Controlled Conversational Models through Conversation-Dedicated Ontology

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1. Context

Recent advances in Large Language Models (LLMs) have improved conversational agents' realism and compliance towards human requirements and needs. However, **controlling conversation flow towards positive outcomes remains crucial**.This Ph.D. aims to **represent conversational knowledge using an ontology to enable language model control**. Ontologies allow to model the knowledge in a domain, defining concepts and characterizing relations between them. While often used for domain-specific knowledge, few have explored using ontologies to guide conversation flow. Convology is a recent example focusing on managing health conversations. We plan to extend Convology's conceptualization capacities to a more general setup, therefore adaptable to general-purpose user/agent conversations.

Want to know more?

My website, gh repo or whatever

2. Methodology

PhD approach. Iterative process by progressive enrichment of the ontology to conceptualize more and more notions related to conversations.

Tools. Protégé, HermiT and Pellet reasoners, owlready2, rdflib, PyTorch, huggingface transformers and parameter-efficient fine-tuning libraries, LoRA adapters.

Conceptualization. Explain our ontology engineering process and how we select and create toy examples.

Control. Explain how we plan to control the conversational dynamic inthe context of a dialogue user-agent.

Challenges. It is not straightforward that what the ontology brings can be fully understood and learnt by an LLM (in our case, we consider for now only decoder-based language models).

3. Motivation & Objectives

The objective of this thesis is to develop **knowledge-enhanced conversational models** that exploit Large Language Models (LLMs) and Ontologies. This consists in improving state-of-the-art LLMs by providing **structured knowledge** to open-domain conversational agents.

Objectives:

- Build a conversation ontology that accounts for interpersonal relationships concepts and their evolution.
- Integrate and assess ontology understanding during fine-tuning.
- Bring control on conversational LLM outputs through encapsulated conversation knowledge.

