
CAPSTONE PROJECT

AGENTIC AI RESEARCH AGENT

Presented By:

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OUTLINE

- Problem Statement
- Proposed System/Solution
- System Development Approach
- Result (Output Image)
- Conclusion
- Future Scope
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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

The Agentic AI Research Agent is a smart AI system designed to automate and enhance academic research.

Key Features:

1. **Intelligent Web Research** : Uses integrated search tools (Google/DuckDuckGo and Wikipedia). Fetches the latest research papers, articles, and summaries.
2. **Automated Summarization** : Converts lengthy research content into clear and concise summaries. Extracts key points and insights for quick understanding.
3. **Hypothesis & Idea Generation** : Suggests new research hypotheses based on analyzed information. Helps researchers explore innovative ideas for projects or papers.
4. **Research Draft Generation** : Generates short, structured sections of research reports or papers. Organizes information in professional and academic format.
5. **Agentic AI Behavior** : Acts proactively by analyzing queries and suggesting next steps. Ensures all responses are professional, structured, and concise.

SYSTEM APPROACH

System Approach

1. **User Interaction Layer** : User enters a research query or topic (e.g., AI in Healthcare)The agent can also respond to greetings or clarification requests.
2. **Agentic AI Processing Layer** : The agent analyzes the inputDecides whether to perform web search, summarization, or hypothesis generationUses reasoning and decision-making to provide accurate results
3. **Knowledge Retrieval Layer** : Uses Google Search and Wikipedia Search toolsRetrieves relevant academic articles, papers, and research summaries
4. **Natural Language Processing & Summarization** : Extracts key points from the collected dataGenerates clear, concise, and structured responses.

Cloud Tools :

IBM Watsonx Agent Lab – Core platform to create the research agent.

Search Tool – For web-based research .

Search Tool – For quick reference and summaries .

RESULT 1

The screenshot displays the IBM watsonx Agent web interface. The browser address bar shows the URL: `datapatform.cloud.ibm.com/wx/agents/d8bc876d-5464-4581-84f6-9136010a4888?project_id=b025c105-ac09-4e87-84a5-6f5791142d3c&context=wx`. The interface includes a top navigation bar with the IBM watsonx logo, an 'Upgrade' button, a help icon, a notification bell, and user information for 'Santanu Ghorui's Account' in 'Dallas'. Below this is a breadcrumb trail: 'Projects / Research Agent / watsonx Agent'. The main workspace is divided into two panels. The left panel, titled 'Build', contains sections for 'Instructions' (with a text area containing 'You are an AI Research Assistant that helps in academic and scientific research.' and 'Behavior Rules: If the user greets (Hi, Hello), reply politely with a short greeting and ask for a research-related query.'), 'Knowledge', 'Tools' (with 'Add a tool' and 'Create custom tool' buttons), and 'Added tools (2)' which lists 'Google search' and 'Wikipedia search'. The right panel, titled 'Agent preview', shows a chat log with a user message 'Hii' and an agent response 'Hello! I can help you with research tasks like summarizing papers or suggesting hypotheses. What would you like to research today?'. Below the chat log is a text input field with the placeholder 'Type something...'. The Windows taskbar at the bottom shows the date as 03-08-2025 and time as 16:22.

Agent Lab (beta) — Docs | IBM x watsonx Agent — Research Age x +

datapatform.cloud.ibm.com/wx/agents/d8bc876d-5464-4581-84f6-9136010a4888?project_id=b025c105-ac09-4e87-84a5-6f5791142d3c&context=wx

IBM watsonx Upgrade ? Santanu Ghorui's Account Dallas SG

Projects / Research Agent / watsonx Agent Share feedback Autosaved 4:22 PM New agent + Deploy

Build AI Model: llama-3-3-70b-instruct

Instructions [Advanced configuration](#)

You are an AI Research Assistant that helps in academic and scientific research.

Behavior Rules:
If the user greets (Hi, Hello), reply politely with a short greeting and ask for a research-related query.

Knowledge

Tools

[Add a tool](#) [Create custom tool](#)

Added tools (2)

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

Wikipedia search
Retrieve information from Wikipedia articles.

