

We use cookies to improve your browsing experience and to analyze our website traffic. By clicking "Accept All" you agree to our use of cookies. [Privacy policy](#) .

[Reject All](#)[Accept All](#) Light[Log in](#)[Sign up](#)[← Back to publications](#)

Mar 11, 2025 • 33 reads • MIT License

# Nexus: A Three-Pronged Agentic AI System for Intelligent Research and Analysis

[3-Agent System](#)[Agentic ai](#)[AI](#)[Gemini](#)[LangChain](#)[LangGraph](#)[LLM](#)[Multi-Agentic AI](#)[Researcher model](#)[Serper API](#)

Mohit Kumar



Diya Ravishankar



Share

## Table of contents

[Abstract](#)[1. Introduction](#)[Objectives of Nexus](#)[2. System Architecture](#)

## 2.1 Backend (Flask & LangGraph)

Nexus is an advanced AI-powered research system designed to automate and enhance the process of gathering, analyzing, and generating structured research content. Traditional research involves **time-consuming manual searches, information filtering, and content structuring**, which often leads to inefficiencies and inconsistencies. Nexus overcomes these challenges by utilizing a **multi-agent AI architecture**, integrating **natural language processing (NLP)**, **web scraping**, and **AI-driven content synthesis** to streamline research workflows.

## 2.2 Agents

Nexus employs **three specialized AI agents**:

## 2.3 Tools & APIs

1. **Research Agent** – Collects real-time research data from trusted sources such as **Google Search, Wikipedia, and ArXiv**.

[View all](#)

2. **Reporting Agent** – Processes collected data and structures it into a **coherent, well-formatted research article**.

3. **Storage Agent** – Saves research outputs in **Markdown ( .md ), JSON ( .json ), and PDF formats** for accessibility and further usage.

Key features of Nexus include **customizable tone settings**, a **fact-checking mechanism** using **Google's Fact Check API**, and **seamless user interaction** via a **frontend interface built with React and Tailwind CSS**. With **automation, AI integration, and structured workflows**, Nexus significantly reduces research time, enhances accuracy, and ensures high-quality content generation.

Link to Project:

[Nexus](#) 

# 1. Introduction

Research is essential in academic, business, and technological domains, yet traditional research methods often require **significant manual effort and verification**. With the vast amount of online information, researchers face challenges such as **misinformation, scattered data sources, and the need for structured content**.

## Objectives of Nexus

- **Automate research workflows** to reduce time and effort.
- **Generate structured research articles** with a logical flow.
- **Verify content accuracy** using fact-checking mechanisms.

- **Allow tone customization** for research reports.
- **Enable multiple output formats** ( `.md` , `.json` , `.pdf` ).

Nexus eliminates **information overload and research inefficiencies** by using AI-powered automation.

## 2. System Architecture

Nexus follows a **modular AI-driven agentic architecture**, where three specialized AI agents work collaboratively.

### 2.1 Backend (Flask & LangGraph)

- **Handles HTTP requests** from the frontend.
- **Manages agent execution** and research processing.
- **Uses Flask** for API development.

### 2.2 Agents

- **Research Agent:** Extracts raw data from multiple sources.
- **Reporting Agent:** Structures the collected data into a **technical article**.
- **Storage Agent:** Saves generated content and allows **PDF exports**.

### 2.3 Tools & APIs

- **Google Search API** – Fetches relevant research sources.
- **Wikipedia API** – Retrieves summarized encyclopedic content.
- **ArXiv API** – Extracts academic papers.
- **Google Fact Check API** – Ensures accuracy.

- **LangGraph** – Manages AI agent workflows.
- **WeasyPrint** – Converts research output to **PDF**.
- **Flask-CORS** – Enables **frontend-backend communication**.

## 2.4 Frontend (React & Tailwind CSS)

- Displays **research results** in an interactive UI.
- Provides a **settings page** for tone customization.
- Uses **Framer Motion** for animations.

## 2.5 Storage System

- Stores **research outputs** in `.md` and `.json` formats.
- Generates **PDFs** for downloadable reports.

