**Open Deep Research -**

AI-Powered Autonomous Research Workflow

**Workflow: Open Deep Research - AI-Powered Autonomous Research Workflow**

**Purpose:**  
This workflow is designed to autonomously conduct deep research on a user's query using advanced language models and search tools. It generates refined search queries, performs web searches, processes the results, and produces a comprehensive research report.

**Workflow Overview**

The workflow is divided into multiple sections:

1. **Chat Trigger & Query Generation**
   * **Chat Message Trigger:**  
     Initiates the workflow when a user sends a chat message. The message input is captured for processing.  
     **Node:** *Chat Message Trigger*  
     **Webhook ID:** cb0b9dbe-1f35-441a-b062-29624b0ebc6a
   * **Generate Search Queries using LLM:**  
     Uses an LLM (via the Chain LLM node) to generate up to four distinct and precise search queries based on the user's input.  
     **Node:** *Generate Search Queries using LLM*  
     **Input:** User query from the Chat Message Trigger.  
     **Output:** JSON list of search queries.
2. **Web Search & Data Extraction**
   * **Perform SerpAPI Search Request:**  
     Executes a search using SerpAPI with the generated query to retrieve organic search results from Google.  
     **Node:** *Perform SerpAPI Search Request*
   * **Parse and Chunk JSON Data:**  
     Processes the JSON output from the LLM to divide the data into manageable chunks for subsequent steps.  
     **Node:** *Parse and Chunk JSON Data*
   * **Perform Jina AI Analysis Request:**  
     Uses Jina AI to analyze the search results for deeper insights.  
     **Node:** *Perform Jina AI Analysis Request*
   * **Extract Relevant Context via LLM:**  
     Consolidates the key context from the search results. This context is intended to help in forming the final comprehensive research report.  
     **Node:** *Extract Relevant Context via LLM*
3. **LLM Memory Buffer & Report Generation**
   * **LLM Memory Buffer (Input Context):**  
     Caches input context over multiple iterations to maintain continuity in the conversation and research process.  
     **Node:** *LLM Memory Buffer (Input Context)*  
     **Configuration:** 20 messages context window.
   * **LLM Memory Buffer (Report Context):**  
     Caches output context for the final report generation.  
     **Node:** *LLM Memory Buffer (Report Context)*
   * **Generate Comprehensive Research Report:**  
     Uses an LLM (configured with a language model such as Anthropic or OpenAI) to generate a detailed research report based on the extracted context and the original user query. The report is formatted in Markdown with clear headings and sections.  
     **Node:** *Generate Comprehensive Research Report*  
     **Output:** A comprehensive, well-structured research report.
4. **Additional Functionality**
   * **Tool Chaining & Batching:**  
     The workflow uses split and batch nodes to handle large amounts of data by breaking it into smaller batches (e.g., using "Split Data for SerpAPI Batching" and "Split Data for Jina AI Batching") to efficiently process and analyze the results.
   * **LLM Response Provider (OpenRouter):**  
     Acts as an additional LLM node that processes the generated search queries and context data to refine the final outputs using the OpenRouter API.  
     **Node:** *LLM Response Provider (OpenRouter)*

**Data Flow Summary**

1. **Initiation:**  
   The workflow is triggered by a chat message received from a user via the Chat Message Trigger node. The user's query is extracted and sent to the "Generate Search Queries using LLM" node.
2. **Query Generation:**  
   The LLM generates several refined search queries. These queries are parsed and chunked for batch processing.
3. **Web Searches:**  
   The refined queries are used to perform searches through SerpAPI and further analyzed by Jina AI. The search results are then processed and relevant context is extracted.
4. **Context Aggregation:**  
   The extracted context is buffered using LLM Memory Buffer nodes to maintain the continuity of the research. This context is essential for generating a comprehensive report.
5. **Report Generation:**  
   The aggregated context and original query are used by the "Generate Comprehensive Research Report" node to create a detailed research report, formatted in Markdown.
6. **Output:**  
   The final report, containing insights, key findings, and detailed analysis, is provided as the workflow’s output.

**Setup Instructions**

1. **API Credentials:**
   * **SerpAPI:** Obtain your API key from [SerpAPI](https://serpapi.com/manage-api-key) and configure it in n8n credentials.
   * **Jina AI:** Configure your Jina AI API key in n8n using the provided credentials settings.
   * **OpenRouter:** Set up the OpenRouter API credentials in n8n for enhanced LLM response processing.
2. **LLM Configuration:**
   * **OpenAI and Anthropic Models:** Ensure your OpenAI and Anthropic credentials are correctly configured in n8n. Choose the model that best suits your research needs (e.g., gpt-4o for OpenAI, google/gemini-2.0-flash-001 for Anthropic).
3. **Batch Processing:**
   * Configure the split and batch nodes to handle large datasets efficiently. Adjust the batch size according to your token limits and performance requirements.
4. **Testing and Deployment:**
   * Use the manual trigger or schedule the workflow to test the process with different user queries.
   * Once verified, deploy the workflow for autonomous research processing.

**Final Output**

The final output of this workflow is a comprehensive research report in Markdown format that includes:

* A summary of key findings.
* Detailed analysis with categorized insights.
* References to source URLs in markdown format.
* Contextual information to support further follow-up actions if needed.

Deploy this workflow to automate deep research tasks and enhance your information retrieval capabilities with the power of AI!

Happy Researching!

