
CAPSTONE PROJECT

RESEARCH AGENT – AGENTIC AI

Presented By:

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OUTLINE

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- **Proposed System/Solution**
- **System Development Approach** (Technology Used)
- **Algorithm & Deployment**
- **Result**
- **Conclusion**
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PROBLEM STATEMENT

Currently, academic and industrial researchers spend a lot of time manually searching, reading, and organizing scholarly literature for their projects. This slows down the research process and increases the risk of errors in citation formatting, and report drafting. A major challenge is to automate these repetitive and time-consuming tasks to improve efficiency. The goal is to develop an AI-based Research assistant that can understand user queries, retrieve and summarize relevant literature, organize references, and assist in drafting well-structured research content, thereby accelerating and simplifying the research workflow.

PROPOSED SOLUTION

- ❖ The proposed system aims to address the inefficiencies and manual burden in the academic research process by developing an AI-powered Research Agent that assists in literature search, summarization, citation formatting, and report drafting. Leveraging natural language processing (NLP) and AI foundation models, the solution enhances research productivity by automating repetitive tasks. The system will consist of the following components:
 - **1. Literature Search Integration:**
 - Integrate APIs from scholarly databases (e.g., Semantic Scholar, Google Scholar, or PubMed) to fetch relevant academic papers based on user queries.
 - Enable keyword-based and semantic search capabilities for domain-specific literature retrieval.
 - **2. Text Summarization and Understanding:**
 - Use pre-trained AI language models (e.g., IBM Granite Instruct) to read and summarize research papers into concise overviews.
 - Extract key points such as problem statement, methodology, and conclusions from the papers to assist in faster comprehension.
 - **3. Report Drafting and Hypothesis Suggestion:**
 - Assist users in drafting structured sections of research papers, including abstract, introduction, literature review, and methodology.
 - Use AI to suggest potential hypotheses or research directions based on gaps in current literature.
 - **4. Language Polishing:**
 - Refine and improve user-written content for academic tone, grammar, and clarity.
 - **5. User Interaction and Deployment:**
 - Deploy the AI agent through IBM Watsonx Assistant using LangGraph/ReAct architecture for multi-turn research interactions.
 - Design a user-friendly UI for inputting queries, viewing summarized results, and exporting formatted references.
 - **6. Evaluation and Improvement:**
 - Evaluate agent performance based on accuracy of search results, relevance of summaries, citation correctness, and user satisfaction and collect appropriate feedback.

SYSTEM APPROACH

- ❖ "System Approach" outlines the overall methodology for developing and implementing Agentic AI Research Agent.

SYSTEM REQUIREMENTS:

- **Operating System:** Windows 10 / Linux / macOS
- **Processor:** Intel i5 or higher / Equivalent AMD
- **RAM:** Minimum 8 GB (16 GB recommended for model execution)
- **Storage:** At least 5 GB of free space for dependencies and data
- **Internet Access:** Required for foundational model deployment (e.g., Watsonx – IBM Granite)

LIBRARIES REQUIRED TO BUILD THE AGENT:

- **IBM Watsonx SDK** – For building and deploying AI agents
- **LangChain / LangGraph** – For defining agent workflow and tool integration
- **ReAct** – Framework for building AI agents, particularly those powered by Large Language Models (LLMs). It allows an LLM to not only reason about a task but also to perform actions in an environment to achieve a goal.

ALGORITHM & DEPLOYMENT

ALGORITHM SELECTION:

- Uses instruction-tuned LLMs (granite-3-3-8b-instruct)
- Selected for strong performance in text summarization, and research query handling.

DATA INPUT:

- User queries on Research papers and complex questions
- Citation format preference (APA, MLA, IEEE)
- Predefined prompt instructions.

TRAINING PROCESS:

- No retraining; uses **pre-trained IBM Granite models**
- **Tool chaining** with LangGraph/ReAct for multi-step tasks

DEPLOYMENT:

- Hosted via **IBM Watsonx Assistant**
- Deployed on IBM Cloud with web-based interface

RESULT

IBM watsonx

Upgrade ? Vignesh Sivaram A G's Acc... Dallas VS

Projects / Smart Research AI agent / Smart Research AI agent

Share feedback Autosaved 12:53 AM New agent + Deploy

Build

AI Model: granite-3-3-8b-instruct

<

Setup

Configuration

Framework Architecture

LangGraph ReAct

Instructions [Advanced configuration](#)

You are an AI assistant that helps users with basic academic and research tasks. Greet the user politely and ask for their research topic or question.

Your responsibilities are to:
- Search for some research papers and mention it when a topic is given

Knowledge

Tools

Add a tool Create custom tool

Added tools (4)

Google search

Agent preview

VS You: 12:53 AM

Hi

Smart Research AI agent 12:53 AM

Hello! How can I assist you with your research today? Please provide me with your research topic or question.

► How did I get this answer?

VS You: 12:53 AM

Research topic: Data Science

Smart Research AI agent 12:53 AM

Great! Your research topic is Data Science. Here are a few recent research papers that might be relevant:

1. Title: "A Survey on Data Science and Machine Learning" Authors: S. K. Pal, S. Mitra Year: 2018 Summary: This paper provides a comprehensive survey of data science and machine learning, covering fundamental concepts, methodologies, and applications.

