

# IBM HACKATHON PROJECT

## RESEARCH AI AGENT

**Presented By:**

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# OUTLINE

- Researchers and students face challenges in quickly finding, summarizing, and organizing academic research. Traditional search engines return too much unstructured data, and manual reading of papers is time-consuming. Our AI Research Agent solves this by autonomously searching literature, summarizing key findings, and providing detailed answers with citations.

# PROBLEM STATEMENT

Researchers, students, and professionals often struggle to stay updated with the rapidly growing volume of academic publications, technical articles, datasets, and evolving research trends. Manually reviewing, filtering, and synthesizing information across multiple domains is time-consuming and inefficient.

## **Proposed Solution:**

An AI Research Agent that uses Natural Language Processing (NLP), Retrieval-Augmented Generation (RAG), to assist users in conducting efficient literature reviews, generating summaries, identifying research gaps, and recommending relevant papers, datasets, or collaborators.

# TECHNOLOGY USED

- IBM cloud lite services
- Natural Language Processing (NLP)
- Retrieval Augmented Generation (RAG)
- IBM Granite model

## IBM CLOUD SERVICES USED

- IBM Cloud Watsonx AI Studio
- IBM Cloud Watsonx AI runtime
- IBM Cloud Agent Lab
- IBM Granite foundation model

# WOW FACTORS

This agent will significantly **reduce research time**, improve the **quality of literature reviews**, **help early-stage researchers** find direction, and foster interdisciplinary collaboration by making knowledge more accessible and actionable.

Unique features:

- Semantic search across research papers, journals, and datasets
- Auto-summarization of selected papers
- Citation and reference analysis to trace influence
- Recommendation of research papers based on a user's current topic
- Trend analysis over time for specific keywords or domains.
- Collaboration mapping: suggests potential co-authors or institutions based on similar research interests.

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## END USERS

### **Students & Researchers**

- University students working on assignments, dissertations, or theses.
- PhD and postdoctoral researchers conducting literature reviews.

### **Educational Institutions**

- Colleges and universities integrating the agent into research labs or libraries.
- Faculty members preparing lectures or course material.

### **Industry R&D Teams**

- Scientists and engineers in companies who need fast access to research findings.
- Corporate knowledge management teams.

### **Libraries & Knowledge Hubs**

- Digital library platforms offering AI-powered literature assistance.

# RESULTS : SETTING UP AGENT

IBM watsonx

Upgrade ? Bell Sahana Priya's Account Dallas SP

Projects / Finical\_Advisor / Research AI Agent

Share feedback β Autosaved 6:06 PM New agent + Deploy Lock Info

Build

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

Setup

Name  
Research AI Agent

Description 100/100  
An IBM Granite-powered AI assistant that searches, summarizes, and explains academic and scientific

Icon Placeholder image

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

What are the challenges in applying AI to drug discovery?

Summarize the key techniques used in Large Language Models.

Agent preview

SP You: 06:05 PM  
What are the challenges in applying AI to drug discovery?

Research AI Agent 06:05 PM  
Hi, I am Research.ai agent. How can I help you?

Applying AI to drug discovery presents several challenges:

- 1. Data Quality and Availability:** AI models, especially deep learning models, require large amounts of high-quality, annotated data for training. In drug discovery, such comprehensive datasets are often unavailable or incomplete due to proprietary concerns, inconsistent data collection methods, and the high cost of generating such data through experiments.
- 2. Model Interpretability:** AI models, particularly complex ones like deep neural networks, are often considered "black boxes" because their decision-making processes are not easily interpretable. In drug discovery, where understanding the rationale behind predictions is crucial for regulatory approval and trust among scientists, this lack of interpretability can be a significant hurdle.
- 3. Validation and Verification:** Validating AI-driven predictions in a biological context is challenging. While AI can suggest potential drug candidates, experimental validation requires extensive wet-lab work, which is time-consuming and expensive.
- 4. Generalizability:** AI models trained on one type of molecular data or for a specific disease may not generalize well to others. Ensuring that AI tools can handle the diversity and complexity of biological systems is a major challenge.
- 5. Integration with Existing Workflows:** Incorporating AI into existing drug discovery pipelines requires not just developing sophisticated algorithms but also ensuring they integrate seamlessly with current laboratory practices, informatics systems, and regulatory requirements.

Type something...



# RESULTS : AGENT PREVIEW

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Build

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

What are the challenges in applying AI to drug discovery?

Summarize the key techniques used in Large Language Models.

List the latest research papers on renewable energy storage systems.

Configuration

Framework: LangGraph Architecture: ReAct

Instructions

You are a helpful assistant that uses tools to answer questions in detail. When greeted, say "Hi, I am Research.ai agent. How can I help you?"

Understanding the Query

The AI agent must first carefully analyze the user's question to identify the topic, domain, and intent. If the

Knowledge

Vector index

IBM\_Granite\_Research\_Agent\_Guide

Agent preview

SP You: 06:08 PM

List the latest research papers on renewable energy storage systems.

Research AI Agent 06:08 PM

I apologize for the confusion, but I need to clarify that I can't directly search databases or fetch the latest research papers as I don't have a tool for that purpose. However, I can guide you on how to find the latest research papers on renewable energy storage systems:

1. **Google Scholar:** You can use Google Scholar (scholar.google.com) to search for recent papers. Use search terms like "renewable energy storage systems" and filter results by year to find the most recent publications.

