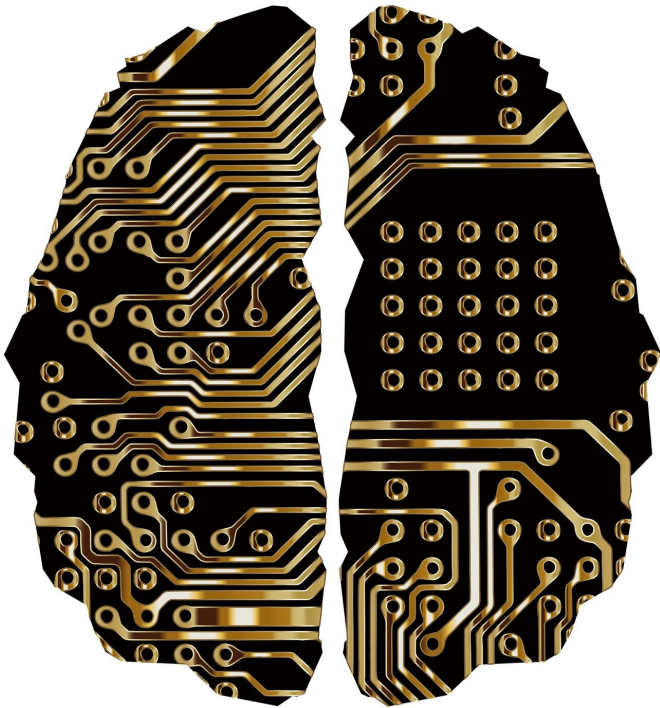


AI and marshmallows: Developing human-AI collaboration

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Despite unprecedented advancements in technology and countless depictions of complex human-AI interactions in sci-fi movies, we have yet to fully achieve AI bots that can engage in conversation as naturally as humans can. Kushal Chawla, researcher at the USC Institute for Creative Technologies (ICT) and a doctoral student in computer science, and collaborators at both the USC Information Sciences Institute (ISI) and ICT are taking us one step closer to this reality by teaching AI how to negotiate with humans.

The research, presented at the 2021 Annual Conference of the North American Chapter of the Association for Computational Linguistics (NAACL) this month, relied on a scenario-based dataset that was collected to teach negotiation skills to human

users through role-play dialogue. With a campsite setting as the imaginary backdrop, participants in the data collection study were instructed to interact with each other as if they were campers negotiating for resources. The researchers discovered a total of nine strategies that the participants utilized throughout the exercise. The stand out lesson: Cooperative strategies of negotiation were more effective than selfish strategies. This information can be used in the future to inform the creation of an automated system that takes various strategies of negotiation into account.

Training AI

CaSiNo, which stands for Camp Site Negotiations, is a scenario-based dataset that was collected to teach negotiation skills to human users through role-play dialogue. It consists of over a thousand negotiation dialogues that are carried out by two participants at a time. At the core of these dialogues, there are three essential camping items that the participants negotiated for—food, water, and firewood. Each participant is assigned a preference order for these items and negotiates based on this model. As the participants negotiate with one another, they come to conclusions about how to allocate the items to best maximize each person's rewards.

Prior to these dialogues, participants underwent a training module that consisted of watching a video tutorial on negotiation. Doing so allowed participants to understand best practices of negotiation to be incorporated into the performance.

"We evaluate the negotiation performance of the participants in three ways: Final points scored depending on what they were able to negotiate for, how satisfied they were with the outcome, and how much their opponents like them," explained Chawla. "All these metrics are crucial in the context of real-world negotiations."

Standing out

Chawla has extensive prior research in AI, but CaSiNo is his most ambitious approach yet.

"One difference with these prior works is that in these cases, the negotiations don't involve language-based communication, but rather are based on button clicks and drop-down choices in a menu," explains Chawla. "However, our work on the CaSiNo dataset would promote the development of AI systems that can negotiate using language (such as in English) and have real, rich conversations with humans."

Similarly, most work in the field of automated negotiation systems has been focused on a menu-driven interface rather than language-based communication. Though these technologies have been easy to navigate, Chawla argued that "they fail to capture free-form emotion and persuasion, which are key components of real-world negotiations." Language, on the other hand, encapsulates human-like characteristics that help ground AI communication in the real world.

Achieving this new level of AI communication requires construction of complex negotiation datasets through which AI can be trained. It can be a challenge to construct the perfect dataset—prior efforts at doing so have often been either too restrictive or too open-ended. In order to find the perfect balance between the two, Chawla and his team approached this challenge by "proposing a novel task that enables linguistically rich and personal conversations, but still in a constrained environment."

Applications in pedagogy and beyond

As an effective way of automating negotiation instead of relying on humans, it's no wonder CaSiNo has a variety of real-world applications. This technology can be applied to various industries, including business, education, entrepreneurship and tech. Specifically, CaSiNo can help with teaching negotiation skills in various pedagogical contexts, whether it be training business students to secure deals or helping lawyers to assess settlement rates more

accurately.

CaSiNo is also highly valuable for improving negotiation skills of conversational AI assistants. Chawla mentions the Google Duplex prototype as an example, in which AI assistants express negotiation skills to automatically make appointments over the phone.

Future directions

Going forward, Chawla and his team are broadly interested in looking deeper into other types of non-collaborative dialogue outside of negotiation, such as persuasion. Non-collaborative dialogue is generally defined as communication "where the goals of the involved parties may not perfectly align with each other."

More specifically, Chawla outlines two directions of future research based on the current work with CaSiNo. Firstly, the team is interested in looking at the predictive capabilities of AI through how emotional expression in CaSiNo dialogues correlates with the outcomes of negotiation. By doing so, these AI agents can be improved to become more emotion-aware. Secondly, the team is looking to improve the believability of [negotiation](#) skills by building upon realistic free-form language training. Ultimately, CaSiNo is a groundbreaking system that will serve as a solid foundation for improvements in human-computer interactions.

Provided by University of Southern California

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