

Use CrewAI

- [GitHub](#)
- [Docs](#)

Quick Overview

Top-down approach

- Goal: What is the crew for? (define the use-case)
- Define all the Tasks required to achieve the goal? (including human review/action)
- Define and Assign the agent(s) required to complete each task
- Define Tools (maybe used by Agent/Task)
- Kickoff Crew process

```
In [1]: from api_key_store import ApiKeyStore
s = ApiKeyStore()

openai_api_key = s.get_api_key(provider="OPENAI")
serp_api_key = s.get_api_key(provider="SerpApi")
```

```
In [2]: s.api_providers
```

```
Out[2]: dict_keys(['OPENAI', 'GOOGLE', 'HUGGING_FACE', 'WOLFRAM_ALPHA', 'ANTHROPIC', 'COHERE', 'LlamaIndex', 'Serp
Api', 'Browserless', 'DeepL', 'PANDASAI', 'GITHUB'])
```

```
In [3]: import os
os.environ["SERPER_API_KEY"] = serp_api_key
os.environ["OPENAI_API_KEY"] = openai_api_key
```

```
In [4]: from crewai import Agent
from crewai_tools import SerperDevTool
```

```
In [5]: import crewai
```

! pip show crewai # 0.30.11
name: crewai Version: 0.30.11 Summary: Cutting-edge framework for orchestrating role-playing, autonomous AI agents. By fostering collaborative intelligence, CrewAI empowers agents to work together seamlessly, tackling complex tasks. Home-page: Author: Joao Moura Author-email: joao@crewai.com License: Location: /home/gongai/anaconda3/envs/crewai/lib/python3.11/site-packages Requires: appdirs, click, embedchain, instructor, langchain, openai, opentelemetry-api, opentelemetry-exporter-otlp-proto-http, opentelemetry-sdk, pydantic, python-dotenv, regex Required-by:

Enter topic of interest

```
In [6]: topic = 'AI Research by Google'
```

Step 1: Assemble Your Agents

Define Tools

```
In [7]: search_tool = SerperDevTool()
```

Define Agents

```
In [8]: # Creating a senior researcher agent with memory and verbose mode
researcher = Agent(
    role='Senior Researcher',
    goal='Uncover groundbreaking technologies in {topic}',
    verbose=True,
    memory=True,
    backstory=(
        "Driven by curiosity, you're at the forefront of"
        "innovation, eager to explore and share knowledge that could change"
        "the world."
    ),
    tools=[search_tool],
    allow_delegation=True
)
```

```
In [9]: # Creating a writer agent with custom tools and delegation capability
writer = Agent(
    role='Writer',
    goal='Narrate compelling tech stories about {topic}',
    verbose=True,
    memory=True,
    backstory=(
```

```
    "With a flair for simplifying complex topics, you craft"  
    "engaging narratives that captivate and educate, bringing new"  
    "discoveries to light in an accessible manner."  
),  
tools=[search_tool],  
allow_delegation=False  
)
```

Step 2: Define the Tasks

```
In [10]: from crewai import Task  
  
# Research task  
research_task = Task(  
    description=(  
        "Identify the next big trend in {topic}."  
        "Focus on identifying pros and cons and the overall narrative."  
        "Your final report should clearly articulate the key points,"  
        "its market opportunities, and potential risks."  
    ),  
    expected_output='A comprehensive 3 paragraphs long report on the latest AI trends.',  
    tools=[search_tool],  
    agent=researcher,  
)  
  
# Writing task with language model configuration  
write_task = Task(  
    description=(  
        "Compose an insightful article on {topic}."  
        "Focus on the latest trends and how it's impacting the industry."  
        "This article should be easy to understand, engaging, and positive."  
    ),  
    expected_output='A 4 paragraph article on {topic} advancements formatted as markdown.',  
    tools=[search_tool],  
    agent=writer,  
    async_execution=False,  
    output_file='new-blog-post.md' # Example of output customization  
)
```

Step 3: Form the Crew

```
In [11]: from crewai import Crew, Process

# Forming the tech-focused crew with some enhanced configurations
crew = Crew(
    agents=[researcher, writer],
    tasks=[research_task, write_task],
    process=Process.sequential, # Optional: Sequential task execution is default
    memory=False, # True,
    cache=False, # True,
    max_rpm=100,
    # share_crew=True
)
```

Issue:

```
OperationalError                                Traceback (most recent call last)
File ~/local/lib/python3.10/site-packages/sqlalchemy/engine/base.py:1967, in
Connection._exec_single_context(self, dialect, context, statement, parameters)
    1966         if not evt_handled:
-> 1967             self.dialect.do_execute(
    1968                 cursor, str_statement, effective_parameters, context
    1969             )
    1971 if self._has_events or self.engine._has_events:
```

root-cause:

```
which jupyter
/home/gongai/.local/bin/jupyter
```

Step 4: Kick It Off

In []:

```
In [12]: # Starting the task execution process with enhanced feedback
result = crew.kickoff(inputs={'topic': topic})
```

```
print(result)
```

> Entering new CrewAgentExecutor chain...

To begin this task, I need to get the latest information on AI Research by Google. The best tool to use for this would be the "Search the internet" tool to find recent articles, blog posts or press releases about Google's AI research projects.

Action: Search the internet

Action Input: {"search_query": "latest AI Research by Google"}

Search results: Title: Google Research - Explore Our Latest Research in Science and AI

Link: <http://research.google/>

Snippet: Discover Google Research. We publish research papers across a wide range of domains and share our latest developments in AI and science research.

Title: Research - Google AI

Link: <https://ai.google/discover/research/>

Snippet: RESEARCH: Tackling the most challenging problems in computer science. Our teams aspire to make discoveries that positively impact society.

Title: Making AI helpful for everyone - Google AI – Google AI

Link: <https://ai.google/>

Snippet: Our AI innovations are built using our responsible AI practices and led by teams at Google DeepMind and Google Research. Learn more. Guided by principles ...

Title: Blog – Google Research

Link: <http://research.google/blog/>

Snippet: The latest research from Google · Conferences & Events · Generative AI · Health & Bioscience · Machine Intelligence · Product · Quantum · Responsible AI ...

Title: Latest AI Developments at Google - AI News

Link: <https://www.artificialintelligence-news.com/categories/ai-companies/google/>

Snippet: Google has unveiled a series of updates to its AI offerings, including the introduction of Gemini 1.5 Flash, enhancements to Gemini 1.5 Pro, and progress on ...

Title: Google Labs

Link: <https://labs.google/>

Snippet: Try the latest AI experiments in Search, and get AI Overviews on even more topics in Labs. Ask anything, get inspired, and easily find what you're looking for.

Title: Google AI: New insights from 6 images of the human brain

Link: <https://blog.google/technology/research/google-ai-research-new-images-human-brain/>

Snippet: Google researchers and Harvard neuroscientists have worked together to reveal incredible images of the human brain.

Title: Publications - Google DeepMind

Link: <https://deepmind.google/research/publications/>

Snippet: Publications. Explore a selection of our recent research on some of the most complex and interesting challenges in AI.

Title: People + AI Research - Google

Link: <https://pair.withgoogle.com/>

Snippet: Our research into computer science, HCI, and design focuses on making ML more understandable, trustworthy, reliably fair, and useful. Browse our collection.

Title: Advancing Healthcare Research & AI in Medicine - Google Health

Link: <https://health.google/health-research/>

Snippet: Our team of clinicians, researchers, and engineers are all working together to create new AI and discover opportunities to increase the availability and ...

Thought:

The search results have provided several useful links for further exploration regarding Google's latest AI research. These include Google's own research site, a blog that offers updates on Google's research, a news site about AI developments at Google, and specific pages about Google's work in areas like healthcare and human-computer interaction. To get a comprehensive understanding of the latest trends in Google's AI research, I need to explore these links in depth. Since this task requires extensive reading and summarizing, I'll delegate this task to my co-worker, the Writer, who is skilled in these areas.

Action: Delegate work to co-worker

Action Input: {"task": "Read and summarize the key points from the provided links", "context": "We are trying to identify the latest trends in AI research by Google. I have found several potential sources of information. Please read through these and provide a summary of the key points. Here are the links: [<http://research.google/>, <https://ai.google/discover/research/>, <http://research.google/blog/>, <https://www.artificialintelligence-news.com/categories/ai-companies/google/>, <https://labs.google/>, <https://blog.google/technology/research/google-ai-research-new-images-human-brain/>, <https://deepmind.google/research/publications/>, <https://pair.withgoogle.com/>, <https://health.google/health-research/>].", "coworker": "Writer"}

> Entering new CrewAgentExecutor chain...

It seems like a fairly complex task as there are multiple sources to evaluate and summarize. A good approach would be to visit each link one by one, extract key points, and then combine them into a single comprehensive summary. I will start with the first link.

Action: Search the internet

Action Input: {"search_query": "http://research.google/"}

Search results: Title: Google Research - Explore Our Latest Research in Science and AI

Link: <http://research.google/>

Snippet: Discover Google Research. We publish research papers across a wide range of domains and share our latest developments in AI and science research.

Title: Google Scholar

Link: <https://scholar.google.com/>

Snippet: Google Scholar provides a simple way to broadly search for scholarly literature. Search across a wide variety of disciplines and sources: articles, theses, ...

Title: Research at Google

Link: <https://research.google.com/search.html?q=customer%20sentiment%20analysis>

Snippet: Research at Google · [{{link.text}}](#) · [{{link.text}}](#) · Home · Publications · People · Teams · Blog · Work at Google. More. Google Scholar · YouTube Tech Talks.

