
CAPSTONE PROJECT

RESEARCH AGENT

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OUTLINE

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PROBLEM STATEMENT

A Research Agent is an AI system designed to assist with academic and scientific research tasks. It autonomously searches for literature, summarizes papers, and organizes references. Using natural language processing, it understands research questions, retrieves relevant information, and can generate reports, suggest hypotheses, and draft research paper sections. It saves time by automating repetitive tasks like citation management and data extraction, enhancing efficiency, accuracy, and innovation in research.

PROPOSED SOLUTION

We propose a **Research Agent**, an AI system that:

- Understands natural language queries.
- Searches for academic papers and news articles.
- Summarizes and organizes research findings.
- Generates hypotheses and drafts report content.
- Automates citation management and data extraction.

Key Tools:

- IBM Watsonx
- LangGraph + ReAct
- Web Search APIs (Google, DuckDuckGo, Wikipedia, Webcrawler)

SYSTEM APPROACH

System Requirements:

- IBM Cloud Lite
- IBM Watsonx Studio
- LangGraph Framework
- ReAct Architecture
- Tools: Google, DuckDuckGo, Wikipedia, Webcrawler

Libraries Used:

- Python (Requests, BeautifulSoup)
- OpenAI LangGraph SDK
- JSON/XML APIs for Web Crawling

ALGORITHM & DEPLOYMENT

Architecture: ReAct (Reasoning + Action)

- Combines reasoning and tool usage.
- Modular execution via LangGraph workflows.

Flow:

- 1.Accepts natural language queries.
- 2.Uses web search tools to fetch info.
- 3.Summarizes or lists findings.
- 4.Generates citations and formats.

Deployment Details:

- IBM Watsonx Cloud
- Model: llama-3-3-70b-instruct
- Runtime: Python 3.11
- Deployed Agent: watsonx Agent

RESULT 1.1

The screenshot displays the IBM watsonx Agent web interface. The browser address bar shows the URL: https://dataplatform.cloud.ibm.com/wx/agents/c4108f6c-4374-4f49-aca5-d0c6e5436072?project_id=b0634ff2-2a3a-42d9-9d62-f21bc833febb&context=wx. The page header includes the IBM watsonx logo, an 'Upgrade' button, a user profile for 'JEELUGU JAGADEESH's Ac...', and a location dropdown for 'Dallas'. The main navigation bar shows 'Projects / Research agent / watsonx Agent', a 'Share feedback' button, a 'beta' badge, an 'Autosaved 9:34 PM' status, and buttons for 'New agent +', 'Deploy', and a lock icon.

The interface is divided into two main panels. The left panel, titled 'Build', contains sections for 'Setup', 'Configuration', 'Instructions', 'Knowledge', and 'Tools'. Under 'Configuration', the 'Framework' is set to 'LangGraph' and the 'Architecture' is set to 'ReAct'. The 'Instructions' section contains the text: 'Assist users with academic and scientific research by performing tasks such as literature review, summarization, hypothesis generation, and citation management using natural language queries.' Below this, there are buttons for 'Add a tool' and 'Create custom tool'. The 'Tools' section shows 'Added tools (4)' with 'Google search' partially visible.

The right panel, titled 'Agent preview', shows a chat history. The first message is from 'You' at 09:33 PM: 'Generate the recent articles about AI?'. The second message is from 'watsonx Agent' at 09:33 PM: 'Here are some recent articles about AI:'. This is followed by a numbered list of seven articles:

1. "Artificial intelligence - BBC News" - This article discusses the use of AI in various fields, including healthcare and finance.
2. "Artificial intelligence | MIT News | Massachusetts Institute of Technology" - This article highlights the latest research and developments in AI, including the use of AI in precision medicine.
3. "Artificial Intelligence - The New York Times" - This article provides an overview of the latest news and trends in AI, including the development of advanced AI systems.
4. "Artificial intelligence news: Chat AI, ChatGPT, AI generator, AI generator news - NBC News" - This article provides the latest news and updates on AI, including the development of chatbots and AI generators.
5. "Artificial Intelligence" - This article provides an overview of the latest research and developments in AI, including the use of AI in machine learning and computation.
6. "AI News | Latest AI News, Analysis & Events" - This article provides the latest news and analysis on AI, including industry trends and events.
7. "Artificial Intelligence - Latest AI News and Analysis - WSJ.com" - This article provides the latest news and analysis on AI, including the development of AI technology and its applications.

