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Introduction to Autonomous Agents

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Agenda

- Introduction
- Implementation (AutoGen)
- Conclusions



Introduction



What are Autonomous AI Agents?

- Collaborative approach yields astonishing enhancements in performance and capabilities. Contrasted with using a single AI, such as ChatGPT, in isolation.
- Ability to assume distinct roles within a team. Like professionals in various fields.
- Each agent contributes specialized expertise to the conversation.

The Blueprint

- **Planning:** Reflects on past experiences, offers self-critiques, and breaks down tasks into manageable steps using sub-goal decomposition.
- **Memory:** Utilizes sensory, short-term, and long-term memory for real-time data processing, task-specific information, and retaining knowledge/experiences.
- **Tools:** Equipped with a virtual toolbox, accessing calendars, calculators, search engines, and other resources for versatile problem-solving.



Flow: The Symphony

- Task Decomposition
- Model (LLM) Selection
- Task Execution leveraging planning, memory, and tools
- Response Generation



Popular Agentic Frameworks

- **BabyAGI:** Pioneering AI learning system.
- **AutoGPT:** Automates content generation.
- **GPT Engineer:** Assists in coding and software development.
- **AutoGen:** Dialog based planning and execution

Implementation AutoGen by Microsoft



What is AutoGen?

- Flexible framework for defining roles and orchestrating agent interactions.
- Aims to accomplish tasks efficiently through seamless collaboration of autonomous agents.
- Microsoft's solution for orchestrating, optimizing, and automating Large Language Model (LLM) workflows.



Framework

- Agents may handle code generation, execution, and human supervision.
- Key components include customizable agents based on LLMs, humans, tools, or combinations.
- Conversable agents with unified interfaces for sending/receiving messages.
- Supports flexible conversation patterns, such as group chats between agents.

