Getting Started with AutoGen

By Lucas Soares

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- ML Engineer
- Instructor at O'Reilly Media
- Curious about all things intelligence

Table of Contents

Table of Contents

Table of Contents

Table of Contents

Table of Contents

Table of Contents

Table of Contents

Table of Contents

Table of Contents

Thought + Action

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- How do we do stuff? We **think** and we **act**

Thought + Action

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- Example: Decision-making process for attending a live-training

Thought + Action

- How do we do stuff? We **think** and we **act**
- Example: Decision-making process for attending a live-training

Thinking:

What to do + planning (order, priority..)

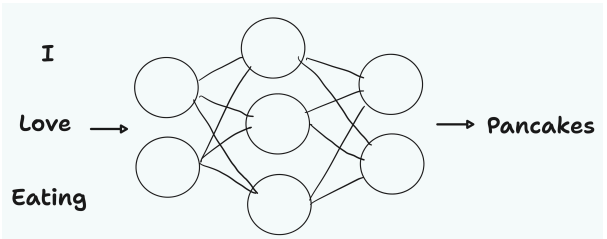
Acting:

used **tools: search, browser, etc...**

What is an Agent? (LLM + Tool)

LLM

Predicts next word/sentence



Tool

Performs actions in the real-world

LLMs can use tools!

- Toolformer

LLMs can use tools!

- Toolformer

> The New England Journal of Medicine is a registered trademark of [QA("Who is the publisher of The New England Journal of Medicine?") → Massachusetts Medical Society] the MMS.

> Out of 1400 participants, 400 (or [Calculator(400 / 1400) → 0.29] 29%) passed the test.

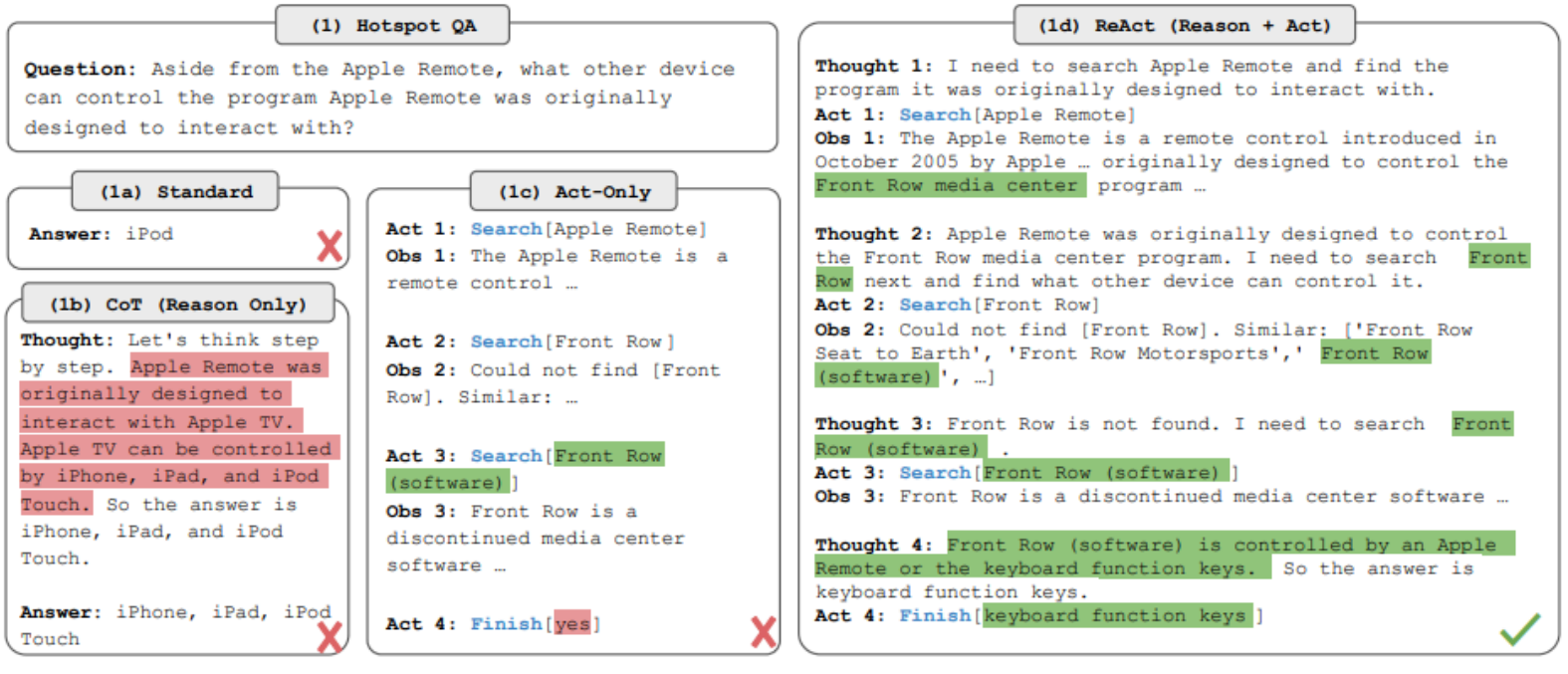
> The name derives from "la tortuga", the Spanish word for [MT("tortuga") → turtle] turtle.

> The Brown Act is California's law [WikiSearch("Brown Act") → The Ralph M. Brown Act is an act of the California State Legislature that guarantees the public's right to attend and participate in meetings of local legislative bodies.] that requires legislative bodies, like city councils, to hold their meetings open to the public.

[1] (Schick u. a., o. J., 2023)

Interleaving Thoughts and Actions

- ReACT: LLMs for **RE**asoning & **ACT**ion.

