

## Practical work proposals

**Proposals by students for new themes are very welcome; following its adoption, these themes are developed in accordance with the general by-laws published in the UC page.**

Some general conditions that all projects must follow (subject to discussion on a case-by-case basis) are:

1. Involving web semantics technologies (URI, RDF, SPARQL, OWL, etc) to represent and query data, information and knowledge;
2. Involving the gathering of knowledge from different existing knowledge sources, represented using web semantics technologies and/or create more/new linked data, which can derive into new knowledge.;
3. Implement the [Linked Open Data Principles](#).

The projects for this unit instance may follow or be inspired by the topics presented below.

**(To be Completed)**

**Large Language Models and Knowledge Graphs: Opportunities and Challenges**

<https://arxiv.org/abs/2308.06374>

Large Language Models (LLMs) have taken Knowledge Representation -- and the world -- by storm. This inflection point marks a shift from explicit knowledge representation to a renewed focus on the hybrid representation of both explicit knowledge and parametric knowledge. In this position paper, we will discuss some of the common debate points within the community on LLMs (parametric knowledge) and Knowledge Graphs (explicit knowledge) and speculate on opportunities and visions that the renewed focus brings, as well as related research topics and challenges.

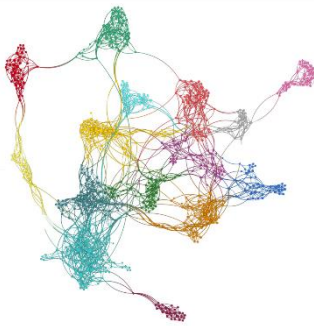
**Unifying Large Language Models and Knowledge Graphs: A Roadmap**

<https://arxiv.org/abs/2306.08302>

Large language models (LLMs), such as ChatGPT and GPT4, are making new waves in the field of natural language processing and artificial intelligence, due to their emergent ability and generalizability. However, LLMs are black-box models, which often fall short of capturing and accessing factual knowledge. In contrast, Knowledge Graphs (KGs), Wikipedia and Huapu for example, are structured knowledge models that explicitly store rich factual knowledge. KGs can enhance LLMs by providing external knowledge for inference and interpretability. Meanwhile, KGs are difficult to construct and evolving by nature, which challenges the existing methods in KGs to generate new facts and represent unseen knowledge. Therefore, it is complementary to unify LLMs and KGs together and simultaneously leverage their advantages. In this article, we present a forward-looking roadmap for the unification of LLMs and KGs. Our

roadmap consists of three general frameworks, namely, 1) KG-enhanced LLMs, which incorporate KGs during the pre-training and inference phases of LLMs, or for the purpose of enhancing understanding of the knowledge learned by LLMs; 2) LLM-augmented KGs, that leverage LLMs for different KG tasks such as embedding, completion, construction, graph-to-text generation, and question answering; and 3) Synergized LLMs + KGs, in which LLMs and KGs play equal roles and work in a mutually beneficial way to enhance both LLMs and KGs for bidirectional reasoning driven by both data and knowledge. We review and summarize existing efforts within these three frameworks in our roadmap and pinpoint their future research directions.

### Data Driven Market Opportunities Map



Every day, we learn about emerging technologies and developments that have the potential to impact our lives, solve real business problems and exploit new open opportunities.

But how do we detect the early proof-of-concept, non-obvious opportunities with real growth potential?

This project aims to develop a visual representation of a given technology or application area (suggestions: food, energy, manufacturing/materials) evolution, providing a sound source

of insight to identify outliers or growing areas with high growth potential. Data can be retrieved from companies' websites, related news, social media, patents databases. The solution must present collected and associated data on a graph-based web interface that identifies outliers and growing opportunities. The implementation must provide tools for users to navigate the application area "graph" in a friendly way.

This project idea will be developed in close collaboration with Fraunhofer Venture experts.

### To trigger new project ideas:

If you've used Google, you've used the cornucopia of Linked data across the Web, through Google's Knowledge Graph (Google's Knowledge Graph is reportedly supported by [Freebase – the knowledge acquired by Google in 2010.](#)) If you've enjoyed the efficiency of rich snippets, you've enjoyed the riches schema.org ([based on RDF](#)) brings to the world of search since 2011. If you've used Wikidata – the structured encyclopedia – you've been using a giant RDF knowledge graph, describing about 100 million topics with over 10 billion properties and relationships. That is also one of the sources from which Google's Knowledge Graph is updated.

Apply these knowledge sources in an area of your interest (a tool to promote knowledge sharing within your Master programme?) to develop a project that both interest you and provides meaningful outputs for you and your colleagues.