2. **IEEE Xplore:** This digital library provides access to technical literature in electrical engineering, computer science, and electronics. You can search for papers related to energy storage using their search function.

3. **ScienceDirect:** This platform offers a vast collection of journals in various fields, including energy storage technologies. You can refine your search by publication date to get the latest research.

4. **arXiv:** An open-access repository of electronic preprints and postprints approved for posting after moderation, not peer review. It includes scientific papers in physics, mathematics, computer science, quantitative biology, quantitative finance, statistics, electrical engineering and systems science, and economics.

5. **ResearchGate:** A social networking site for scientists and researchers to share papers, ask questions, and find collaborators. You can follow researchers in the field of renewable energy storage to get updates on their latest work.

Remember to check the references of the papers you find to discover more relevant research.

Type something...

edunet  
foundation

# RESULTS : TOOLS USED

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Build

AI

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

Add a tool

Create custom tool

Added tools (6)

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 - IBM\_Granite\_Research\_Agent\_Guide

Search documents with vector indexes.

Webcrawler

Retrieve information from a website.

Weather

Retrieve the weather of a city.

Agent preview

2. **Pre-training and Fine-tuning:** LLMs are typically pre-trained on massive text datasets using unsupervised learning objectives, such as predicting masked words (like in BERT) or next-sentence prediction (like in T5). This pre-training phase helps the model learn general language understanding. After pre-training, the model can be fine-tuned on specific tasks (like translation, summarization, or question-answering) using supervised learning with task-specific datasets.

3. **Scalability and Distribution:** To handle the vast amounts of data and model parameters, LLMs are often distributed across multiple GPUs or machines. Techniques like model parallelism (splitting model layers across devices) and data parallelism (processing different batches on different devices) are used to scale training.

4. **Knowledge Distillation:** Large models can be too computationally expensive for deployment in many scenarios. Knowledge distillation involves training a smaller "student" model to mimic the behavior of a larger "teacher" model. This allows for more efficient deployment of LLM capabilities.

5. **Reinforcement Learning from Human Feedback (RLHF):** To align LLMs with human values and improve their performance on specific tasks, techniques like RLHF are used. This involves training a reward model on human preferences, which is then used to fine-tune the LLM via reinforcement learning.

6. **Multimodal Learning:** Recent advancements include incorporating other modalities (like images) into language models, enabling them to understand and generate content that integrates text and visual information.

For more detailed information, you might want to refer to the following resources:

- Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., ... & Polosukhin, I. (2017). Attention is all you need. Advances in neural information processing systems, 30. [Link](#)
- Devlin, J., Chang, M. W., Lee, K., & Toutanova, K. (2018). BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding. arXiv preprint arXiv:1810.04805. [Link](#)
- Quyang, L., Wu, J., Xu, X., Chen, D., Mishkin, P., & Ni, J. (2022). Training language models to follow

Type something...

# RESULTS : DEPLOYED AI AGENT

Research AI Agent ✓ Deployed Online

API reference

Test

Evaluations

Preview

New chat +



You 07:03 PM

What are the challenges in applying AI to drug discovery?



Research AI Agent 07:03 PM

Hi, I am Research.ai agent. How can I help you?

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- 2. Model Interpretability:** AI models, particularly complex ones like deep neural networks, are often considered "black boxes" because their decision-making processes are not easily interpretable. In drug discovery, where understanding the rationale behind predictions is crucial for regulatory approval and trust, this lack of interpretability poses a significant challenge.
- 3. Validation and Verification:** Validating AI-driven predictions in a biological context is complex. Traditional experimental validation is time-consuming and expensive. Moreover, the dynamic nature of biological systems means that in silico predictions may not always translate accurately to in vivo scenarios.



Type something...



## About this deployment

### Name

Research AI Agent

### Description

An IBM Granite-powered AI agent that searches, summarizes academic and scientific

### Deployment Details

Deployment ID: `86f89674-`

Serving name:

No serving name.

Software specification:  
`runtime-24.1-py3.11` ⚙️

Hardware specification:  
Extra extra small: 1 CPU ar

Copies:  
1

### Tags

wx-agent

### Associated asset

[Research AI Agent](#)  
`f8e31fcf-4077-4ae2-bed1`

Last modified  
13 minutes ago

# CONCLUSION

- 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.

## GITHUB LINK

- **GitHub Repository Link :**  
**<https://github.com/SahanaPriyaG/Research-AI-Agent.git>**

# FUTURE SCOPE

- Multilingual Research Support
- Voice-Activated Research Assistant
- Real-Time Collaboration Features
- Research Gap and Novel Topic Identification
- Integration with Publishing Platforms
- AI-Assisted Paper Drafting

# IBM CERTIFICATIONS

IBM **SkillsBuild**

Completion Certificate



This certificate is presented to

Sahana Priya 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: 29 Jul 2025 (GMT)

Learning hours: 20 mins

In recognition of the commitment to achieve  
professional excellence



**Sahana Priya G**

Has successfully satisfied the requirements for:

**Getting Started with Artificial Intelligence**



Issued on: Jul 20, 2025  
Issued by: IBM SkillsBuild

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**THANK YOU**