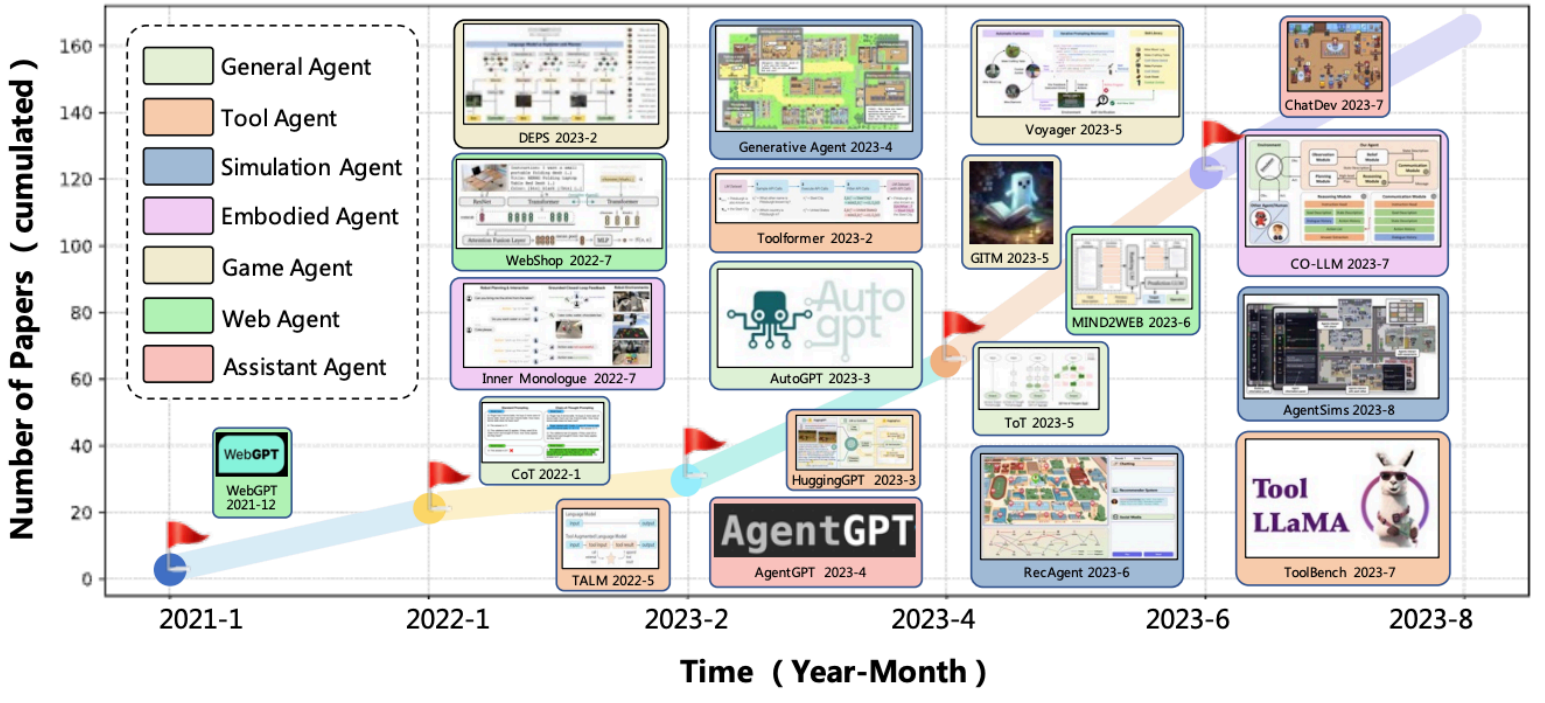


[2] Yao, X., et al. (2023)

Agents Are Getting Popular

Agents Are Getting Popular

- A Survey on Large Language Model based Autonomous Agents



[3] (Wang et al. 2024)

Popular Agent Implementations

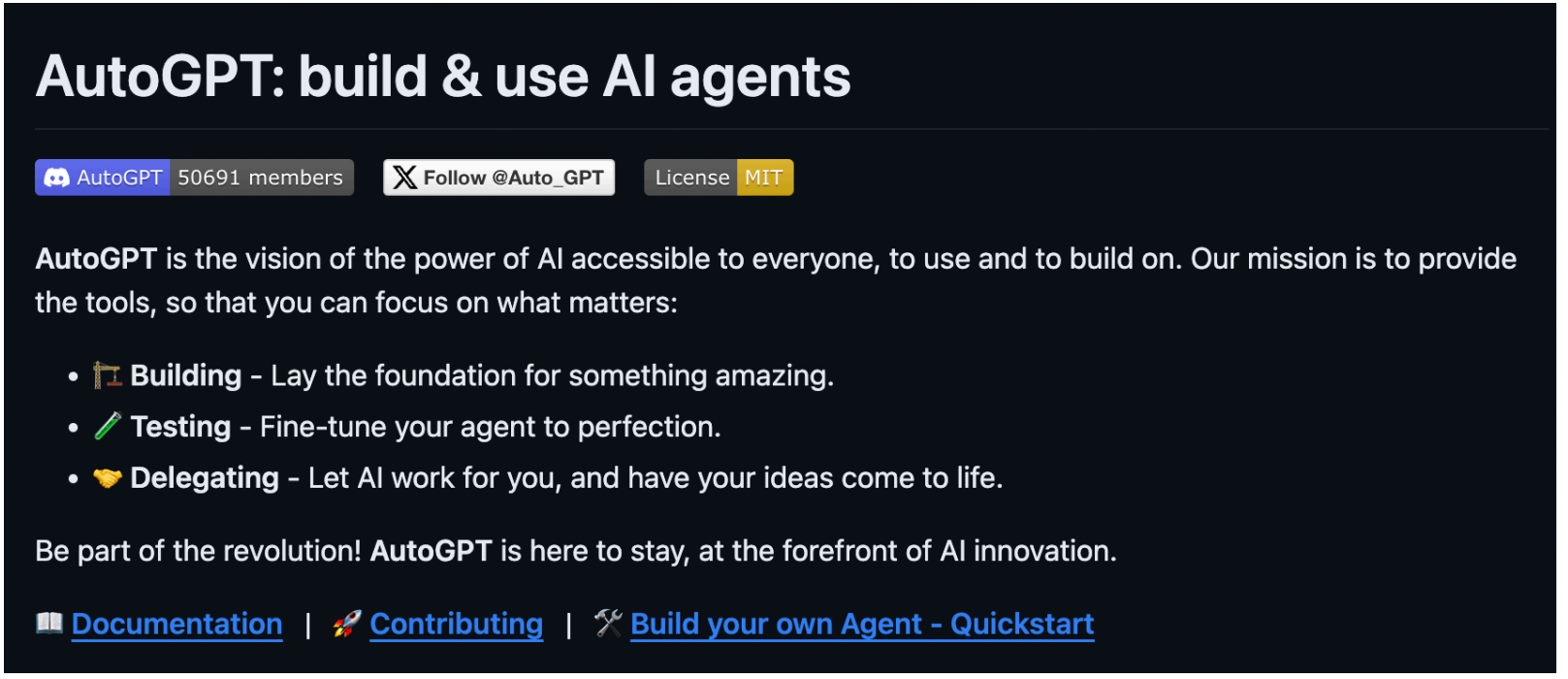
Popular Agent Implementations

- BabyAGI: separate planning and execution steps

[4] BabyAGI

Popular Agent Implementations

- AutoGPT: created for long-running, open-ended goals



[5] AutoGPT

Popular Agent Implementations

- GPT-Researcher: produce detailed, factual and unbiased research reports

[6] GPT-Researcher

Popular Agent Implementations

- Custom GPTs for specific tasks

[7] Custom GPT OpenAI Blog Post

Agents in 3 Levels of Complexity

Level 1: LLM + functions inside the prompt

Level 1: LLM + functions inside the prompt

- Inspired by 'Toolformer'