Below is the documentation for the provided workflow **"Open Deep Research - AI-Powered Autonomous Research Workflow"**. This documentation outlines the workflow's purpose, describes each component, and explains the data flow so you can understand and maintain it.

**Workflow: Open Deep Research - AI-Powered Autonomous Research Workflow**

**Purpose:**  
This autonomous research workflow is designed to leverage advanced language models and search APIs to generate comprehensive research reports. It accepts a user's query, refines it into precise search queries, gathers and processes search results, and finally produces a detailed Markdown report summarizing the findings.

**Workflow Components**

1. **Chat Input and Query Generation**

* **Chat Message Trigger**
  + **Type:** Chat Trigger (via webhook)
  + **Function:** Receives the user’s research query.
  + **Configuration:**
    - Webhook ID: cb0b9dbe-1f35-441a-b062-29624b0ebc6a
    - Input is captured and made available as chatInput.
* **Generate Search Queries using LLM**
  + **Type:** LLM Chain
  + **Function:** Processes the user query to generate up to four distinct search queries.
  + **Input:** User query from the Chat Message Trigger.
  + **Output:** A JSON list of search queries, for example: ["query1", "query2", "query3", "query4"].

2. **Web Search and Data Processing**

* **Split Data for SerpAPI Batching**
  + **Type:** Split In Batches Node
  + **Function:** Splits the generated JSON search queries into batches for efficient processing with SerpAPI.
* **Perform SerpAPI Search Request**
  + **Type:** HTTP Request
  + **Function:** Executes a web search using SerpAPI with each batched query.
  + **Configuration:**
    - URL: https://serpapi.com/search
    - Query Parameters include the search query (q) and API key.
* **Split Data for Jina AI Batching**
  + **Type:** Split In Batches Node
  + **Function:** Splits search result data for further processing by Jina AI.
* **Perform Jina AI Analysis Request**
  + **Type:** HTTP Request
  + **Function:** Sends the batched data to Jina AI to perform deeper analysis and extract further context.
  + **Configuration:**
    - URL format: https://r.jina.ai/{endpoint}
    - Authentication: Configured via n8n credentials.
* **Extract Relevant Context via LLM**
  + **Type:** AI Agent
  + **Function:** Uses an LLM to process the analyzed search results and extract relevant context that will support the final report.
  + **Input:** Merged context data from previous steps.
  + **Output:** Concise context text extracted from the search results.

3. **Memory Buffer and Report Generation**

* **LLM Memory Buffer (Input Context)**
  + **Type:** Memory Buffer Node
  + **Function:** Stores and manages the input context over multiple iterations to maintain continuity.
  + **Configuration:**
    - Session Key: my\_test\_session
    - Context Window Length: 20 messages
* **LLM Memory Buffer (Report Context)**
  + **Type:** Memory Buffer Node
  + **Function:** Accumulates context information for final report generation.
* **Generate Comprehensive Research Report**
  + **Type:** AI Agent
  + **Function:** Using the aggregated context and the original user query, this node generates a detailed research report in Markdown format.
  + **Output:** The report includes key findings, detailed analysis, and relevant source links (formatted in Markdown).

4. **LLM Response Provider and Tool Integration**

* **LLM Response Provider (OpenRouter)**
  + **Type:** LLM Node (using OpenRouter API)
  + **Function:** Further refines the search query results or context using an additional language model.
* **Additional Tool Nodes and Batching**
  + **Split and Batch Nodes:**
    - Used to divide large datasets into manageable batches for processing.
  + **Aggregation Nodes:**
    - Combine processed data from various sources for final output.

5. **Final Output and Response**

* **Return Final Report**
  + The final output is a Markdown-formatted research report that summarizes the user's query, key insights, and reference links.
  + This report is returned as the workflow’s final response.

**Data Flow Summary**

1. **Query Reception:**  
   The workflow is triggered by a chat message containing the user's research query.
2. **Query Generation:**  
   The input query is transformed into multiple refined search queries by the LLM.
3. **Web Searches:**  
   The refined queries are used to perform web searches via SerpAPI, and results are processed in batches.  
   Jina AI further analyzes these results to extract deeper context.
4. **Context Aggregation:**  
   Relevant contexts from search results are collected using memory buffer nodes to maintain a comprehensive view.
5. **Report Generation:**  
   An AI Agent uses the aggregated context to generate a structured research report in Markdown format.
6. **Final Output:**  
   The workflow returns the final research report for the user to review and utilize.

**Setup Instructions**

1. **Credentials Configuration:**
   * **SerpAPI:** Configure your SerpAPI API key in n8n.
   * **Jina AI:** Set up your Jina AI API key in n8n.
   * **OpenRouter:** Ensure your OpenRouter API credentials are configured.
   * **OpenAI/Anthropic:** Configure and select the appropriate language models.
2. **Batch Processing Settings:**
   * Adjust batch sizes in the split nodes to optimize token usage and performance.
3. **Memory Buffer Configuration:**
   * Set up memory buffer nodes to ensure context continuity across multiple iterations.
4. **Testing:**
   * Use the manual trigger node to test the workflow with different queries.
   * Review the generated research report for accuracy and comprehensiveness.
5. **Deployment:**
   * Once testing is complete, deploy the workflow for autonomous research processing.

**Final Output**

The workflow outputs a comprehensive research report in Markdown format that includes:

* **A summary of key findings.**
* **Detailed analysis with clear sections.**
* **Relevant source URLs formatted in Markdown.**
* **Contextual insights supporting further research.**