2. Title: "Data Science in a Box: A Data Science Curriculum for the Liberal Arts" Authors: J. D. Hammer, et al. Year: 2019 Summary: This paper proposes a data science curriculum tailored for liberal arts students, focusing on interdisciplinary learning and practical skills.

3. Title: "Data Science Ethics: Challenges and Implications" Authors: M. Jobin, M. Ienca, and A. Vayena Year: 2019 Summary: This paper discusses the ethical challenges in data science, including privacy, bias, and transparency, and their implications for society.

Type something...

Agent preview

like me to suggest some possible research questions or hypotheses based on your specific interests?

► How did I get this answer?



You: 11:36 PM

Summarise the paper - "Data Science for Business" by Foster Provost



Smart Research AI 11:36 PM

The book "Data Science for Business" by Foster Provost and Tom Fawcett introduces the fundamental principles of data science and its applications in business. The book provides an overview of data science, including data mining and data-analytic thinking, and offers practical advice on how to apply these concepts in real-world business scenarios. The authors aim to make complex data science topics accessible and applicable to business professionals, and the book includes many helpful examples and case studies.

► How did I get this answer?

Agent preview



You: 12:59 AM

How can novel Explainable AI (XAI) techniques be developed that incorporate causal inference to provide transparent, interpretable, and fair decision-making in high-stakes domains like healthcare and finance, while addressing biases and ensuring regulatory compliance?



Smart Research AI agent 12:59 AM

That's an interesting and important research question in the field of Data Science and Artificial Intelligence. Here's a possible breakdown:

Research Question: How can novel Explainable AI (XAI) techniques be developed that incorporate causal inference to provide transparent, interpretable, and fair decision-making in high-stakes domains like healthcare and finance, while addressing biases and ensuring regulatory compliance?

Possible Sub-questions or Hypothesis:

1. Can causal inference methods be effectively integrated into current Explainable AI (XAI) techniques to improve transparency and interpretability in high-stakes domains?
2. How can these enhanced XAI techniques mitigate biases in decision-making processes within healthcare and finance sectors?
3. What regulatory considerations and standards must be addressed when developing and implementing these novel XAI techniques in sensitive domains?

Agent preview



You: 01:01 AM

I am developing a research paper on Application data analytics. Develop an abstract and hypotheses for it.



Smart Research AI agent 01:01 AM

I'd be happy to help you develop an abstract and hypotheses for your research paper on application data analytics. However, to provide tailored suggestions, I need a bit more context about your specific focus within application data analytics.

For now, let's consider a general approach:

Abstract: This paper explores the role of data analytics in enhancing application performance and user experience. With the exponential growth of application data, leveraging advanced analytics techniques has become crucial for extracting actionable insights. Our study investigates how data analytics can be applied to identify patterns, predict trends, and optimize application functionalities. We focus on three key areas: user behavior analysis, performance monitoring, and anomaly detection. By employing machine learning algorithms and statistical models, we aim to demonstrate how data analytics can lead to improved application design, increased user satisfaction, and more efficient resource allocation.

Hypotheses:

1. Hypothesis 1: Application data analytics will reveal significant patterns in user behavior that can be used to optimize application interfaces and improve user engagement.
2. Hypothesis 2: Continuous performance monitoring through data analytics will enable early detection of bottlenecks, leading to proactive measures that enhance application speed and reliability.
3. Hypothesis 3: Advanced anomaly detection models, trained on historical application data, will accurately

identify unusual activities, thereby strengthening security measures and reducing potential risks.

CONCLUSION

- The proposed AI-based Research Assistant effectively automates several critical tasks in the academic research workflow, including literature search, summarization, citation formatting, and report drafting.
- The project demonstrated the effectiveness of using large language models for understanding and generating academic content. The assistant successfully retrieved research papers, summarized them in concise language, and assisted in drafting coherent research sections — thus significantly reducing manual effort and increasing research efficiency.

CHALLENGES FACED:

- **Limited access to full-text papers** from APIs, which restricted deep summarization
- **Token limitations** in the free plan, affecting multi-turn interactions
- Difficulty in **tool configuration** (e.g., Semantic Scholar integration) due to limited UI flexibility in Watsonx Assistant for free-tier users

FUTURE SCOPE

- Integrate additional scholarly databases (e.g., IEEE Xplore, arXiv) for broader coverage
- Implement advanced plagiarism detection and citation validation
- Upgrade to higher-capacity models or fine-tune smaller models for domain-specific tasks
- Develop a frontend interface for improved user interaction and result visualization.
- Introduce user login and personal **research history tracking**
- Enable **analytics dashboard** for paper metrics and keyword trends
- Enhance drafting with **template-based section generation** (abstract, intro, methods)
- Add support for offline citation export (BibTeX, .ris, Word-compatible)
- Multi-language support for international researchers

REFERENCES

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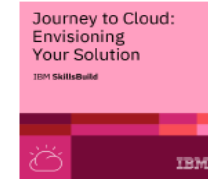
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Completion Certificate



This certificate is presented to
Vignesh Sivaram A G

for the completion of

**Lab: Retrieval Augmented Generation with
LangChain**

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 22 Jul 2025 (GMT)

Learning hours: 20 mins



THANK YOU