EXTENDING DEFEASIBILITY BEYOND RATIONAL CLOSURE

This project explores how defeasible reasoning, a form of non-monotonic logic, can be extended and made more interpretable beyond Rational Closure (RC). The optimisation of RC was combined with natural language processing for knowledge base (KB) creation and visualisation. These systems enhance both theoretical understanding and practical scalability and accessibility. Bridging the gap between formal logical frameworks and real-world usability.

BACKGROUND

https://extrc.vercel.app

Example Query:

Do Teslas emit CO_2?

SCAN TO TRY THE TESLA REASONING DEMO

Knowledge Base:

- Cars typically emit CO_2
- Teslas are cars
- Tesla's do not typically emit CO_2

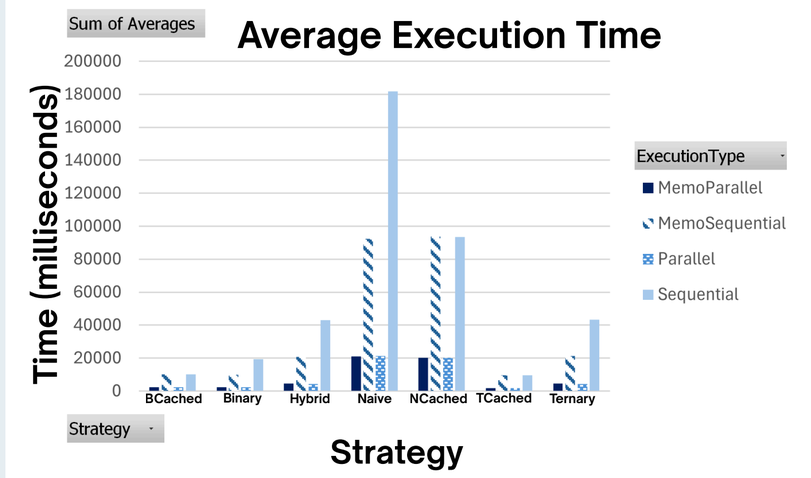
RC will explore whether the typical emission of CO_2 applies to Teslas, or if the exception overrides the generalisation.

RESEARCH OBJECTIVES

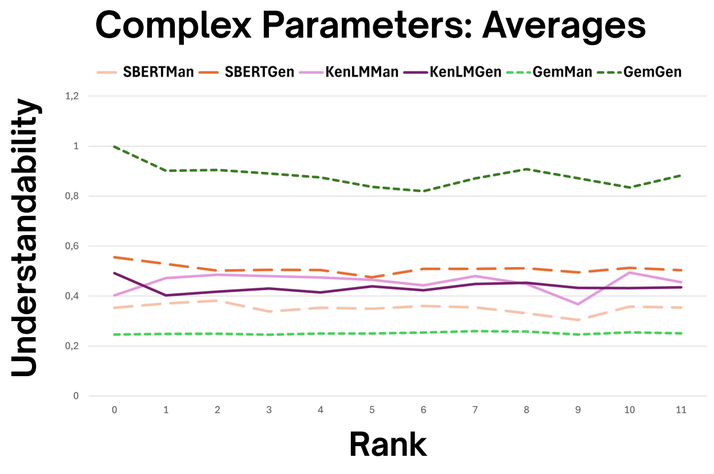
1. To develop a deeper understanding of Rational Closure, its limitations, and to optimise its computational performance.

2. To create interfaces and explanations that support interpretability for non-expert users.

3. To apply natural language processing to generate and evaluate sentences from a symbolic knowledge base.



GRAPH SHOWING AVERAGE RESULTS FROM THE 10K50_MIXED DATASET



UNDERSTANDABILITY OF NATURAL LANGUAGE KB

CONCLUSIONS

The integrated approach makes defeasible reasoning scalable, understandable, and interpretable. Optimisations improved efficiency, clarity, and usability. Future work includes adaptive controllers, focused KB generation, and user-influenced defaults with focus on accessibility.

RESULTS

Parallelisation cut runtimes by ~85–89%, memoization improved mixed and half-repeated queries by ~40–46%, while hybrid traversal underperformed fixed strategies. Natural language generation improved KB understandability, and interface-based explanations reduced cognitive load and enhanced debugging.

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