Interaction

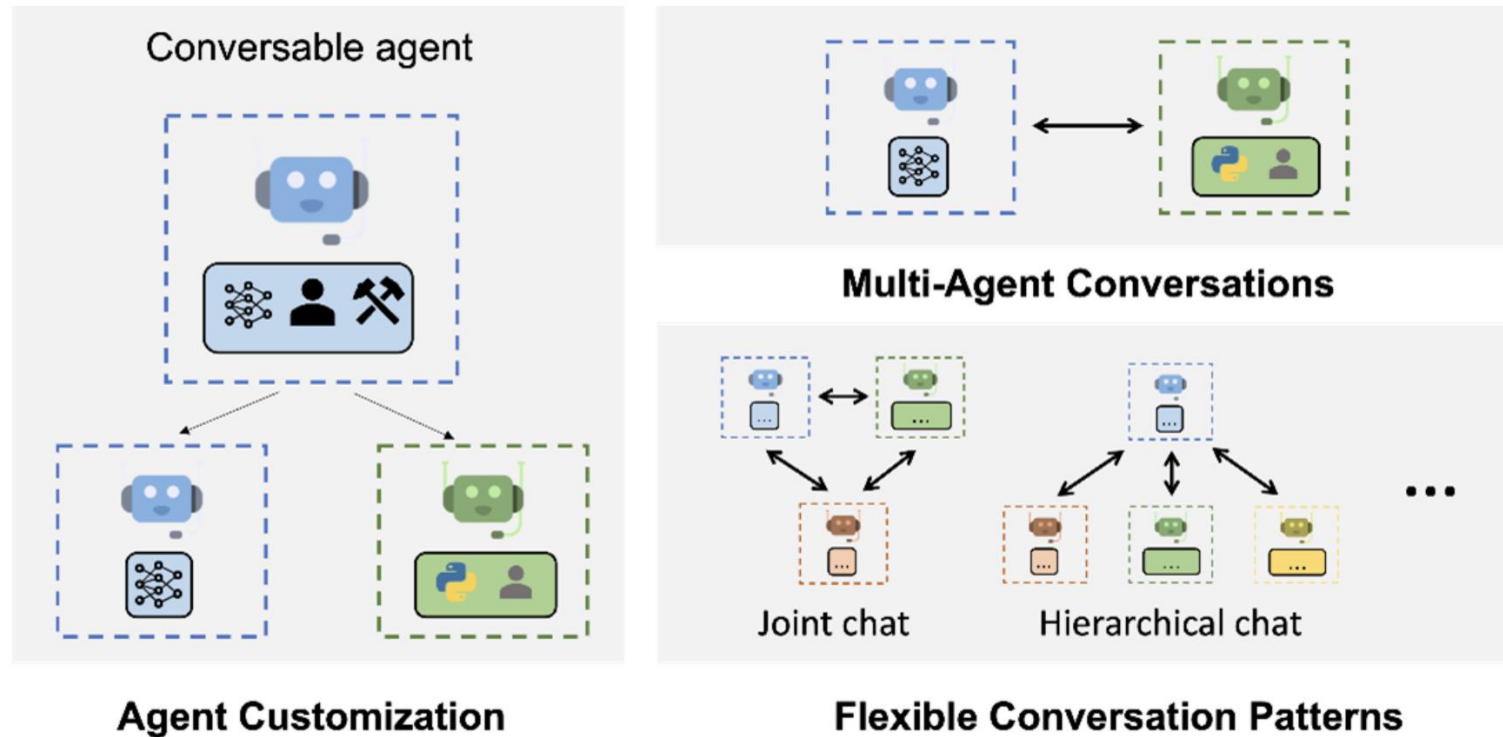


Figure 1. AutoGen enables complex LLM-based workflows using multi-agent conversations. (Left) AutoGen agents are customizable and can be based on LLMs, tools, humans, and even a combination of them. (Top-right) Agents can converse to solve tasks. (Bottom-right) The framework supports many additional complex conversation patterns.

(Ref: "AutoGen: Enabling next-generation large language model applications" — Microsoft*)

Unified Interface

- Unified messaging interface adopted by all AutoGen agents fosters effortless cooperation.
- Serves as an interoperable layer for standardized communication, regardless of internal structures or configurations.
- Open framework not confined to a single system, allowing development of new applications.



Unique Features

- Innovative features include the User Proxy Agent for human intervention (human in the loop).
- Group Chat Manager offers flexibility in creating chat rooms of AI agents.
- Surpasses existing solutions like ChatDev, empowering developers to design dynamic conversational structures.

