Agent Interpolation in Distributed Systems (Invited Talk)

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Abstract

We introduce a new type of proof formalism for multiagent modal epistemic logics with S5-type modalities, viewed here as a logic of multiagent epistemic reasoning in distributed systems. We use this formalism to give a constructive proof that multiagent epistemic logic S5 enjoys a strong form of Craig interpolation property with respect to both propositional variables and agents, the latter in the form of agent-indexed knowledge modalities, a fact that has previously been proven using semantic methods. Our new proof formalism uses cross-word sequents that combine the features of hypersequents to represent individual S5 modalities—equivalence classes of individual agents—with nested sequents to represent the tree structure for alternating agent modalities—intersecting equivalence classes of distinct individual agents. The resulting calculus is sound and cut-free complete, allowing for strongly terminating proof search, and yields decidability and the finite model property for multiagent epistemic logic S5. No strongly terminating nested sequent calculus for S5 has been provided so far, and combining the structural features of hypersequents and nested sequents seems to be necessary to obtain computationally effective interpolation for agents rather than merely propositional variables. We further obtain Lyndon interpolation for propositional variables, which goes beyond existing semantic proofs of agent interpolation for multi agent epistemic logic S5. The talk is based on joint work with Wesley Fussner and Roman Kuznets [1].

Acknowledgments

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References

[1] M. Bílková, W. Fussner, R. Kuznets, Agent interpolation in distributed systems, in: U. Fahrenberg, W. Fussner, L. Santocanale (Eds.), Relational and Algebraic Methods in Computer Science, Springer Nature Switzerland, Cham, 2026, pp. 95–113.

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