At the bottom of the 'Agent preview' panel, there is a text input field with the placeholder text 'Type something...' and a send button.

RESULT 1.2

The screenshot displays the IBM watsonx Agent web interface. The browser address bar shows the URL: https://dataplatform.cloud.ibm.com/wx/agents/c4108f6c-4374-4f49-aca5-d0c6e5436072?project_id=b0634ff2-2a3a-42d9-9d62-f21bc833febb&context=wx. The interface is divided into two main sections: 'Build' on the left and 'Agent preview' on the right.

Build Section:

- Model:** llama-3-3-70b-instruct
- Knowledge:** A dropdown menu.
- Tools:** A section with two buttons: 'Add a tool' and '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.
 - Webcrawler:** Retrieve information from a website.

Agent preview Section:

The chat history shows the following interaction:

- You:** 09:33 PM
Generate the recent articles about AI?
- watsonx Agent:** 09:33 PM
Here are some recent articles about AI:
 1. "Artificial intelligence - BBC News" - This article discusses the use of AI in various fields, including healthcare and finance.
 2. "Artificial intelligence | MIT News | Massachusetts Institute of Technology" - This article highlights the latest research and developments in AI, including the use of AI in precision medicine.
 3. "Artificial Intelligence - The New York Times" - This article provides an overview of the latest news and trends in AI, including the development of advanced AI systems.
 4. "Artificial intelligence news: Chat AI, ChatGPT, AI generator, AI generator news - NBC News" - This article provides the latest news and updates on AI, including the development of chatbots and AI generators.
 5. "Artificial Intelligence" - This article provides an overview of the latest research and developments in AI, including the use of AI in machine learning and computation.
 6. "AI News | Latest AI News, Analysis & Events" - This article provides the latest news and analysis on AI, including industry trends and events.
 7. "Artificial Intelligence - Latest AI News and Analysis - WSJ.com" - This article provides the latest news and analysis on AI, including the development of AI technology and its applications.

At the bottom of the chat window, there is a text input field with the placeholder text 'Type something...' and a 'Show desktop' button.

RESULT 1.3

The screenshot displays the IBM watsonx Agent interface. The top navigation bar includes the IBM watsonx logo, an 'Upgrade' button, a user profile for 'JEELUGU JAGADEESH's Ac...', and a location dropdown for 'Dallas'. The main header shows the breadcrumb 'Projects / Research agent / watsonx Agent' and a 'Share feedback' button. The interface is divided into two main panels: 'Build' on the left and 'Agent preview' on the right.

Build Panel:

- Model:** llama-3-3-70b-instruct
- Framework:** LangGraph
- Architecture:** ReAct
- Instructions:** Assist users with academic and scientific research by performing tasks such as literature review, summarization, hypothesis generation, and citation management using natural language queries.
- Buttons:** 'Add a tool' and 'Create custom tool'.
- Added tools (4):** Google search

Agent preview Panel:

- You: 12:36 PM:** what's new in LLM in 2025
- watsonx Agent 12:36 PM:** Based on the search results, there are several updates and developments in the field of Large Language Models (LLMs) in 2025. Some of the key updates include:
 - The emergence of a new enterprise LLM leader, with usage and spend surging in the market.
 - Updates to Apple's On-Device and Server Foundation Language Models, including new token representations and figures.
 - The release of BeyondATC's February update, which includes LLM in the early access program.
 - Google's update to its Gemini 2.5 LLM series, with a new entry-level model and pricing changes.
 - The OWASP Top 10 LLM Security Risks 2025, which includes examples and mitigation strategies for prompt injection attacks, sensitive information disclosure, and other security risks.
 - Updates to the Cambridge LL.M. program for 2025-2026, including a thread for applicants to share updates and discuss the program.
 - The OWASP Top 10 for LLM Applications 2025, which reflects a maturing understanding of how LLMs and generative AI technologies are applied in real-world scenarios.
- Input field:** Type something...