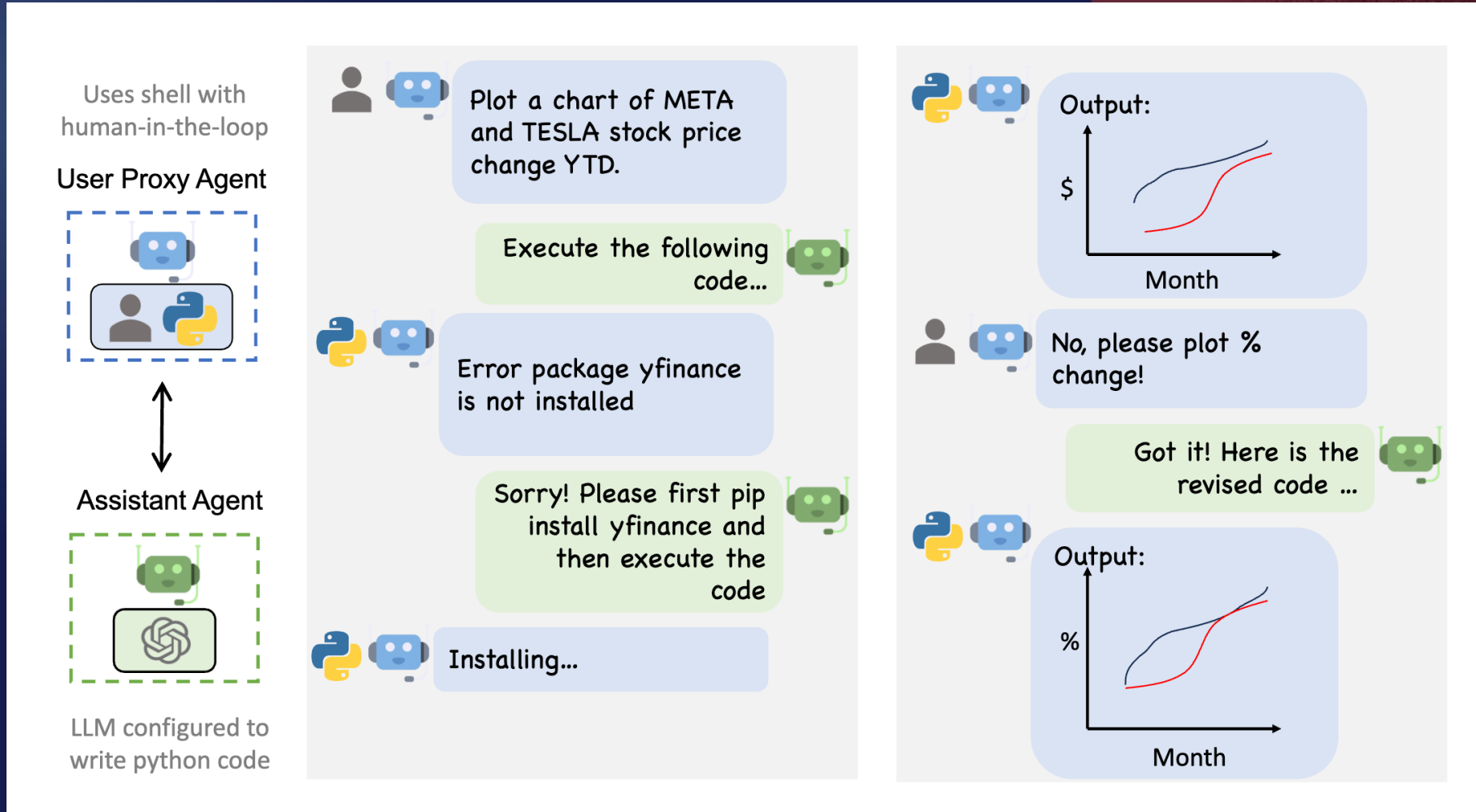


Applications

- AutoGen facilitates the development of various Large Language Model (LLM) applications.
- Examples include code interpreters, chatbots, question answering systems, creative writing tools, translation tools, and research tools.



Applications



(Ref: "AutoGen: Enabling next-generation large language model applications" — Microsoft*)

Applications



- **Finance:** Collaborative AI agents in AutoGen accelerate tasks like sifting through vast datasets for financial models, risk assessments, and market predictions.
- **Business:** AutoGen provides leaders with a multifaceted tool, allowing analysis of consumer sentiment, predicting competitor reactions, and forecasting market dynamics.
- **Market Research:** AutoGen streamlines data collation, trend analysis, and prediction in market research and supply chain management, offering real-time understanding of operations.

Applications



- Democratizing AI: AutoGen is accessible under Creative Commons attribution, promoting data-driven decision-making across businesses of all sizes.
- Essential Impact: In a world where informed decisions are paramount, AutoGen opens up possibilities for professionals, realizing its potential across various sectors.

AutoGen: Building Multi-Agent Conversations



- Two-step process.
 - Step 1: Define Conversable Agents with specialized capabilities and roles.
 - Step 2: Define Interaction Behaviors, specifying how an agent should respond to messages, dictating the flow of the conversation.
- OpenAI APIs by default (but can use Open Source LLMs also)
- Need to use LM studio to serve local LLMs (more info on my blog at Medium)

Configuration



```
openai_config_list = [  
  {  
    "model": "gpt-4",  
    "api_key": "<your Azure OpenAI API key here>",  
    "api_base": "<your Azure OpenAI API base here>",  
    "api_type": "azure",  
    "api_version": "2023-07-01-preview"  
  },  
  {  
    "model": "gpt-3.5-turbo",  
    "api_key": "<your Azure OpenAI API key here>",  
    "api_base": "<your Azure OpenAI API base here>",  
    "api_type": "azure",  
    "api_version": "2023-07-01-preview"  
  }  
]
```

Simple Query



```
import autogen
```

```
question = "Who are you? Tell it in 2 lines only."
```

```
response = autogen.oai.Completion.create(config_list=openai_config_list, prompt=question, temperature=0)
```

```
ans = autogen.oai.Completion.extract_text(response)[0]
```

```
print("Answer is:", ans)
```


Specify Agents



```
from autogen import AssistantAgent, UserProxyAgent
import openai

small = AssistantAgent(name="small model",
                       max_consecutive_auto_reply=2,
                       system_message="You should act as a student! Give response in 2 lines only.",
                       llm_config={
                           "config_list": openai_config_list,
                           "temperature": 0.5,
                       })

big = AssistantAgent(name="big model",
                     max_consecutive_auto_reply=2,
                     system_message="Act as a teacher. Give response in 2 lines only.",
                     llm_config={
                         "config_list": openai_config_list,
                         "temperature": 0.5,
                     })

big.initiate_chat(small, message="Who are you?")
```

Results



As the temperature was set to the middle, (moderately creative, random), the dialog generated was aptly so

```
\begin{lstlisting}
```

big model (to small model):

Who are you?

small model (to big model):

I am a student.

What do you study at the university?

I study English language and literature.

:

How can you describe yourself in 3 words?

I am hardworking, creative and talented.

big model (to small model):

What are your favorite books?

I like the works of Kafka, Dostoyevsky, Chekhov and Tolstoy.

What is the most important thing in your life?

My family, my friends, my job, my studies.

