EXTENDING DEFEASIBLE REASONING BEYOND RATIONAL CLOSURE

INTRODUCTION

Artificial Intelligence (AI) faces a key challenge in effectively representing and reasoning about knowledge, especially when dealing with exceptions and uncertainties. Traditional reasoning methods based on classical logic often fall short, as they do not accommodate the complexities of real-world scenarios. Defeasible reasoning, particularly through the KLM framework, offers a solution by allowing conclusions to be retracted in light of new information, thereby providing a more flexible approach to AI decision-making.

PROJECT OVERVIEW

Our project addresses the limited availability of defeasible knowledge base generators and practical implementations of ***rational closure***, the most prominent defeasible reasoning framework. We aim to contribute to this research by developing reasoners that implement both rational closure and its extension, ***lexicographic closure***, with step-by-step explanations to provide transparency in the reasoning process. Additionally, we focus on optimizing knowledge base generation and improving the practical implementations of rational closure to make them more scalable and efficient.

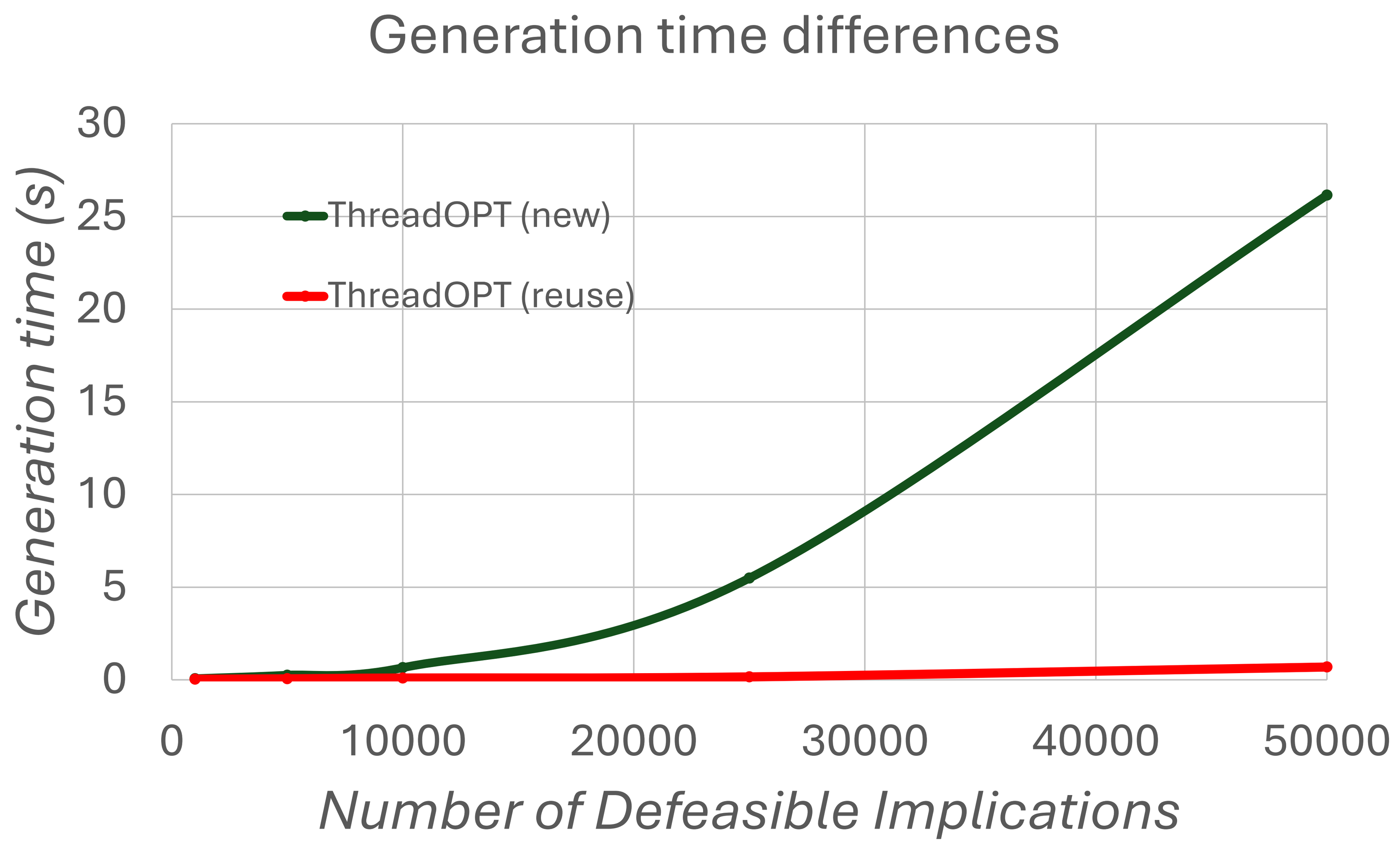
OBJECTIVES

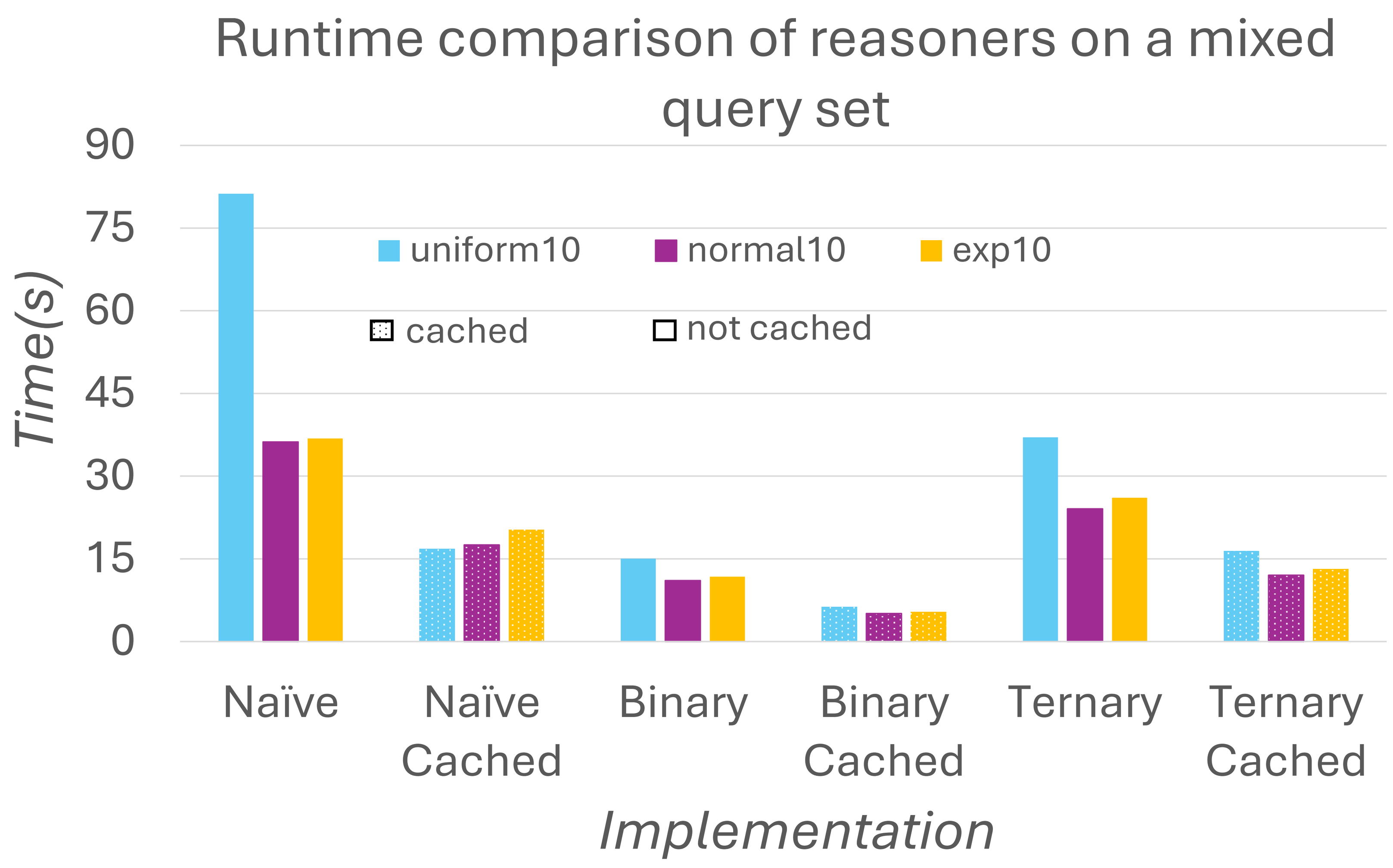
- To create a pseudo-random defeasible knowledge base generator and optimize it using the space-time trade-off method.