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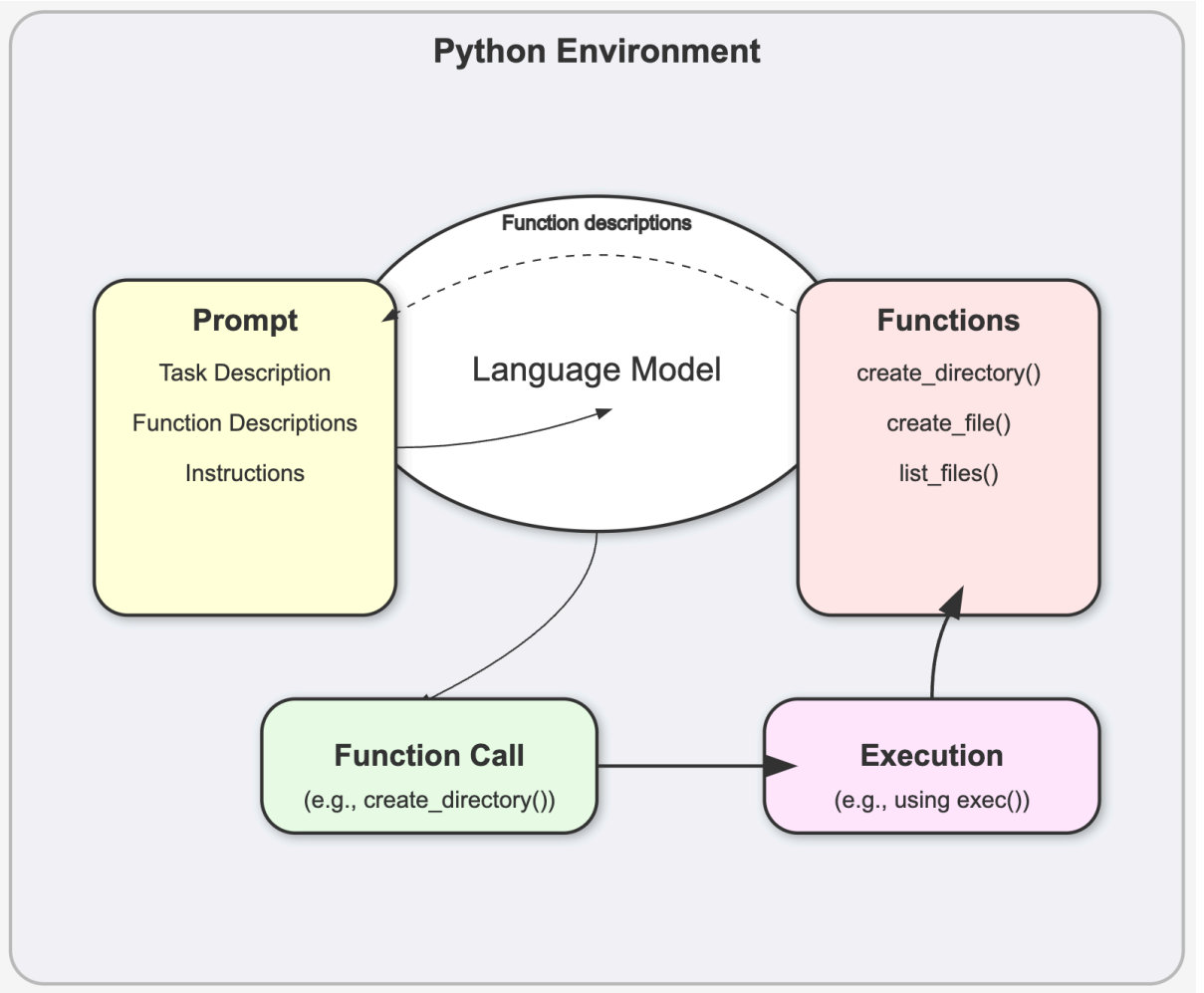
Level 1: LLM + functions inside the prompt



Limitations

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- **Probabilistic outputs** make function calls unreliable

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- Need for **structured ways to prepare the inputs** of the function calls
- Putting entire functions inside text prompts is clunky and **non-scalable**
- Solution? **OpenAI Functions**!

Level 2: OpenAI Function Calling

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- Standard way to connect models to outside tools.

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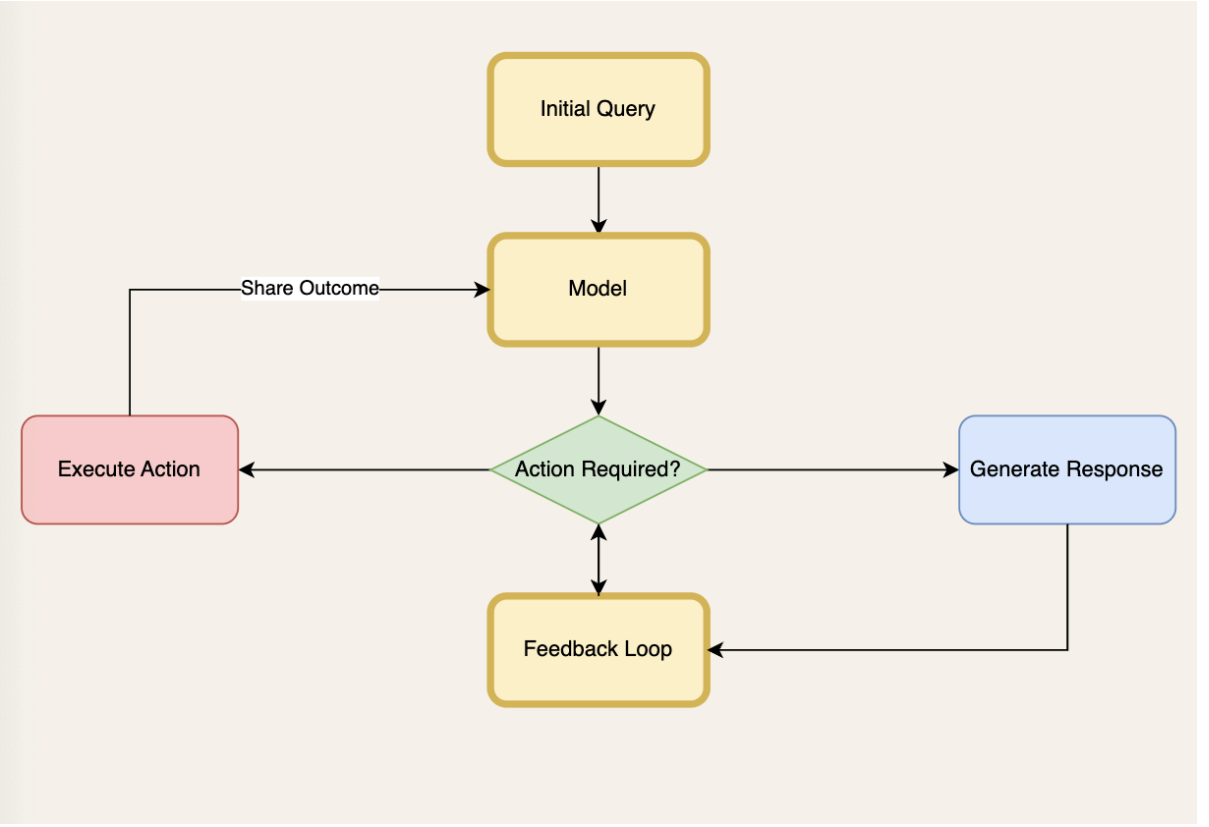

