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NUS National University of Singapore | NExT++ | 中国人民大学 RENMIN UNIVERSITY OF CHINA | 高瓴人工智能学院 Gaoling School of Artificial Intelligence

Large Language Model Powered Agents in the Web

Tutorial at SIGIR 2024 in Washington D.C.

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Resources

- Tutorial Website:
  - Slides
  - Videos
  - Future updates

Outline

- Part 1: Introduction of LLM-powered Agents
- Part 2: LLM-powered Agents with Tool Learning
- Part 3: LLM-powered Agents in Social Network
- Part 4: LLM-powered Agents in Recommendation
- Part 5: LLM-powered Conversational Agents
- Part 6: Open Challenges and Beyond

Motivation - Artificial General Intelligence (AGI)

LLMs are not AGI

Aim of AGI

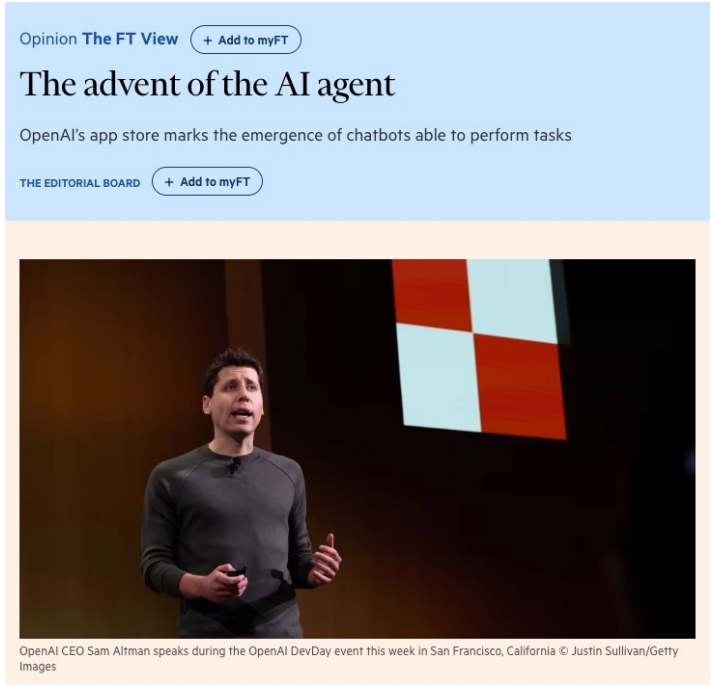
- **Large LLMs** exhibit characteristics of **artificial general intelligence (AGI)**, which has **cognitive abilities** similar to that of human.
- In other words, AI can now perform most functions that humans are capable of doing.

Autonomous AI Agents

What is AI Agent? Why it is important?

AI Agents

- **LLM-powered Agents** are artificial entities that **enhance LLMs** with **essential capabilities**, enabling them to sense their environment, make decisions, and take actions.



- **Sam Altman** (Former CEO of OpenAI) himself said in his keynote: *"GPTs and Assistants are **precursors** to **agents**. They will gradually be able to plan and to perform more complex actions on your behalf. These are our first step toward AI Agents."*
- **Bill Gates** said in his BLOG: *"**Agents** are not only going to change how everyone interacts with computers. They're also going to **upend the software industry**, bringing about the biggest revolution in computing since we went from typing commands to tapping on icons."*
- Application:

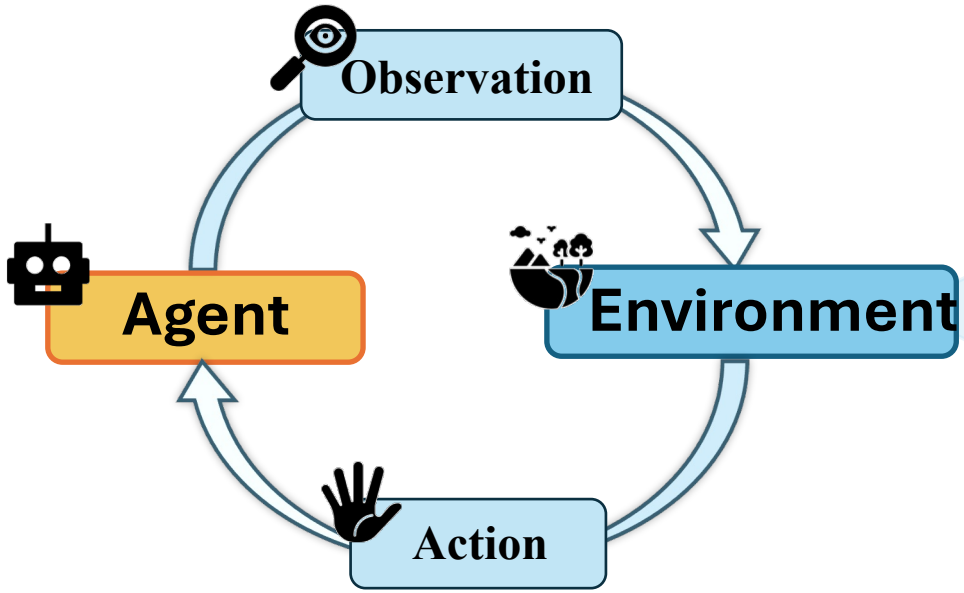
be my eyes **AI-powered visual assistance.**

News in Financial Times. " The advent of the AI agent" .
GatesNotes. "The Future of Agents: AI is about to completely change how you use computers".

The Framework of LLM-powered Agents

From LLM to AI Agent

- This paves the way for the use of AI agents to simulate users and other entities, as well as their interactions.



