BRNO FACULTY UNIVERSITY OF INFORMATION OF TECHNOLOGY TECHNOLOGY

Simulation of Human Interaction using AI

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Abstract

Simulation of believable human interaction can strengthen the application of large language models (LLMs) in computational social sciences and improve the insights and value of market research using AI agents. In this work, a *PerSimChat* framework is designed that provides an experimental environment for simulating multiple human conversations using LLM agents with persona data. Simultaneously, a new approach is proposed for selecting the order of the agent's speech called *One-By-One Talk with Agent's Need to Talk*. Empirical studies demonstrate the framework's performance on many evaluation dimensions, and the system achieves competitive results with other multi-agent debate systems on reasoning and mathematics benchmarks.

Cognitive Modules

The proposed PerSimChat framework implements the human brain's cognitive functions, namely shortterm and long-term memory with memory consolidation, perception, action, reflection, natural language and long-term planning.



Experimental Results

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The PerSimChat framework outperforms the baseline solutions in dimensions focused on the naturalness. The replacement of the GPT-40 model with the Lakmoos system even improves these results.

Model 1	Model 2	Wins (%)	Ties (%)	Losses (%)
GPT-40	ω	40.00	16.67	43.33
Mistral Small	8	34.48	6.90	58.62
Mistral Nemo	8	42.86	10.71	46.43

Table 1. FairEval evaluation of using various models and the proprietary Lakmoos model in the PerSimChat framework.

Method	Believability	Credibility	Relevance
Single-Agent Zero-Shot	8.65 ± 0.82	7.96 ± 0.88	8.4 ± 0.81
AutoGen	8.67 ± 0.79	8.69 ± 1.51	8.15 ± 2.13
PerSimChat	8.76 ± 0.59	8.78 ± 0.52	8.51 ± 0.84

Table 2. Comparison of the PerSimChat with baseline solutions on evaluation dimensions.

Method 1	Method 2	Model	Data Source	Wins (%)	Ties (%)	Losses (%)
PerSimChat	PerSimChat	GPT-40	Generated/∞	26.67	33.33	40.00
PerSimChat	PerSimChat	GPT-4o/∞	ω	31.03	17.24	51.72
Single-Agent Zero-Shot	PerSimChat	GPT-4o/∞	ω	43.33	10.0	46.67
AutoGen	PerSimChat	GPT-4o/∞	ω	23.33	46.67	30.0

Table 3. FairEval evaluation with baselines using Lakmoos data about personas and proprietary Lakmoos system.



Lakmoos Al System

Figure 1. The architecture of cognitive modules in the PerSimChat framework.

Need to Talk and Consensus Openness

The main contribution of this work is a new approach for selecting the order of the multiple agents' speech — One-By-One Talk with Agent's Need to Talk. The consensus openness scores are generated during the group discussion, while a judge agent decides when the consensual solution is reached.



Figure 2. Group debate scenario with consensus openness scores and judge agent.

Comparison of PerSimChat framework with baseline solutions using GPT-40 and Lakmoos system.

System Comparison on Evaluation Dimensions



Figure 3. Evaluation of the PerSimChat framework with baseline solutions on naturalness evaluation dimensions.

Persona Description

The framework uses generated persona data or real data provided by Lakmoos AI, s.r.o.

PerSimChat Application

This work also provides a user interface for the implemented PerSimChat framework.

A Simulation of Human Interaction Using AI

Name and Surname: Josef Svoboda

Description: Josef Svoboda is a down-to-earth, 50-year-old family man who enjoys the simple pleasures of life in a small town in the Czech Republic, where he shares a cozy home with his wife and two children. A hardworking man with a high school diploma, he values tradition, loyalty, and good company. His weekdays are spent balancing work and family, while weekends bring the thrill of a football match with friends or the quiet patience of fishing by the lake. Once a week, he retreats to his favorite pub, where laughter and stories flow as easily as the cold beer in his hand. Dressed in sturdy jeans, a well-worn flannel, and practical boots, his style reflects his pragmatic nature, uncomplicated, reliable, and effortlessly classic. Though a man of few words, his firm handshake, and warm smile speak volumes about his honest and steady character.

Characteristics:

• Age: 50

- Gender: Male
- Marital Status: Married
- Residence: Small town in the Czech Republic
- Financial Status: Financially stable

Traits:

• Loyal & Devoted

- Hardworking
- Easygoing
- Routine-Oriented
- Stubborn
- Not Tech-Savvy
- Occasionally Gruff

Listing 1. The example of a generated persona profile description.

Agents Configuration	01:53:52 PM	Li Real-Time D Analysis
•	What are the most important factors to consider when choosing between an electric vehicle and a traditional gasoline-powered car, and how do these factors	ر Persona 1
Persona 1 Active	^{LD} vary depending on geographical location and lifestyle needs?	© Response Time ★ Coherence 8.0
DpenAI GPT-40 V	Tereza Šafářová 4 OpenAl GPT-40 01:53:59 PM	00:08
Radek Vávra v	I believe electric vehicles (EVs) are ideal for someone like me working in a bustling European city. The infrastructure in places like Prague supports and	☆ Sentiment 0 Engagement4.5
Dersona 2 Active	and personal values.	
OpenAl GPT-40 v	Radek Vávra 4 OpenAl GPT-40 01:54:08 PM	ش Persona 2
	Given these factors, I'm skeptical about EVs unless they prove cost-effective and reliable over the long term, especially considering the potential challenges of infrastructure in smaller towns compared to cities like Prague. Do you think the infrastructure will improve enough to make EVs viable for everyone?	© Response Time 8.5 00:09
Persona 3 Active DpenAl GPT-40	Tereza Šafářová 4 OpenAl GPT-40 01:54:17 PM	☆ Sentiment⑦ Engagement7.07.5
ereza Šafářová v	Radek, I appreciate your concerns. While small towns face challenges, urban centers like Prague show great potential for EVs. Improved infrastructure can make EVs viable for more people, aligning with sustainability and innovation priorities that many of us share.	Persona 3
Simulation Settings	Radek Vávra 4 OpenAl GPT-40 01:54:27 PM	© Response Time 8.0
synchronous Processing complex Simulation Analysis	 I see Tereza's confidence in EVs, especially in Prague. But in smaller towns, like mine, practical challenges remain—the infrastructure isn't quite there yet. Gas cars still seem more reliable, and until infrastructure catches up, I'm sticking with what works. 	00:09 ☆ Sentiment © Engagement
ersation Topic	Tereza Šafářová 4 OpenAl GPT-40 01:54:37 PM	7.5 7.0
Settings		
lanning and Reflection	Type a message	Trends
lemory Filtering		Average Response Time

Figure 4. User interface of the PerSimChat application.



