
CAPSTONE PROJECT

RESEARCH AGENT

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GitHub Repo: <https://github.com/your-username/research-ai-agent-ibm>

PROBLEM STATEMENT

Researchers spend significant time manually searching, reading, summarizing, and managing citations for academic content. These repetitive and time-consuming tasks reduce productivity and delay discoveries. There is a need for an intelligent assistant that can automate research tasks efficiently.

PROPOSED SOLUTION

- This project proposes a Research Assistant Agent built using **IBM Watsonx Agent Lab** with **LLaMA-3-70B-instruct** model. The agent uses natural language prompts to:
 - Summarize scientific documents
 - Suggest research hypotheses
 - Draft report sections
 - Format citations (APA)
 - Search the web using Google Search tool
- It supports document grounding using a **Vector Index** and is configured entirely via **no-code interface** on IBM Cloud Lite.

SYSTEM APPROACH

- System Requirements

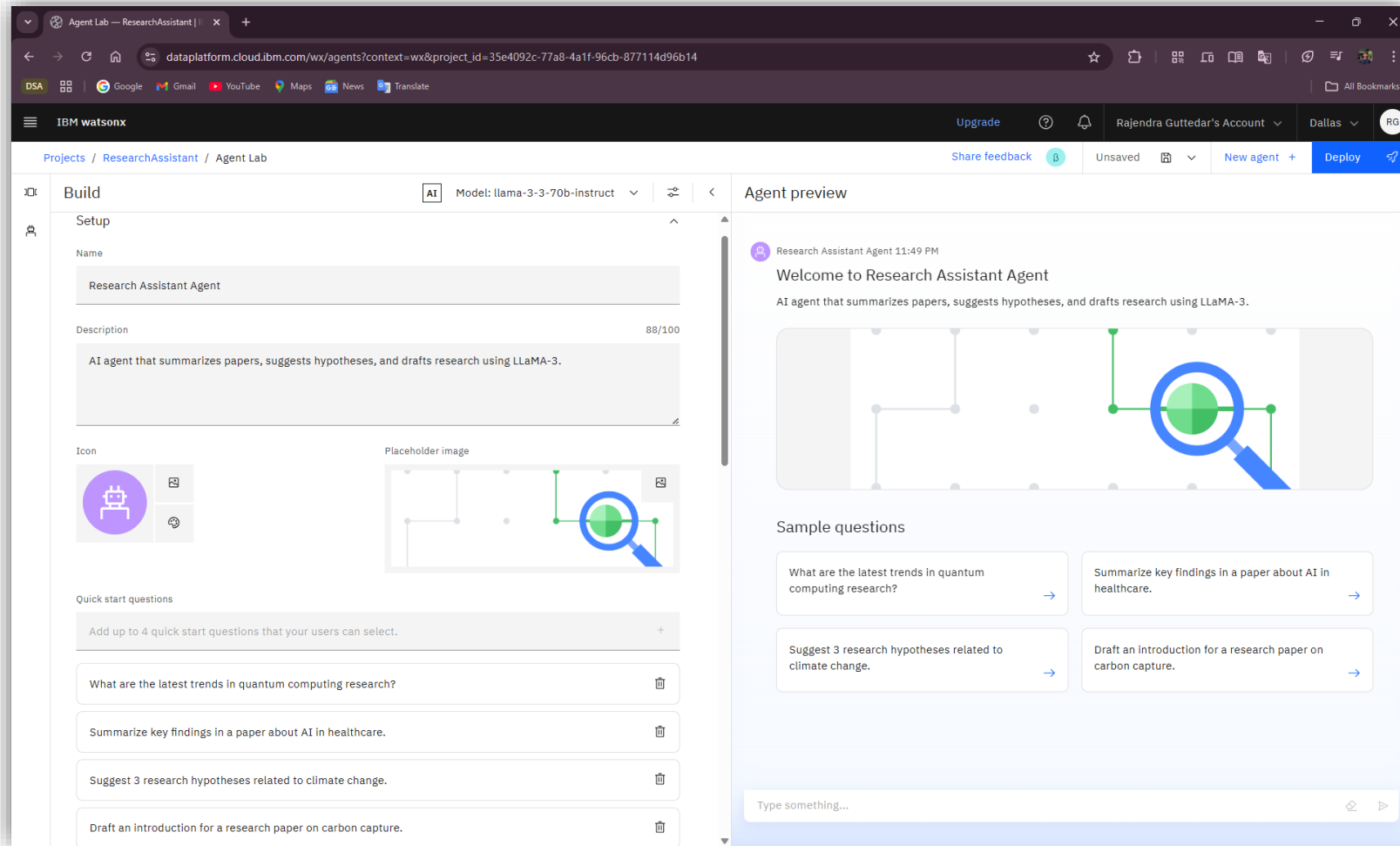
- IBM Cloud Lite Account (free tier access)
- IBM Watsonx.ai Studio (for Prompt Lab & Agent Lab)
- **Modern browser** (Chrome, Firefox, Edge recommended)
- (Optional) IBM Cloud Object Storage for document uploads
- (Optional) Academic PDFs for grounding (Vector Index)