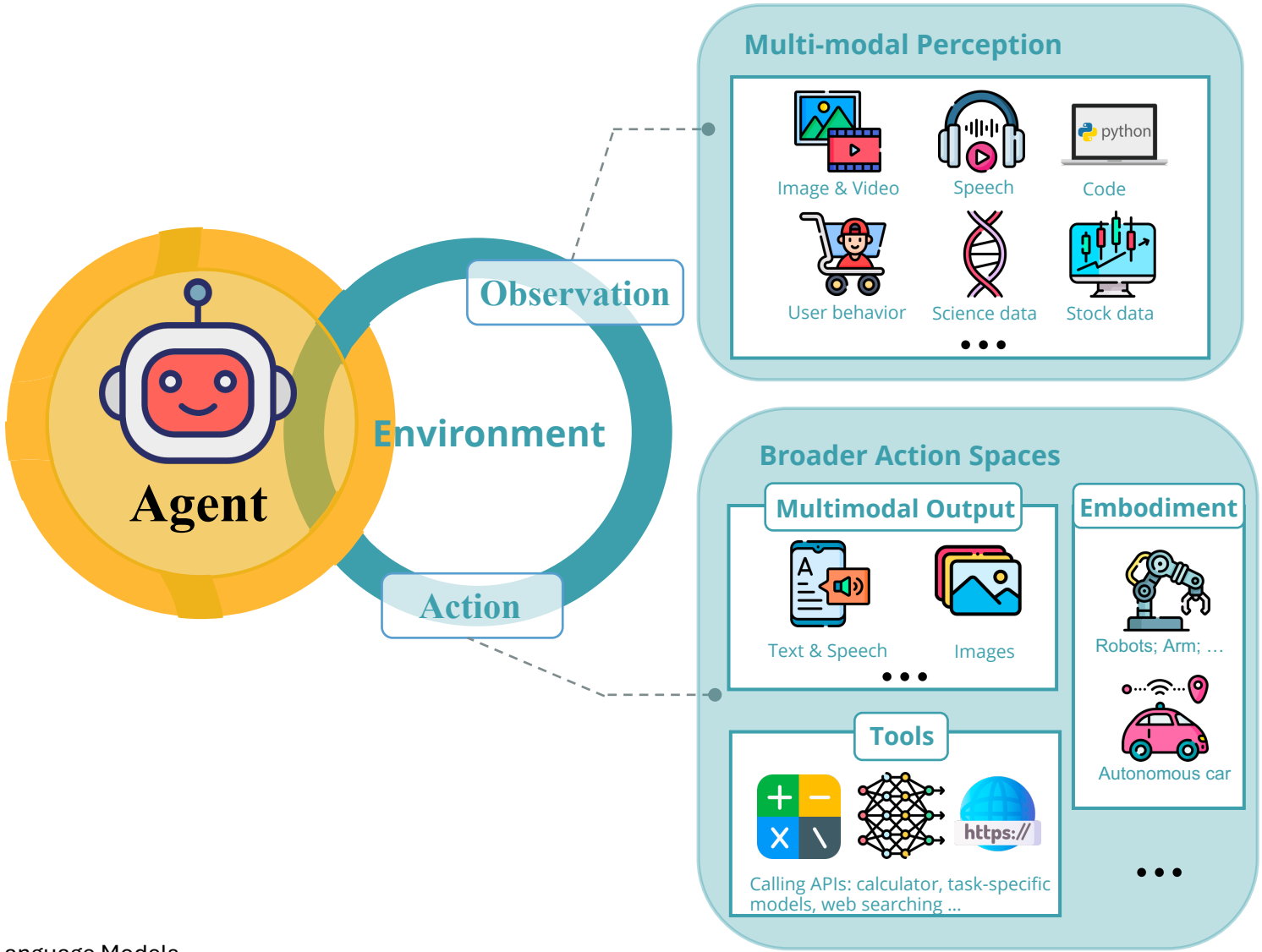
Environment

- The external **context** or **surroundings** in which the agent operates and makes decisions.
- Human & Agents' behaviors
- External database and knowledges