Agent preview

SG You: 04:22 PM
Hii

watsonx Agent 04:22 PM
Hello! I can help you with research tasks like summarizing papers or suggesting hypotheses. What would you like to research today?
► How did I get this answer?

Type something...

29°C Light rain Search 16:22 03-08-2025

RESULT 2

The screenshot displays the IBM watsonx Agent web interface. The browser address bar shows the URL: `datapatform.cloud.ibm.com/wx/agents/d8bc876d-5464-4581-84f6-9136010a4888?project_id=b025c105-ac09-4e87-84a5-6f5791142d3c&context=wx`. The interface includes a top navigation bar with the IBM watsonx logo, an 'Upgrade' button, and user information for Santanu Ghorui. Below this is a breadcrumb trail: Projects / Research Agent / watsonx Agent. The main workspace is divided into two panels. The left panel, titled 'Build', contains configuration options for the AI model (set to 'llama-3-3-70b-instruct'), framework ('LangGraph'), and architecture ('ReAct'). It also includes a section for instructions, where the user has defined the role as an 'AI Research Assistant' and set behavior rules. The right panel, titled 'Agent preview', shows a conversation log. The user's input is 'Summarize the recent research on Artificial Intelligence in healthcare.' The watsonx Agent's response is a detailed summary of recent research on AI in healthcare, covering its applications, benefits, risks, and future potential. The interface also features a 'Deploy' button and a 'Share feedback' link.

IBM watsonx

Upgrade

Santanu Ghorui's Account

Dallas

SG

Projects / Research Agent / watsonx Agent

Share feedback

Autosaved 4:24 PM

New agent +

Deploy

Build

AI Model: llama-3-3-70b-instruct

Configuration

Framework: LangGraph

Architecture: ReAct

Instructions

Advanced configuration

You are an AI Research Assistant that helps in academic and scientific research.

Behavior Rules:

If the user greets (Hi, Hello), reply politely with a short greeting and ask for a research-related query.

Knowledge

Tools

Add a tool

Create custom tool

Added tools (2)

Google search

Retrieve information from the Internet with the Google search engine.

Agent preview

You: 04:23 PM

Summarize the recent research on Artificial Intelligence in healthcare.

watsonx Agent 04:23 PM

Recent research on Artificial Intelligence in healthcare has shown promising results in transforming the practice of healthcare. AI systems are being adopted by healthcare organizations to automate time-consuming, high-volume repetitive tasks, and there is evidence that AI can perform as well as or better than humans at key healthcare tasks, such as diagnosing diseases. However, there are also concerns about the use of AI in healthcare, including the potential for bias and the need for human oversight.

Some of the recent research studies have focused on the use of AI in clinical practice, including the use of AI-powered chatbots to help patients with medication adherence and the use of AI algorithms to analyze medical images. There is also a growing interest in the use of AI in healthcare research, including the use of AI to analyze large datasets and identify patterns that may not be apparent to human researchers.

Overall, the use of AI in healthcare has the potential to revolutionize the way healthcare is delivered, but it is important to carefully consider the potential benefits and risks of AI in healthcare and to ensure that AI systems are designed and implemented in a way that prioritizes patient safety and well-being.

References:

"Artificial intelligence in healthcare: transforming the practice of medicine" (PMC8285156)

Type something...