# 3. Backend Components and Code Breakdown

## 3.1 Main Workflow ( `main.py` )

The backend initializes the **workflow pipeline**, ensuring that the three AI agents execute sequentially.

```
from langgraph.graph.state import StateGraph
from config import generate_response
from state import ResearchState
from workflow_nodes import get_research, generate_news_article, save_output

def create_workflow():
    workflow = StateGraph(state_schema=ResearchState)

    workflow.add_node("research_agent", get_research)
    workflow.add_node("reporting_agent", generate_news_article)
    workflow.add_node("storage_agent", save_output)

    workflow.add_edge("research_agent", "reporting_agent")
    workflow.add_edge("reporting_agent", "storage_agent")

    workflow.set_entry_point("research_agent")
    workflow.set_finish_point("storage_agent")

    return workflow.compile()
```

This function defines the workflow:

**Research Agent** → Extracts research data.

**Reporting Agent** → Generates a structured article.

**Storage Agent** → Saves the article and allows PDF export.

## 4. Detailed Breakdown of Each Agent

### 4.1 Research Agent (Data Collection)

The Research Agent collects data from multiple sources and fact-checks the results.

```
def get_research(state: dict) -> dict:
    research_tool = ResearchTool()
    topic = state["topic"]

    google_results = research_tool.search_google(topic)
    wiki_results = research_tool.search_wikipedia(topic)
    arxiv_results = research_tool.search_arxiv(topic)
    fact_check = research_tool.fact_check(topic)

    research_summary = f"Google: {google_results}\n\nWikipedia: {wiki_results}\n\nArxiv: {arxiv_results}"

    return {"research_summary": research_summary, "fact_check_results": fact_check}
```

## 4.2 Reporting Agent (Content Generation)

The Reporting Agent converts research data into a structured article.

```
def generate_news_article(state: dict) -> dict:
    research_state = state

    if not research_state["research_summary"].strip():
        research_state["article"] = "No research data available."
        return research_state

    article_prompt = f"""
    Based on the following research, write a compelling and detailed news article:

    {research_state["research_summary"]}

    **Ensure the article follows this format:**
    - **Title**
    - **Introduction**
    - **Key Insights**
    - **Industry Impact**
    - **Future Prospects**
    - **Conclusion**
    """

    response = generate_response(article_prompt)
    research_state["article"] = response.strip()

    return research_state
```

### 4.3 Storage Agent (Data Persistence)

The Storage Agent saves research results in .md and .json formats.

```
def save_output(state: ResearchState) -> dict:
    topic = state["topic"].replace(" ", "_")
    article = state["article"]
    research_summary = state["research_summary"]

    if not article.strip():
        state["message"] = "⚠️ No article content to save."
        return state

    article_path = os.path.join(BASE_DIR, f"{topic}.md")
    json_path = os.path.join(BASE_DIR, f"{topic}.json")

    os.makedirs(BASE_DIR, exist_ok=True)

    with open(article_path, "w", encoding="utf-8") as f:
        f.write(f"# {topic}\n\n{article}")

    return state
```

## 5. Results

Nexus successfully streamlines the research process through automation, AI-driven content generation, and structured workflows. Below are the key outcomes observed:

### 5.1 Functionality Demonstration

- **Automated Research:** Extracts **real-time** research data from **Google**, **Wikipedia**, and **ArXiv**.
- **AI-Generated Content:** Produces **coherent**, **structured** articles.
- **Customizable Tone:** Allows users to select the **tone** of the article (formal, technical, simplified, etc.).
- **Multi-Format Storage:** Saves research output in **Markdown** ( `.md` ), **JSON** ( `.json` ), and **PDF**.
- **Fact-Checking:** Verifies accuracy using **Google Fact Check API**.



- **Interactive UI:** Displays results in an **intuitive frontend interface**.
- **PDF Generation:** Provides **downloadable** research reports.

## 5.2 Example Output

*Topic: Impact of AI on Healthcare*

**Generated Article:**

### 1. Introduction

- Overview of AI in healthcare.

### 2. AI-Driven Diagnostics

- How AI assists in disease detection.

### 3. Future Trends

- The future role of AI in medicine.