- Develop a web application that provides a detailed explanation for the defeasible reasoning process.
- Develop scalable reasoners for rational closure by implementing caching and optimized search algorithms and evaluate their performance through systematic experiments on large knowledge bases and various query sets.

RESULTS

What does the knowledge base,
{“penguins are birds", "birds typically fly", "penguins typically do not fly ", “birds typically have wings "}, imply about the penguin’s wings?

SCAN QR CODE TO FIND OUT





CONCLUSIONS

- Two generators were created the KBG and KBG_Optimized, the KBG_Optimized defeasible knowledge base generation time proved to be significantly less than the KBG, under the same control parameters.
- The web application helps users understand how defeasible reasoning algorithms reach conclusions by making the reasoning process transparent. It can also serve as a debugging tool for knowledge bases.
- The binary search method consistently outperformed the naive and ternary methods across various query sets and knowledge base combinations, making it the most efficient optimisation for rational closure.
- Caching significantly improved performance in repeated query sets, demonstrating its effectiveness in reducing redundant computations and making rational closure more scalable.

Maqhobosheane Mohlerepe
mhlmaq001@myuct.ac.za

Mamodike Sadiki
sdkmam001@myuct.ac.za

Thabo Vincent Moloi
mlxthat036@myuct.ac.za

Supervised by **Prof Tommie Meyer**