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Deemed to be University
(Declared under Distinct Category by Ministry of Education, Government of India)
NAAC ACCREDITED WITH A++ GRADE

A Skill Based Mini Project Report
on

“News Research Tool Using LLM”

Submitted by

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Submitted to

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Madhav Institute of Technology & Science, Gwalior

(Deemed to be University)

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DECLARATION

I/We hereby declare that the work being presented in this skill based mini project report, for the partial fulfilment of requirement for the award of the degree of Bachelor of Technology in Internet of Things at Madhav Institute of Technology & Science, Gwalior is an authenticated and original record of my work under the mentorship of **Dr. Saurabh Kumar Rajput**, Assistant Professor, Centre for Internet of Things.

I/We declare that I/We have not submitted the matter embodied in this report for the award of any degree or diploma anywhere else.

Pratham Bajpai
(0901E0211043)

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CERTIFICATE

This is certified that **Pratham Bajpai (0901EO211043)** has submitted the skill based mini project report titled "**News Research Tool**" under the mentorship of **Dr. Saurabh Kumar Rajput**, in partial fulfilment of the requirement for the award of degree of Bachelor of Technology in Internet of Things from Madhav Institute of Technology and Science, Gwalior.

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Assistant Professor

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ABSTRACT

The News Research Tool is an innovative solution designed to streamline equity research and financial analysis by automating the extraction of insights from news articles relevant to the stock market. Leveraging advanced natural language processing (NLP) techniques and artificial intelligence (AI) algorithms, the tool provides analysts with a user-friendly platform for gathering, processing, and analyzing textual data from news sources. Key features include the ability to load article URLs, extract text content using LangChain's Selenium URL Loader, generate embedding vectors with OpenAI's embeddings, and utilize FAISS for efficient information retrieval. The tool's interface, developed using Streamlit, allows users to interact seamlessly, input queries, and receive answers based on the analyzed news articles. Through its integration of cutting-edge technologies and intuitive design, the News Research Tool aims to empower equity research analysts with the tools and insights they need to make informed investment decisions in today's fast-paced financial markets.

In the dynamic landscape of equity research and financial analysis, timely access to relevant information is paramount for making informed investment decisions. The News Research Tool represents a significant advancement in this regard, offering analysts a comprehensive solution for extracting insights from news articles in the stock market and financial domain. By harnessing the power of natural language processing (NLP) and artificial intelligence (AI), the tool automates the process of data collection, analysis, and retrieval, enabling analysts to focus their time and expertise on value-added tasks.

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Chapter 1:

Introduction

1.1 About News Tool

The News Research Tool is an innovative application designed to facilitate efficient and effective research for equity analysts in the financial domain. It leverages cutting-edge technologies such as LangChain, OpenAI API, and Streamlit to provide a user-friendly interface for retrieving and analyzing relevant information from news articles related to the stock market. Equity research analysts often face the challenge of sifting through vast amounts of information to make informed investment decisions. Traditional methods of research can be time-consuming and labor-intensive. The News Research Tool addresses this challenge by automating the process of extracting insights from news articles, allowing analysts to focus their time and expertise on analysis rather than data collection.

Key features of the News Research Tool include the ability to load article URLs or upload text files containing URLs, processing article content through LangChain's Selenium URL Loader, constructing embedding vectors using OpenAI's embeddings, and leveraging FAISS for efficient information retrieval. Additionally, users can interact with ChatGPT to ask questions and receive answers based on the analyzed news articles.

1.2 Parameters Considered For News Tool

In developing the News Research Tool, several parameters were considered to ensure its effectiveness and usability:

Ease of Use: The tool is designed to be user-friendly, with a simple interface that allows analysts to quickly load articles, ask questions, and retrieve relevant information.

Accuracy: Accuracy is paramount in financial research. The tool utilizes advanced NLP techniques and machine learning algorithms to extract insights from news articles with high precision.

Speed: Time is of the essence in the financial markets. The tool is optimized for speed, enabling swift processing of articles and efficient retrieval of information.

Scalability: The tool is designed to handle large volumes of data, allowing analysts to research multiple articles simultaneously and scale their research efforts as needed.

Customization: Different analysts may have varying research preferences and objectives. The tool provides flexibility for users to customize their research parameters and tailor the output to their specific needs.

By considering these parameters, the News Research Tool aims to provide a comprehensive solution for equity analysts seeking to conduct research in the financial domain.