Title: Google User Experience Research - Discover How UX Research ...

Link: <https://userresearch.google.com/>

Snippet: We'd love to know about your Google user experience. Sign up to participate in UX research and influence Google products, whether you use them or not.

Title: Dataset Search

Link: <https://datasetsearch.research.google.com/>

Snippet: Learn more about Dataset Search.

Title: Big Picture: Google Visualization Research

Link: <https://research.google.com/bigpicture/>

Snippet: We explore how information visualization can make complex data accessible, useful, and even fun. Our focus is on ways to illuminate the data and algorithms ...

Title: Welcome To Colab - Colab - Google

Link: <https://colab.research.google.com/>

Snippet: Developing and training neural networks; Experimenting with TPUs; Disseminating AI research; Creating tutorials. To see sample Colab notebooks that demonstrate ...

Thought:

The first link leads to the main page of Google Research, where they publish research papers across various

domains and share the latest developments in AI and science research. The information doesn't provide specific trends but it's a good starting point. Let's move on to the next link.

Action: Search the internet

Action Input: {"search_query": "https://ai.google/discover/research/"}

Search results: Title: Research - Google AI

Link: <https://ai.google/discover/research/>

Snippet: RESEARCH: Tackling the most challenging problems in computer science. Our teams aspire to make discoveries that positively impact society.

Title: PaLM 2 - Google AI

Link: <https://ai.google/discover/palm2/>

Snippet: ... Google's legacy of breakthrough research in machine learning and responsible AI. It excels at advanced reasoning tasks, including code and math ...

Title: Making AI helpful for everyone - Google AI – Google AI

Link: <https://ai.google/>

Snippet: Our AI innovations are built using our responsible AI practices and led by teams at Google DeepMind and Google Research. Learn more. Guided by principles ...

Title: Google Research - Explore Our Latest Research in Science and AI

Link: <http://research.google/>

Snippet: Discover Google Research. We publish research papers across a wide range of domains and share our latest developments in AI and science research.

Title: Blogs – Google AI

Link: <https://ai.google/discover/blogs/>

Snippet: Additional blogs to explore ; FOR Researchers. People & AI Research Blog ; For IT Leaders. Google Cloud Blog ; FOR BUSINESS LEADERS. Transform with Google Cloud ...

Title: Learn about our leading AI models - Google AI

Link: <https://ai.google/discover/our-models/>

Snippet: Discover the AI models behind our most impactful innovations, understand their capabilities, and find the right one when you're ready to build your own AI ...

Title: Google Science AI

Link: <https://ai.google/discover/scienceai/>

Snippet: Together, our aim is to enable scientific innovation for a better world. Explore how teams at Google are using AI to accelerate scientific discovery.

Title: Advancing Education Using Google AI

Link: <https://edu.google.com/why-google/ai-for-education/>

Snippet: Discover how AI technology and tools can be used for education to create personalized and enriched learning experiences.

Title: Google Generative AI

Link: <https://ai.google/discover/generativeai/>

Snippet: Explore how teams at Google are using Generative AI to create new experiences. Historically, AI was used to understand and recommend information. Now, ...

Title: AI & Machine Learning Products & Services | Google Cloud

Link: <https://cloud.google.com/products/ai>

Snippet: A single platform for data scientists and engineers to create, train, test, monitor, tune, and deploy ML and AI models. Choose from over 130 models in Vertex's ...

Thought:

The second link shares information about Google AI's research. They are tackling challenging problems in computer science with the aim to make positive societal impacts. There's also a mention of Google's legacy of breakthrough research in machine learning and responsible AI, implying a continued focus on these areas. Let's continue to the next link.

Action: Search the internet

Action Input: {"search_query": "http://research.google/blog/"}

Search results: Title: Blog – Google Research

Link: <http://research.google/blog/>

Snippet: The latest research from Google · Conferences & Events · Generative AI · Health & Bioscience · Machine Intelligence · Product · Quantum · Responsible AI ...

Title: AI in software engineering at Google: Progress and the path ahead

Link: <https://research.google/blog/ai-in-software-engineering-at-google-progress-and-the-path-ahead/>

Snippet: In this blog, we present our newest AI-powered improvements within the context of the continuing transformation of Google's internal software ...

Title: Research | Google Blog

Link: <https://blog.google/technology/research/>

Snippet: Research is a core part of our culture. Learn more about Google's latest breakthroughs.

Title: Blog - Google Research

Link: <http://blog.research.google/2022/?m=1>

Snippet: Google Research Blog. Google Research Blog. Google Research. Philosophy · Research Areas · Publications · People · Resources · Outreach · Careers · Blog. Search.

Title: Advances in private training for production on-device language ...

Link: <http://research.google/blog/advances-in-private-training-for-production-on-device-language-models/>

Snippet: In this blog we discuss how years of research advances now power the private training of Gboard LMs, since the proof-of-concept development of ...

Title: Social learning: Collaborative learning with large language models

Link: <http://research.google/blog/social-learning-collaborative-learning-with-large-language-models/>

Snippet: We outline a framework for social learning in which LLMs share knowledge with each other in a privacy-aware manner using natural language.

Title: Patchscopes: A unifying framework for inspecting hidden ...

Link: <http://research.google/blog/patchscopes-a-unifying-framework-for-inspecting-hidden-representations-of-language-models/>

Snippet: Avi Caciularu and Asma Ghandeharioun, Research Scientists, Google Research. Patchscopes is a new framework that aims to unify a variety of ...

Title: A decoder-only foundation model for time-series forecasting

Link: <http://research.google/blog/a-decoder-only-foundation-model-for-time-series-forecasting/>

Snippet: Careers · Blog. Search. Blog. A decoder-only foundation model for time-series forecasting. February 2, 2024. Posted by Rajat Sen and Yichen Zhou, Google ...

Title: Speed Matters - Google Research

Link: <http://research.google/blog/speed-matters/>

Snippet: At Google, we've gathered hard data to reinforce our intuition that "speed matters" on the Internet. Google runs experiments on the search ...

Title: Solving the minimum cut problem for undirected graphs

Link: <http://research.google/blog/solving-the-minimum-cut-problem-for-undirected-graphs/>

Snippet: Careers · Blog. Search. Blog. Solving the minimum cut problem for undirected graphs. April 16, 2024. Di Wang, Research Scientist, Google Research.

Thought:

The third link is a blog from Google Research that provides updates on their latest projects. The blog covers a wide range of topics, including Generative AI, Health & Bioscience, Machine Intelligence, Product, Quantum, and Responsible AI. Some specific areas of research include AI in software engineering, private training for on-device language models, collaborative learning with large language models, and time-series forecasting.

asting. Next, I'll explore the fourth link.

Action: Search the internet

Action Input: {"search_query": "https://www.artificialintelligence-news.com/categories/ai-companies/google/"}

Search results: Title: Latest AI Developments at Google - AI News

Link: <https://www.artificialintelligence-news.com/categories/ai-companies/google/>

Snippet: Categories. Deep & Reinforcement Learning · Machine Learning · Robotics · Voice Recognition. AI News provides artificial intelligence news and jobs, industry ...

Title: AI News - Artificial Intelligence News

Link: <https://www.artificialintelligence-news.com/>

Snippet: Artificial Intelligence News provides the latest AI news and trends. Explore industry research and reports from the frontline of AI technology news.

Title: About AI News

Link: <https://www.artificialintelligence-news.com/about-us/>

Snippet: Categories. Deep & Reinforcement Learning · Machine Learning · Robotics · Voice Recognition. AI News provides artificial intelligence news and jobs, industry ...

Title: 76 Artificial Intelligence (AI) Companies to Know | Built In

Link: <https://builtin.com/artificial-intelligence/ai-companies-roundup>

Snippet: From Google and Amazon to Apple and Microsoft, every major tech company is dedicating resources to breakthroughs in artificial intelligence.

Title: How AI companies are beating Google, Apple and Amazon - YouTube

Link: <https://www.youtube.com/watch?v=5uBiI9m6hXQ>

Snippet: Stop data brokers from exposing your personal information. Go to my sponsor <https://aura.com> ...

Title: AI pioneers turn whistleblowers and demand safeguards

Link: <https://www.artificialintelligence-news.com/2024/06/06/ai-pioneers-turn-whistleblowers-demand-safeguards/>

Snippet: Categories. Deep & Reinforcement Learning · Machine Learning · Robotics · Voice Recognition. AI News provides artificial intelligence news and ...

Title: AI News

Link: <https://www.artificialintelligence-news.com/artificial-intelligence-news/>

Snippet: Categories. Deep & Reinforcement Learning · Machine Learning · Robotics · Voice Recognition. AI News provides artificial intelligence news and jobs, industry ...

Title: Artificial Intelligence Stocks: The 10 Best AI Companies | Investing
Link: <https://money.usnews.com/investing/articles/artificial-intelligence-stocks-the-10-best-ai-companies>
Snippet: AI stocks are having a moment. Here are 10 of the best AI companies on Wall Street.

Title: Latest Applications for AI - AI News
Link: <https://www.artificialintelligence-news.com/categories/ai-applications/>
Snippet: Categories. Deep & Reinforcement Learning · Machine Learning · Robotics · Voice Recognition. AI News provides artificial intelligence news and jobs, industry ...

Title: Artificial Intelligence News | AI Development News | Developer News
Link: <https://www.developer-tech.com/categories/developer-ai/>
Snippet: ... company's approach to integrating AI into ... Google continues AI push with new Gemini tools for developers ... Categories. API · Artificial Intelligence · Cloud ...

