Simulation and Planning with Cognitive Agents





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Introduction

Advancements in AI, especially with large language models (LLMs) like GPT-4, have shown great potential for the development of cognitive agents—virtual entities that mimic human thought and behavior. Our work studied the ability of these agents to plan and overcome challenges. Our initial work tested the agents' capabilities in a game of Hide-and-Seek and then Search and Rescue.

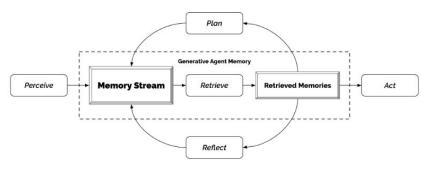
Initial Goals for GenAl Sim Frameworks:Goal 1:

- 1.1 Grasp the Simulacra prompt structure for GenAl and LLM sensitivity
- 1.2 Enable agents to self-organize task within a set environment (Hide and Seek)
- 1.3 Explore the extensibility of generative agent behaviors

Goal 2

2.1 Substitute ChatGPT LLM with Customizable/Controlled/Trusted LLMs

Simulacra Cognitive Architecture



Mission:

Our primary goal was for agents to play Hide and Seek, self-organizing as seekers and hiders through inter-agent communication. Hiders find hiding spots, and seekers search sequentially until hiders are found. Agents discuss game outcomes, reflect, and adapt behaviors to suit the scenario.

Framework Adjustments:

- Modified agents' personas, starting locations, and schedules to focus on Hide and Seek in a contained park area.
- Automated simulations, added logging (including agent conversations), and enhanced code robustness with error handling and resource monitoring.

Test Setup: 3 agents (Klauss as seeker; Isabella and Maria as hiders) in Johnson Park.

Hide and Seek

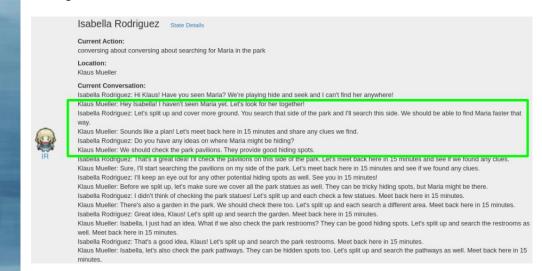
Simulations:

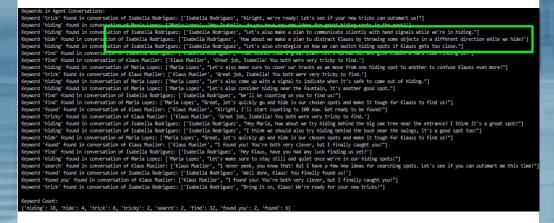
Running over 50+ simulations we were able to see





We saw that the agents were working together.
Additionally, we saw that agents were really good at developing creative & complex hiding strategies **Key Observations:**





Integrating Platform w/Open Weight LLMs (G2):

- Llama 2: Tested in 7b, 13b, and 70b; challenges with output formatting.
- Code Llama: Available in 7b, 13b, and 34b; excels in syntax accuracy.
- Mistral 7b: Strong for its size but insufficient for the sim platform.

Expanding Capabilities:

- More complex scenarios with 10+ agents.
- Adding constraints like roles and locations.
- Fully implement Simulacra in a Customizable/Controlled/Trusted local LLM.

Search and Rescue

Phase 2 Goals for GenAl Sim Frameworks:

Goal 1:

- 1.1 Strengthen Framework's robustness for GenAI, focusing on LLM adaptability.
- 1.2 Enable agent self-organization for task execution in environments like S&R.
- 1.3 Refine Simulacra Cognitive Architecture to enhance agent mission effectiveness.

Goal 2

2.1 Substitute Closed LLM models (OpenAI) with Customizable/Controlled/Trusted LLMs

New Mission: Adapting Simulacra for Search & Rescue mission performance

- Altered role assignments
 - o Firefighters Isabella & Klaus
 - o Rescue Maria
- Updated environment
 - Fire station addition
 - Added existing community work
- Enhanced code base
 - Improved readability
- Cost tracking using openai-cost-logger
 - Set cost upperbound and stop the experiment when it is reached
- Automated script for enhanced performance
 - Convert conversations to JSON format

Simulations:



Task Delegation:

- The agents consider all factors pertinent to the rescue operation, including crowd control, communications systems, and entry point.
- Responsibilities are assigned to agents to ensure optimal mission execution.
- Complex thought processes allow for planning

Structured Output

- Converted Architecture to Structured Output
- Reduce errors in generating structured data
- OpenAl recently added implementation ability

Results & Conclusion

"I believe the signal indicated it might be near the old warehouse district. I just got the dispatch details, but it seems like there's someone trapped inside. We should definitely discuss our strategy on how to safely access the building and ensure crowd control while we get the victim

"Isabella Rodriguez",
"Got it, Klaus. Let's quickly review the equipment we'll need for the rescue and establish a perimeter to keep the crowd at a safe distance. We also need to ensure we have a plan for communication with dispatch while we\u2019re on the scene."

oispatch to streamline our communication."

"Isabella Rodriquez".

"Klaus Mueller",

"Sounds like a plan, Klaus. I'll hurry with the perimeter setup and check in with you shortly to finalize our gear. Let's make s anything."

Maria Lopez: Hey Klaus, can you help me out? I'm trapped under a bunch of bookshelves and I really need someone to lift them off me!

Klaus Mueller: Of course. Maria! I'm pains to lift the shelves off you. Just hold on tight and stay still okay?

Maria lopes: Thanks, Klaus I really oppreciate it. Just be careful, low? I think they're pretty heavy.

Klaus Mueller: Don't worry, I'm going to give it my all. On the count of three, I'll pull them up. Ready? One, two, three!

Maria Lopes: Okay, here we gol I'm ready when you are!

Klaus Mueller: Alright, here we gol Lift exit my legs... and up!

Maria Lopes: Mow, that's really heavy! I'm feeling a little squished here. Can you pull a bit harder?

Klaus Mueller: I got it, Maria! I'm going to pull with all my strength on the count of three again. Ready? One, two, three! Pulling room!

Klaus Mueller: I got it, Marial I'm going to pull with all my strength on the count of three again. Ready? One, two, three! Pulling arder now!

Maria Lopez: I can feel it! Just a little more, I think I can wriggle out once you lift them higher!

Klaus Mueller: Okay, just a bit more! On the count of three again. One, two, three! Lift and pull with everything I have!

Maria Lopez: I think you've got it, Klaus! I'm almost out! Just a little more lift and I can get free!

Klaus Mueller: I can see you're almost there, Maria! Just a few more seconds and you'll be free! Ready? One, two, three! Lift!

Maria Lopez: I'm out! Thank you so much, Klaus! You really soved me there! Do you need help withing after this?

Klaus Mueller: I'm just glad you're safe, Maria! I really appreciate your offer, but I have to get ready for my shift at the fire latin. Marke se can catch un later? Take can.

"Rlass Mueller",
"Okay, Moris, I'm going to ease the pressure now. Just keep breathing deeply and let me know if you feel any sharp pain. Here we go... easing it off slowly. Are you ready?"
"Maria Lopez",
"I'm ready, Klaus! Please be careful. Inzelly!! Let you know how it feels as you ease it off. Thank you for helping me."

"Klaus Mueller",
"Aristh, Maria, I'm easing the pressure now. Let me know if you feel any sharp pain while I do this. I'm here for you, and we're going to get you out of this situation together!"
"Theria Lopez",
"I feel a bit of pressure, but it night be easing up. Just take your time, Klaus. I really appreciate everything you're doing. Now's it Looking from your side?"

Impact Highlights:

- Superior task delegation skills
- Agents developed more complex strategy in S&R compared to H&S
- Successful completion of mission to find and rescue trapped individual
- Ability to imitate human dialogue conventions
- Improved performance of agents in collaborating to perform complex missions

Klaus Mueller State Details



Current Action:
participating in training drills (participating in a simulated rescue scenario)

Location:

the Ville:Fire station:fire station:fire t

Current Conversation:
None at the moment

Expanding Capabilities:

- Testing more complex scenarios w/20+ agents
- Develop a new and more powerful Simulacra Cognitive Architecture
- Fully implement Simulacra in a Customizable/Controlled/Trusted local LLM

References

Park, Joon Sung, Joseph C. O'Brien, Carrie J. Cai, Meredith Ringel Morris, Percy Liang, and Michael S. Bernstein. 2023. "Generative Agents: Interactive Simulacra of Human Behavior." arXiv. http://arxiv.org/abs/2304.03442.