### 4. Conclusion

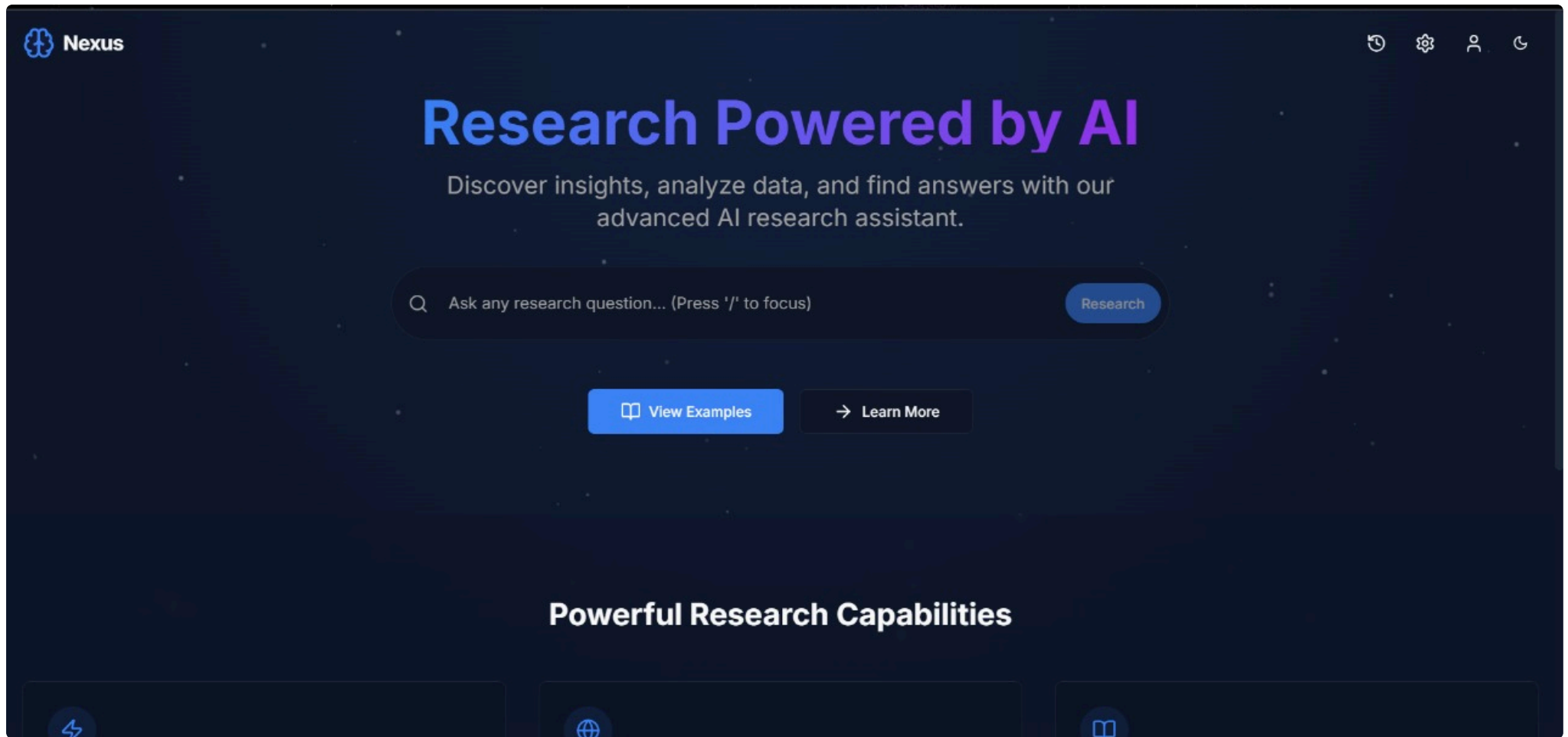
- Summary and impact.

## 6. UI/UX (Frontend)

Nexus features a **modern, responsive UI** that allows users to input a topic, process research, and view/download results. Below are images illustrating different sections of the UI.


### 6.1 Home Page





*Description: The homepage where users can enter a research topic.*



## 6.2 Research Processing

*Description: The system processing the research request in real-time.*


 **Nexus**



[← Back to Home](#)

# Research Results

Topic: "Baby"



Ask any research question... (Press '/' to foc...

Research

Research Progress

20%

Initializing

Searching

Analyzing

Synthesizing

Complete

Searching for sources...