Level 2: OpenAI Function Calling

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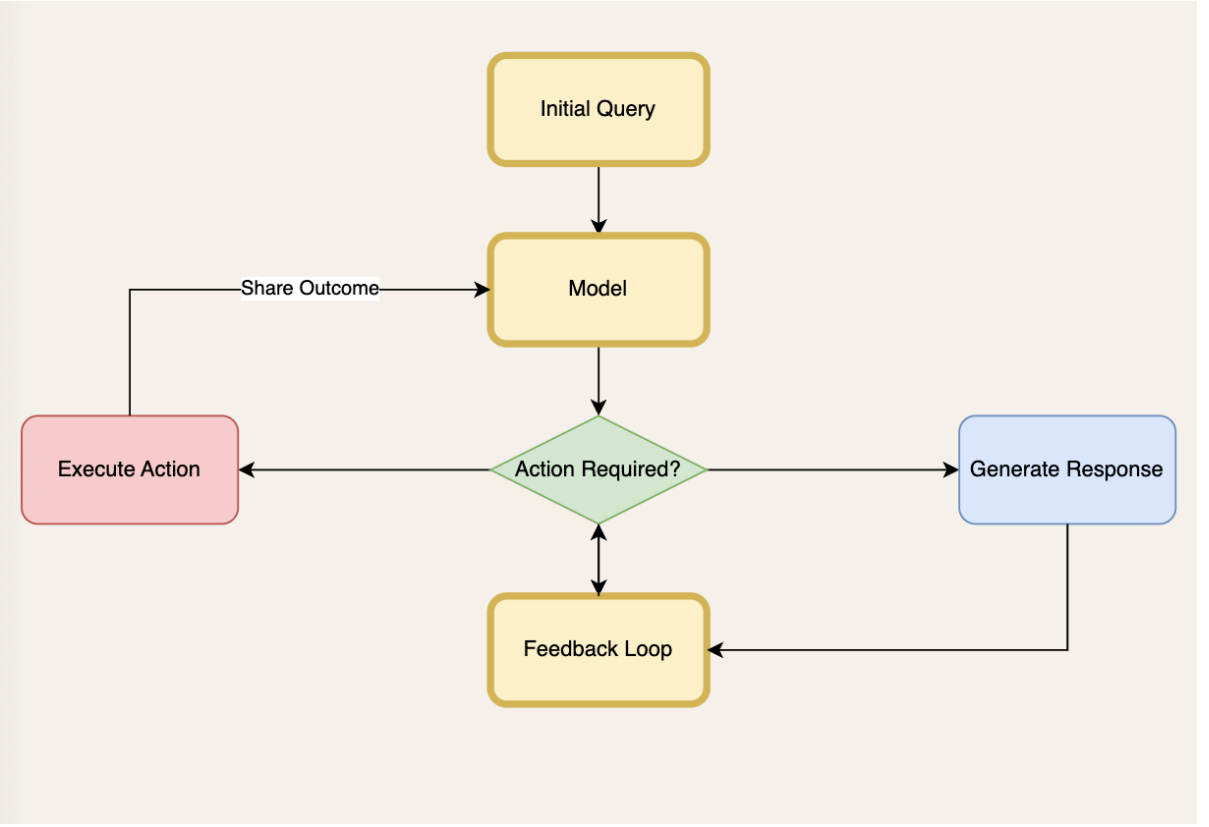

[8] OpenAI Function Calling Docs

Level 3: Autonomous Agents

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- The Agent Loop

OpenAI's Bet on a Cognitive Architecture

Q&A

Break 10 Minutes

Agents and AutoGen

How Can We Effectively Perform Tasks with Agents?

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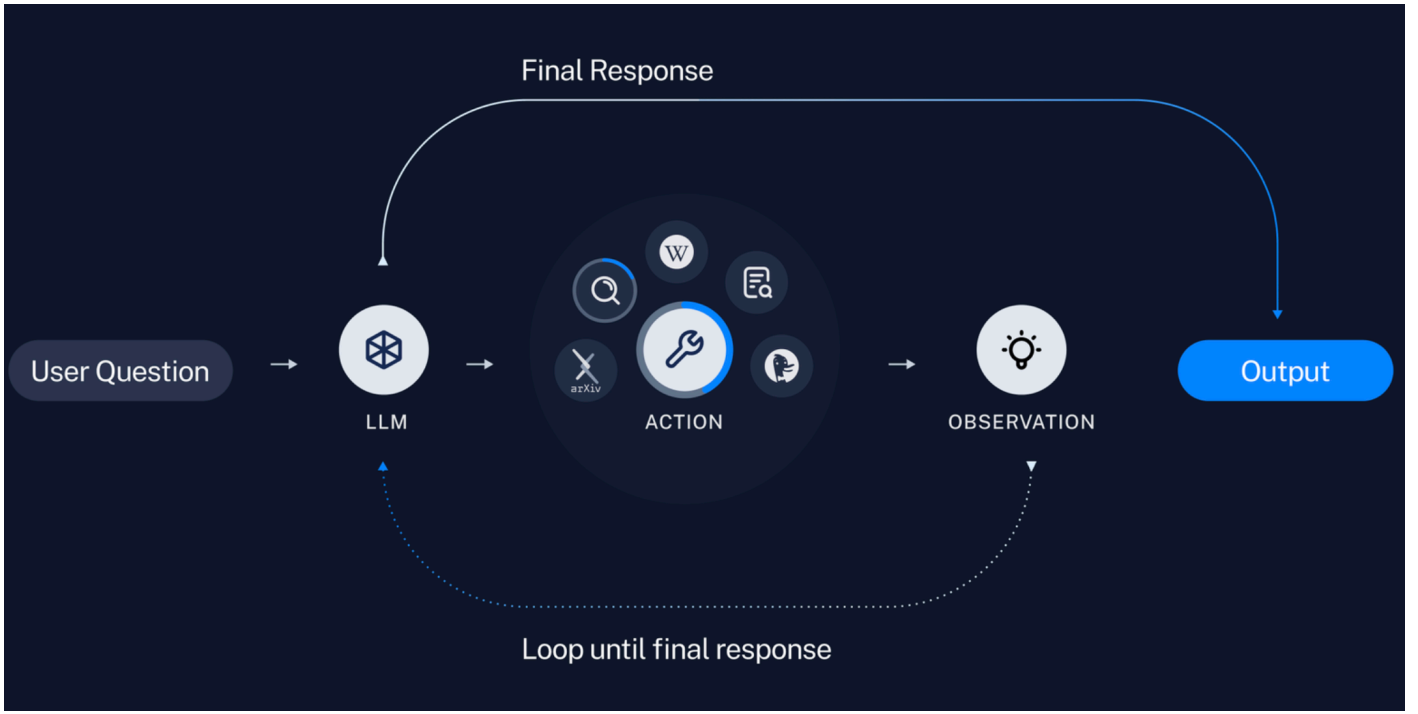
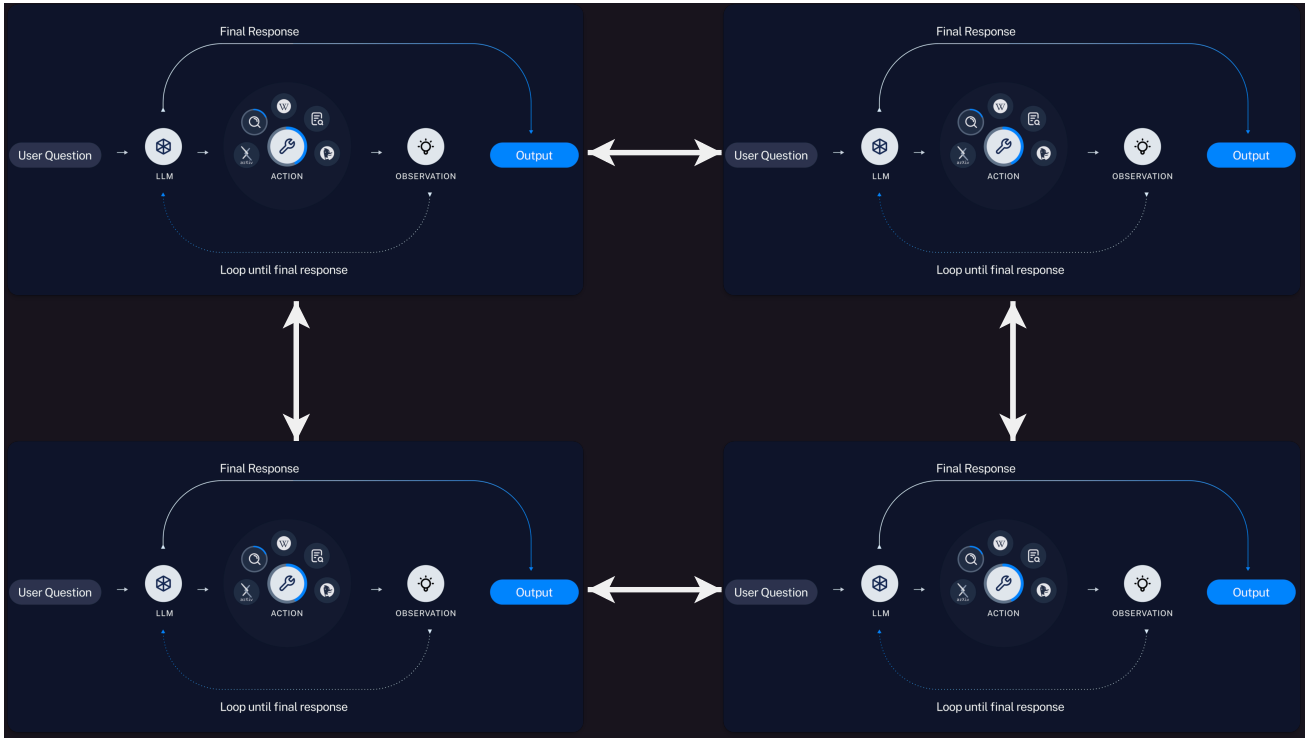


