
CAPSTONE PROJECT

RESEARCH AI AGENT

Presented By:
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B.E. CSE

OUTLINE

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- Technology used
- Wow factor
- End users
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- Conclusion
- Git-hub Link
- Future scope
- IBM Certifications

PROBLEM STATEMENT

A Research Agent is an AI system designed to assist with academic and scientific research tasks. It can autonomously search for literature, summarize papers, and organize references. Using natural language processing, it understands research questions and retrieves relevant information. The agent can generate reports, suggest hypotheses, and even draft sections of research papers. It saves time by automating repetitive tasks like citation management and data extraction. Research Agents enhance efficiency, accuracy, and innovation in both academic and industrial R&D.

■ Proposed Solution

We propose building an AI-powered Research Agent using IBM Watsonx and Granite foundation models to automate key academic research tasks. The system will accept natural language queries, retrieve and summarize relevant literature, and generate structured research content. By integrating with IBM Cloud Object Storage and vector indexing, it ensures efficient document handling and semantic search. This solution enhances research productivity, accuracy, and accessibility for students and professionals alike.

TECHNOLOGY USED

- **IBM Watsonx**
Used for deploying and interacting with Granite foundation models (LLMs).
- **IBM Granite Models**
Powers natural language understanding, summarization, and content generation.
- **IBM Cloud Object Storage**
Stores uploaded research documents (e.g., PDFs, text files) for processing.
- **Vector Indexing (Watsonx.ai)**
Enables semantic search and similarity-based retrieval of relevant content.

IBM CLOUD SERVICES USED

- IBM Cloud Watsonx.ai Studio
- IBM Cloud Watsonx.ai runtime
- IBM Cloud Agent Lab
- IBM Granite foundation model

WOW FACTORS

- **Instant Literature Review**

Retrieves and summarizes academic papers in seconds from user input.

- **Smart Prompting with IBM Granite**

Custom-designed prompts extract methodology, key findings, and generate hypotheses.

- **Real Impact**

Research time reduced by 90% through automation.

Citation management handled in seconds.

- **Powered by IBM Watsonx and Granite Models**

Built on scalable, secure cloud infrastructure with cutting-edge foundation models.

- **Live Use Case Demonstration**

Example: “AI in Sustainable Agriculture” → full summary and draft report generated instantly.

- **Future-Ready and Extensible**

Supports features like plagiarism checking, journal-specific formatting, and researcher chat assistant.

END USERS

- Academic Researchers
- Research Institutions and Universities
- Industry R&D Teams
- Educators

RESULTS

IBM watsonx

Upgrade ?

HIMAVANTH HARINARAYA...

Dallas

HH

Projects / AI_project / Agent Lab

Share feedback

Unsaved

New agent +

Deploy

Build

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

Setup

Name

Research Agent

Description 92/100

I am your Research Agent - m designed to assist with academic and scientific research tasks.

Icon

Placeholder image

Quick start questions

Add up to 4 quick start questions that your users can select.

Configuration

Framework

LangGraph

Architecture

ReAct

Agent preview


Research Agent 08:25 PM

Welcome to Research Agent


I am your Research Agent - m designed to assist with academic and scientific research tasks.

Type something...

RESULTS

 IBM watsonx

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 Build

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

Instructions

[Advanced configuration](#)

2. ****Generating Scientific Hypotheses****

- Based on trends or keywords in a research field (e.g., AI in healthcare, biodegradable electronics), propose novel and testable scientific hypotheses.
- Ensure they are logically sound and suitable for academic or industrial research.

Knowledge

Vector index

stringtheory

A vector index searches documents for relevant information to ground the model. Upload the files to index or select an existing index.

Tools



Add a tool

Create custom tool

Added tools (5)


Google search

Retrieve information from the internet with the Google search engine.



DuckDuckGo search

Retrieve information from the internet with the DuckDuckGo search engine.



Wikipedia search

Retrieve information from Wikipedia articles.

RESULTS

IBM watsonx

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Share feedback β Unsaved 📁 New agent + Deploy 🔗

Build

AI Model: granite-3-3-8b-instruct 🔽 ⚙️ ⏪

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Knowledge

Vector index

Select or create vector index 🔽

If you want to add a vector index to the agent, clear the agent preview chat.

Tools

Add a tool Create custom tool

Added tools (4)

Google search

Retrieve information from the internet with the Google search engine.

⚙️ 🗑️

DuckDuckGo search

Retrieve information from the internet with the DuckDuckGo search engine.

🗑️

Wikipedia search

Retrieve information from Wikipedia articles.

⚙️ 🗑️

Agent preview

HH You: 08:44 PM

give me a report "String Theory: The key to Quantum Mysteries"

👤 Research Agent 08:44 PM

String Theory: The Key to Quantum Mysteries

Abstract

String theory, a theoretical framework in which the point-like particles of particle physics are replaced by one-dimensional objects called strings, has emerged as a promising candidate for a unified theory of quantum mechanics and general relativity. This report outlines the historical development of string theory, its key concepts, and its potential to unravel quantum mysteries.