Thought:

The fourth link leads to a page on AI News that provides updates on the latest AI developments at Google. It doesn't provide specific details in the search results, but it indicates that the page covers various categories such as Deep & Reinforcement Learning, Machine Learning, Robotics, and Voice Recognition. This suggests that Google is active in these areas of AI research. Let's proceed to the fifth link.

Action: Search the internet

Action Input: {"search_query": "https://labs.google/"}

Search results: Title: Google Labs
Link: <https://labs.google/>
Snippet: Labs.Google is Google's home for the latest AI tools, technology and discourse.

Title: Search Labs - Google Labs
Link: <https://labs.google.com/search>
Snippet: Welcome to Search Labs. Test new featuresDiscover AI and moreTell us what you ... What can we do to make Search Labs better? Share feedback. googlegoogle_labs.

Title: Try experiments in Search Labs - Google Labs
Link: <https://labs.google.com/search/install>
Snippet: Test early-stage Google Search experiments and share your feedback. Get started in Google Chrome on desktop or in the Google App on your phone.

Title: Try experiments in Search Labs - Computer - Google Help
Link: <https://support.google.com/websearch/answer/13572013?hl=en&co=GENIE.Platform%3DDesktop>

Snippet: Search Labs is a program for people to experiment with early-stage Google Search experiences and share feedback. If you're eligible and interested in Search ...

Title: Search Labs

Link: <https://search.google/ways-to-search/search-labs/>

Snippet: Try the latest AI experiments in Search and share your feedback directly with our team. Explore the latest experiments by tapping the icon in the Google app, ...

Title: Google Search Help

Link: <https://support.google.com/websearch/thread/226573083/unwanted-and-unsolicited-image-i-e-https-labs-google-com-search-experiments-source-ntp-appeare?hl=en>

Snippet: Unwanted and unsolicited image, i.e., <https://labs.google.com/search/experiments?source=ntp>, appeared. I did not solicit this image and ...

Title: Experiments with Google

Link: <https://experiments.withgoogle.com/>

Snippet: Since 2009, coders have created thousands of amazing experiments using Chrome, Android, AI, WebVR, AR and more. We're showcasing projects here, along with ...

Title: Labs.Google - Hacker News

Link: <https://news.ycombinator.com/item?id=38730107>

Snippet: We had to wait a long time but web technology is now finally able to recreate the flash websites of yore without using flash.

Thought:

The fifth link is Google Labs, which is Google's home for the latest AI tools, technology, and discourse. It seems like a platform for testing early-stage Google technologies and experiments. It's a place where innovative ideas are tested and feedback is collected. Let's move on to the next link.

Action: Search the internet

Action Input: {"search_query": "https://blog.google/technology/research/google-ai-research-new-images-human-brain/"}

Search results: Title: Google AI: New insights from 6 images of the human brain

Link: <https://blog.google/technology/research/google-ai-research-new-images-human-brain/>

Snippet: Google researchers and Harvard neuroscientists have worked together to reveal incredible images of the human brain.

Title: Blog – Google Research

Link: <http://research.google/blog/>

Snippet: The latest research from Google · Conferences & Events · Generative AI · Health & Bioscience · Machine Intelligence · Product · Quantum · Responsible AI ...

Title: Ten years of neuroscience at Google yields maps of human brain

Link: <http://research.google/blog/ten-years-of-neuroscience-at-google-yields-maps-of-human-brain/>

Snippet: Marking ten years of connectomics research at Google, we are releasing a publication in Science about a reconstruction at the synaptic level ...

Title: Full scan of 1 cubic millimeter of brain tissue took 1.4 petabytes of ...

Link: https://www.reddit.com/r/IsaacArthur/comments/lcrokfn/full_scan_of_1_cubic_millimeter_of_brain_tissue/

Snippet: Full scan of 1 cubic millimeter of brain tissue took 1.4 petabytes of data, equivalent to 14,000 4 K movies – Google's AI experts assist ...

Title: Research - Google AI

Link: <https://ai.google/discover/research/>

Snippet: RESEARCH: Tackling the most challenging problems in computer science. Our teams aspire to make discoveries that positively impact society.

Title: Project Starline: Google and HP partner on 2025 commercialization

Link: <https://blog.google/technology/research/google-project-starline-hp-partnership/>

Snippet: We are proud to partner with Google to bring this technology ... 6 incredible images of the human brain built with the help of Google's AI.

Title: google AI and harvard researchers release detailed images of ...

Link: <https://www.designboom.com/technology/google-ai-harvard-researchers-images-human-brain-3d-mapping-05-13-2024/>

Snippet: Researchers from Google and Harvard University have recently released a new set of detailed images of the human brain and its neural ...

Title: Google DeepMind and Isomorphic Labs introduce AlphaFold 3 AI ...

Link: <https://blog.google/technology/ai/google-deepmind-isomorphic-alphafold-3-ai-model/>

Snippet: Our new AI model AlphaFold 3 can predict the structure and interactions of all life's molecules with unprecedented accuracy.

Title: Google DeepMind

Link: <https://deepmind.google/>

Snippet: Hear how AI can transform our world. Blog – Discover our latest AI breakthroughs, projects, and updates. Events – Meet our team and learn more about our ...

Title: Making AI helpful for everyone - Google AI – Google AI

Link: <https://ai.google/>

Snippet: At Google, we want to make AI helpful for everyone because we think that AI can meaningfully improve people's lives.

Thought:

The sixth link is a specific blog post about Google's AI research on the human brain. Google researchers and Harvard neuroscientists have collaborated on this project. This indicates Google's interest in leveraging AI for advancements in neuroscience. Let's gather information from the seventh link now.

Action: Search the internet

Action Input: {"search_query": "https://deepmind.google/research/publications/"}

Search results: Title: Publications - Google DeepMind

Link: <https://deepmind.google/research/publications/>

Snippet: Publications. Explore a selection of our recent research on some of the most complex and interesting challenges in AI.

Title: Publications - Google DeepMind

Link: <https://deepmind.google/research/publications/?page=2>

Snippet: Publications. Explore a selection of our recent research on some of the most complex and interesting challenges in AI. 157 publications Load ...

Title: Google DeepMind

Link: <https://deepmind.google/>

Snippet: Breakthrough AI system accurately predicts the 3D models of protein structures – and accelerates research in nearly every field of biology. Responsibility. We ...

Title: Publications - Google DeepMind

Link: <https://deepmind.google/research/publications/?q=reinforcement+learning&page=7>

Snippet: Explore a selection of our recent research on some of the most complex and interesting challenges in AI. 154 publications Load previous. Date ...

Title: Publications - Google DeepMind

Link: <https://deepmind.google/research/publications/?q=reinforcement+learning&page=6>

Snippet: Explore a selection of our recent research on some of the most complex and interesting challenges in AI. 153 publications Load previous. Date ...

Title: google-deepmind/deepmind-research - GitHub

Link: <https://github.com/google-deepmind/deepmind-research>

Snippet: This repository contains implementations and illustrative code to accompany DeepMind publications. Along with publishing papers to accompany research ...

Title: Google DeepMind's latest research at ICML 2023

Link: <https://deepmind.google/discover/blog/google-deepmind-research-at-icml-2023/>

Snippet: Google DeepMind researchers are presenting more than 80 new papers at the 40th International Conference on Machine Learning (ICML 2023), ...

Title: Google Research - Explore Our Latest Research in Science and AI

Link: <http://research.google/>

Snippet: Discover Google Research. We publish research papers across a wide range of domains and share our latest developments in AI and science research.

Title: DeepMind's latest research at ICLR 2023

Link: <https://deepmind.google/discover/blog/deepminds-latest-research-at-iclr-2023/>

Snippet: See the full list of DeepMind papers and schedule of events at ICLR 2023. ... research teams are presenting 29 papers ... About Google DeepMind ...

Title: Millions of new materials discovered with deep learning

Link: <https://deepmind.google/discover/blog/millions-of-new-materials-discovered-with-deep-learning/>

Snippet: We share the discovery of 2.2 million new crystals – equivalent to nearly 800 years' worth of knowledge. We introduce Graph Networks for ...

Thought:

The seventh link is Google DeepMind's page for their research publications. It showcases their recent research on some of the most complex and interesting challenges in AI. It indicates that DeepMind is actively engaged in cutting-edge AI research, including predicting the 3D models of protein structures, presenting over 80 new papers at the International Conference on Machine Learning, and discovering 2.2 million new crystals with deep learning. Now let's look at the eighth link.

Action: Search the internet

Action Input: {"search_query": "https://pair.withgoogle.com/"}

Search results: Title: People + AI Research - Google

Link: <https://pair.withgoogle.com/>

Snippet: People + AI Research (PAIR) is a multidisciplinary team at Google that explores the human side of AI by doing fundamental research, building tools, creating ...

Title: People + AI Guidebook

Link: <https://pair.withgoogle.com/guidebook/>

Snippet: People + AI Guidebook. pair.withgoogle.com/guidebook. Published May 8 ... Based on a work at pair.withgoogle.com. Google Research · Google Design.

Title: People + AI Guidebook - Google Design - Medium

Link: <https://medium.com/google-design/https-medium-com-jessholbrook-people-ai-guidebook-41ec2ee5ec3f>

Snippet: <https://pair.withgoogle.com>. This Guidebook will help you build human-centered AI products. It will enable you to avoid common mistakes, ...

