From Theory to Performance: Building Efficient Reasoners for Standpoint Logic

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This proposal is to do an M2 internship with me, Lucía Gómez Álvarez, and in collaboration with a second advisor, depending on the chosen topic. First, I will discuss the technical content of the internship and later some details about me and our potential collaboration.

1 Research context

Human knowledge is often partial and shaped by perspective. For instance, terms like "forest" or "tumour" can mean different things to different communities or data sources. Integrating such heterogeneous knowledge bases without losing meaning or causing inconsistencies is a key challenge in AI and the Semantic Web.

Standpoint Logic (SL) is a recently developed logical framework designed to model and reason about such perspective-dependent knowledge. It enables explicit representation of multiple viewpoints and structured ways to combine or compare them. You can find an introduction in [Gómez Álvarez and Rudolph, 2021, Gómez Álvarez et al., 2022].

In recent results we have established *tight complexity bounds* for SL and have shown that, remarkably, the framework remains *theoretically efficient*—many interesting fragments do not increase the complexity of the underlying base language. This makes SL an attractive foundation for scalable, multi-perspective reasoning.

The key question now is:

Can we bring this theoretical efficiency to practice?

2 Internship topic: From Theory to Performance

Building on our recent theoretical results on Standpoint Description Logic—where we have defined algorithms and reasoning strategies [Gómez Álvarez et al., 2023b, Gómez Álvarez et al., 2023a, Gómez Álvarez and Rudolph, 2024, Gómez Álvarez and Rudolph, 2025]—this topic invites you to take the next step: turning these ideas into practice.

You will work on the design and implementation of reasoning systems for Standpoint Logic (SL), exploring how to make them efficient, scalable, and usable. A proposal for the core algorithms will be provided at the start of your internship, but you will have the opportunity to experiment, optimise, and innovate, proposing your own improvements or alternative approaches.

Depending on your interests, you could also explore integration with existing reasoning frameworks, or develop benchmarks and evaluations on real-world knowledge bases to test the performance of your system.

This topic is ideal if you enjoy combining theory and practice, coding intelligent systems, and tackling challenges in logic-based AI. It also offers an excellent path toward a PhD within the **SPaRK project** (see below), which focuses on advancing Standpoint Logic for knowledge representation.

3 About me

I did my PhD at the University of Leeds under the supervision of Dr. Brandon Bennett. After my PhD, I worked as a postdoc at TU Dresden in the research group led by Prof. Sebastian Rudolph. Since the beginning of 2024, I am a CRCN Inria researcher at the mOeX team, at the Inria Centre of the University Grenoble Alpes.

Broadly speaking, I work on the representation of interesting features of knowledge via logical languages (e.g., using modal and description logics), on the study of their theoretical properties, and on the implementation of reasoning algorithms for these languages.

I recently obtained a JCJC grant for the project SPaRK (Integrating Perspectives: Standpoint Logic for Knowledge Representation), which covers the topics proposed here and will start soon. As part of this project, we will be looking for a PhD student, a postdoc and a research engineer to join the team.

4 About the candidate

I am looking for a student who is intrinsically motivated to work on some research topic that I also find interesting, so that we can collaborate. I propose some topics in this document, but if you are interested in working on something else, feel free to contact me about it. I offer flexible supervision (either close and active or more autonomous on your side) to help you solve some interesting research questions. On top of that, if the collaboration works well and you are interested, we would be very happy if this internship could lead to a PhD position within the SPaRK project. **Prerequisite knowledge**. I assume that you are somewhat familiar with the syntax and semantics of first-order logic (FOL) or description logic (DL). On top of that, it will be useful if you have an interest in algorithms, reasoning systems, and software development.

References

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