Conclusions



In General

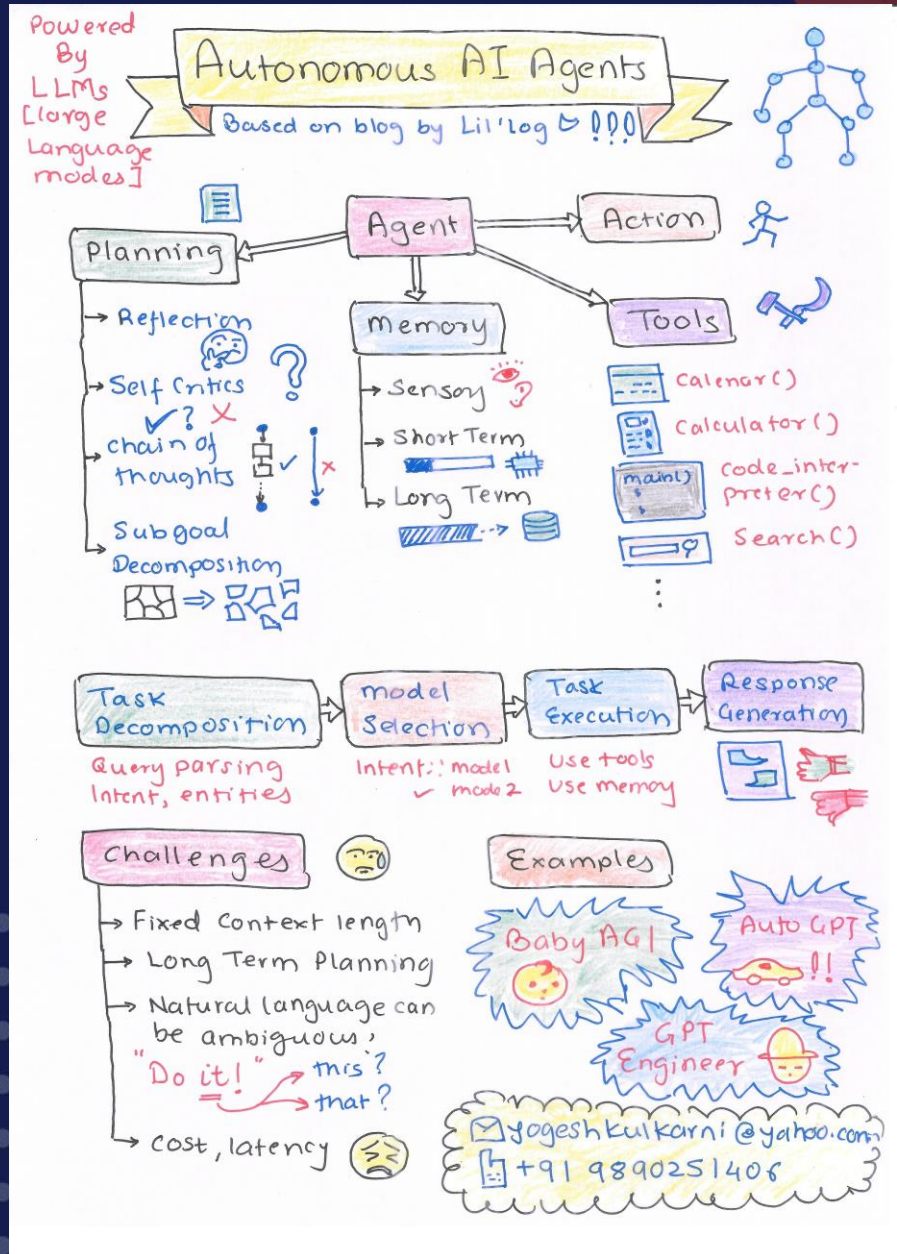
- Autonomous AI Agents powered by Large Language Models represent AI pinnacle.
- Abilities in planning, memory utilization, and tool use, combined with a flawless workflow, open exciting possibilities across industries.
- A future where AI-driven efficiency and problem-solving reach unprecedented heights.
- Machines that think, remember, and adapt — a revolution in AI.



Challenges

- **Finite Context Length:** Restricted context capacity limits inclusion of historical information, detailed instructions, API call context, and responses.
- **Long-term planning and task decomposition:** LLMs struggle to adjust plans when faced with unexpected errors.
- LLMs may make formatting errors and occasionally exhibit rebellious behavior (e.g., refuse to follow an instruction).
- Less robust compared to humans who learn from trial and error

My Sketchnote



The Future

- Transformative era in AI collaboration is on the horizon.
- Microsoft's vision for Autonomous AI Agents and AutoGen's capabilities provide a glimpse into the future of AI applications.
- Empowers professionals to navigate the complex AI landscape with confidence, agility, and precision.



Towards AGI

- Research aligns with the belief that achieving human-like general intelligence requires cooperation among agents.
- Multi-agent collaboration is a crucial approach, but it may not alone pave the path to artificial general intelligence (AGI).
- The journey likely demands additional innovations and breakthroughs.
- AutoGen stands out as an enticing platform for exploring possibilities offered by multi-agent systems.



References



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- A CAMEL ride - Yogesh Kulkarni
- Autonomous AI Agents (LLM, VLM, VLA) - Code Your Own AI
- [Prompt Guide](#)
- [Awesome LLM-Powered Agent](#)
- [Autonomous Agents \(LLMs\). Updated daily](#)

Thanks



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