Title: PAIR - YouTube

Link: <https://www.youtube.com/channel/UCnnns-uu4yy9BXfYSPIX5AA>

Snippet: The People + AI Research (PAIR) initiative at Google advances the research and design of people-centric AI systems. We're interested in the full spectrum of ...

Title: Can someone explain Google PAIR to me like I'm five? - Reddit

Link: https://www.reddit.com/r/programmatic/comments/yin9tx/can_someone_explain_google_pair_to_me_like_im_five/

Snippet: Is PAIR really just a new protocol for targeting audiences across various ad exchanges in a cookie-less/clean-room environment?

Title: PAIR: the People + AI Research Initiative - The Keyword

Link: <https://blog.google/technology/ai/pair-people-ai-research-initiative/>

Snippet: Today we're announcing the People + AI Research initiative (PAIR) which brings together researchers across Google to study and redesign the ways ...

Title: Apache-2.0 license - GitHub

Link: <https://github.com/PAIR-code/ai-explorables>

Snippet: <https://pair.withgoogle.com/explorables/>. Contribute to PAIR-code/ai-explorables development by creating an account on GitHub.

Title: Can't Pair Google Messages : r/beeper - Reddit

Link: https://www.reddit.com/r/beeper/comments/18nnjab/cant_pair_google_messages/

Snippet: The short answer is.. Whatever device you're using say (Andriod w/ Google Messages) and then you're trying to login another device (Laptop, ...

Title: People + AI Research - Medium

Link: <https://medium.com/people-ai-research>

Snippet: ... Lucas Dixon. Meet the new co-leads of PAIR: Lucas Dixon and Michael Terry. Read more... 147. Go to the profile of People + AI Research @ Google.

Title: Unable to pair Google Messages with Google Account

Link: <https://support.google.com/messages/thread/272669556/unable-to-pair-google-messages-with-google-account>

nt?hl=en

Snippet: Every time I open Google Messages, click the profile icon, then Device Pairing, I get "Can't pair with your Google Account right now."

Thought:

The eighth link is about Google's People + AI Research (PAIR) initiative. PAIR is a multidisciplinary team within Google that explores the human side of AI, conducting fundamental research, building tools, and creating design resources. The focus on the human-centered aspect of AI is a noteworthy trend in Google's AI research. Next, I'll check the ninth link.

Action: Search the internet

Action Input: {"search_query": "https://health.google/health-research/"}

Search results: Title: Advancing Healthcare Research & AI in Medicine - Google Health

Link: <https://health.google/health-research/>

Snippet: Explore the healthcare technology advancements developed by our team of clinicians, researchers, and engineers to improve our understanding of health.

Title: Google Health research publications

Link: <https://health.google/health-research/publications/>

Snippet: Our health research publications allow us to share ideas and work collaboratively through comprehensive publications and associated blog posts.

Title: AI Imaging & Diagnostics - Google Health

Link: <https://health.google/health-research/imaging-and-diagnostics/>

Snippet: Our diagnostic imaging research aims to improve disease detection with AI. Advanced imaging and diagnostics may eventually help with treatment plans.

Title: Health - Google Research

Link: <https://research.google/teams/health/>

Snippet: We are working to create new machine learning tools and discover opportunities to increase the availability and accuracy of healthcare globally.

Title: What Is Google Health? - Google Health

Link: <https://health.google/>

Snippet: At Google Health, we're dedicated to improving the physical and mental health and patient care that women+ receive, through our research, product development, ...

Title: Participate in research with Google Health Studies

Link: <https://health.google/consumers/health-studies/>

Snippet: The Google Health Studies app lets you securely contribute to health research studies with leading institutions, right from your phone.

Title: Google is committed to health equity

Link: <https://health.google/health-equity/>

Snippet: Google Health, Google Cloud Platform, Fitbit, and Fitabase are partnering to advance health equity and mitigate health disparities. Researchers at academic ...

Title: The Value of Genomic Analysis - Google Health

Link: <https://health.google/health-research/genomics/>

Snippet: Discover how Google is using DeepVariant to improve the accuracy of genomic analysis, which identifies variants in DNA that indicate genetic disorders.

Title: Health Tech & Research Partners - Google Health

Link: <https://health.google/partners/>

Snippet: We've partnered with world-class clinical, public health and academic organizations to deploy transformative healthcare tools and services.

Title: Transforming Smartphone Sensors into Health Insights

Link: <https://health.google/health-research/mobile-sensing/>

Snippet: We are developing sensing technologies to detect vital health information that can work on smartphones around the world. By making health knowledge ...

Thought:

The ninth link is about Google Health's research. They are working on healthcare technology advancements to improve our understanding of health. Some areas of focus include diagnostic imaging research for disease detection, creating new machine learning tools for healthcare, genomics, and developing sensing technologies to detect vital health information. This shows Google's interest in leveraging AI for advancements in health and medicine. I have now gathered information from all the links. It's time to compile this into a comprehensive summary.

Final Answer:

Google's AI research spans a wide range of applications and domains. They publish research papers across various domains and share the latest developments in AI and science on Google Research. The focus of Google AI's research is on tackling challenging problems in computer science with the aim to make discoveries that positively impact society. Google Research's blog posts reveal that they are exploring a wide range of topics, including Generative AI, Health & Bioscience, Machine Intelligence, Product, Quantum, and Responsible AI. Google Labs serves as a platform for testing early-stage Google technologies and collecting feedback. Google researchers are also collaborating with Harvard neuroscientists to leverage AI for advancements in neu

roscience. Google's DeepMind is actively engaged in cutting-edge AI research, including predicting the 3D models of protein structures, presenting over 80 new papers at the International Conference on Machine Learning, and discovering 2.2 million new crystals with deep learning. People + AI Research (PAIR) initiative focuses on the human-centered aspect of AI, exploring the human side of AI, conducting fundamental research, building tools, and creating design resources. Google Health is working on healthcare technology advancements to improve our understanding of health, including diagnostic imaging research for disease detection, creating new machine learning tools for healthcare, genomics, and developing sensing technologies to detect vital health information.

> Finished chain.

Google's AI research spans a wide range of applications and domains. They publish research papers across various domains and share the latest developments in AI and science on Google Research. The focus of Google AI's research is on tackling challenging problems in computer science with the aim to make discoveries that positively impact society. Google Research's blog posts reveal that they are exploring a wide range of topics, including Generative AI, Health & Bioscience, Machine Intelligence, Product, Quantum, and Responsible AI. Google Labs serves as a platform for testing early-stage Google technologies and collecting feedback. Google researchers are also collaborating with Harvard neuroscientists to leverage AI for advancements in neuroscience. Google's DeepMind is actively engaged in cutting-edge AI research, including predicting the 3D models of protein structures, presenting over 80 new papers at the International Conference on Machine Learning, and discovering 2.2 million new crystals with deep learning. People + AI Research (PAIR) initiative focuses on the human-centered aspect of AI, exploring the human side of AI, conducting fundamental research, building tools, and creating design resources. Google Health is working on healthcare technology advancements to improve our understanding of health, including diagnostic imaging research for disease detection, creating new machine learning tools for healthcare, genomics, and developing sensing technologies to detect vital health information.

Thought:

The observation from the Writer provides a comprehensive summary of the latest trends in AI research by Google. It's clear that Google is involved in a wide variety of AI applications, including Generative AI, Machine Intelligence, Quantum, and Responsible AI. They are also making significant strides in healthcare technology advancements and human-centered AI research. I will now craft a three-paragraph report, detailing the key points, market opportunities, and potential risks.

Action: Delegate work to co-worker

Action Input: {"task": "Craft a comprehensive three-paragraph report", "context": "Based on the summaries you provided, we know that Google's AI research spans a wide range of applications and domains. They are exploring Generative AI, Machine Intelligence, Quantum, and Responsible AI. They are also making significant strides in healthcare technology advancements and human-centered AI research. Please create a report that details these key points, the market opportunities they present, and any potential risks. Here are some points to consider: \n- Generative AI, Machine Intelligence, Quantum, and Responsible AI research and their appl

ications\n- Collaborations with Harvard neuroscientists for advancements in neuroscience\n- DeepMind's cutting-edge AI research, including predicting the 3D models of protein structures and discovering new crystals with deep learning\n- The human-centered aspect of AI explored by the People + AI Research (PAIR) initiative\n- Healthcare technology advancements by Google Health, including diagnostic imaging research for disease detection, creating new machine learning tools for healthcare, genomics, and developing sensing technologies to detect vital health information", "coworker": "Writer"}

> Entering new CrewAgentExecutor chain...

To craft a comprehensive report, I need to gather more specific and recent information about these key points: Generative AI, Machine Intelligence, Quantum, Responsible AI, Google's collaborations with Harvard, DeepMind's AI research, the PAIR initiative, and Google Health's advancements.

Action: Search the internet

Action Input: {"search_query": "Google AI research Generative AI applications"}

Search results: Title: Google Generative AI

Link: <https://ai.google/discover/generativeai/>

Snippet: Empowering businesses and governments to build generative AI applications quickly, efficiently, and responsibly - armed with the best of Google's research and ...

Title: Generative AI | Google Cloud

Link: <https://cloud.google.com/ai/generative-ai>

Snippet: Bring generative AI to real-world experiences quickly, efficiently, and responsibly, powered by Google's most advanced technology and models including ...

Title: Generative AI Examples | Google Cloud

Link: <https://cloud.google.com/use-cases/generative-ai>

Snippet: Generative AI is a category of artificial intelligence that can create new text, images, video, audio, or code. Learn how it works with Google Cloud.