RESULT 3

The screenshot displays the IBM watsonx Agent web interface. The browser tabs show 'Agent Lab (beta) — Docs | IBM' and 'watsonx Agent — Research Agent'. The address bar contains the URL: `datapatform.cloud.ibm.com/wx/agents/d8bc876d-5464-4581-84f6-9136010a4888?project_id=b025c105-ac09-4e87-84a5-6f5791142d3c&context=wx`. The top navigation bar includes the IBM watsonx logo, an 'Upgrade' button, a help icon, a notification bell, the user profile 'Santanu Ghorui's Account', the location 'Dallas', and a user avatar 'SG'. Below the navigation bar, there are links for 'Projects / Research Agent / watsonx Agent', a 'Share feedback' button, an 'Autosaved 4:25 PM' status, a 'New agent +' button, and a 'Deploy' button. The main interface is divided into two tabs: 'Build' and 'Agent preview'. The 'Agent preview' tab is active, showing a conversation history. The conversation starts with a user message at 04:23 PM: 'Based on the current research in renewable energy AI, suggest 3 possible research hypotheses or innovative ideas.' The watsonx Agent responds at 04:23 PM: 'Here are three possible research hypotheses or innovative ideas based on current research in renewable energy AI:'. The response includes two numbered items: 1. 'Optimization of Renewable Energy Grids using AI-powered Predictive Analytics:' with a hypothesis and an innovative idea; 2. 'AI-driven Design and Optimization of Solar Panels and Wind Turbines:' with a hypothesis and an innovative idea. At the bottom of the chat area is a text input field with the placeholder 'Type something...'. The Windows taskbar at the bottom shows the date and time as 16:25 on 03-08-2025, along with system icons for weather (29°C, Light rain), search, and various application icons.

Agent Lab (beta) — Docs | IBM watsonx Agent — Research Agent

datapatform.cloud.ibm.com/wx/agents/d8bc876d-5464-4581-84f6-9136010a4888?project_id=b025c105-ac09-4e87-84a5-6f5791142d3c&context=wx

IBM watsonx Upgrade ? Bell Santanu Ghorui's Account Dallas SG

Projects / Research Agent / watsonx Agent Share feedback Autosaved 4:25 PM New agent + Deploy

Build > Agent preview

SG You: 04:23 PM
Based on the current research in renewable energy AI, suggest 3 possible research hypotheses or innovative ideas.

watsonx Agent 04:23 PM
Here are three possible research hypotheses or innovative ideas based on current research in renewable energy AI:

1. Optimization of Renewable Energy Grids using AI-powered Predictive Analytics:

Hypothesis: AI-powered predictive analytics can optimize the performance of renewable energy grids by accurately forecasting energy demand and supply, thereby reducing energy waste and increasing the overall efficiency of the grid.

Innovative Idea: Develop an AI-powered predictive analytics platform that uses machine learning algorithms to analyze historical weather data, energy consumption patterns, and other factors to predict energy demand and supply in real-time. This platform can be integrated with existing grid management systems to optimize energy distribution and reduce energy waste.

2. AI-driven Design and Optimization of Solar Panels and Wind Turbines:

Hypothesis: AI can be used to design and optimize solar panels and wind turbines to maximize energy production and reduce costs.

Innovative Idea: Develop an AI-powered design and optimization platform that uses machine learning algorithms and computational simulations to design and optimize solar panels and wind turbines for specific environmental conditions. This platform can be used to identify the most efficient materials, shapes, and sizes for solar panels and wind turbines,

Type something...

29°C Light rain Search ENG IN 16:25 03-08-2025

RESULT 4

The screenshot displays the IBM watsonx Agent web interface. The browser address bar shows the URL: `dataplatfom.cloud.ibm.com/wx/agents/d8bc876d-5464-4581-84f6-9136010a4888?project_id=b025c105-ac09-4e87-84a5-6f5791142d3c&context=wx`. The interface includes a top navigation bar with the IBM watsonx logo, an 'Upgrade' button, and user account information for 'Santanu Ghorui's Account' in 'Dallas'. Below this is a breadcrumb trail: 'Projects / Research Agent / watsonx Agent'. The main content area is titled 'Agent preview' and shows a conversation log. The user's input is: 'Create a short introduction section for a research report on the impact of AI in education, including 3 references.' The watsonx Agent's response is: 'Here is a short introduction section for a research report on the impact of AI in education: The integration of Artificial Intelligence (AI) in education has been a topic of increasing interest in recent years. AI has the potential to revolutionize the way we learn and teach, from personalized learning platforms to intelligent tutoring systems. Research has shown that AI can improve student outcomes, increase efficiency, and enhance the overall learning experience (Bakia et al., 2012) [1]. Additionally, AI can help teachers with tasks such as grading and feedback, allowing them to focus more on instruction and student support (Ritter et al., 2017) [2]. However, there are also concerns about the potential risks and challenges associated with the use of AI in education, such as bias and job displacement (Selwyn, 2019) [3]. This report aims to explore the impact of AI in education, including its benefits, challenges, and future directions. References: [1] Bakia, M., Sheu, J., & Reyes, A. (2012). Trends in educational technology: A review of the literature. Journal of Educational Technology Development and Exchange, 5(1), 1-24. [2] Ritter, S., Anderson, J. R., & Koedinger, K. R. (2017). The role of artificial intelligence in education: A review of the literature. Journal of Educational Data Mining, 9(1), 1-33. [3] Selwyn, N. (2019). What's the problem with education and technology? Learning, Media and Technology, 44(1), 1-14. To gather more information on this topic, I can suggest the following function call:'. A text input field at the bottom of the chat area contains the placeholder text 'Type something...'. The Windows taskbar at the bottom shows the date as 03-08-2025, the time as 16:25, and the weather as 29°C with light rain.