SYSTEM APPROACH

■ Libraries / Tools Required

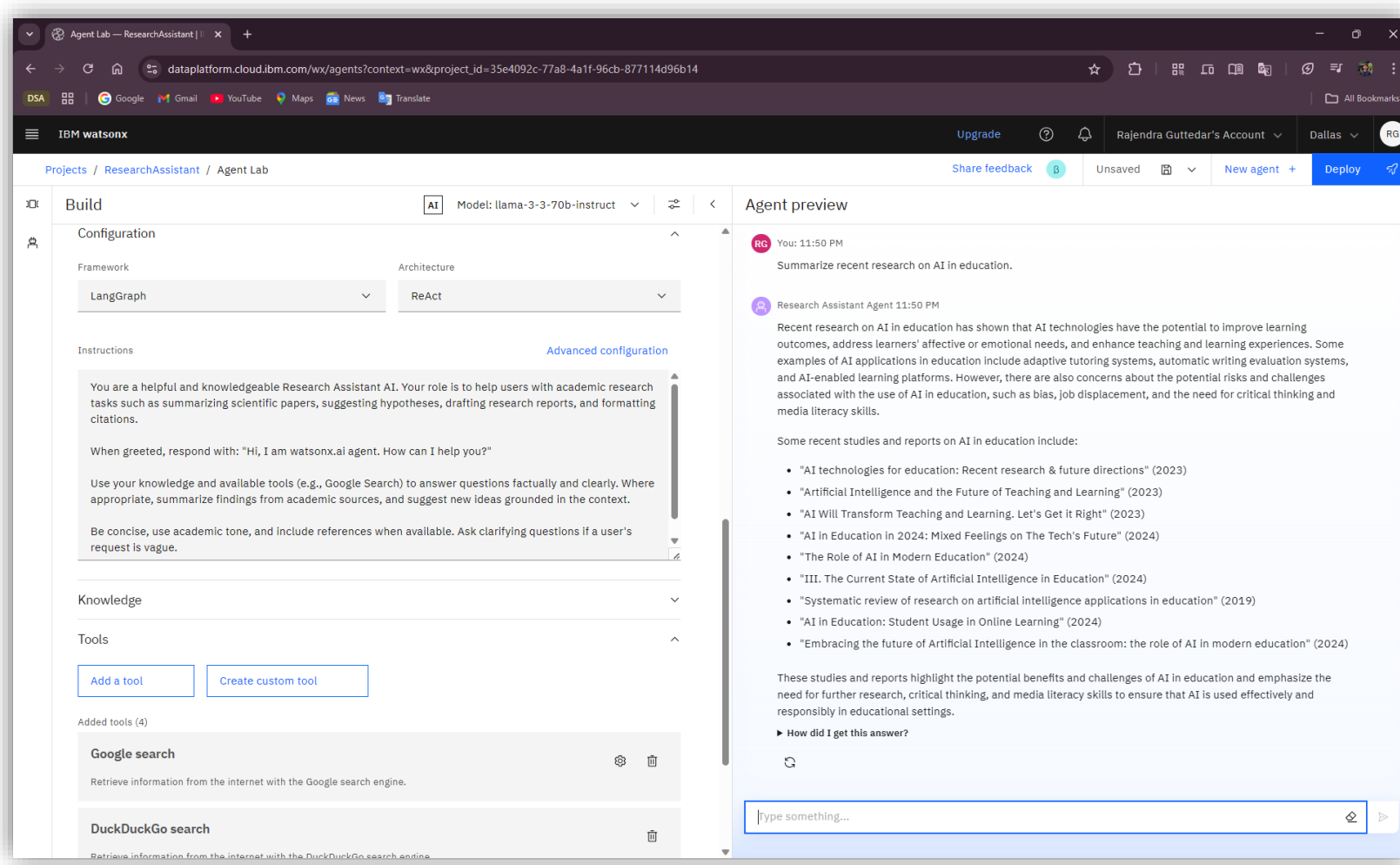
- **LLaMA-3-70B-instruct** – Foundation model for summarization, hypothesis generation, and drafting
- **Watsonx Prompt Lab** – For prompt experimentation and testing model behavior
- **Watsonx Agent Lab** – For designing no-code multi-step agent workflows
- **Google Search Tool** – Prebuilt tool for retrieving information from the web
- **Vector Index** – For grounding answers using uploaded research documents (PDFs, DOCX, TXT)