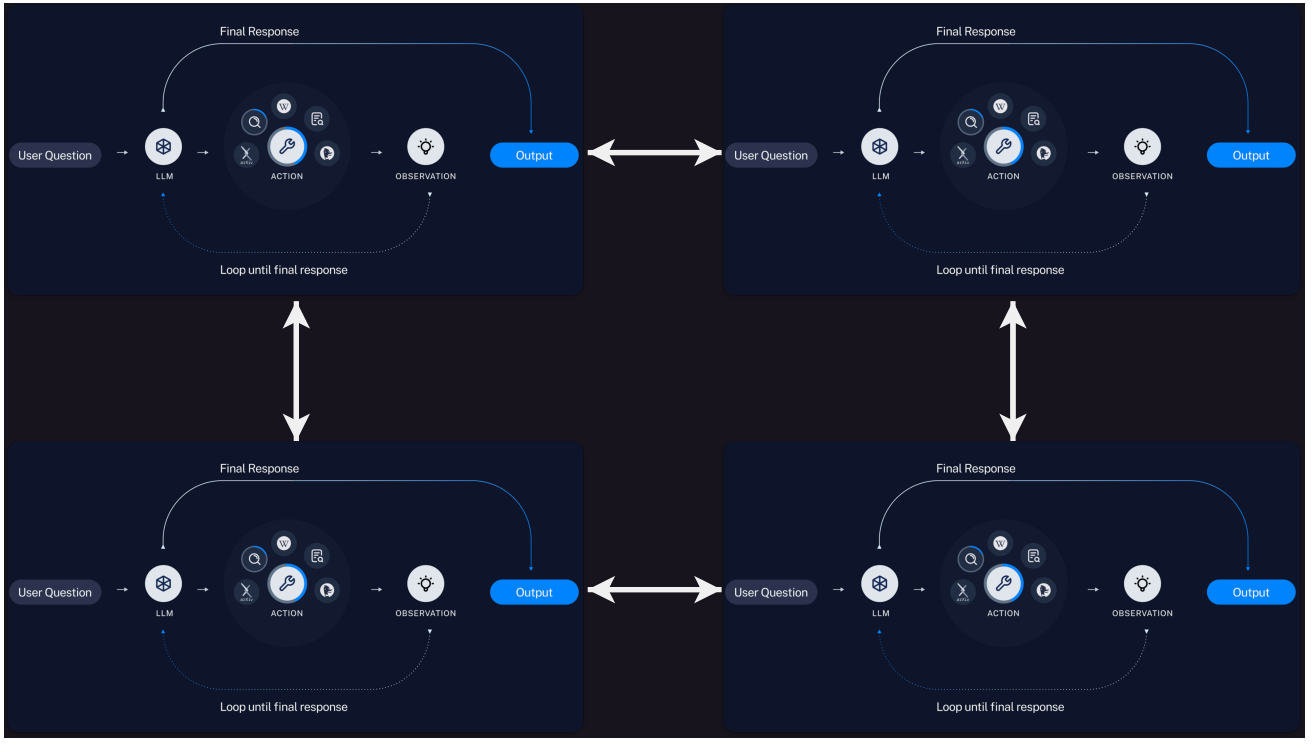
- The Agent Loop

OpenAI's Bet on a Cognitive Architecture

Good Agents Colaborate

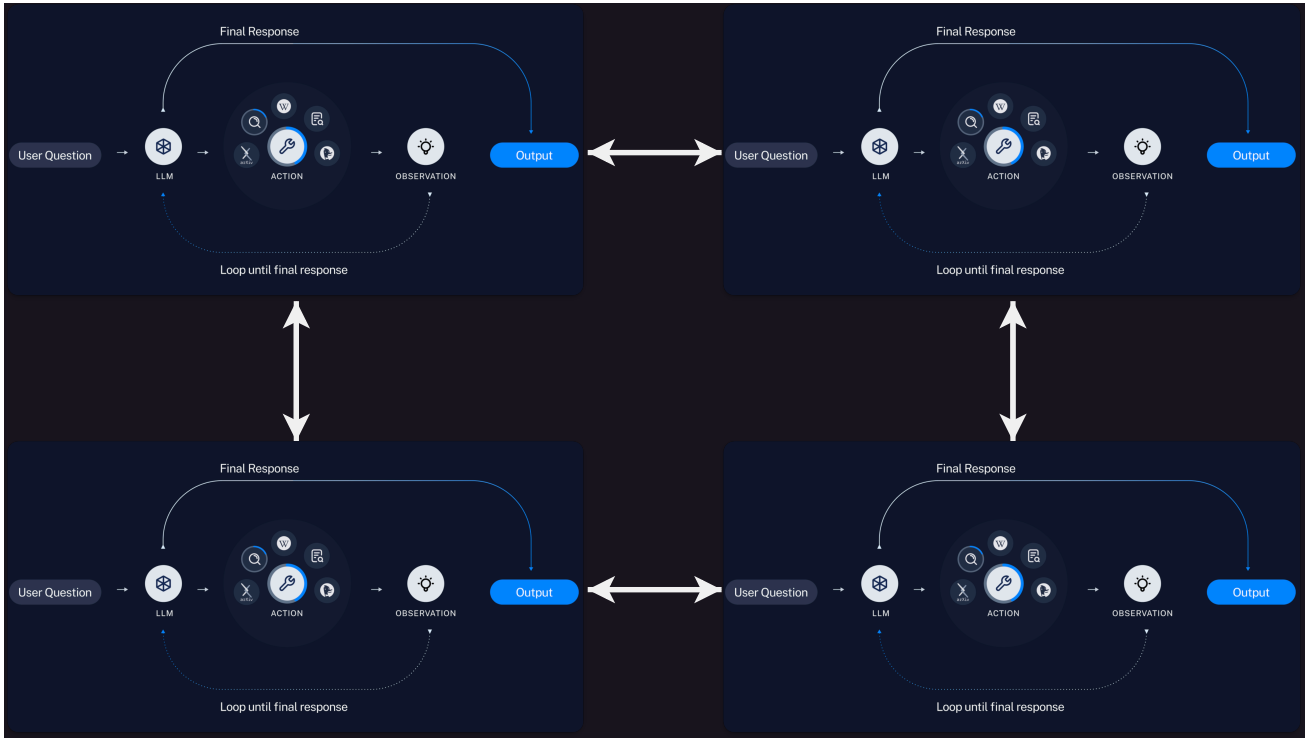


Good Agents Colaborate



- With the increasing complexity of tasks, agents need to **collaborate** to achieve their goals

Good Agents Colaborate



- With the increasing complexity of tasks, agents need to **collaborate** to achieve their goals
- AutoGen is a framework that facilitates the creation of agents that can easily collaborate through a 'conversation-centric' paradigm

What is AutoGen? (Level 4?)

