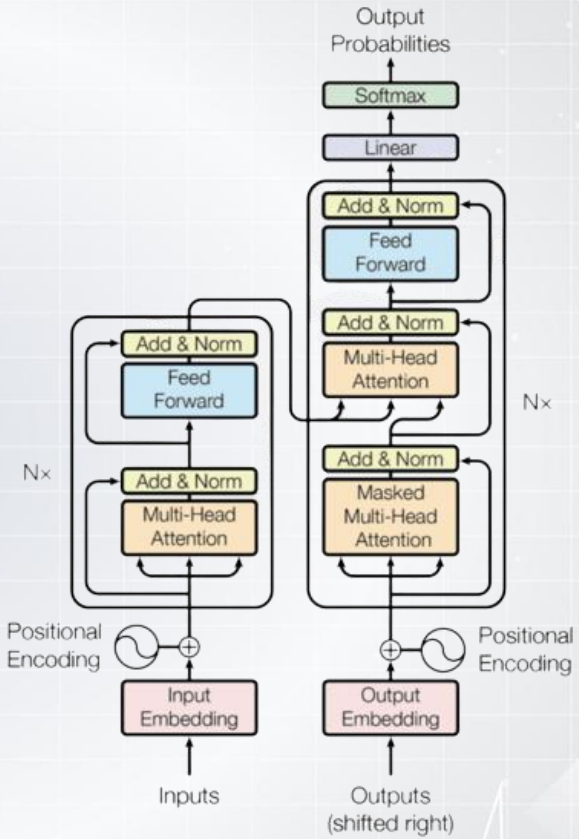
Apache Spark is employed to preprocess text data prior to publishing it, as well as for performing read and write operations with Elasticsearch. By processing queries similarly to indexed documents, the data can be efficiently prepared for AI model execution.

DOCUMENT INDEXING

Elasticsearch is used to store and index documents, allowing for efficient retrieval of information relevant to a given query.

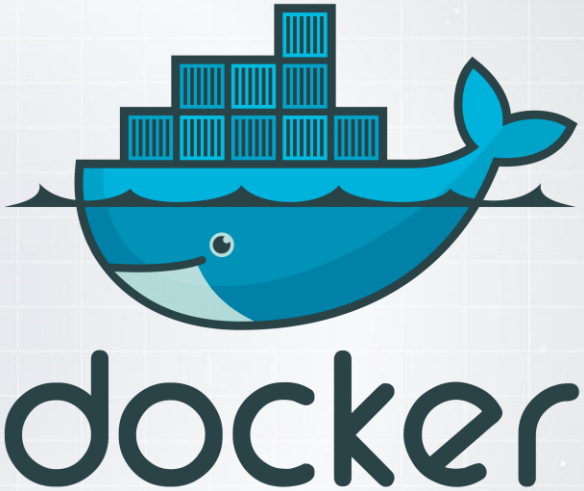
NLP AND NLU

Cutting-edge NLP architectures are utilized to comprehend the provided prompt and carry out a particular task.



CONTAINERIZATION

The services are containerized and isolated using Docker, a platform that allows for efficient and consistent deployment of applications across different environments.