RESULT



- **Title:** *Agent Setup & Overview*
- The agent is built using **LLaMA-3-70B-instruct** in IBM Watsonx Agent Lab.
- Designed to **summarize papers, suggest hypotheses, and draft research content.**
- Includes 4 Quick Start Questions for common academic tasks.
- The preview shows how users interact via chat interface.
- Agent is fully configured and ready to handle academic queries in real-time.

RESULT



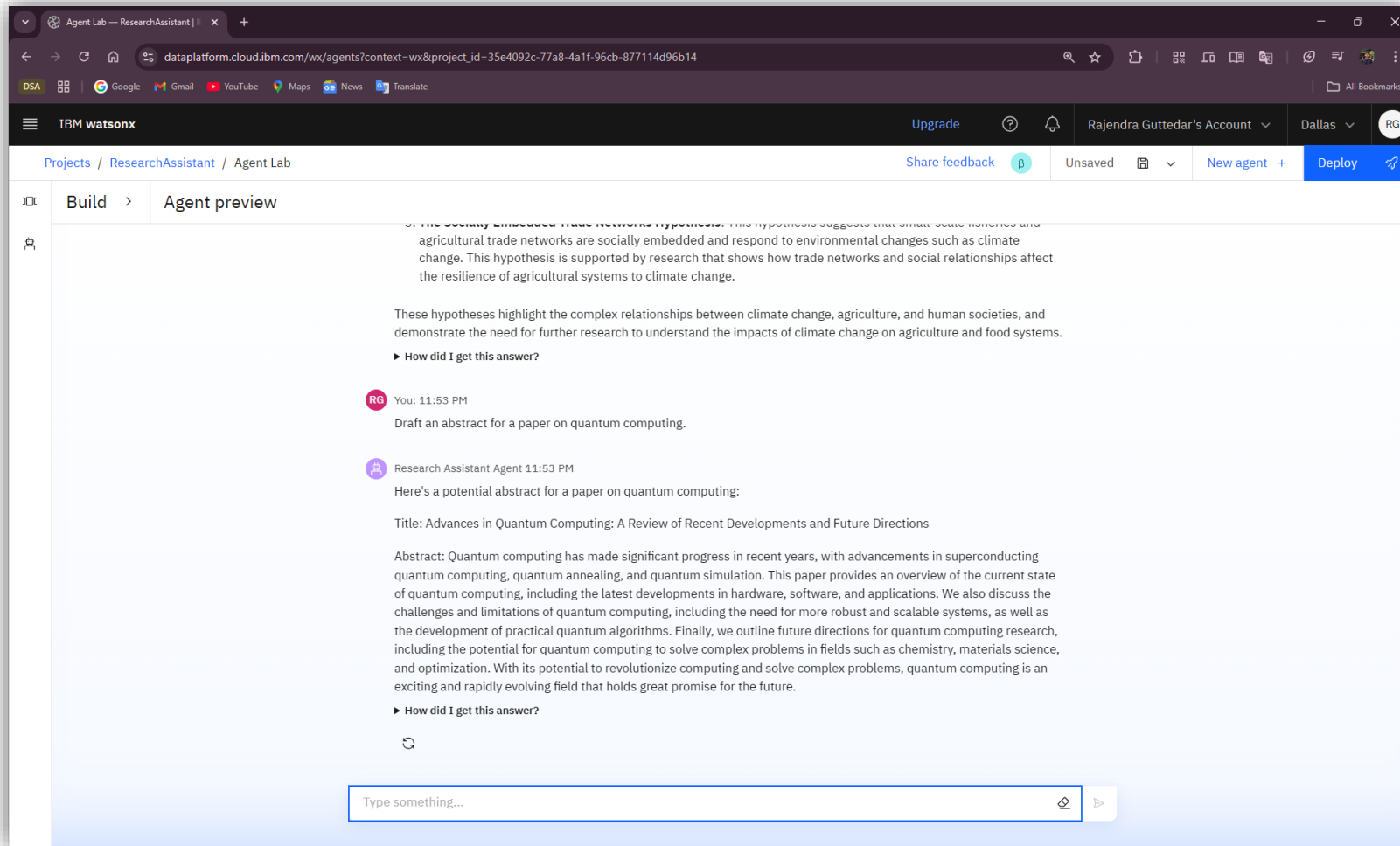
- **Title:** *Summarization Capability*
- *“Summarize research on AI in education.”*
- Returns structured academic summaries and research titles.
- Highlights key points from multiple recent studies.
- Uses a clear, factual academic tone suitable for literature reviews.
- *Demonstrates accurate summarization of complex, domain-specific content.*