Title: Making AI helpful for everyone - Google AI – Google AI

Link: <https://ai.google/>

Snippet: A development platform for building and scaling generative AI applications. ... Our AI innovations are built using our responsible AI practices and led by teams ...

Title: Scientists' Perspectives on the Potential for Generative AI in their ...

Link: <https://research.google/pubs/scientists-perspectives-on-the-potential-for-generative-ai-in-their-fields/>

Snippet: There is potential for Generative AI to have a substantive impact on the methods and pace of discovery for a range of scientific disciplines. ... In addition to ...

Title: Announcing new generative AI experiences in Google Workspace
Link: <https://workspace.google.com/blog/product-announcements/generative-ai>
Snippet: Google Cloud announces generative AI support in Vertex AI and Generative AI App Builder, helping businesses and governments build gen apps.

Title: Google I/O 2024: New generative AI experiences in Search
Link: <https://blog.google/products/search/generative-ai-google-search-may-2024/>
Snippet: We're bringing AI Overviews to everyone in the U.S. and adding new gen AI experiences to take more of the legwork out of searching.

Title: Use generative AI to research documents in Pinpoint - Google Help
Link: <https://support.google.com/pinpoint/answer/14338615?hl=en>
Snippet: Research your collection with generative AI. In the right-hand panel of a collection, you can ask research questions and receive AI-powered answers. Scroll in ...

Title: PaLM 2 - Google AI
Link: <https://ai.google/discover/palm2/>
Snippet: PaLM 2 is powering generative AI features like email summarization in Gmail and brainstorming and rewriting in Docs.

Title: Understanding Google Generative AI: Applications, Tools, Models ...
Link: https://medium.com/@sabine_vdl/understanding-google-generative-ai-applications-tools-models-and-use-cases-735cf4b19636
Snippet: Generative AI refers to the application of Artificial Intelligence in creating new content such as text, images, music and videos using natural ...

Thought:

The search results have provided valuable information about Google's Generative AI. It seems that Google is using this technology in a variety of applications, including in real-world experiences, in Google Workspace, and even in Google Search. Now, I should gather information about the next key point: Machine Intelligence.

Action: Search the internet

Action Input: {"search_query": "Google AI research Machine Intelligence applications"}

Search results: Title: Machine Intelligence - Google Research
Link: <https://research.google/research-areas/machine-intelligence/>
Snippet: Google is at the forefront of innovation in Machine Intelligence, with active research exploring virtually all aspects of machine learning, including deep ...

Title: Applications of artificial intelligence (AI) | Google Cloud

Link: <https://cloud.google.com/discover/ai-applications>

Snippet: AI is utilized in different industries such as agriculture and education. Learn about AI applications with Google Cloud.

Title: Research - Google AI

Link: <https://ai.google/discover/research/>

Snippet: We regularly publish in academic journals, release projects as open source, and apply research to Google products to benefit users at scale. Learn more about ...

Title: AI & Machine Learning Products & Services | Google Cloud

Link: <https://cloud.google.com/products/ai>

Snippet: Innovate, optimize and amplify your SaaS applications using Google's data and machine learning solutions such as BigQuery, Looker, Spanner and Vertex AI.

Title: Google Research - Explore Our Latest Research in Science and AI

Link: <http://research.google/>

Snippet: Discover Google Research. We publish research papers across a wide range of domains and share our latest developments in AI and science research.

Title: Making AI helpful for everyone - Google AI – Google AI

Link: <https://ai.google/>

Snippet: At Google, we want to make AI helpful for everyone because we think that AI can meaningfully improve people's lives.

Title: People + AI Research - Google

Link: <https://pair.withgoogle.com/>

Snippet: We believe that for machine learning to achieve ... A friendly, practical guide that lays out some best practices for creating useful, responsible AI applications ...

Title: Google's Artificial Intelligence And Machine Learning Research ...

Link: <https://www.forbes.com/sites/jonyounger/2019/01/16/googles-ai-and-ml-research-priorities-freelancers-take-note/>

Snippet: Without doubt, artificial intelligence and machine learning are major areas of innovation for the greater tech community.

Title: Advancing Healthcare Research & AI in Medicine - Google Health

Link: <https://health.google/health-research/>

Snippet: Explore the healthcare technology advancements developed by our team of clinicians, researchers, and engineers to improve our understanding of health.

Title: Top 15 AI projects powering Google products in 2024

Link: <https://research.aimultiple.com/ai-is-already-at-the-heart-of-google/>

Snippet: From smartphone assistants to image recognition and translation, a myriad of AI functionality hides within Google apps that you daily use. We ...

Thought:

The search results indicate that Google's Machine Intelligence research is extensive and is integrated into a variety of applications. It seems that Google is using Machine Intelligence to innovate, optimize, and amplify its services. Now, it's time to look into Google's research and applications in the field of Quantum Computing.

Action: Search the internet

Action Input: {"search_query": "Google AI research Quantum applications"}

Search results: Title: Google Quantum AI

Link: <https://quantumai.google/>

Snippet: XPRIZE Quantum Applications | Google Quantum AI is a 3-year, \$5M global competition designed to advance the field of quantum algorithms towards pro-society real ...

Title: Research Publications | Google Quantum AI

Link: <https://quantumai.google/research>

Snippet: Google Quantum AI is advancing the state of the art in quantum computing and developing the hardware and software tools to operate beyond classical ...

Title: Quantum Computing - Google Research

Link: <https://research.google/research-areas/quantum-computing/>

Snippet: Quantum Computing is the design of hardware and software that replaces Boolean logic by quantum laws at the algorithmic level. For certain computations such as ...

Title: Google, GESDA and XPRIZE launch new competition in Quantum ...

Link: <https://blog.google/technology/research/google-gesda-and-xprize-launch-new-competition-in-quantum-applications/>

Snippet: XPRIZE Quantum Applications is designed to reward research contributions which most advance the field of quantum algorithms towards real-world ...

Title: Google, XPRIZE Launch \$5M Quantum Application Challenge

Link: <https://www.hpcwire.com/2024/03/04/google-xprize-launch-5m-quantum-application-challenge/>

Snippet: Google Quantum AI, the XPRIZE Foundation, and the Geneva Science and Diplomacy Anticipator (GESDA)

Foundation have announced a 3-year, \$5 ...

Title: Google Quantum AI Team Demystifies Quantum Computing & Its ...

Link: <https://thequantuminsider.com/2024/06/07/google-quantum-ai-team-demystifies-quantum-computing-its-future-potential/>

Snippet: The Google Quantum AI team is committed to pushing the boundaries of quantum computing to tackle complex problems that classical computers can't ...

Title: [PDF] Our focused and responsible approach to quantum computing

Link: <https://ai.google/static/documents/approach-quantum-computing.pdf>

Snippet: Google Quantum AI aims to build this computer. Our roadmap is shown below, and includes six technical milestones towards top quality quantum computing hardware ...

Title: Google Launches \$5M Quest for Real-World Quantum Applications

Link: <https://www.iotworldtoday.com/quantum/google-launches-5m-quest-for-real-world-quantum-applications>

Snippet: Google Quantum AI and Google.org, the charitable arm of Google, have launched a three-year, \$5 million global competition to find quantum computing ...

Title: Overview | XPRIZE Quantum Applications

Link: <https://www.xprize.org/prizes/qc-apps>

Snippet: This prize brings together XPRIZE's expertise in designing, launching and executing large-scale competitions, Google Quantum AI's extensive ...

Title: Google's Quantum Computing Technology in 2024 Review

Link: <https://thequantuminsider.com/2023/05/08/google-quantum-computing/>

Snippet: Quantum algorithms and applications can also be built on Google's cloud-based quantum computing platform, the Google Quantum AI (QAI) platform.

Thought:

The search results indicate that Google is heavily invested in Quantum Computing. It seems they are advancing the field of quantum algorithms and have even launched a global competition for real-world quantum applications. Now, I need to find information about Google's research and principles in the field of Responsible AI.

Action: Search the internet

Action Input: {"search_query": "Google AI research Responsible AI"}

Search results: Title: Responsible AI Practices - Google AI

Link: <https://ai.google/responsibility/responsible-ai-practices/>

Snippet: Responsible AI practices ; Fairness · Design your model using concrete goals for fairness and inclusion · Use representative datasets to train and test your model.

Title: Responsible AI - Google Research

Link: <https://research.google/teams/responsible-ai/>

Snippet: Develop machine learning methodologies that represent AI at its best (responsible, fair, transparent, robust, and inclusive), and apply them in the real world.

Title: Responsible AI | Google Cloud

Link: <https://cloud.google.com/responsible-ai>

Snippet: Responsible AI tools are an increasingly effective way to inspect and understand AI models. We're building resources like Explainable AI, Model Cards, and the ...

Title: Responsible AI - Google Research

Link: <https://research.google/research-areas/responsible-ai/>

Snippet: We examine and shape emerging AI models, systems, and datasets used in research, development, and practice. This research uncovers foundational insights and ...

Title: Google AI Principles

Link: <https://ai.google/responsibility/principles/>

Snippet: Google AI is committed to developing and using artificial intelligence responsibly. Our AI Principles provide a guiding framework for our work, ...

Title: Introduction to Responsible AI | Machine Learning

Link: <https://developers.google.com/machine-learning/resources/intro-responsible-ai>

Snippet: Responsible AI considers the societal impact of the development and scale of these technologies, including potential harms and benefits. The AI ...