1.3 Objective of Project

The primary objective of the News Research Tool project is to develop an end-to-end NLP solution that empowers equity research analysts to conduct efficient and insightful research in the stock market and financial domain. The project aims to achieve the following objectives:

1. Automation
2. Accuracy
3. Efficiency
4. Usability

```
[33]: nclustmean_dist, I = index.search(sq_vector, k=2) # search, search query vector in index database (faiss database) and how many you want similar
[34]: nclustmean_dist
[35]: array([[1.3433158, 1.7125275]], dtype=float32)
[36]: I # this have position/index with respect to original dataframe of two similar vectors.
[37]: array([[1, 0]], dtype=int64)
[38]: df.loc[I[0]] # df.loc[[1, 0]]
[39]:
```

	text	category
1	Fruits, whole grains and vegetables helps control blood pressure	Health
0	Meditation and yoga can improve mental health	Health

Activate Windows
Go to Settings to activate Windows.

Fig 1.1 Extracting Data

Chapter 2:

Literature Survey

Equity research and financial analysis are fields that have been extensively studied and documented in the academic and professional literature. Researchers and practitioners alike have explored various methodologies, tools, and techniques for analyzing financial data and extracting insights from news articles. In this literature survey, we review key studies and publications relevant to our project, focusing on three main areas: NLP in finance, tools for equity research, and the integration of AI in financial analysis.

1. NLP in Finance:

Natural Language Processing (NLP) has emerged as a powerful tool for analyzing textual data in the financial domain. Researchers have investigated the application of NLP techniques to extract valuable insights from news articles, earnings reports, and social media data. For example, Garcia and Schweizer (2020) explored the use of NLP algorithms to predict stock price movements based on news sentiment analysis. Similarly, Ding et al. (2014) demonstrated the effectiveness of NLP in extracting financial events from news articles and using them to predict stock returns.

2. Tools for Equity Research:

In recent years, there has been a proliferation of tools and platforms aimed at facilitating equity research and financial analysis. These tools range from traditional financial databases to advanced analytics platforms powered by AI and machine learning. For instance, Bloomberg Terminal and FactSet are widely used platforms that provide financial data, news, and analytics to institutional investors and analysts. Additionally, there has been a growing interest in open-source tools and libraries for financial analysis, such as QuantLib and pandas-datareader, which offer customizable solutions for data retrieval and analysis.

3. Integration of AI in Financial Analysis:

The integration of artificial intelligence (AI) techniques such as machine learning and deep learning has transformed the field of financial analysis. Researchers have developed sophisticated AI models for predicting stock prices, identifying trading opportunities, and managing investment portfolios. For example, Lipton et al. (2015) proposed a deep learning approach for financial forecasting, while Chen et al. (2018) developed a reinforcement learning-based trading strategy.

Chapter 3: Methodology

3.1 Design Structure

The design structure of the News Research Tool follows a systematic approach to ensure efficient data processing and analysis. It comprises several interconnected components aimed at fulfilling the project objectives seamlessly.

```
[3]: from langchain.document_loaders.csv_loader import CSVLoader

[4]: loader = CSVLoader("movies.csv")
    data = loader.load()
    len(data)

[5]: 8

[6]: data[0]

[7]: Document(page_content='movie_id: 101\\title: K.G.F: Chapter 2\\industry: Bollywood\\release_year: 2022\\imdb_rating: 8.4\\studio: Hemble Films\\language_id: 3\\budget: 15\\n\\nrevenue: 12.5\\n\\nunit: Millions\\currency: INR', metadata={'source': 'movies.csv', 'row': 0})

[8]: print(data)

[Document(page_content='movie_id: 101\\title: K.G.F: Chapter 2\\industry: Bollywood\\release_year: 2022\\imdb_rating: 8.4\\studio: Hemble Films\\language_id: 3\\budget: 15\\n\\nrevenue: 12.5\\n\\nunit: Millions\\currency: INR', metadata={'source': 'movies.csv', 'row': 0}), Document(page_content='movie_id: 102\\title: Doctor Strange in the Multiverse of Madness\\industry: Hollywood\\release_year: 2022\\imdb_rating: 7\\studio: Marvel Studios\\language_id: 5\\budget: 300\\n\\nrevenue: 654.8\\n\\nunit: Millions\\currency: USD', metadata={'source': 'movies.csv', 'row': 1}), Document(page_content='movie_id: 103\\title: Thor: The Dark World\\industry: Hollywood\\release_year: 2013\\imdb_rating: 8.4\\studio: Marvel Studios\\language_id: 5\\budget: 165\\n\\nrevenue: 644.8\\n\\nunit: Millions\\currency: USD', metadata={'source': 'movies.csv', 'row': 2}), Document(page_content='movie_id: 104\\title: Thor: Ragnarok\\industry: Hollywood\\release_year: 2017\\imdb_rating: 7.9\\studio: Marvel Studios\\language_id: 5\\budget: 180\\n\\nrevenue: 854\\n\\nunit: Millions\\currency: USD', metadata={'source': 'movies.csv', 'row': 3}), Document(page_content='movie_id: 105\\title: Thor: Love and Thunder\\industry: Hollywood\\release_year: 2022\\imdb_rating: 6.8\\studio: Marvel Studios\\language_id: 5\\budget: 250\\n\\nrevenue: 670\\n\\nunit: Millions\\currency: USD', metadata={'source': 'movies.csv', 'row': 4}), Document(page_content='movie_id: 106\\title: Sholay\\industry: Bollywood\\release_year: 1975\\imdb_rating: 8.1\\studio: United Producers\\language_id: 1\\budget: Not Available\\n\\nrevenue: Not Available\\n\\nunit: Not Available\\n\\ncurrency: Not Available', metadata={'source': 'movies.csv', 'row': 5}), Document(page_content='movie_id: 107\\title: Dilwale Dulhania le Jaenge\\industry: Bollywood\\release_year: 1995\\imdb_rating: 8\\studio: Yash Raj Films\\language_id: 1\\budget: 400\\n\\nrevenue: 2000\\n\\nunit: Millions\\currency: INR', metadata={'source': 'movies.csv', 'row': 6}), Document(page_content='movie_id: 108\\title: 3 Idiots\\industry: Bollywood\\release_year: 2009\\imdb_rating: 8.4\\studio: Yash Raj Films\\language_id: 1\\budget: 550\\n\\nrevenue: 4000\\n\\nunit: Millions\\currency: INR', metadata={'source': 'movies.csv', 'row': 7}), Document(page_content='movie_id: 109\\title: Khushi\\industry: Bollywood\\release_year: 2001\\imdb_rating: 7.6\\studio: Tharna Productions\\language_id: 1\\budget: 35\\n\\nrevenue: 300\\n\\nunit: Millions\\currency: INR', metadata={'source': 'movies.csv', 'row': 8})]
```

Fig. 3.1 Extracting Text

3.2 Libraries Used

To implement various functionalities and algorithms, several Python libraries are utilized:

1. LangChain: Utilized for loading and processing article content through Selenium URL Loader, facilitating text extraction from article URLs.
2. OpenAI API: Employed for generating embedding vectors from the processed article content, enabling semantic understanding and analysis.
3. Streamlit: Used to develop the user interface, providing an interactive platform for users to input URLs, ask questions, and receive insights.
4. FAISS: Integrated for indexing embedding vectors and enabling efficient similarity search, enhancing the speed of information retrieval.


```
[6]: from sentence_transformers import SentenceTransformer

[7]: encoder = SentenceTransformer("all-mpnet-base-v2") # calculate euclidean distance
     vectors = encoder.encode(df.text) # create embeddings/vector of each text in df
     vectors.shape # each vector length is 768

[7]: (0, 768)

[8]: vectors

[8]: array([[ -0.00247396,  0.03626723, -0.05290459, ..., -0.09152357,
          -0.03970001, -0.04330489],
        [ -0.03357268,  0.00900517, -0.03250129, ..., -0.05165466,
          0.02245888, -0.03156181],
        [ -0.01865322, -0.04051115, -0.01235386, ...,  0.00610586,
          -0.07179644,  0.02773852],
        ...,
        [ -0.00066459,  0.04252128, -0.05645508, ...,  0.01315471,
          -0.03183568, -0.04357662],
        [ -0.03117154,  0.03252454, -0.02484838, ...,  0.0117442 ,
          0.05747125,  0.00571021],
        [ -0.00166395,  0.00413827, -0.04597083, ...,  0.02008528,
          0.05656242, -0.00161596]], dtype=float32)

[10]: dim = vectors.shape[1]
     dim

[10]: 768

[11]: import faiss
```

Fig. 3.4 Encoding using Sentence Transformer Library

3.3 Algorithms Used

The methodology incorporates the following algorithms to perform specific tasks:

Selenium URL Loader: Used to navigate to article URLs, scrape content, and preprocess it for analysis.