Agent Lab (beta) — Docs | IBM x watsonx Agent — Research Age x +

dataplatfom.cloud.ibm.com/wx/agents/d8bc876d-5464-4581-84f6-9136010a4888?project_id=b025c105-ac09-4e87-84a5-6f5791142d3c&context=wx

IBM watsonx Upgrade ? Santanu Ghorui's Account Dallas SG

Projects / Research Agent / watsonx Agent Share feedback Autosaved 4:25 PM New agent + Deploy

Build > Agent preview

You: 04:24 PM
Create a short introduction section for a research report on the impact of AI in education, including 3 references.

watsonx Agent 04:24 PM
Here is a short introduction section for a research report on the impact of AI in education:

The integration of Artificial Intelligence (AI) in education has been a topic of increasing interest in recent years. AI has the potential to revolutionize the way we learn and teach, from personalized learning platforms to intelligent tutoring systems. Research has shown that AI can improve student outcomes, increase efficiency, and enhance the overall learning experience (Bakia et al., 2012) [1]. Additionally, AI can help teachers with tasks such as grading and feedback, allowing them to focus more on instruction and student support (Ritter et al., 2017) [2]. However, there are also concerns about the potential risks and challenges associated with the use of AI in education, such as bias and job displacement (Selwyn, 2019) [3]. This report aims to explore the impact of AI in education, including its benefits, challenges, and future directions.

References: [1] Bakia, M., Sheu, J., & Reyes, A. (2012). Trends in educational technology: A review of the literature. Journal of Educational Technology Development and Exchange, 5(1), 1-24. [2] Ritter, S., Anderson, J. R., & Koedinger, K. R. (2017). The role of artificial intelligence in education: A review of the literature. Journal of Educational Data Mining, 9(1), 1-33. [3] Selwyn, N. (2019). What's the problem with education and technology? Learning, Media and Technology, 44(1), 1-14.

To gather more information on this topic, I can suggest the following function call:

Type something...

29°C Light rain 16:25 03-08-2025

CONCLUSION

The Agentic AI Research Agent automates academic research tasks. It performs web-based search, summarization, and hypothesis generation. The system saves time and reduces manual research effort. It provides structured and professional research outputs. Future improvements can include PDF analysis and automated report generation.

FUTURE SCOPE

The Agentic AI Research Agent can be enhanced with several advanced features to improve its effectiveness in academic research. In the future, it can integrate PDF and document analysis to automatically summarize research papers and generate insights. Connecting the agent to academic databases like IEEE, Springer, and PubMed will allow access to verified and high-quality research content. The system can also be upgraded to produce automated research reports, including structured summaries, key points, and hypotheses. Voice-based interaction and advanced agentic AI capabilities, such as multi-step reasoning and cross-paper analysis, can make the agent more interactive and intelligent, supporting a wider range of research tasks efficiently.

REFERENCES

The development and concept of the Agentic AI Research Agent are inspired by widely used online academic and research platforms. Core reference sources include IBM Watsonx Agent Lab documentation for building the AI agent, Google Scholar and Wikipedia for general research and academic knowledge retrieval, and DuckDuckGo for web-based information searches. For future integration with academic databases, platforms like IEEE Xplore and PubMed are considered as reliable sources for accessing verified research papers and scholarly content.

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This certificate is presented to

Santanu Ghorui

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