RESULT 1.4

The screenshot displays the IBM watsonx Agent web interface. The browser address bar shows the URL: `https://dataplatfom.cloud.ibm.com/ml-runtime/deployments/edfc8171-a708-4f98-b366-1305ebaf19c1/chat?space_id=97f8b1e2-95cf-4503-92c9-677d673d3a33&context=wx&flush=t...`. The page header includes the IBM watsonx logo, an 'Upgrade' button, and user information for 'JEELUGU JAGADEESH's Ac...' with a location of 'Dallas'.

The main content area is titled 'Deployment spaces / Research agent_1 / watsonx Agent /'. Below this, the 'watsonx Agent' is shown with a 'Deployed' status and an 'Online' indicator. There are three tabs: 'API reference', 'Test', and 'Preview', with 'Preview' being the active tab. A 'New chat +' button is located on the right side of the chat area.

The chat history shows a user query at 09:38 PM: 'find recent papers on AI & ML in cancer detection?'. The watsonx Agent responds at 09:38 PM: 'Here are some recent papers on AI and ML in cancer detection:'.

The response lists five papers:

1. "Machine Learning and AI in Cancer Prognosis, Prediction, and Diagnosis" (2023) - This paper reviews the current state of AI and ML in cancer prognosis, prediction, and diagnosis, and discusses the potential of these technologies to improve cancer care.
2. "AI and Cancer: The Emerging Revolution" (2025) - This article discusses the emerging role of AI in cancer prevention, treatment, and diagnosis, and highlights the potential of AI to revolutionize the field of cancer research.
3. "The Application of Artificial Intelligence to Cancer Research: A Review" (2023) - This paper reviews the current state of AI in cancer research, including its applications in cancer diagnosis, treatment, and prevention.
4. "Applied Machine Learning in Cancer Research: A Systematic Review" (2022) - This paper reviews the current state of machine learning in cancer research, including its applications in cancer diagnosis, treatment, and prevention.
5. "AI and Cancer: NCI" (2024) - This article discusses the current state of AI in cancer research, including its...

The right sidebar, titled 'About this deployment', contains the following information:

- Name:** watsonx Agent
- Description:** Change this description to reflect your particular agent
- Deployment Details:**
 - Deployment ID: edfc8171-a708-4f...
 - Serving name: No serving name.
 - Software specification: runtime-24.1-py3.11
 - Hardware specification: Extra extra small: 1 CPU and 2 GB RAM
 - Copies: 1
- Tags:** wx-agent
- Associated asset:** watsonx Agent (fbb33ae1-799b-4130-88f5-2d654f211c9b)

The date '01 August 2025' is displayed at the bottom right of the sidebar.

CONCLUSION

- The Research Agent demonstrates the capability to assist with academic queries using natural language.
It efficiently retrieves and processes research content, generating human-like responses with references.
The system greatly reduces time and effort for students, educators, and researchers.

FUTURE SCOPE

- Integrate with academic databases like IEEE Xplore, Springer, and PubMed.
- Add PDF parsing and annotation capabilities.
- Voice interaction using IBM Watson Speech-to-Text.
- Enable offline knowledge storage (local knowledge base).
- Connect with LaTeX/BibTeX tools for paper drafting.

REFERENCES

- IBM Watsonx Documentation
- LangGraph and ReAct Architecture Papers
- Research articles on AI in Cancer Detection
- News sources: BBC, MIT, NYT, WSJ, NBC
- Tools: Google Search API, DuckDuckGo API, Wikipedia API

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Completion Certificate



This certificate is presented to
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for the completion of

**Lab: Retrieval Augmented Generation with
LangChain**

(ALM-COURSE_3824998)

According to the Adobe Learning Manager system of record

Completion date: 24 Jul 2025 (GMT)

Learning hours: 20 mins



THANK YOU