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- Its main features
  - **Conversable agents**: a generic design of agents that can leverage LLMs, human input, tools or a combination of these to facilitate creating agents with different roles

What is AutoGen? (Level 4?)

- AutoGen is a framework for building agents that can collaborate through conversational patterns to accomplish tasks
- Its main features
  - **Conversable agents**: a generic design of agents that can leverage LLMs, human input, tools or a combination of these to facilitate creating agents with different roles
  - **Conversation Programming**: Programming paradigm centered around inter-agent conversations

Conversable Agents

Conversable Agents

- **Conversable**: Entity with a specific role that can pass messages to send and receive information to and from other conversable agents, e.g., to start or continue a conversation.

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- **Customizable**: Based on application-specific needs, each agent can be configured to have a mix of basic back-end types to display complex behavior in multi-agent conversations.

Conversable Agents

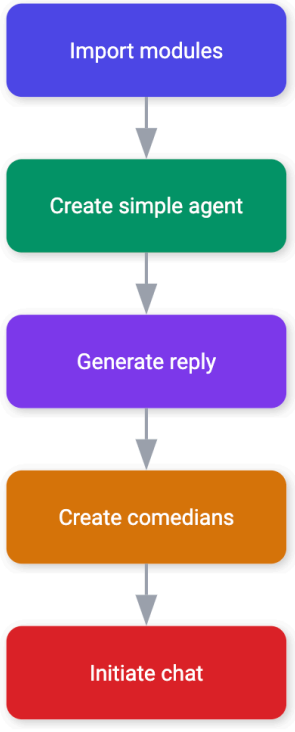
- **Conversable**: Entity with a specific role that can pass messages to send and receive information to and from other conversable agents, e.g., to start or continue a conversation.
- **Customizable**: Based on application-specific needs, each agent can be configured to have a mix of basic back-end types to display complex behavior in multi-agent conversations.
- **Example**:

```
assistant = autogen.AssistantAgent(
            name="assistant",
            llm_config=llm_config,
            )
```

Code

```
import os
from autogen import ConversableAgent

agent = ConversableAgent("chatbot",
llm_config={"config_list": [{"model": "gpt-4",
"api_key": os.environ.get("OPENAI_API_KEY")}]},
code_execution_config=False,
function_map=None,
human_input_mode="NEVER",)

reply = agent.generate_reply(messages=[{"content": "Tell me a joke.",
"role": "user"}])
print(reply)

cathy = ConversableAgent(
"cathy",
system_message="Your name is Cathy and
you are a part of a duo of comedians.",
llm_config={"config_list": [{"model": "gpt-4", "temperature": 0.9,
"api_key": os.environ.get("OPENAI_API_KEY")}]},
human_input_mode="NEVER",)

joe = ConversableAgent("joe",
system_message="Your name is Joe and
you are a part of a duo of comedians.",
llm_config={"config_list": [{"model": "gpt-4", "temperature": 0.7,
"api_key": os.environ.get("OPENAI_API_KEY")}]},
human_input_mode="NEVER",)

result = joe.initiate_chat(cathy, message="Cathy, tell me a joke.",
max_turns=5)
```

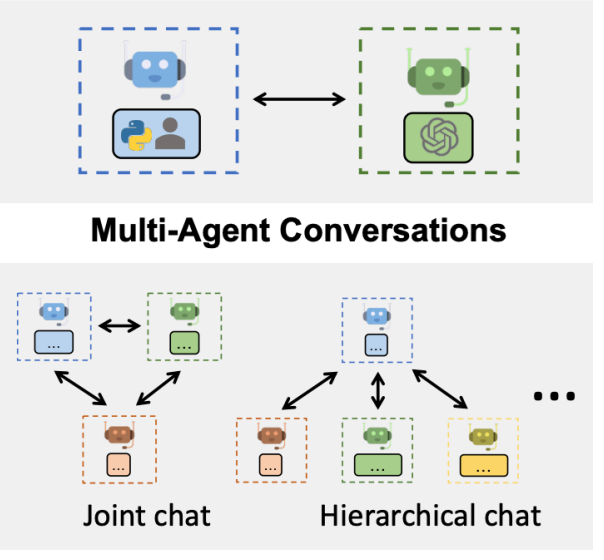
Execution Flow



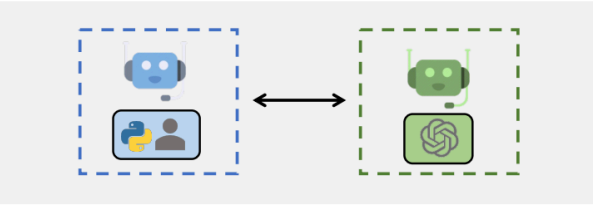
Autogen Docs

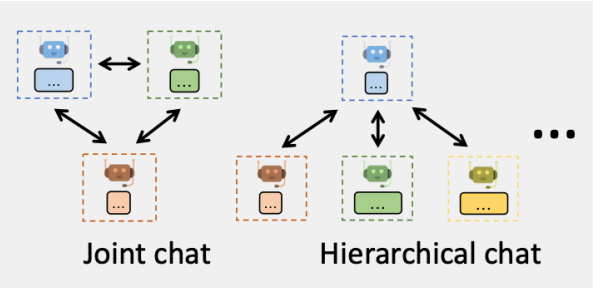
Conversation Programming

Conversation Programming



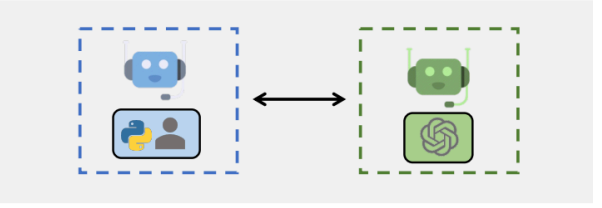
Conversation Programming

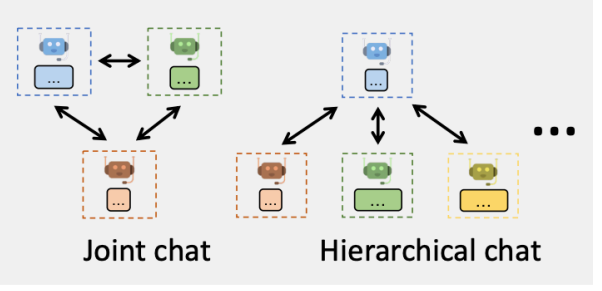




- Paradigm that blends computation and control flow within multi-agent conversations.

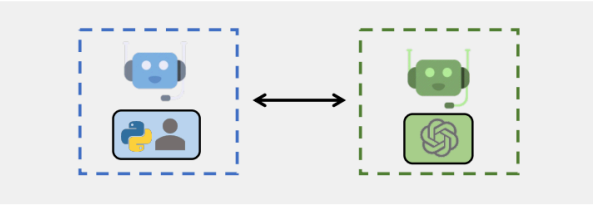
Conversation Programming

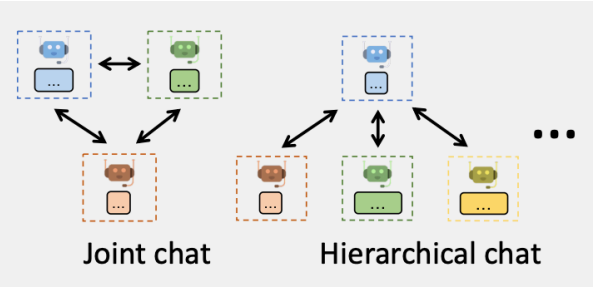




- Paradigm that blends computation and control flow within multi-agent conversations.
- Merges programming and natural language control.