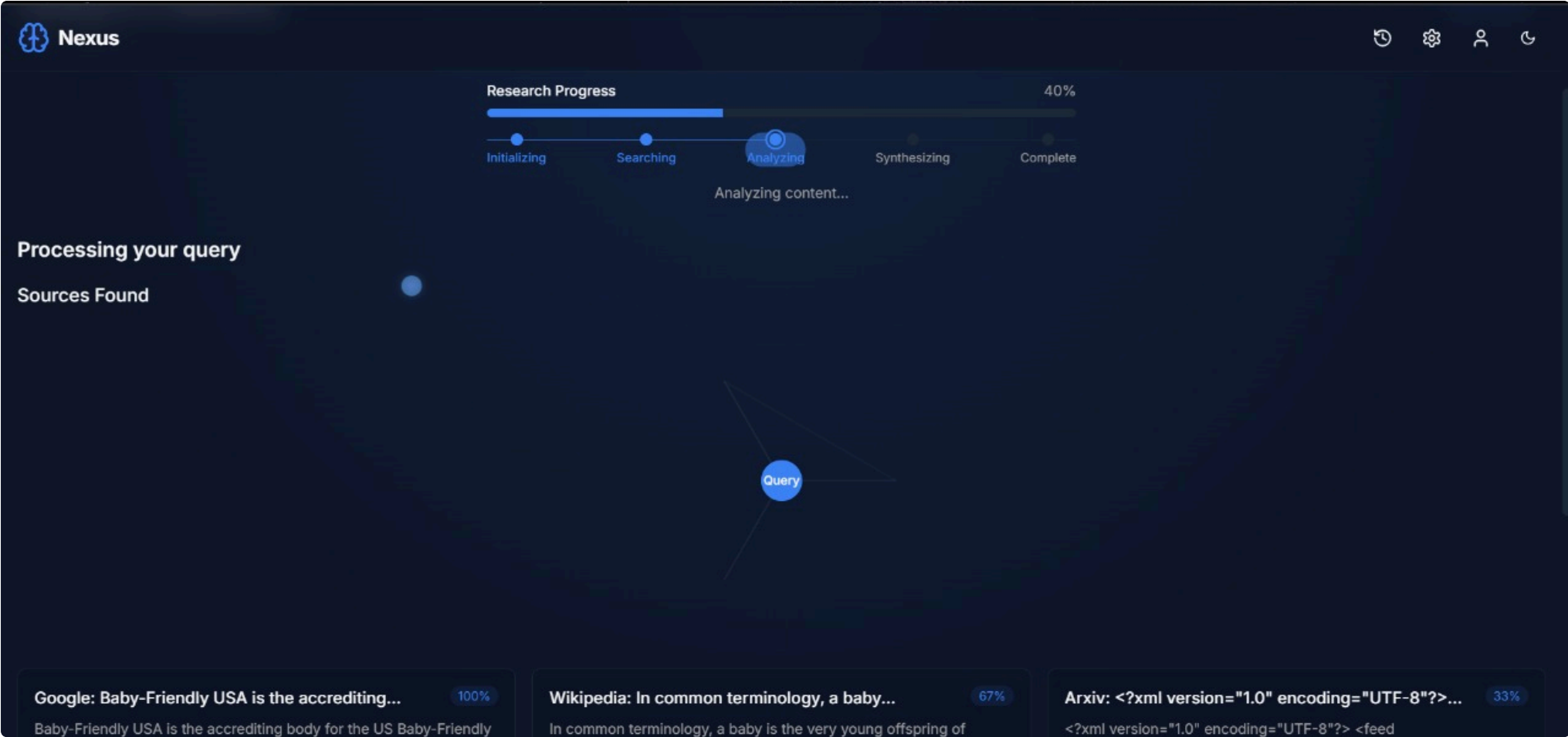
## Processing your query

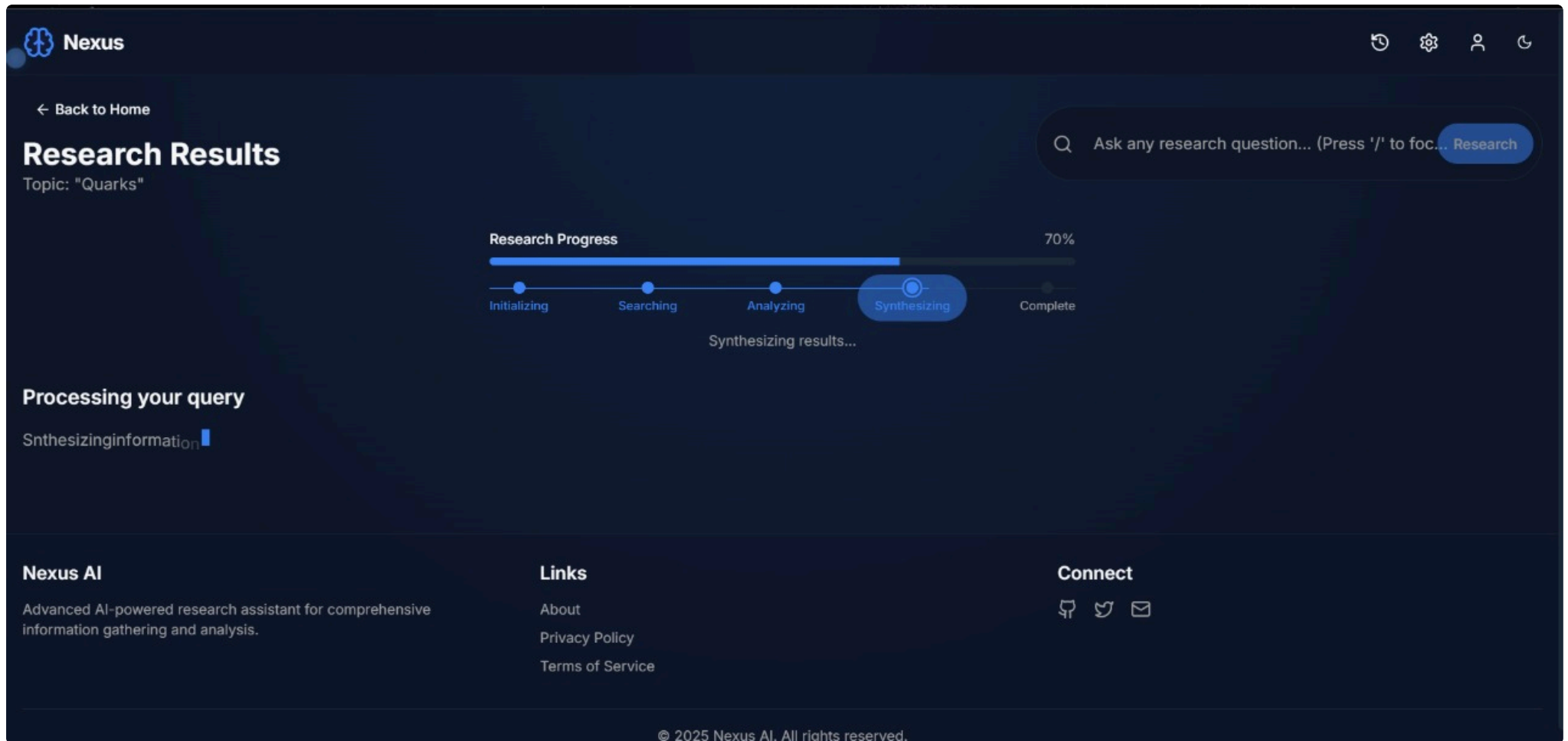
Searching for relevant sources...

Nexus AI

Links


Connect









## 6.3 Results Display


*Description: A detailed article is displayed with structured content.*


 Nexus





# Research Results

Topic: "Quarks"

 Ask any research question... (Press '/' to foc... Research

 Save

 Share

 Export

Completed on 3/11/2025, 8:33:09 AM

Article

Sources & Visualization

## Delving Deeper into the Heart of Matter: Understanding Quarks

**Introduction:**  
Quarks, the fundamental building blocks of matter, have long captivated scientists. These elusive particles, never observed in isolation, are the key components of protons and neutrons, residing at the core of every atom. Recent research continues to shed light on these enigmatic particles, deepening our understanding of the universe's fundamental structure. From theoretical explorations on arXiv to the surprisingly relevant world of e-commerce, the word "quark" has taken on a multifaceted meaning, highlighting the importance of clear scientific communication.

**Key Insights:**  
Our understanding of quarks stems primarily from observing hadrons, composite particles formed by the strong force binding quarks together. The most common hadrons are protons and neutrons, which form the nuclei of atoms. Key properties of quarks include:

**Confinement:** Quarks are never found alone due to a phenomenon called color confinement. They exist only within hadrons or in extreme conditions like quark-gluon plasmas.