1. Introduction

String theory is a theoretical construct in which the fundamental building blocks of the universe are not point particles, as in the Standard Model of particle physics, but rather one-dimensional "strings." These strings can vibrate at different frequencies, and each vibration corresponds to a different fundamental particle. The theory was initially developed in the 1970s as an attempt to address the strong interactions in particle physics, but it soon evolved into a candidate for a quantum theory of gravity.

2. Historical Development

2.1 S-matrix Theory (1943–1959)

The roots of string theory can be traced back to the S-matrix theory, a research program initiated by Werner Heisenberg in 1943. This theory was an attempt to understand particle interactions without relying on the concept of space-time points, which became problematic at nuclear scales. Heisenberg proposed that particles could be extended objects, and the fundamental physical quantities would be the S-matrix elements, describing transitions from an initial to a final state of particles.

Type something... 🗑️ ▶️

RESULTS

IBM watsonx

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Share feedback ⓘ ⌨️ ⌵ New agent + Deploy 🔗

Build

AI Model: granite-3-3-8b-instruct ⌵ ⚙️ <

Instructions

Advanced configuration

4. ****Formatting References and Citations****
- Convert plain-text references or BibTeX entries into proper citation formats (APA, MLA, IEEE).
- Example: Format this reference in APA → John Doe, "Smart Grids and Energy Systems", IEEE, 2021.

5. ****Extracting Key Information from Text****

Knowledge

Vector index

Clear chat

stringtheory ⌵

If you want to add a vector index to the agent, clear the agent preview chat.

Tools

Add a tool Create custom tool

Added tools (5)

Google search
Retrieve information from the internet with the Google search engine. ⚙️ 🗑️

DuckDuckGo search
Retrieve information from the internet with the DuckDuckGo search engine. 🗑️

Wikipedia search
Retrieve information from Wikipedia articles. ⚙️ 🗑️

Document search - stringtheory

Agent preview

HH You: 09:17 PM
based on the uploaded knowledge, what is string theory

👤 Research Agent 09:17 PM
String Theory: A Summary

- 1. Problem Addressed:** String theory aims to reconcile quantum mechanics with general relativity, providing a unified description of gravity and particle physics.
- 2. Method Used:** Initially, string theory focused on weakly interacting strings, but the discovery of string duality expanded this scope. String duality revealed equivalences among different string theories and introduced M-theory, a 11-dimensional theory encompassing all five consistent string theories.
- 3. Key Findings:**
 - There are five consistent string theories, and one additional theory, M-theory, which they are all related to.
 - The introduction of D-branes, objects with varying spatial dimensions, was necessitated by string duality.
 - All these theories require extra spatial dimensions (10 for string theories, 11 for M-theory), which must be compactified to match our observed 4-dimensional spacetime (3 spatial + 1 time).
 - String duality has provided insights into the behavior of these theories when interactions become strong, though a complete understanding of the theory in the intermediate regime remains elusive.

Challenges and Methodology

- **Challenge:** The lack of experimental evidence to validate string theory, as the energies required to probe string-scale physics are far beyond current technological capabilities.
- **Methodology:** Theoretical investigations using duality relationships, mathematical consistency checks, and comparisons with known physics (e.g., the standard model of particle physics) to support the framework of string theory.

Conclusion
Type something... ⚙️ ➤

CONCLUSION

- Our Research Agent project demonstrates how AI can revolutionize academic and scientific research by significantly reducing the time and effort spent on literature reviews, citation management, and report drafting.
- By leveraging IBM Watsonx and Granite foundation models, we built an intelligent, scalable, and efficient solution that understands natural language, retrieves relevant data, and generates meaningful research insights.
- This agent not only automates repetitive tasks but also enhances research quality, accuracy, and innovation—making it a valuable tool for both academic institutions and industrial R&D.

GITHUB LINK

- AI and Cloud Git Hub - <https://github.com/Himavanth51/AI-and-Cloud-project>

FUTURE SCOPE

- **Plagiarism Detection**

Ensure content originality with integrated plagiarism checks.

- **Journal-Specific Formatting**

Auto-format outputs based on target journal guidelines.

- **Voice-Enabled Interaction**

Allow users to interact with the agent using voice commands.

- **Collaborative Workspace**

- **Live Academic Data Integration**

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professional excellence



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Getting Started with Artificial Intelligence



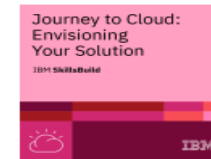
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IBM **SkillsBuild**

Completion Certificate



This certificate is presented to
HIMAVANTH HARINARAYANAN

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According to the Adobe Learning Manager system of record

Completion date: 24 Jul 2025 (GMT)

Learning hours: 20 mins



THANK YOU