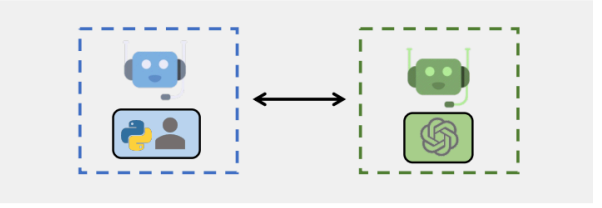
Conversation Programming

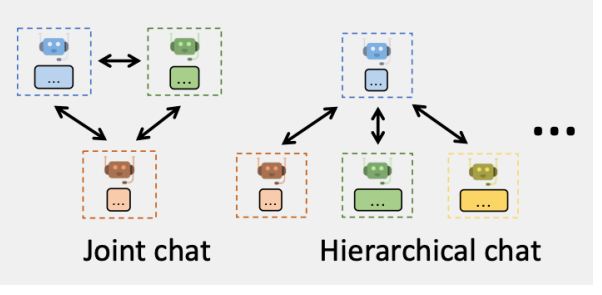




- Paradigm that blends computation and control flow within multi-agent conversations.
- Merges programming and natural language control.
- **Computation**: Role-specific, conversation-centric actions.

Conversation Programming





- Paradigm that blends computation and control flow within multi-agent conversations.
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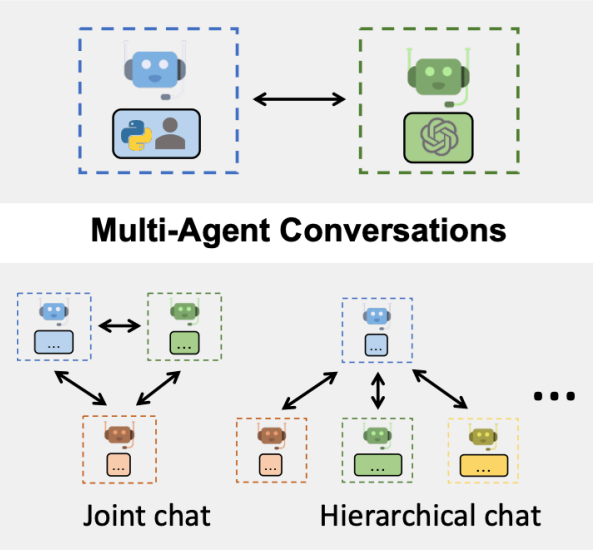
- **Control Flow**: Defined by conversation dynamics among agents.

Conversation Programming



- Paradigm that blends computation and control flow within multi-agent conversations.
- Merges programming and natural language control.
- **Computation**: Role-specific, conversation-centric actions.
- **Control Flow**: Defined by conversation dynamics among agents.
- **Efficiency**: Streamlines AI development for various skill levels.

Design Patterns

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- **Unified Interfaces**: Standardized interfaces for agent interactions.

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- **Auto-Reply**: auto-reply mechanism for continuous conversation flow.

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- Supports static and dynamic flows.

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- **Unified Interfaces**: Standardized interfaces for agent interactions.
- **Auto-Reply**: auto-reply mechanism for continuous conversation flow.

Dynamic Conversations

- Supports static and dynamic flows.
- Customizable reply functions for adaptive conversations.

Autogen Demo - Building Our First Agent

Lucas I want an easier way to get Started!

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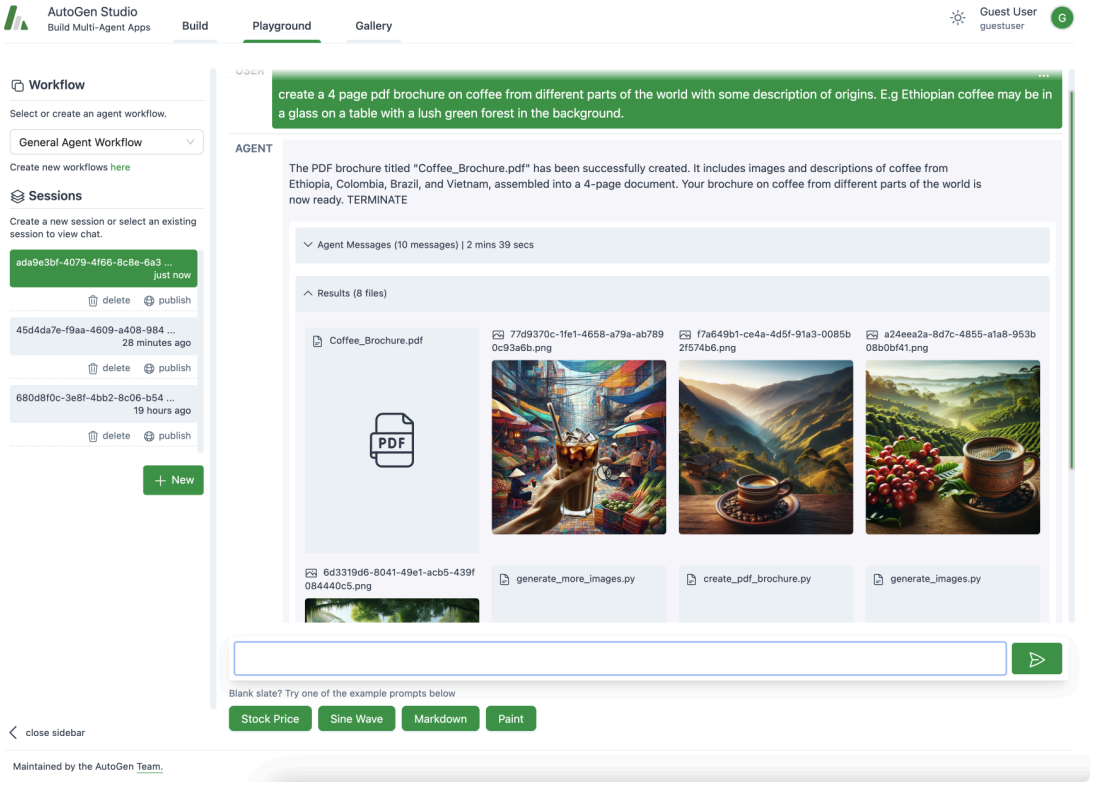
- **AutoGenStudio** is a tool that simplifies the process of building and interacting with autogen agents.



[Autogen Studio Docs]

Autogen Demo - Building a Research Assistant

Diverse Conversation Patterns

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- Pattern = *How you set up the interaction*

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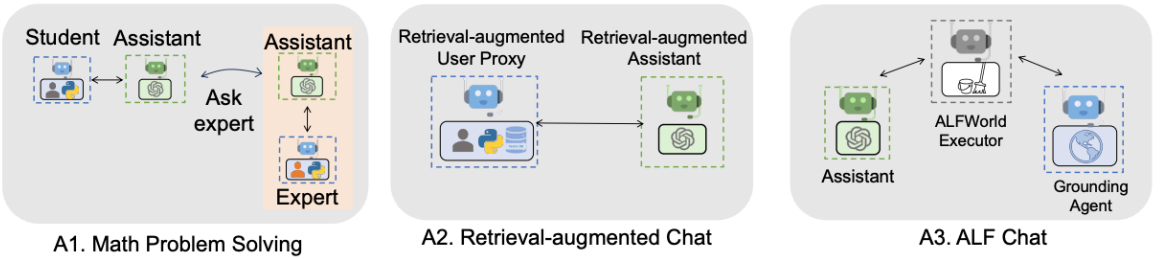

Figure 3: Six examples of diverse applications built using `AutoGen`. Their conversation patterns show `AutoGen`'s flexibility and power.