**Types:** Several types or "flavors" of quarks exist, including up, down, charm, strange, top, and bottom. Protons and neutrons are composed of up and down quarks.

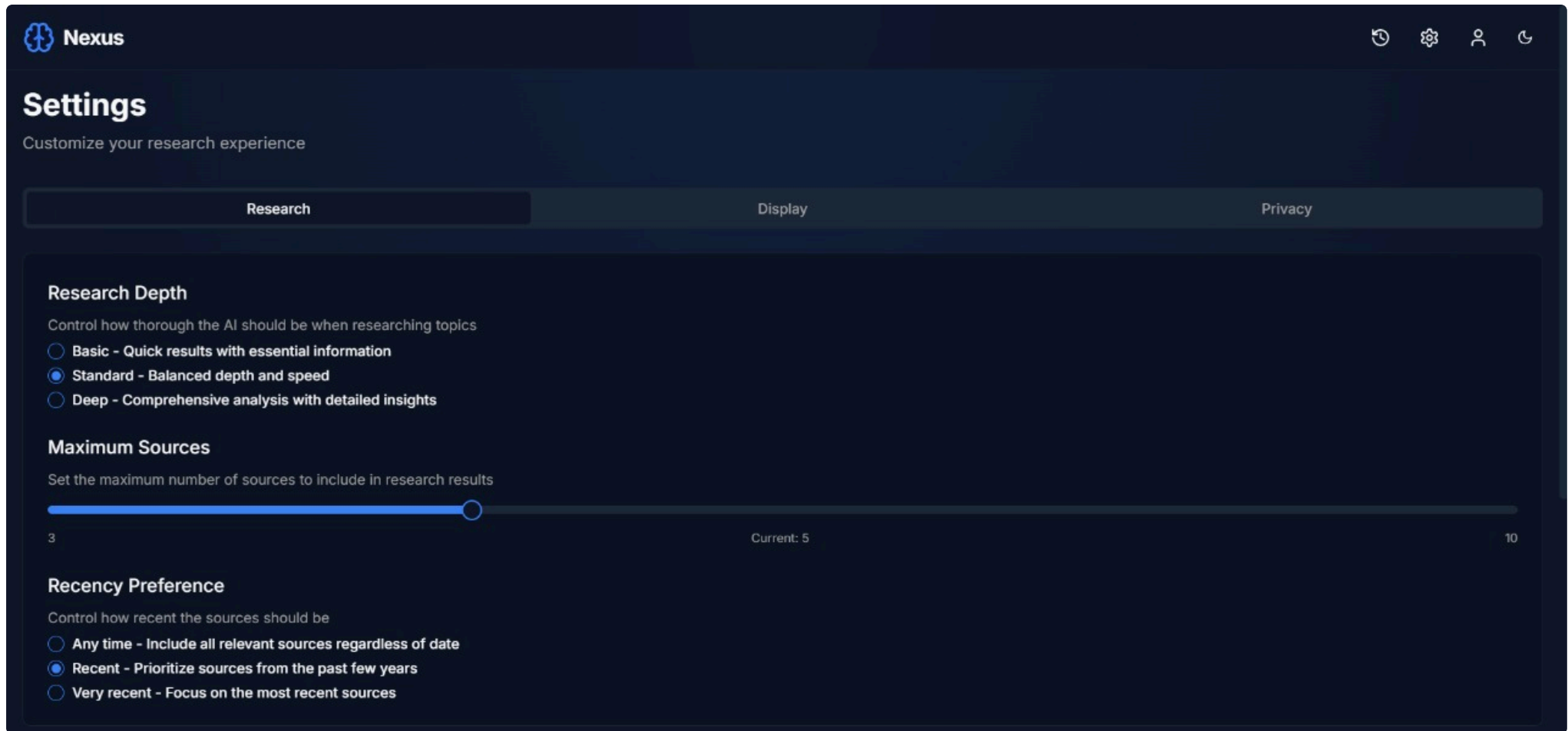
**Fundamental Force:** The strong force, mediated by particles called gluons, binds quarks together within hadrons.

Research on arXiv, a preprint server for scientific papers, reveals extensive ongoing investigation into quark behavior. A search reveals over 60,000 articles related to quarks, covering a wide range of topics, from the properties of quark matter to the theoretical existence of quark stars. One example found delves into the "Isovector properties of quark matter and quark stars," indicating ongoing theoretical work on the behavior of quarks under extreme densities.