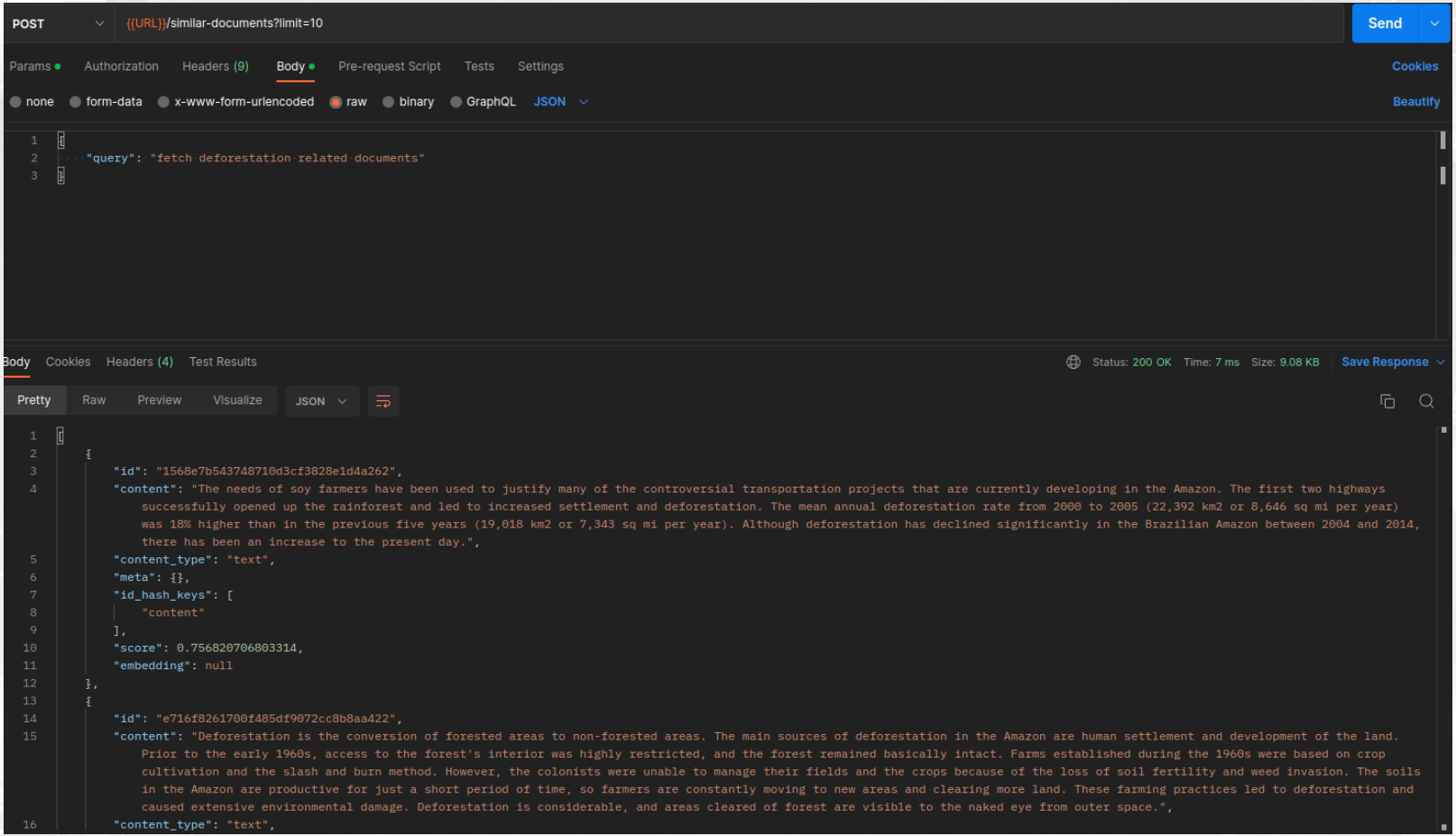


API DEVELOPMENT

The provision of communication between the services is facilitated through HTTP requests via FastAPI.