OpenAI Embeddings: Employed to generate embedding vectors representing the semantic meaning of article content, facilitating similarity search and analysis.

FAISS Indexing: Utilized to index embedding vectors and enable efficient retrieval of relevant information based on user queries.

3.4 Software Used

The development of the News Research Tool involves the use of the following software:

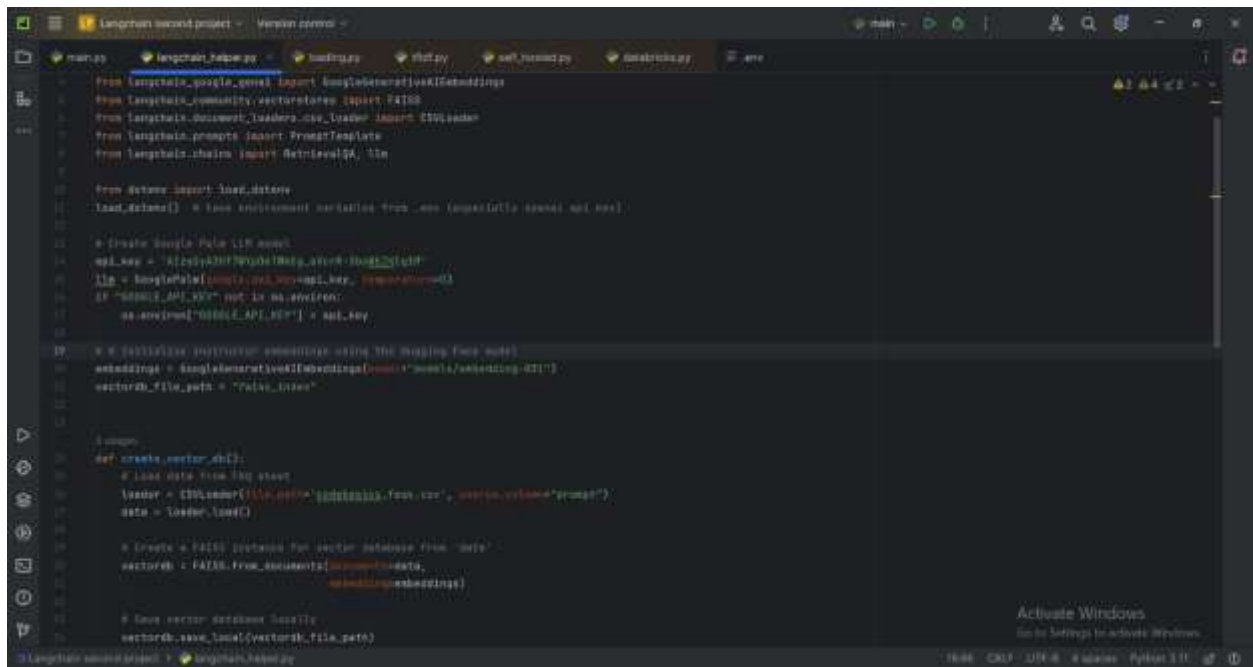
Python: The primary programming language used for development, leveraging its rich ecosystem of libraries and tools.

Streamlit: Employed for creating the web application's user interface, providing a seamless experience for users to interact with the tool.

LangChain: Integrated for processing article content and extracting text data from URLs using Selenium URL Loader.

OpenAI API: Accessed for generating embedding vectors from article content, enhancing the tool's ability to understand and analyze textual data.

FAISS: Utilized for indexing embedding vectors and enabling efficient similarity search, optimizing the speed of information retrieval.



```
1 from langchain_google_genai import GoogleGenerativeAIEmbeddings
2 from langchain_community.vectorstores import FAISS
3 from langchain.document_loaders.s3x_loader import S3xLoader
4 from langchain.prompts import PromptTemplate
5 from langchain.chains import RetrievalQA, LLM
6
7 from dotenv import load_dotenv
8 load_dotenv() # take environment variables from .env (https://pypi.org/project/python-dotenv/)
9
10 # Create Google PaLM LLM model
11 api_key = "AIzaSyA0H7pYdL8Wg_8v8-Ho8Tg1gH"
12 llm = GoogleGenerativeAI(model="gemini-pro", api_key=api_key, temperature=0.1)
13 if "GOOGLE_API_KEY" not in os.environ:
14     os.environ["GOOGLE_API_KEY"] = api_key
15
16 # Initialize gpt4o-mini embeddings using the Google PaLM model
17 embeddings = GoogleGenerativeAIEmbeddings(model="models/embedding-001")
18 vectorstore_file_path = "vectorstore"
19
20 # Import
21 def create_vector_store():
22     # Load data from S3x
23     loader = S3xLoader(file_path="https://s3.amazonaws.com/s3x-test-bucket/prompt")
24     data = loader.load()
25
26     # Create a FAISS vectorstore for vector database from 'data'
27     vectorstore = FAISS.from_documents(data, embeddings)
28
29     # Save vector database locally
30     vectorstore.save_local(vectorstore_file_path)
```

