SMARTER: Structured Multi-sourced AI Reasoning for Enhanced Decision-Making

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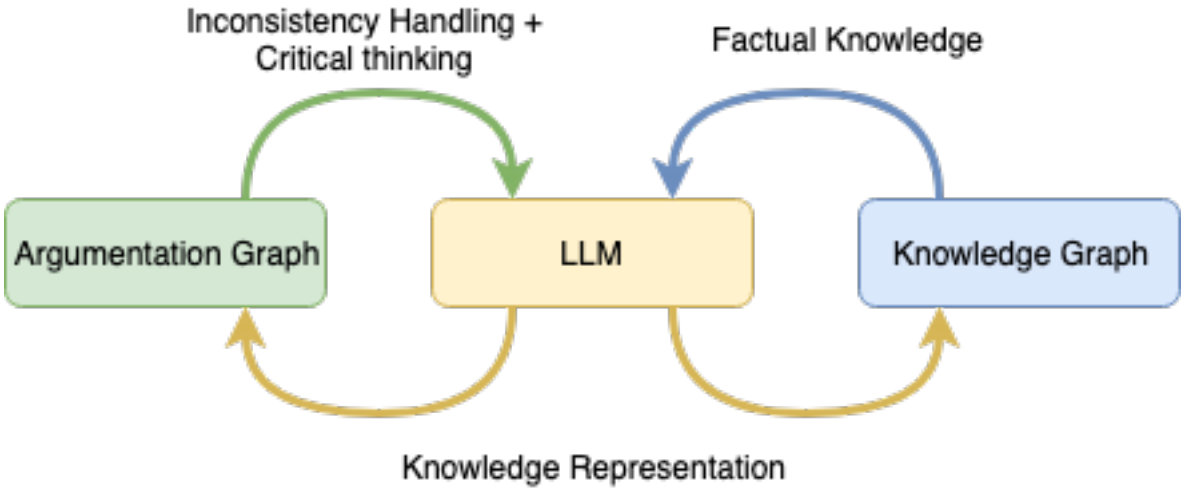
Context

SMARTER (Structured Multi-sourced AI Reasoning for Enhanced Decision-Making) aims to build a framework for integrating large language models with argumentation graphs and knowledge graphs to allow robust reasoning in decision-support scenarios.

Large language models (LLMs), like OpenAI's GPT-4, or Google Bard, are transformer models, with tens or hundreds of billions of training parameters, that can learn from massive amounts of text data and perform various natural language tasks such as text generation, text understanding, translation, question answering, and more. However, due to their large number of parameters, these models usually require powerful hardware to train. Those models also suffer from several other problems [5,8,9] which limit their implementation in decision-support systems (DSSs): (*1) LLMs have poor logical inference and planning capabilities and which are required in complex decision tasks, (2) they often hallucinate and produce statements which are not true, and (3) LLMs do not handle inconsistencies well and may generate contradictory outputs when faced with different contexts or viewpoints.*

We plan to connect LLMs with knowledge graphs (KGs), which contain curated and verified information, to increase factual accuracy by allowing these models to verify the veracity of their generated content, reducing the likelihood of misinformation and enhancing the quality of their outputs. While there has been previous work on allowing the exploration of knowledge graphs by LLMs [6,7] through techniques such as the Iterative Reading-then-Reasoning (IRR) method, this has not been done with argumentation graphs yet. We hypothesize that combining LLMs with argumentation will increase its critical thinking capabilities [1] and its abilities to reason with inconsistencies. Indeed, argumentation [3] is a non-monotonic formalism that allows reasoning in the presence of a large number of inconsistent data and to manipulate abstract and unstructured knowledge. This formalism encodes knowledge as arguments and relies on their interactions to perform reasoning tasks. The use of argumentation is ideal for this project as it is easily understood by humans, facilitates reasoning, and allows users to interact with the system via dialogues [2,10].



Objectives

1. Collect the necessary data and build argumentation and knowledge graphs.
2. Set-up appropriate interfaces and the framework for the LLM to interact with the graphs.
3. Investigate different LLMs and fine-tuning methods to improve performance.
4. Integrate this into a DSS and evaluate it in various decision scenarios.

The intern will have to complete the following procedure to get access to the restricted research area: https://liris.cnrs.fr/intranet/service-administratif/nouveau-membre.

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