03

EXPERIMENTAL RESULTS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Send
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Authorization
Headers (9)
Body
Pre-request Script
Tests
Settings
Cookies
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form-data
x-www-form-urlencoded
raw
binary
GraphQL
JSON
Beautify
{
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}
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Headers (4)
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Save Response
Pretty
Raw
Preview
Visualize
JSON
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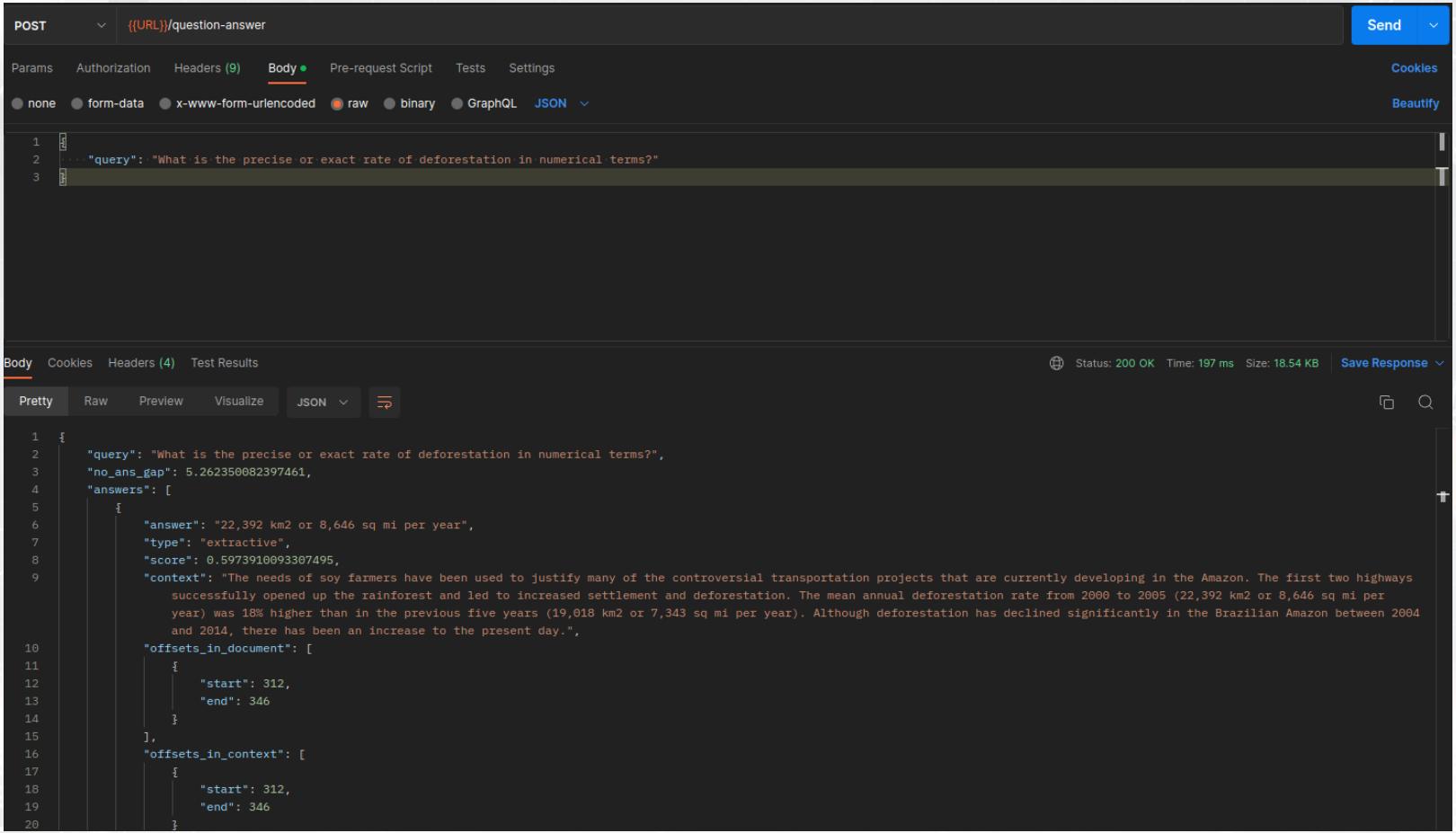
POST
{{URL}}/question-answer
Send
Params
Authorization
Headers (9)
Body
Pre-request Script
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Settings
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raw
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GraphQL
JSON
Beautify
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Pretty
Raw
Preview
Visualize
JSON
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