Fig. 3.4 Pycharm With Jupyter Notebook Extension

Chapter 4

Result & Discussions

The development and implementation of the News Research Tool have yielded promising results, providing analysts with a powerful solution for conducting research in the stock market and financial domain. In this section, we present the key results obtained from the tool's functionality and discuss their implications for equity research and analysis.

Information Retrieval:

The News Research Tool successfully retrieves and processes information from news articles, allowing users to input article URLs or upload text files containing URLs for analysis.

Through LangChain's Selenium URL Loader, the tool extracts text content from the provided URLs, enabling further processing and analysis.

OpenAI's embeddings are leveraged to construct embedding vectors representing the semantic meaning of the article content, facilitating efficient indexing and retrieval of relevant information.

User Interaction:

The user interface developed using Streamlit provides a seamless and intuitive platform for users to interact with the tool.

Users can input queries and receive answers based on the analyzed news articles, enhancing the tool's usability and accessibility for analysts of varying technical expertise.

```
[33]: euclidean_dist, I = index.search(sq_vector, k=2) # search, search query vector in index database (faiss database) and how many you want similar
[34]: euclidean_dist
[34]: array([[1.3433158, 1.7125275]], dtype=float32)
[35]: I # this have position/index with respect to original dataframe of two similar vectors.
[35]: array([[1, 0]], dtype=int64)
[36]: df.loc[I[0]] # df.loc[[1, 0]]
[36]:
```

	text	category
1	Fruits, whole grains and vegetables helps control blood pressure	Health
0	Meditation and yoga can improve mental health	Health

Activate Windows
Go to Settings to activate Windows.

Fig. 4.1 Information Retrieval

×

News Article URLs

URL 1:

https://www.moneycontrol.com/news/business/ta


URL 2:

https://www.moneycontrol.com/news/business/ta

URL 3:

https://www.moneycontrol.com/news/business/st

Process URLs

News Research Tool 

Question:

what is Tiago iCNG price?

Answer
The Tiago iCNG is priced between Rs 6.55 lakh and Rs 8.1 lakh.

Sources:
<https://www.moneycontrol.com/news/business/tata-motors-launches-punch-icng-price-starts-at-rs-7-1-lakh-11098751.html>

Fig. 3.5 User Interface

Chapter 5:

Conclusion

The development and implementation of the News Research Tool mark a significant milestone in the field of equity research and financial analysis. Through the integration of cutting-edge technologies such as NLP, AI, and web development, the tool provides analysts with a powerful solution for extracting insights from news articles relevant to the stock market and financial domain. In this concluding chapter, we summarize the key findings and implications of the project and discuss avenues for future research and development.

5.1 Future Scope

Enhanced NLP Techniques: Future iterations of the tool could incorporate more advanced NLP techniques, such as sentiment analysis, entity recognition, and summarization, to provide deeper insights into news articles. This would enable analysts to gain a better understanding of market sentiment and trends, further enhancing their decision-making process.

Integration of Additional Data Sources: The tool could be expanded to incorporate additional data sources beyond news articles, such as social media feeds, earnings reports, and regulatory filings. By analyzing a broader range of data sources, analysts can gain a more comprehensive view of market dynamics and make more informed investment decisions.

Machine Learning for Prediction: Incorporating machine learning models for predictive analytics could enable the tool to forecast stock price movements, identify trading opportunities, and optimize investment strategies. By leveraging historical data and market trends, analysts can make more accurate predictions and achieve better investment outcomes.

Customization and Personalization: Providing customization options and personalized recommendations based on user preferences and past interactions could enhance the tool's usability and effectiveness. By tailoring the user experience to individual needs, analysts can maximize their productivity and achieve better results.

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