Title: More ways Google is delivering on its responsible AI commitment

Link: <https://blog.google/technology/ai/google-responsible-ai-commitment-update/>

Snippet: Today we're announcing new AI safeguards to protect against misuse and new tools that use AI to make learning more engaging and accessible.

Title: Google Splits Up a Key AI Ethics Watchdog - WIRED

Link: <https://www.wired.com/story/google-splits-up-responsible-innovation-ai-team/>

Snippet: "If implemented properly, Responsible AI makes products better by uncovering and working to reduce the harm that unfair bias can cause, ...

Title: At I/O, Google Talks Up 'Responsible AI.' What's That All About?

Link: <https://www.cnet.com/tech/services-and-software/at-io-google-talks-up-responsible-ai-whats-that-all-about/>

Snippet: In the keynote presentation, Google outlined its approach to responsible AI, which includes a comb

ination of automated and human resources. "We' ...

Title: Google AI Review Process

Link: <https://ai.google/responsibility/ai-governance-operations/>

Snippet: RESPONSIBILITY: AI Governance reviews and operations. We assess proposals for new AI research and applications for alignment with our Principles.

Thought:

The search results provide a wealth of information about Google's Responsible AI research. It's clear that Google is committed to developing AI responsibly, with dedicated tools, methodologies, and principles to guide this work. I have gathered key information about Generative AI, Machine Intelligence, Quantum Computing, and Responsible AI. Now, I need to gather information about Google's collaborations with Harvard, DeepMind's AI research, the PAIR initiative, and Google Health's advancements.

Action: Search the internet

Action Input: {"search_query": "Google AI research collaboration with Harvard neuroscientists"}

Search results: Title: Google AI: New insights from 6 images of the human brain

Link: <https://blog.google/technology/research/google-ai-research-new-images-human-brain/>

Snippet: Google researchers and Harvard neuroscientists have worked together to reveal incredible images of the human brain.

Title: Epic science inside a cubic millimeter of brain - Harvard Gazette

Link: <https://news.harvard.edu/gazette/story/2024/05/the-brain-as-weve-never-seen-it/>

Snippet: Published in Science, the study is the latest development in a nearly 10-year collaboration with scientists at Google Research, combining ...

Title: Harvard/Google Use AI to Help Produce Astonishing 3D Map of ...

Link: <https://www.hpcwire.com/2024/05/10/harvard-google-use-ai-to-help-produce-astonishing-3d-map-of-brain-tissue/>

Snippet: Harvard/Google Use AI to Help Produce Astonishing 3D Map of Brain Tissue · Although LLMs are getting all the notice lately, AI techniques of many ...

Title: Google and Harvard unveil most detailed ever map of human brain

Link: <https://www.cnn.com/2024/05/15/world/human-brain-map-harvard-google-scni/index.html>

Snippet: Working from a sliver of tissue no bigger than a grain of rice, researchers have built an astonishingly complex map of the human brain.

Title: Ten years of neuroscience at Google yields maps of human brain

Link: <http://research.google/blog/ten-years-of-neuroscience-at-google-yields-maps-of-human-brain/>

Snippet: Through collaborations with researchers at the Howard Hughes Medical Institute, Harvard University, and Max Planck Institute we have also ...

Title: Google and Harvard researchers map fragment of human brain

Link: <https://www.htworld.co.uk/news/research-news/google-and-harvard-researchers-map-fragment-of-human-brain/>

Snippet: Researchers at Harvard University and Google have co-created the largest synaptic-resolution, 3D reconstruction of a piece of human brain to ...

Title: Google and Harvard Map a Tiny Piece of the Human Brain With ...

Link: <https://singularityhub.com/2024/05/13/google-and-harvard-map-a-tiny-piece-of-the-human-brain-with-extreme-precision/>

Snippet: Aided by machine learning tools from Google Research, the Harvard team traced neurons, blood vessels, and other brain cells at nanoscale levels.

Title: New 3D map charted with Google AI reveals 'mysterious but ...

Link: <https://www.livescience.com/health/neuroscience/new-3d-map-charted-with-google-ai-reveals-mysterious-but-beautiful-slice-of-human-brain>

Snippet: Harvard and Google researchers have collaborated to map a tiny fragment of an adult human brain in unprecedented detail.

Title: Mind-Blowing 3D Brain Map! Google AI & Harvard Just ... - YouTube

Link: <https://www.youtube.com/watch?v=W6jPB1DdRyE>

Snippet: Join me as we dive into a groundbreaking achievement in neuroscience! Google AI and ...

Title: Harvard and Google Neuroscience Breakthrough - SciTechDaily

Link: <https://scitechdaily.com/harvard-and-google-neuroscience-breakthrough-intricately-detailed-1400-terabyte-3d-brain-map/>

Snippet: A collaborative effort between Harvard and Google has led to a breakthrough in brain science, producing an extensive 3D map of a tiny ...

Thought:

The search results show that Google has collaborated with Harvard neuroscientists to reveal incredible images of the human brain. They used AI to help produce a detailed 3D map of brain tissue, an achievement which required machine learning tools from Google Research. Now, I will gather information about DeepMind's AI research.

Action: Search the internet

Action Input: {"search_query": "DeepMind AI research"}

Search results: Title: Google DeepMind

Link: <https://deepmind.google/>

Snippet: Artificial intelligence could be one of humanity's most useful inventions. We research and build safe artificial intelligence systems.

Title: Google DeepMind - Wikipedia

Link: https://en.wikipedia.org/wiki/Google_DeepMind

Snippet: Google DeepMind Technologies Limited is a British-American artificial intelligence research laboratory which serves as a subsidiary of Google.

Title: Google DeepMind: What It Does, How AGI Goal Differs From OpenAI

Link: <https://www.businessinsider.com/google-deepmind>

Snippet: DeepMind is Google's AI research hub focused on building artificial general intelligence. DeepMind has been applied to real-world problems ...

Title: Google DeepMind - YouTube

Link: https://www.youtube.com/@Google_DeepMind

Snippet: Inside Google DeepMind. We live in an exciting time when AI research and technology are delivering extraordinary advances. In the coming years, AI – and ...

Title: Google consolidates its DeepMind and Research teams amid AI push

Link: <https://www.reuters.com/technology/google-consolidates-its-deepmind-research-teams-amid-ai-push-2024-04-18/>

Snippet: The search engine giant had merged its research units Google Brain and DeepMind a year back to sharpen its focus on AI development and get ahead ...

Title: Materials-predicting AI from DeepMind could revolutionize ... - Science

Link: <https://www.science.org/content/article/materials-predicting-ai-deepmind-could-revolutionize-electronics-batteries-and-solar>

Snippet: Last month, they described an AI algorithm that runs on laptops and can predict the weather as accurately as large, supercomputer-driven models.

Title: Google consolidates AI-focused DeepMind, Research teams

Link: <https://www.foxbusiness.com/technology/google-consolidates-ai-focused-deepmind-research-teams>

Snippet: Google DeepMind was created last year through the merger of the Google Brain team with DeepMind and other researchers focused on AI systems.

Thought:

The search results show that DeepMind, a subsidiary of Google, is a hub for AI research. Their focus is on building artificial general intelligence and applying it to real-world problems. Now, I will gather information about the People + AI Research (PAIR) initiative.

Action: Search the internet

Action Input: {"search_query": "People + AI Research initiative"}

Search results: Title: People + AI Research

Link: <https://pair.withgoogle.com/>

Snippet: We are ResearchersArtists. People + AI Research (PAIR) is a multidisciplinary team at Google that explores the human side of AI by doing fundamental research ...

Title: PAIR: the People + AI Research Initiative - The Keyword

Link: <https://blog.google/technology/ai/pair-people-ai-research-initiative/>

Snippet: The goal of PAIR is to focus on the "human side" of AI: the relationship between users and technology, the new applications it enables, and how ...

Title: Responsible AI at Google Research: PAIR

Link: <http://research.google/blog/responsible-ai-at-google-research-pair/>

Snippet: PAIR (People + AI Research) first launched in 2017 with the belief that "AI can go much further – and be more useful to all of us – if we ...

Title: Google's new People+AI Research effort is exactly what AI needs

Link: <https://medium.com/architect/google-s-new-people-ai-research-effort-is-exactly-what-ai-needs-8fe18d99010b>

Snippet: Google announced an effort called People + AI Research that's focused on studying and improving the ways that people, from researchers to ...

Title: A New Google Project Sets Out to Solve Artificial Stupidity - WIRED

Link: <https://www.wired.com/story/google-artificial-intelligence-people-ai-research/>

Snippet: PAIR, for People + AI Research initiative, was announced today and will be led by two experts in data visualization, Fernanda Viégas and Martin ...

Title: Playing with AI Fairness - People + AI Research

Link: <https://pair-code.github.io/what-if-tool/ai-fairness.html>

Snippet: Researchers and designers at Google's PAIR (People and AI Research) initiative created the What-If visualization tool as a pragmatic resource for developers ...

Title: People + AI Research (PAIR) - Boston Global Forum

Link: <https://bostonglobalforum.org/news/people-ai-research-pair/>

Snippet: The PAIR project is an initiative of Google to research about AI where human input plays an early role in the learning process of an AI ...

Title: Google starts researching design for artificial intelligence systems

Link: <https://www.cnbc.com/2017/07/10/google-starts-researching-design-for-artificial-intelligence-systems.html>

Snippet: The research initiative will involve collaborations with people in multiple Google product groups, as well as professors from Harvard and MIT.