RESULT

The screenshot displays the IBM watsonx Agent Lab interface. The 'Build' tab is active, showing the configuration for an agent using the 'llama-3-3-70b-instruct' model. The 'Model parameters' panel is open, displaying sliders for Frequency penalty, Presence penalty, Temperature, and Top P (nucleus sampling), along with input fields for Max tokens and Random seed. The 'Agent preview' tab shows a conversation history where a user asks for hypotheses about climate change and agriculture, and the agent responds with three detailed hypotheses: The Climate Change Hypothesis, The Limiting Factors Hypothesis, and The Socially Embedded Trade Networks Hypothesis. The interface also includes a 'Configuration' section with Framework (LangGraph) and Architecture (ReAct) options, and an 'Instructions' section with a prompt for the agent's role.

- **Title:** *Hypothesis Generation*
- The user asks: *“Suggest 3 hypotheses about climate change and agriculture.”*
- AI generates 3 thoughtful and well-supported hypotheses.
- Covers topics like climate impact, farmer adaptation, and trade networks.
- Reasoning is grounded in scientific logic and evidence patterns.
- *Highlights the model’s ability to ideate and support academic reasoning.*

RESULT



- **Title:** *Research Abstract Drafting*
- **Prompt:** *“Draft an abstract for a paper on quantum computing.”*
- AI generates a formal abstract with title, objectives, trends, and future scope.
- Language mimics scholarly writing and follows academic structure.
- Content is coherent, well-formed, and publication-ready.
- *Shows the agent's capability in generating high-quality research sections.*

RESULT

The screenshot shows the IBM Watsonx Agent Lab interface. The browser address bar displays the URL: `dataplatform.cloud.ibm.com/wx/agents?context=wx&project_id=35e4092c-77a8-4a1f-96cb-877114d96b14`. The interface includes a navigation bar with "IBM watsonx" and a top bar with "Upgrade", "Rajendra Guttadar's Account", "Dallas", and a user profile icon. The main content area is titled "Agent preview" and shows a chat history. The chat history includes a user message: "Give APA citations for recent papers on vaccine development." and an assistant response: "Here are some recent papers on vaccine development with APA citations:". The assistant response lists five citations with their titles, years, URLs, and APA citation placeholders. The citations are:

- "Why vaccines matter: understanding the broader health, economic, and social benefits" (2020) - <https://pmc.ncbi.nlm.nih.gov/articles/PMC7482790/>
 - APA citation: [Author's name]. (2020). Why vaccines matter: Understanding the broader health, economic, and social benefits. [Journal name], [Volume], [Pages].
- "Biotech's role in advancing HIV vaccine development" (2024) - <https://www.tandfonline.com/doi/full/10.1080/22221751.2024.2384460>
 - APA citation: [Author's name]. (2024). Biotech's role in advancing HIV vaccine development. [Journal name], [Volume], [Pages].
- "Edward Jenner and the history of smallpox and vaccination" (2020) - <https://pmc.ncbi.nlm.nih.gov/articles/PMC1200696/>
 - APA citation: [Author's name]. (2020). Edward Jenner and the history of smallpox and vaccination. [Journal name], [Volume], [Pages].
- "Vaccine development for pathogenic fungi: current status and future directions" (2023) - <https://www.tandfonline.com/doi/full/10.1080/14760584.2023.2279570>
 - APA citation: [Author's name]. (2023). Vaccine development for pathogenic fungi: Current status and future directions. [Journal name], [Volume], [Pages].
- "Impact of Vaccines; Health, Economic and Social Perspectives" (2020) - <https://pmc.ncbi.nlm.nih.gov/articles/PMC7371956/>
 - APA citation: [Author's name]. (2020). Impact of vaccines; health, economic, and social perspectives. [Journal name], [Volume], [Pages].

At the bottom of the chat area, there is a text input field with the placeholder "Type something..." and a send button.

- **Title:** *Citation Formatting (APA Style)*
- **Prompt:** *"Give APA citations for recent papers on vaccine development."*
- Returns 5 citations with URLs and proper APA-style formatting.
- Each entry includes placeholders for volume, pages, and authors.
- Useful for automating reference lists and bibliography creation.
- *Demonstrates the agent's accuracy in formatting academic references.*

CONCLUSION

- This AI Research Agent simplifies literature review and scientific writing tasks using IBM Watsonx Agent Lab. It removes coding complexity by offering a no-code experience while leveraging the powerful LLaMA-3-70B-instruct model. The system significantly boosts productivity and enables researchers to focus on creativity, analysis, and innovation instead of repetitive tasks.
- The successful integration of tools like Google Search, vector indexing, and multi-step prompting demonstrates the potential of agentic AI in academic and industrial research. This project lays the foundation for more advanced, context-aware, and autonomous research workflows in the future.

FUTURE SCOPE

- Live integration with APIs like arXiv, PubMed
- Support for LaTeX, Markdown, or Word export
- Expand language support (multilingual summarization)
- Real-time PDF parsing and vector similarity search
- Embed agent in research platforms or LMS systems

REFERENCES

- IBM Watsonx.ai Documentation
<https://www.ibm.com/cloud/watsonx>
- LLaMA-3 Model Overview – Meta AI
<https://ai.meta.com/llama>
- Agent Lab in Watsonx – IBM Developer Guide
<https://cloud.ibm.com/docs/watsonx>
- "Chain-of-Thought Prompting Elicits Reasoning in Large Language Models"
Jason Wei et al., 2022
<https://arxiv.org/abs/2201.11903>
- "Attention is All You Need"
Vaswani et al., 2017 (Transformer model paper)
<https://arxiv.org/abs/1706.03762>
- IBM Cloud Object Storage Overview
<https://cloud.ibm.com/catalog/services/cloud-object-storage>
- GitHub Repository (Project Files & Prompts):
<https://github.com/Rajendra0309/IBM-Cloud-Project-Research-AI-Agent.git>
- arXiv API Documentation
<https://arxiv.org/help/api>

PROJECT REPOSITORY

GitHub Repository

All project files, screenshots, setup steps, and prompt templates are available at:

<https://github.com/Rajendra0309/IBM-Cloud-Project-Research-AI-Agent.git>

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