- Virtual & Physical environment

The Framework of LLM-powered Agents

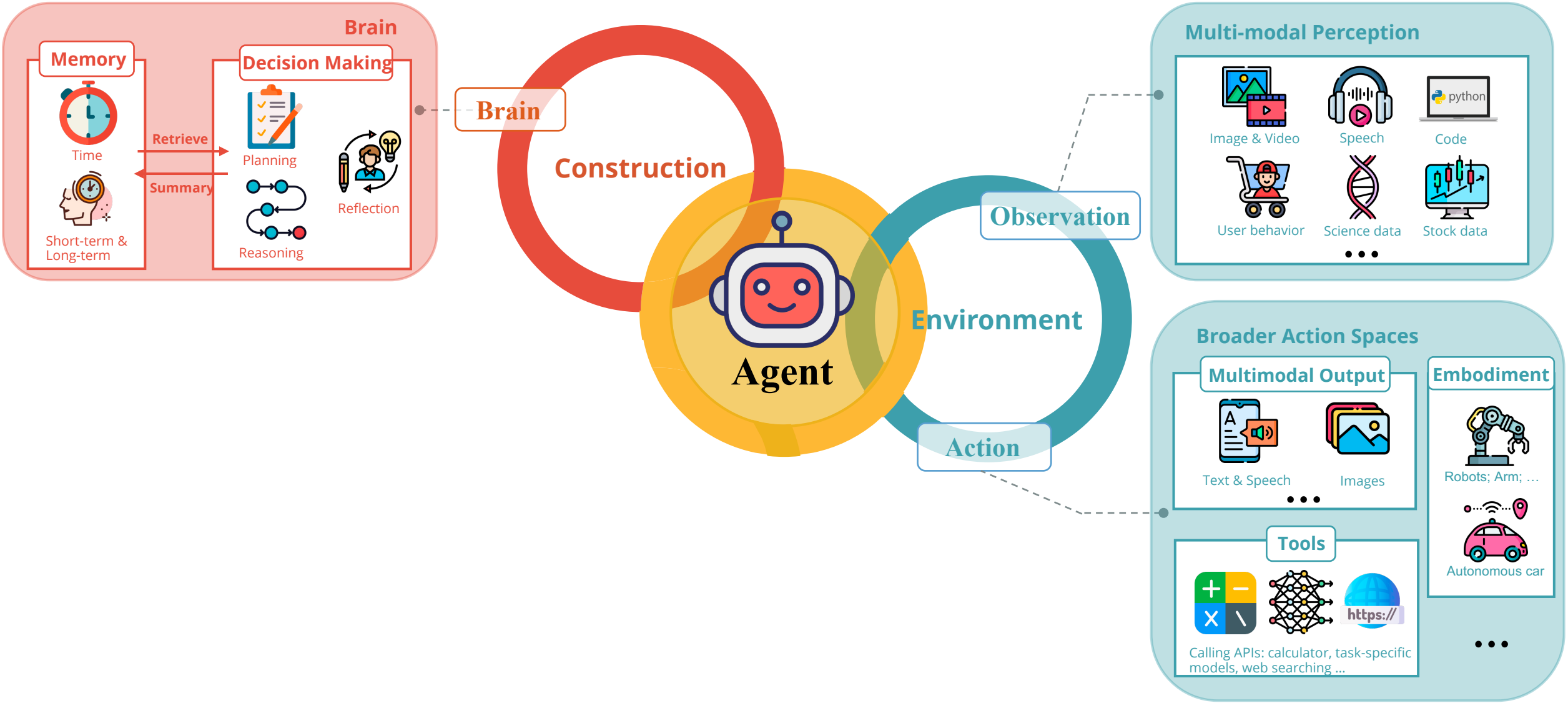
Observation & Action



Guanzhi Wang et al., Voyager: An Open-Ended Embodied Agent with Large Language Models.

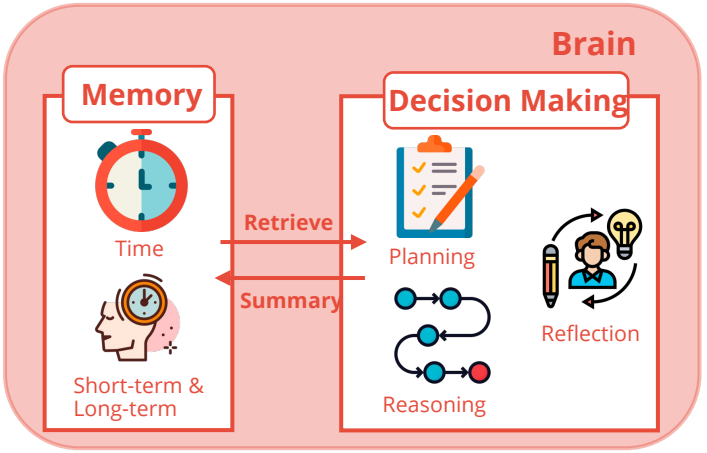
The Framework of LLM-powered Agents

Brain



The Framework of LLM-powered Agents

Brain



- **Memory:** "memory stream" stores sequences of agent's past observations, thoughts and actions:
  - Sufficient space for long-term and short-term memory;
  - Abstraction of long-term memory;
  - Retrieval of past relevant memory;

- **Decision Making Process:**
  - **Planning: Subgoal** and **decomposition**: Able to break down large tasks into smaller, manageable subgoals, enabling efficient handling of complex tasks.
  - **Reasoning:** Capable of doing **self-criticism** and **self-reflection** over past actions**, learn from mistakes** and **refine** them for future steps, thereby improving the quality of final results.
- Personalized memory and reasoning process foster **diversity** and **independence** of AI Agents.

The Framework of LLM-powered Agents

Overview