Title: Google's People + AI Research Initiative Presents deeplearn.js

Link: <https://tisch.nyu.edu/itp/events/fall-2017/google-people---ai-research-initiative-presents-deeplearn-js>

Snippet: Google stops by ITP to present deeplearn.js, Google's new open-source javascript machine learning library.

Title: Google Wants to Build a More 'Human' A.I. | Dice.com Career Advice

Link: <https://www.dice.com/career-advice/google-wants-build-human-ai>

Snippet: Google wants to start building artificial intelligence with "people in mind," via a new research initiative and some open-source tools.

> Entering new CrewAgentExecutor chain...

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I encountered an error while trying to use the tool. This was the error: Error code: 429 - {'error': {'mess

age': 'Your account is not active, please check your billing details on our website.', 'type': 'billing_not_active', 'param': None, 'code': 'billing_not_active'}}.

Tool Delegate work to co-worker accepts these inputs: Delegate work to co-worker(task: str, context: str, coworker: Optional[str] = None, **kwargs) - Delegate a specific task to one of the following co-workers: [Writer]

The input to this tool should be the co-worker, the task you want them to do, and ALL necessary context to execute the task, they know nothing about the task, so share absolute everything you know, don't reference things but instead explain them.

```

-----
RateLimitError                                Traceback (most recent call last)
Cell In[12], line 2
      1 # Starting the task execution process with enhanced feedback
----> 2 result = crew.kickoff(inputs={'topic': topic})
      3 print(result)

File ~/.local/lib/python3.10/site-packages/crewai/crew.py:264, in Crew.kickoff(self, inputs)
    261 metrics = []
    263 if self.process == Process.sequential:
--> 264     result = self._run_sequential_process()
    265 elif self.process == Process.hierarchical:
    266     result, manager_metrics = self._run_hierarchical_process() # type: ignore # Unpacking a string
is disallowed

File ~/.local/lib/python3.10/site-packages/crewai/crew.py:305, in Crew._run_sequential_process(self)
    300 if self.output_log_file:
    301     self._file_handler.log(
    302         agent=role, task=task.description, status="started"
    303     )
--> 305 output = task.execute(context=task_output)
    306 if not task.async_execution:
    307     task_output = output

File ~/.local/lib/python3.10/site-packages/crewai/task.py:183, in Task.execute(self, agent, context, tools)
    181 self.thread.start()
    182 else:
--> 183     result = self._execute(
    184         task=self,
    185         agent=agent,
    186         context=context,
    187         tools=tools,
    188     )
    189     return result

File ~/.local/lib/python3.10/site-packages/crewai/task.py:192, in Task._execute(self, agent, task, context, tools)
    191 def _execute(self, agent, task, context, tools):
--> 192     result = agent.execute_task(
    193         task=task,
    194         context=context,
    195         tools=tools,

```

```

196     )
197     exported_output = self._export_output(result)
198     self.output = TaskOutput(
199         description=self.description,
200         exported_output=exported_output,
201         raw_output=result,
202     )

```

File ~/.local/lib/python3.10/site-packages/crewai/agent.py:236, in Agent.execute_task(self, task, context, tools)

```

233 self.agent_executor.tools_description = render_text_description(parsed_tools)
234 self.agent_executor.tools_names = self.__tools_names(parsed_tools)
--> 236 result = self.agent_executor.invoke(
237     {
238         "input": task_prompt,
239         "tool_names": self.agent_executor.tools_names,
240         "tools": self.agent_executor.tools_description,
241     }
242 )["output"]
244 if self.max_rpm:
245     self._rpm_controller.stop_rpm_counter()

```

File ~/.local/lib/python3.10/site-packages/langchain/chains/base.py:163, in Chain.invoke(self, input, config, **kwargs)

```

161 except BaseException as e:
162     run_manager.on_chain_error(e)
--> 163     raise e
164 run_manager.on_chain_end(outputs)
166 if include_run_info:

```

File ~/.local/lib/python3.10/site-packages/langchain/chains/base.py:153, in Chain.invoke(self, input, config, **kwargs)

```

150 try:
151     self._validate_inputs(inputs)
152     outputs = (
--> 153         self._call(inputs, run_manager=run_manager)
154         if new_arg_supported
155         else self._call(inputs)
156     )
158     final_outputs: Dict[str, Any] = self.prep_outputs(
159         inputs, outputs, return_only_outputs
160     )

```

```
161 except BaseException as e:
```

File ~/.local/lib/python3.10/site-packages/crewai/agents/executor.py:128, in CrewAgentExecutor._call(self, inputs, run_manager)

```
126 while self._should_continue(self.iterations, time_elapsed):
127     if not self.request_within_rpm_limit or self.request_within_rpm_limit():
--> 128         next_step_output = self._take_next_step(
129             name_to_tool_map,
130             color_mapping,
131             inputs,
132             intermediate_steps,
133             run_manager=run_manager,
134         )
136         if self.step_callback:
137             self.step_callback(next_step_output)
```

File ~/.local/lib/python3.10/site-packages/langchain/agents/agent.py:1138, in AgentExecutor._take_next_step(self, name_to_tool_map, color_mapping, inputs, intermediate_steps, run_manager)

```
1129 def _take_next_step(
1130     self,
1131     name_to_tool_map: Dict[str, BaseTool],
1132     (...)
1133     run_manager: Optional[CallbackManagerForChainRun] = None,
1134 ) -> Union[AgentFinish, List[Tuple[AgentAction, str]]]:
1135     return self._consume_next_step(
--> 1136         [
1137             a
1138             for a in self._iter_next_step(
1139                 name_to_tool_map,
1140                 color_mapping,
1141                 inputs,
1142                 intermediate_steps,
1143                 run_manager,
1144             )
1145         ]
1146     )
```

File ~/.local/lib/python3.10/site-packages/langchain/agents/agent.py:1138, in <listcomp>(.0)

```
1129 def _take_next_step(
1130     self,
1131     name_to_tool_map: Dict[str, BaseTool],
1132     (...)
1133     run_manager: Optional[CallbackManagerForChainRun] = None,
1134 ) -> Union[AgentFinish, List[Tuple[AgentAction, str]]]:
1135     return self._consume_next_step(
--> 1136         [
1137             a
1138             for a in self._iter_next_step(
1139                 name_to_tool_map,
1140                 color_mapping,
1141                 inputs,
1142                 intermediate_steps,
1143                 run_manager,
1144             )
1145         ]
1146     )
```

```

1135     run_manager: Optional[CallbackManagerForChainRun] = None,
1136 ) -> Union[AgentFinish, List[Tuple[AgentAction, str]]]:
1137     return self._consume_next_step(
-> 1138         [
1139             a
1140             for a in self._iter_next_step(
1141                 name_to_tool_map,
1142                 color_mapping,
1143                 inputs,
1144                 intermediate_steps,
1145                 run_manager,
1146             )
1147         ]
1148     )

```

File ~/.local/lib/python3.10/site-packages/crewai/agents/executor.py:192, in CrewAgentExecutor._iter_next_step(self, name_to_tool_map, color_mapping, inputs, intermediate_steps, run_manager)

```

189     intermediate_steps = self._prepare_intermediate_steps(intermediate_steps)
191     # Call the LLM to see what to do.
--> 192     output = self.agent.plan( # type: ignore # Incompatible types in assignment (expression has type
                                type "AgentAction | AgentFinish | list[AgentAction]", variable has type "AgentAction")
193                             intermediate_steps,
194                             callbacks=run_manager.get_child() if run_manager else None,
195                             **inputs,
196                         )
198 except OutputParserException as e:
199     if isinstance(self.handle_parsing_errors, bool):

```

File ~/.local/lib/python3.10/site-packages/langchain/agents/agent.py:397, in RunnableAgent.plan(self, intermediate_steps, callbacks, **kwargs)

```

389 final_output: Any = None
390 if self.stream_runnable:
391     # Use streaming to make sure that the underlying LLM is invoked in a
392     # streaming
393     (...)
395     # Because the response from the plan is not a generator, we need to
396     # accumulate the output into final output and return that.
--> 397     for chunk in self.runnable.stream(inputs, config={"callbacks": callbacks}):
398         if final_output is None:
399             final_output = chunk

```

File ~/.local/lib/python3.10/site-packages/langchain_core/runnables/base.py:2875, in RunnableSequence.strea

```

m(self, input, config, **kwargs)
    2869 def stream(
    2870     self,
    2871     input: Input,
    2872     config: Optional[RunnableConfig] = None,
    2873     **kwargs: Optional[Any],
    2874 ) -> Iterator[Output]:
-> 2875     yield from self.transform(iter([input]), config, **kwargs)

```

File ~/.local/lib/python3.10/site-packages/langchain_core/runnables/base.py:2862, in RunnableSequence.transform(self, input, config, **kwargs)

```

    2856 def transform(
    2857     self,
    2858     input: Iterator[Input],
    2859     config: Optional[RunnableConfig] = None,
    2860     **kwargs: Optional[Any],
    2861 ) -> Iterator[Output]:
-> 2862     yield from self._transform_stream_with_config(
    2863         input,
    2864         self._transform,
    2865         patch_config(config, run_name=(config or {}).get("run_name") or self.name),
    2866         **kwargs,
    2867     )

```

File ~/.local/lib/python3.10/site-packages/langchain_core/runnables/base.py:1881, in Runnable._transform_stream_with_config(self, input, transformer, config, run_type, **kwargs)

```

    1879 try:
    1880     while True:
-> 1881         chunk: Output = context.run(next, iterator) # type: ignore
    1882         yield chunk
    1883         if final_output_supported:

```

File ~/.local/lib/python3.10/site-packages/langchain_core/runnables/base.py:2826, in RunnableSequence._transform(self, input, run_manager, config)

```

    2817 for step in steps:
    2818     final_pipeline = step.transform(
    2819         final_pipeline,
    2820         patch_config(
    2821             (...)
    2822         ),
    2823     )
    2824 )
-> 2826 for output in final_pipeline:

```

2827 **yield** output

File ~/.local/lib/python3.10/site-packages/langchain_core/runnables/base.py:1282, in Runnable.transform(self, input, config, **kwargs)

```

1279 final: Input
1280 got_first_val = False
-> 1282 for ichunk in input:
1283     # The default implementation of transform is to buffer input and
1284     # then call stream.
1285     # It'll attempt to gather all input into a single chunk using
1286     # the '+' operator.
1287     # If the input is not addable, then we'll assume that we can
1288     # only operate on the last chunk,
1289     # and we'll iterate until we get to the last chunk.
1290     if not got_first_val:
1291         final = ichunk

```

File ~/.local/lib/python3.10/site-packages/langchain_core/runnables/base.py:4736, in RunnableBindingBase.transform(self, input, config, **kwargs)

```

4730 def transform(
4731     self,
4732     input: Iterator[Input],
4733     config: Optional[RunnableConfig] = None,
4734     **kwargs: Any,
4735 ) -> Iterator[Output]:
-> 4736     yield from self.bound.transform(
4737         input,
4738         self._merge_configs(config),
4739         **{**self.kwargs, **kwargs},
4740     )

```

File ~/.local/lib/python3.10/site-packages/langchain_core/runnables/base.py:1300, in Runnable.transform(self, input, config, **kwargs)

```

1297         final = ichunk
1299 if got_first_val:
-> 1300     yield from self.stream(final, config, **kwargs)

```

File ~/.local/lib/python3.10/site-packages/langchain_core/language_models/chat_models.py:249, in BaseChatModel.stream(self, input, config, stop, **kwargs)

```

242 except BaseException as e:
243     run_manager.on_llm_error(
244         e,

```

```

245         response=LLMResult(
246             generations=[[generation]] if generation else []
247         ),
248     )
--> 249     raise e
250 else:
251     run_manager.on_llm_end(LLMResult(generations=[[generation]]))

```

File ~/.local/lib/python3.10/site-packages/langchain_core/language_models/chat_models.py:229, in BaseChatModel.stream(self, input, config, stop, **kwargs)

```

227 generation: Optional[ChatGenerationChunk] = None
228 try:
--> 229     for chunk in self._stream(messages, stop=stop, **kwargs):
230         if chunk.message.id is None:
231             chunk.message.id = f"run-{run_manager.run_id}"

```

File ~/.local/lib/python3.10/site-packages/langchain_openai/chat_models/base.py:408, in ChatOpenAI._stream(self, messages, stop, run_manager, **kwargs)

```

405 params = {**params, **kwargs, "stream": True}
407 default_chunk_class = AIMessageChunk
--> 408 for chunk in self.client.create(messages=message_dicts, **params):
409     if not isinstance(chunk, dict):
410         chunk = chunk.dict()

```

File ~/.local/lib/python3.10/site-packages/openai/_utils/_utils.py:277, in required_args.<locals>.inner.<locals>.wrapper(*args, **kwargs)

```

275     msg = f"Missing required argument: {quote(missing[0])}"
276     raise TypeError(msg)
--> 277 return func(*args, **kwargs)

```

File ~/.local/lib/python3.10/site-packages/openai/resources/chat/completions.py:590, in Completions.create(self, messages, model, frequency_penalty, function_call, functions, logit_bias, logprobs, max_tokens, n, presence_penalty, response_format, seed, stop, stream, stream_options, temperature, tool_choice, tools, top_logprobs, top_p, user, extra_headers, extra_query, extra_body, timeout)

```

558 @required_args(["messages", "model"], ["messages", "model", "stream"])
559 def create(
560     self,
561     (...)
588     timeout: float | httpx.Timeout | None | NotGiven = NOT_GIVEN,
589 ) -> ChatCompletion | Stream[ChatCompletionChunk]:
--> 590     return self._post(
591         "/chat/completions",

```



```

592     body=maybe_transform(
593         {
594             "messages": messages,
595             "model": model,
596             "frequency_penalty": frequency_penalty,
597             "function_call": function_call,
598             "functions": functions,
599             "logit_bias": logit_bias,
600             "logprobs": logprobs,
601             "max_tokens": max_tokens,
602             "n": n,
603             "presence_penalty": presence_penalty,
604             "response_format": response_format,
605             "seed": seed,
606             "stop": stop,
607             "stream": stream,
608             "stream_options": stream_options,
609             "temperature": temperature,
610             "tool_choice": tool_choice,
611             "tools": tools,
612             "top_logprobs": top_logprobs,
613             "top_p": top_p,
614             "user": user,
615         },
616         completion_create_params.CompletionCreateParams,
617     ),
618     options=make_request_options(
619         extra_headers=extra_headers, extra_query=extra_query, extra_body=extra_body, timeout=ti
meout
620     ),
621     cast_to=ChatCompletion,
622     stream=stream or False,
623     stream_cls=Stream[ChatCompletionChunk],
624 )

```

File ~/local/lib/python3.10/site-packages/openai/_base_client.py:1240, in SyncAPIClient.post(self, path, cast_to, body, options, files, stream, stream_cls)

```

1226 def post(
1227     self,
1228     path: str,
1229     (...)
1235     stream_cls: type[_StreamT] | None = None,

```

```

1236 ) -> ResponseT | _StreamT:
1237     opts = FinalRequestOptions.construct(
1238         method="post", url=path, json_data=body, files=to_httpx_files(files), **options
1239     )
-> 1240     return cast(ResponseT, self.request(cast_to, opts, stream=stream, stream_cls=stream_cls))

```

File ~/.local/lib/python3.10/site-packages/openai/_base_client.py:921, in SyncAPIClient.request(self, cast_to, options, remaining_retries, stream, stream_cls)

```

912 def request(
913     self,
914     cast_to: Type[ResponseT],
915     (...)
919     stream_cls: type[_StreamT] | None = None,
920 ) -> ResponseT | _StreamT:
-> 921     return self._request(
922         cast_to=cast_to,
923         options=options,
924         stream=stream,
925         stream_cls=stream_cls,
926         remaining_retries=remaining_retries,
927     )

```

File ~/.local/lib/python3.10/site-packages/openai/_base_client.py:1005, in SyncAPIClient._request(self, cast_to, options, remaining_retries, stream, stream_cls)

```

1003 if retries > 0 and self._should_retry(err.response):
1004     err.response.close()
-> 1005     return self._retry_request(
1006         options,
1007         cast_to,
1008         retries,
1009         err.response.headers,
1010         stream=stream,
1011         stream_cls=stream_cls,
1012     )

```

```

1014 # If the response is streamed then we need to explicitly read the response
1015 # to completion before attempting to access the response text.
1016 if not err.response.is_closed:

```

File ~/.local/lib/python3.10/site-packages/openai/_base_client.py:1053, in SyncAPIClient._retry_request(self, options, cast_to, remaining_retries, response_headers, stream, stream_cls)

```

1049 # In a synchronous context we are blocking the entire thread. Up to the library user to run the client in a

```

```

1050 # different thread if necessary.
1051 time.sleep(timeout)
-> 1053 return self._request(
1054     options=options,
1055     cast_to=cast_to,
1056     remaining_retries=remaining,
1057     stream=stream,
1058     stream_cls=stream_cls,
1059 )

```

File ~/.local/lib/python3.10/site-packages/openai/_base_client.py:1005, in SyncAPIClient._request(self, cast_to, options, remaining_retries, stream, stream_cls)

```

1003 if retries > 0 and self._should_retry(err.response):
1004     err.response.close()
-> 1005     return self._retry_request(
1006         options,
1007         cast_to,
1008         retries,
1009         err.response.headers,
1010         stream=stream,
1011         stream_cls=stream_cls,
1012     )
1014 # If the response is streamed then we need to explicitly read the response
1015 # to completion before attempting to access the response text.
1016 if not err.response.is_closed:

```

File ~/.local/lib/python3.10/site-packages/openai/_base_client.py:1053, in SyncAPIClient._retry_request(self, options, cast_to, remaining_retries, response_headers, stream, stream_cls)

```

1049 # In a synchronous context we are blocking the entire thread. Up to the library user to run the client in a
1050 # different thread if necessary.
1051 time.sleep(timeout)
-> 1053 return self._request(
1054     options=options,
1055     cast_to=cast_to,
1056     remaining_retries=remaining,
1057     stream=stream,
1058     stream_cls=stream_cls,
1059 )

```

File ~/.local/lib/python3.10/site-packages/openai/_base_client.py:1020, in SyncAPIClient._request(self, cast_to, options, remaining_retries, stream, stream_cls)

```
1017         err.response.read()
1019         log.debug("Re-raising status error")
-> 1020         raise self._make_status_error_from_response(err.response) from None
1022     return self._process_response(
1023         cast_to=cast_to,
1024         options=options,
1025         (...)
1027         stream_cls=stream_cls,
1028     )
```

```
RateLimitError: Error code: 429 - {'error': {'message': 'Your account is not active, please check your billing details on our website.', 'type': 'billing_not_active', 'param': None, 'code': 'billing_not_active'}}
```

In []:

In []: