Peer Response 1

Ali Alzahmi

Hi Ali, your post about Agent Communication Languages (ACLs) in multi-agent systems was interesting and valuable. You have also pointed out clearly the importance of ACLs in allowing agents to share not only information but also intentions, goals, and commitments, which is essential in systems acting in diverse and dynamic environments. Your focus on the semantic quality of ACLs was especially appealing to me because it indicates their exceptional worth compared to simple syntactic method calls. Such an attitude is consistent with contemporary surveys of multi-agent systems, which note that heterogeneous agent communication is a key to coordination and collective intelligence (Guo et al., 2024).

I also liked your scalability argument. As you said, new agents can be easily integrated via ACLs without making significant changes in how new communication protocols are designed, which is essential to an open and adaptable environment. This is aligned with the recent literature on multi-agent reinforcement learning, in which interaction between agents substantially increases cooperation and system performance (Zhu et al., 2024). Performatives like inform, request, or play-game help show how ACLs can learn the logic and reasoning framework of actions taken by agents, which is key to more intelligent distributed systems (Calegari et al., 2021).

Meanwhile, I would have to say I like the fact that you recognized the limitations. Computational and reasoning complexity of ACLs is still a barrier, particularly in real-time or resource-constrained applications. This is one of the reasons why industries tend to use less complex and efficient communication systems such as APIs or message queues. However, I believe that an exciting research direction to explore in the future is the fusion of ACL concepts with contemporary engines, including large language model-driven multi-agent systems. The methods would allow finding a balance between semantic richness and practical efficiency, and the ACL-inspired communication would become more feasible in the application.

Your discussion has generally given a balanced perspective of ACLs' strengths and weaknesses, and your insights align with the emerging research directions.

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Peer Response 2

Ali Alhammadi

Hello Ali, your post gives a clear and organised summary of how Agent Communication Languages (ACLs), particularly KQML, can facilitate communication in multi-agent systems (MAS). I concur with your point that ACLs go beyond mere syntactic message passing to concentrating on the semantics of interaction so that agents can exchange data, intentions, and commitments. The given view is backed by the recent research, which highlights that the agents created using large language models rely highly on the communication frameworks to organise the knowledge and unlock the collective intelligence in the complex systems (Li et al., 2023).

I also liked how you focused on heterogeneous environments. ACLs provide a platform of interoperability, an important element in fields like supply-chain management and distributed applications, by facilitating standardisation across a wide range of platforms and programming languages. The latter echoes the discoveries in multi-agent reinforcement learning, where scalability and coordination issues of the dynamical environment are addressed by proper communication protocols (Canese et al., 2021).

Your discussion of ACL limitations was well-balanced. Their complexity of computation can make them inapplicable to real-time (or high-performance) systems due to the requirement of complex reasoning mechanisms. The problem is also well understood in the existing literature on multi-agent reinforcement learning in uncertain and noisy settings, where communication efficiency is essential to the system's reliability (Tung et al., 2021).

An opportunity that can be tapped is in hybrid models. Recent advances in multi-agent systems integrate logic-based communication frameworks with machine learning approaches (Li et al., 2023; Canese et al., 2021). For example, logic-based representations (Calegari et al., 2021) with learning based communication can allow the agent to balance efficiency and interpretability. This implies the possibility of ACLs becoming more useful as a tool for real-life situations, especially where autonomy and versatility are needed.

Your post effectively highlights the potential of the ACLs as well as their challenges, and linking them to the research enhances your analysis further.

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Peer Response 3

Mansour Saeed Mubarak Hamdan Al Hamdani

Hi Mansour, you have presented a clear and well-organised description of the concept of Agent Communication Languages (ACLs) or KQML and how the languages of communication enable agents to interact successfully with other agents in multi-agent systems. Your focus on standardisation and interoperability is critical since MAS must manage heterogeneous agents coordinating across different platforms and tasks. Recent literature emphasising the advantages of large language model-based agents to take advantage of structured communication structures to maximise coordination in dynamic and complex environments (Cheng et al., 2024) reinforces this view.

I concur with your argument that the ontological nature of KQML enhances teamwork in distributed settings. By conveying domain knowledge in an organised manner, agents are able to develop shared understanding and attain more advanced types of collaboration, which have been noted as a major characteristic in classic and more contemporary MAS studies (Zhang et al., 2024).

Verbosity, complexity, and security risks are also valid points you made. These constraints reflect existing issues in the literature, in which the implementation of knowledge-intensive communication must consume extensive computational resources and be carefully designed to be efficient and safe (Ma et al., 2024). Your analogy to method invocation in Python or Java is not invalid, since those tend to be more efficient in systems that are tightly coupled and are less able to offer the same semantic interoperability among agents of different kinds.

One potential continuation of your argument may be that the large language models (LLMs) are now embedded into agent communication protocols. Existing studies indicate that LLM-powered agents can exploit superior memory processes and natural language logic to address specific gaps of past ACL systems (Cheng et al., 2024; Zhang et al., 2024). This makes it possible to apply it practically outside of academia and could solve your scalability and adaptability problems.

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