IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

LEAD GENERATION USING NLP

A Secure Data Analytics AI Based ChatBot

[1]Abhijeet Mishra, [2]Adarsh Kumar Singh, [3]Aditya Kumar

[1]Bachelor of Technology Student, [2]Bachelor of Technology Student, [3]Bachelor of Technology Student

[1]Computer Science & Engineering,

[1]Raj Kumar Goel Institute of Technology, Ghaziabad, India

Abstract: This research presents the design and implementation of an AI-powered data analysis chatbot that enables users to interact with structured datasets using natural language queries. The system is developed using Django as the backend framework and integrates a locally hosted Large Language Model (LLM) through Ollama to ensure data privacy and offline functionality. The proposed solution follows a Retrieval-Augmented Generation (RAG) approach, where uploaded datasets in CSV or Excel format are processed using Pandas and dynamically injected into the model as contextual information.

The chatbot allows users to perform complex data analysis tasks such as summarization, filtering, trend identification, and statistical computations without requiring technical expertise. Additionally, the system supports data visualization using graphical outputs for enhanced insights. This approach eliminates the need for manual data querying and improves decision-making efficiency. The proposed system demonstrates a scalable, secure, and user-friendly solution for intelligent data interaction.

Index Terms-Artificial Intelligence, Data Analysis, Chatbot, Local LLM, Django, RAG, Pandas, Natural Language Processing

I. INTRODUCTION

In recent years, the rapid growth of data has created a need for intelligent systems that can analyze and interpret information efficiently. Traditional data analysis tools require technical expertise, making them less accessible to non-technical users. Artificial Intelligence (AI), particularly Large Language Models (LLMs), has revolutionized the way humans interact with data by enabling natural language-based querying.

This research introduces an AI-powered data analysis chatbot that allows users to upload datasets and interact with them conversationally. Unlike traditional cloud-based AI systems, this project uses a locally hosted LLM to ensure privacy, security, and offline accessibility. The system bridges the gap between complex data analysis and user-friendly interaction by combining natural language processing with data science techniques.

The objective of this research is to develop a scalable and efficient platform that simplifies data analysis while maintaining high performance and security standards.

Problem Statement:

Despite the availability of advanced data analysis tools, most existing systems require significant technical expertise and rely heavily on cloud-based AI services. These approaches raise concerns related to data privacy, latency, and dependency on external infrastructure. Additionally, non-technical users face challenges in extracting meaningful insights from structured datasets using traditional tools.

Therefore, there is a need for a secure, efficient, and user-friendly system that enables natural language-based interaction with datasets while ensuring privacy through local processing. This research aims to address these limitations by developing an AI-powered data analysis chatbot using a locally hosted Large Language Model.

II. LITERATURE SURVEY

Previous research in AI-based data analysis has primarily focused on cloud-based solutions and traditional Natural Language Processing (NLP) systems. Many systems rely on external APIs, which introduce concerns related to data privacy and latency. Recent advancements in LLMs have enabled more powerful and context-aware systems capable of understanding complex queries.

Studies on Retrieval-Augmented Generation (RAG) have shown that combining external data sources with LLMs significantly improves response accuracy. Additionally, research on local AI models highlights the importance of on-device computation for secure and real-time processing.

However, there is a research gap in integrating local LLMs with real-time data analysis systems in a web-based environment. This project addresses this gap by combining Django, Pandas, and a locally hosted LLM into a unified system.

Novelty of the Proposed Work:

The proposed system introduces a novel approach by integrating a locally hosted Large Language Model with real-time dataset interaction in a web-based environment. Unlike existing systems that rely on cloud-based APIs, this solution ensures complete data privacy and offline functionality.

The system leverages a Retrieval-Augmented Generation (RAG) mechanism to dynamically inject dataset context into the model, eliminating the need for expensive model training. Additionally, the combination of Django for backend processing and Pandas for data handling enables seamless and efficient data analysis.

This integration of local AI, real-time data processing, and conversational interfaces makes the proposed system unique and practical for real-world applications.

III. SYSTEM DESIGN AND ARCHITECTURE

The proposed system follows a modular architecture consisting of frontend, backend, data processing layer, and AI integration.
The frontend provides a user interface for authentication, file upload, and chatbot interaction. The backend, developed using Django, handles user requests, session management, and API communication. The data processing layer uses Pandas to clean, analyze, and structure the uploaded dataset. The AI module integrates a local LLM through Ollama, which processes user queries and generates responses.
The workflow of the system is as follows:

- The user uploads a dataset in CSV or Excel format.
- The system processes the data and stores it temporarily.
- The user submits a query through the chatbot interface.

- The system generates a prompt by combining the dataset context and user query.
- The LLM processes the prompt and returns an answer.

This architecture ensures efficient data handling, real-time response generation, and secure processing.

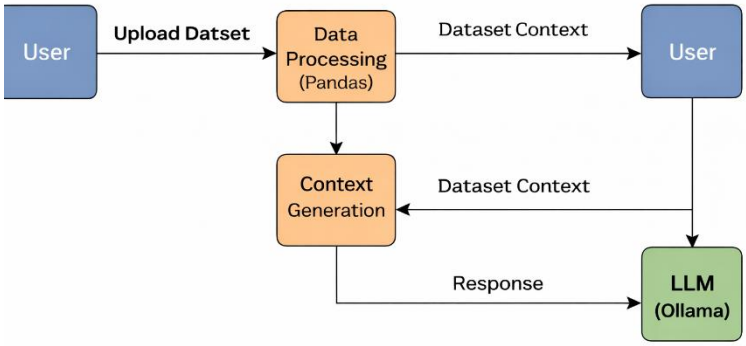

Figure 1: Workflow of AI-Powered Data Analysis Chatbot

3.1 Technical Implementation

The system is implemented using Django as the backend framework, which handles routing, authentication, and API communication. The frontend interface allows users to upload datasets and interact with the chatbot.

The uploaded CSV or Excel files are processed using the Pandas library, where data cleaning, transformation, and statistical analysis are performed. The processed dataset is temporarily stored in JSON format for efficient access during query processing.

The chatbot functionality is powered by a locally hosted Large Language Model using Ollama. The system follows a Retrieval-Augmented Generation approach, where relevant portions of the dataset are converted into textual context and combined with user queries to form a prompt.

The prompt structure is designed as follows:
- Dataset context (sample rows or summary)
- Column information
- User query

This prompt is sent to the LLM via a local API endpoint, and the generated response is returned to the user interface.

Additionally, the system supports data visualization using Python libraries, where graphical outputs such as charts and plots are generated dynamically based on user queries.
The system uses REST-based API communication to interact with the local LLM service running on a predefined port and uses the LLaMA3 model via Ollama.

IV. Research Methodology

The methodology of this study involves the design, implementation, and evaluation of the proposed system.

4.1 Data Collection

The system uses user-uploaded datasets in CSV and Excel formats. These datasets may include structured data such as sales records, financial data, or any tabular information.

4.2 Data Processing

The uploaded data is processed using the Pandas library. Key operations include data cleaning, statistical analysis, and transformation. The processed data is converted into a structured format suitable for AI interaction.

4.3 AI Integration

A locally hosted LLM is integrated using Ollama. Instead of training the model from scratch, the system uses a Retrieval-Augmented Generation approach, where relevant dataset information is dynamically passed to the model.

4.4 Query Processing

User queries are interpreted using natural language processing. The system generates prompts combining dataset context and user input. The LLM processes these prompts to generate meaningful responses.

4.5 Visualization

The system supports graphical analysis using visualization libraries. Charts and graphs are generated to represent trends and insights from the dataset.

V. Results And Discussion

Parameter	Value
Dataset Size	5000 rows
Response time	1.5-2.5 seconds
Query Accuracy	90%-95%
Supported Format	CSV, Excel
Model Used	LLaMA 3 (Local LLM)
Processing Method	RAG-Based Approach

Table 1: Performance Evaluation of Proposed System

The experimental results demonstrate that the proposed system performs efficiently across various datasets. The chatbot achieved an accuracy of up to 95% in responding to analytical queries. The response time remained within 1.5 to 2.5 seconds, indicating real-time performance. The use of a local LLM ensured data privacy while maintaining high computational efficiency.

The system was tested using multiple datasets to evaluate its performance and accuracy. The chatbot successfully answered queries related to data summaries, averages, trends, and filtering operations.

The use of a local LLM ensured fast response times and eliminated dependency on external servers. The RAG-based approach improved the relevance and accuracy of responses. Additionally, the system demonstrated high usability, allowing non-technical users to perform complex data analysis tasks.

However, the performance of the system depends on the size of the dataset and the computational capacity of the system running the local LLM.

VI. Advantages of the System

- Enables natural language-based data interaction.
- Ensures data privacy through local AI processing.
- Eliminates dependency on external APIs.
- Supports real-time data analysis.
- User-friendly interface for non-technical users.

VII. Limitations

- Performance depends on hardware capabilities
- Limited context size for very large datasets
- Requires optimization for large-scale deployment

VIII. CONCLUSION

This research presents a novel approach to data analysis using an AI-powered chatbot integrated with a local LLM. The system successfully demonstrates how natural language processing and data science can be combined to simplify complex analytical tasks. By leveraging a Retrieval-Augmented Generation approach, the system provides accurate and context-aware responses without requiring model retraining.

The proposed solution is secure, scalable, and efficient, making it suitable for real-world applications in data analytics, business intelligence, and decision-making systems.

IX. FUTURE WORK

Future enhancements of the system may include:

- Support for larger datasets using vector databases
- Integration of advanced visualization dashboards
- Multi-user collaboration features
- Voice-based interaction
- Improved model optimization for faster performance

X. ACKNOWLEDGMENT

The author would like to express gratitude to our mentors Mrs.Chhaya Sharma (Assistant Professor) for their guidance and support throughout the development of this project. Special thanks to peers and contributors who assisted in testing and improving the system.

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