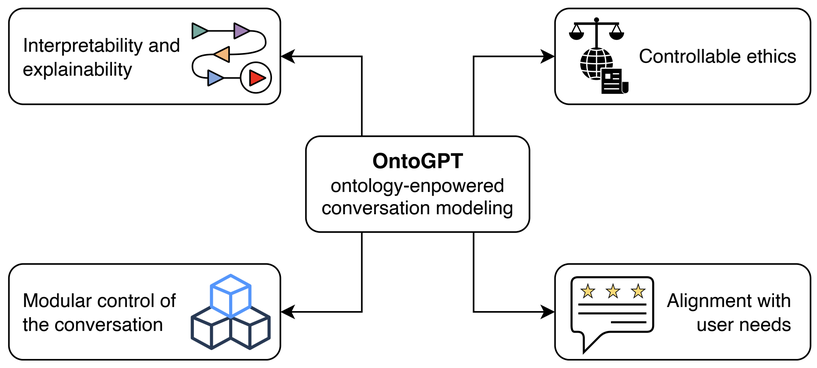
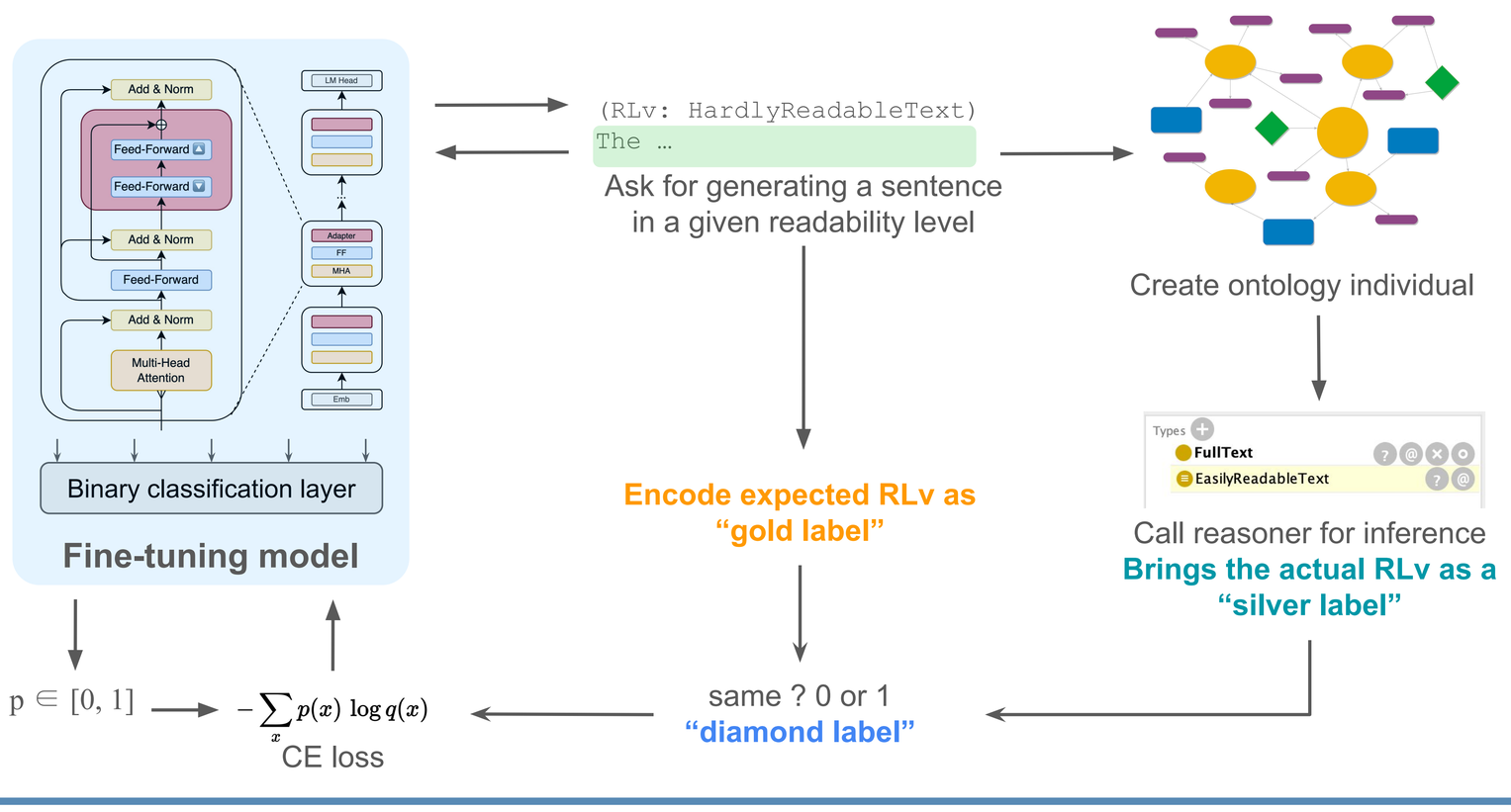


Figure 1: The benefits of ontology-LLM hybridation systems for conversation modeling

4. OntoGPT: LLM Fine-Tuning Based on Ontology Validation

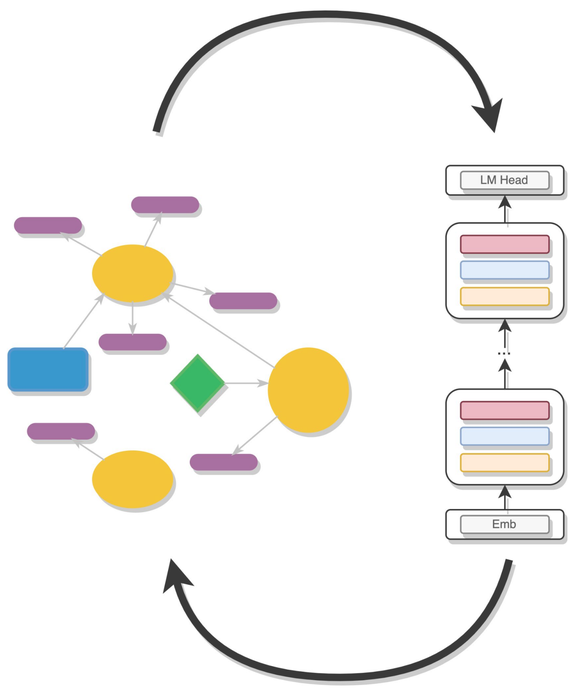
An end-to-end integration pipeline where the ontology information is assimilated at fine-tuning time.



5. Advances & Perspectives

Advances in ontology building:

- Advance 1
- Advance 2



Key findings in LLMs:

- Challenges to setup the fine-tuning procedure
- Computational time