**Industry Impact:**

## 6.4 Settings Page

*Description: Users can adjust the tone of the research article.*



## 7. Conclusion

Nexus provides an **AI-powered solution** for **efficient, accurate, and structured research**. By automating information retrieval, content synthesis, and storage, Nexus eliminates the manual workload traditionally associated with research.

### 7.1 Key Takeaways

- AI-driven research automation significantly **reduces research time**.

- **Structured article generation** ensures **clarity and readability**.
- **Fact-checking integration** enhances **credibility**.
- **Multi-format storage options** make research results more **accessible**.

## 7.2 Future Enhancements

- **Cloud-based storage** for persistent access to research history.
- **Integration with additional research sources** for broader knowledge coverage.
- **Support for multiple languages** for global accessibility.
- **Advanced AI models** for more **nuanced content generation**.

## 8. Tech Stack

Nexus is built using **modern web technologies** to ensure efficiency, scalability, and a seamless user experience.

### 8.1 Frontend

- **React.js** → Frontend framework for UI development.
- **Tailwind CSS** → Utility-first styling for a modern, responsive interface.
- **Framer Motion** → Smooth animations and UI interactions.

### 8.2 Backend

- **Flask** → Python-based backend framework for API handling.
- **LangGraph** → Manages agent workflow execution.
- **WeasyPrint** → Converts research output to **PDF**.

### 8.3 APIs & AI Models



- Google Search API → Retrieves online research data.
- Wikipedia API → Fetches encyclopedic knowledge.
- ArXiv API → Extracts academic research papers.
- Google Fact Check API → Verifies claim authenticity.
- Google Gemini API → AI-driven **text generation** for structured content.

Comments ▾

Files

[example\\_output.pdf](#)



No comments yet!

[Sign in](#) or [create an account](#) to comment

Enter a query to research and get a detailed response using Tavily and OpenRouter.

Research Query

Latest advancements in quantum computing

☐ Deep Research Mode

**Research Settings**

Writing Style	Language	Citation Format
Select writing style	Select language	Select citation style
<input checked="" type="radio"/> Academic	<input checked="" type="radio"/> English	<input checked="" type="radio"/> APA
<input type="radio"/> Business	<input type="radio"/> Spanish	<input type="radio"/> MLA

AI Agent Based Deep Research

AI Research Agent

ahmadsanaarooq/Multi\_Agent\_Research\_A...

**Multi-Agent Research Assistant (LangChain Only)**

Enter a topic below and the AI agents will collaborate to create a research report for you.

Research Topic

The future of AI in healthcare

Start Research

**Research Report**

Senior Technology Report: The Transformative Impact of Artificial Intelligence in Healthcare

Introduction:


Artificial intelligence (AI) is rapidly reshaping the healthcare landscape, ushering in an era of unprecedented advancements in diagnostics, treatment, and delivery of care. This report examines the key trends driven by AI in healthcare, highlighting its transformative potential while acknowledging the associated challenges and the need for responsible implementation. The integration of AI is not merely an incremental improvement; it represents a fundamental shift in how healthcare is approached, promising to improve efficiency, accessibility, and ultimately, patient outcomes.

Multi-Agent Research Assistant

1


Mar 22, 2025 • 20 reads

ai-research   document-generation   +11



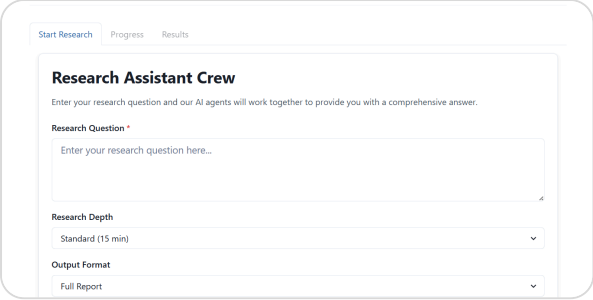
May 30, 2025 • 16 reads

Python - Google API - Web Scrape



Jul 31, 2025 • 11 reads

Langchain   MULTI-AGENT   +2



Cerebral Collective: A Multi-Agent Research Intelligence Platform

Z

Jul 13, 2025 • 62 reads

academic-research   ai-orchestration

+10

© Ready Tensor, Inc.