- Adaptable to different agent autonomies and topologies.

Examples of Conversation Patterns

Autogen Demo (Student - Assistant - Expert)

1. Student - Assistant - Expert

1. Student - Assistant - Expert

```
assistant = autogen.AssistantAgent(
      name="assistant",
      system_message="You are a helpful assistant.",
      llm_config={
          "timeout": 600,
          "seed": 42,
          "config_list": config_list,
      },
  )

mathproxyagent = MathUserProxyAgent(
      name="mathproxyagent",
      human_input_mode="NEVER",
      code_execution_config={"use_docker": False},
  )

math_problem = (
    "Find all $x$ that satisfy the inequality $(2x+10)(x+3)<(3x+9)(x+8)$. Express
)
mathproxyagent.initiate_chat(assistant, problem=math_problem)
```

Autogen Demo (Retrieval Augmented Chat)

2. Retrieval Augmented Chat

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```
assistant = RetrieveAssistantAgent(
    name="assistant",
    system_message="You are a helpful assistant.",
    llm_config={
        "timeout": 600,
        "cache_seed": 42,
        "config_list": config_list,
    },
)
ragproxyagent = RetrieveUserProxyAgent(
    name="ragproxyagent",
    human_input_mode="NEVER",
    max_consecutive_auto_reply=3,
    retrieve_config={
        "task": "code",
        "docs_path": [
            "https://raw.githubusercontent.com/microsoft/FLAML/main/website/docs
            "https://raw.githubusercontent.com/microsoft/FLAML/main/website/docs
            os.path.join(os.path.abspath(""), "..", "website", "docs"),
        ],
        ...
        ...
    code_execution_config=False,  # set to False if you don't want to execute th
)
assistant.reset()
code_problem = "How can I use FLAML to perform a classification task and use spa
ragproxyagent.initiate_chat(assistant, problem=code_problem, search_string="spar
```

Autogen Demo (Writer - Commander - Safeguard)

3. Writer - Commander - Safeguard (multi-agent coding)

3. Writer - Commander - Safeguard (multi-agent coding)

```
assistant = autogen.AssistantAgent(
    name="assistant",
    llm_config={
        "cache_seed": 42,  # seed for caching and reproducibility
        "config_list": config_list,  # a list of OpenAI API configurations
        "temperature": 0,  # temperature for sampling
    },  # configuration for autogen's enhanced inference API which is compatible
)
# create a UserProxyAgent instance named "user_proxy"
user_proxy = autogen.UserProxyAgent(
    name="user_proxy",
    human_input_mode="NEVER",
    max_consecutive_auto_reply=10,
    is_termination_msg=lambda x: x.get("content", "").rstrip().endswith("TERMINA
    code_execution_config={
        "work_dir": "coding",
        "use_docker": False,  # set to True or image name like "python:3" to use
    },
)
# the assistant receives a message from the user_proxy, which contains the task
user_proxy.initiate_chat(
    assistant,
    message="""What date is today? Compare the year-to-date gain for META and TE
)
```

Autogen Demo (Dynamic Group Chat)

4. Dynamic Group Chat

4. Dynamic Group Chat

```
llm_config = {"config_list": config_list_gpt4, "cache_seed": 42}
user_proxy = autogen.UserProxyAgent(
    name="User_proxy",
    system_message="A human admin.",
    code_execution_config={"last_n_messages": 2, "work_dir": "groupchat"},
    human_input_mode="TERMINATE",
)
coder = autogen.AssistantAgent(
    name="Coder",
    llm_config=llm_config,
)
pm = autogen.AssistantAgent(
    name="Product_manager",
    system_message="Creative in software product ideas.",
    llm_config=llm_config,
)
groupchat = autogen.GroupChat(agents=[user_proxy, coder, pm], messages=[], max_rou
manager = autogen.GroupChatManager(groupchat=groupchat, llm_config=llm_config)
user_proxy.initiate_chat(
manager, message="Find a latest paper about gpt-4 on arxiv and find its potential
)
```

Break 10 minutes

Recipe for Building AutoGen Agent Workflows

Step 1: Prepare Agent Configurations

- Config path with model name & API key
- Default configuration for each agent

```
config_file_or_env = './OAI_CONFIG_LIST'  # modify path
default_llm_config = {
  'temperature': 0
}
```

Step 2: Creating AgentBuilder Instance

- Create `AgentBuilder` instance
  - Use configuration path & default config
  - Specify builder & agent models

```
from autogen.agentchat.contrib.agent_builder import AgentBuilder
builder = AgentBuilder(config_file_or_env=config_file_or_env, builder_model='gpt-4
```

Step 3: Specifying the Building Task

- Define building task with description & examples
  - Helps build manager decide on agents
  - Example Task: "Create a multi-agent system for task X"

```
building_task = "Find a paper on arxiv about artificial intelligence,
and analyze its application in some domain. For example, find a latest
paper about gpt-4 on arxiv and find its potential applications in
software."
```

Step 4: Building Group Chat Agents

- Use `build()` method to generate agents
- Include a user proxy for tasks involving coding
  - `agent_list, agent_configs = builder.build(building_task, default_llm_config, coding=True)`

```
agent_list, agent_configs = builder.build(building_task, default_llm_config,
coding=True)
```

Step 5: Executing the Task

- Agents collaborate in a group chat to complete task
- Combine LLMs, human inputs, and tools
- Example: `start_task(execution_task, agent_list, llm_config)`

```
import autogen
def start_task(execution_task: str, agent_list: list, llm_config: dict):
    config_list = autogen.config_list_from_json(config_file_or_env, filter_dict={"

    group_chat = autogen.GroupChat(agents=agent_list, messages=[], max_round=12)
    manager = autogen.GroupChatManager(
        groupchat=group_chat, llm_config={"config_list": config_list, **llm_config
    )
    agent_list[0].initiate_chat(manager, message=execution_task)

start_task(
    execution_task="Find a recent paper about gpt-4 on arxiv and find its potentia
    agent_list=agent_list,
    llm_config=default_llm_config
)
```

source: AutoGen Blog

Step 6: Clearing Agents & Saving Configurations

- Clear agents post-task if next task differs
- Save information of built group chat agents

```
builder.clear_all_agents(recycle_endpoint=True)
saved_path = builder.save()
```

- Configurations will be saved in JSON format like such:

```
// FILENAME: save_config_TASK_MD5.json
{
"building_task": "Find a paper on arxiv about artificial intelligence,
and analyze its application in some domain. For example, find a latest
paper about gpt-4 on arxiv and find its potential applications in
software." ,
"agent_configs": [
{
    "name": "...",
    .....
},
...
],
"manager_system_message": "...",
"code_execution_config": {...},
"default_llm_config": {...}
}
```

Autogen Demo - Agent Builder Recipe

Autogen Demo - Inserting AutogenStudio into the Workflow

Autogenstudio Demo - Local LLMs

Autogen Demo - Building a Research Assistant

Autogen Demo - Personal Assistant

Conclusion and Q&A

References

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