Tutorial@ISWC 2026

The 25th International Semantic Web Conference

Bari, Italy

OntoLM: Ontology Embedding, Reasoning and Construction with Large Language Model





The University of Manchester



University of Exeter

Speakers



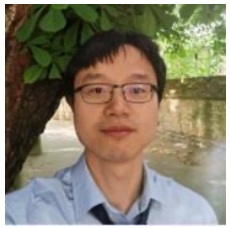
Hui Yang
The University of Manchester

Ontology, KRR,
Neural-symbolic AI



Jiaoyan Chen
The University of Manchester

Knowledge Graph, Ontology, KRR,
AI and LLM with KRR



Hang Dong
University of Exeter

ML for structured data and
knowledge, LLM, Healthcare

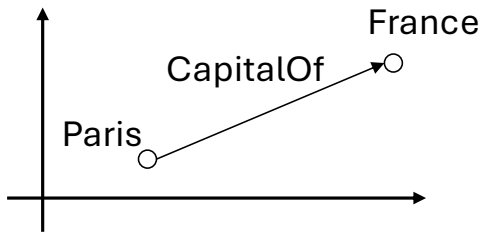
A bit more on myself (Jiaoyan)

- 2016: PhD in Computer Scince in Zhejiang University
  - Semantic Web, ML, spatial data anlaysis
- 2017-2022 (full-time) & 2022 – 2025 (part-time): Senior Researcher in the KRR group in Univeristy of Oxford
  - Knowledge graph, ontology, semantic data annotation, zero-shot learning
  - EPSRC ConCur, Samsung Research UK, eBay, Tencent, Alan Turing Institute, SIRIUS Norway
- 2022 – now (Lecturer / Senior Lecturer): Department of Computer Science, The University of Manchester
  - Knowledge graph, ontology, RAG, LLM, agentic AI
  - EPSRC OntoEm, SNOMED International

Why This Tutorial?

- Knowledge representation learning (embedding)
  - Vector-based (dense) representation of symbolic knowledge
  - Augmentation with machine learning and data mining
  - Reasoning under uncertainty & incompleteness
  - Knowledge curation, and domain applications

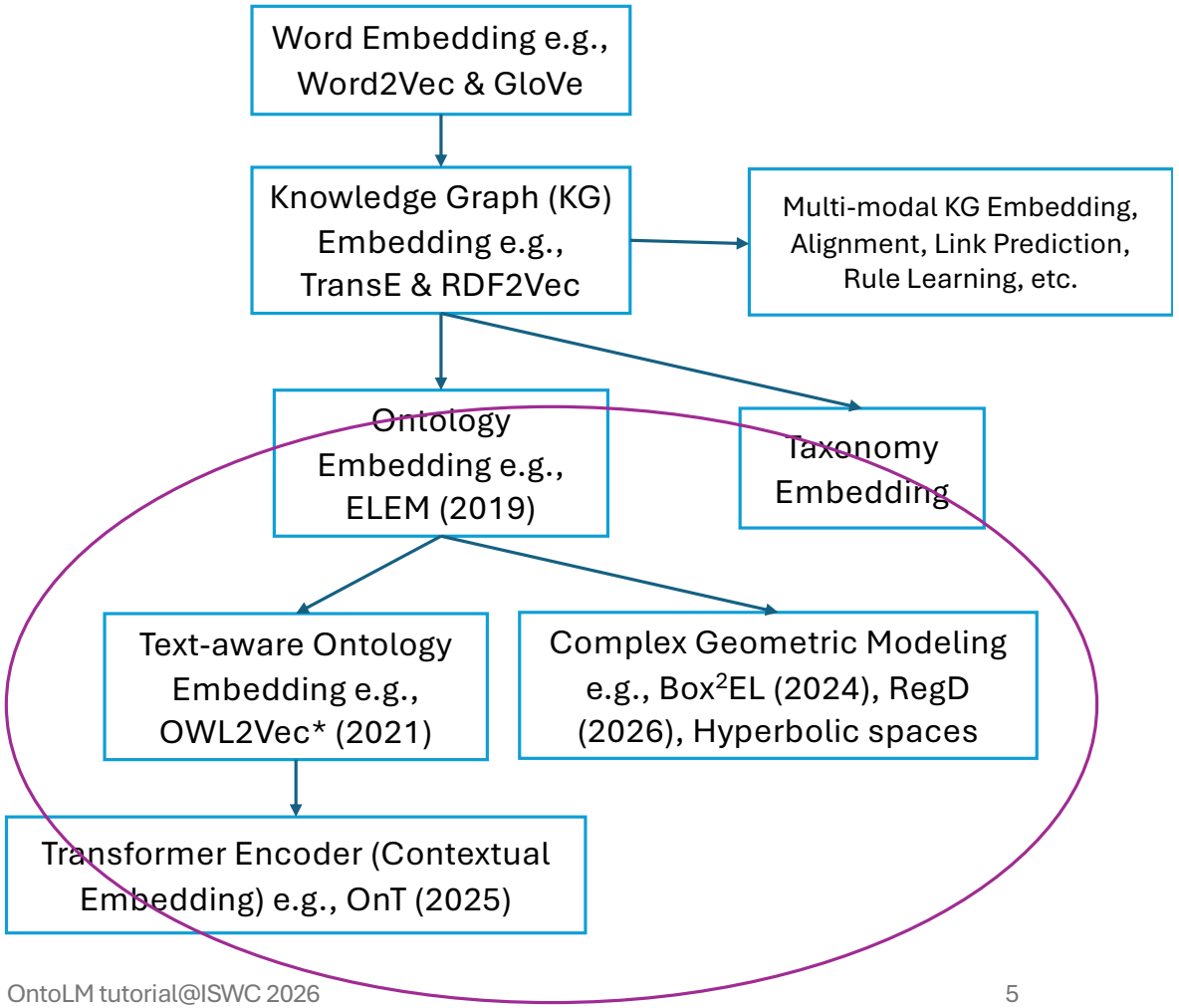
- Word embedding e.g., Word2Vec
  - $V_{king} - V_{queen} \approx V_{man} - V_{woman}$ (distributional hypothesis)
  - $\cos(V_{cat}, V_{kitten}) > \cos(V_{cat}, V_{dog})$ (similarity in usage; cooccurrence)



TransE: modeling relation as a translation mapping (KG embedding)

Why This Tutorial?

- A brief (and incomplete) summary of KG & ontology embedding development



Chen, Jiaoyan, et al. "Ontology embedding: a survey of methods, applications and resources." *IEEE Transactions on Knowledge and Data Engineering* 37.7 (2025): 4193-4212.

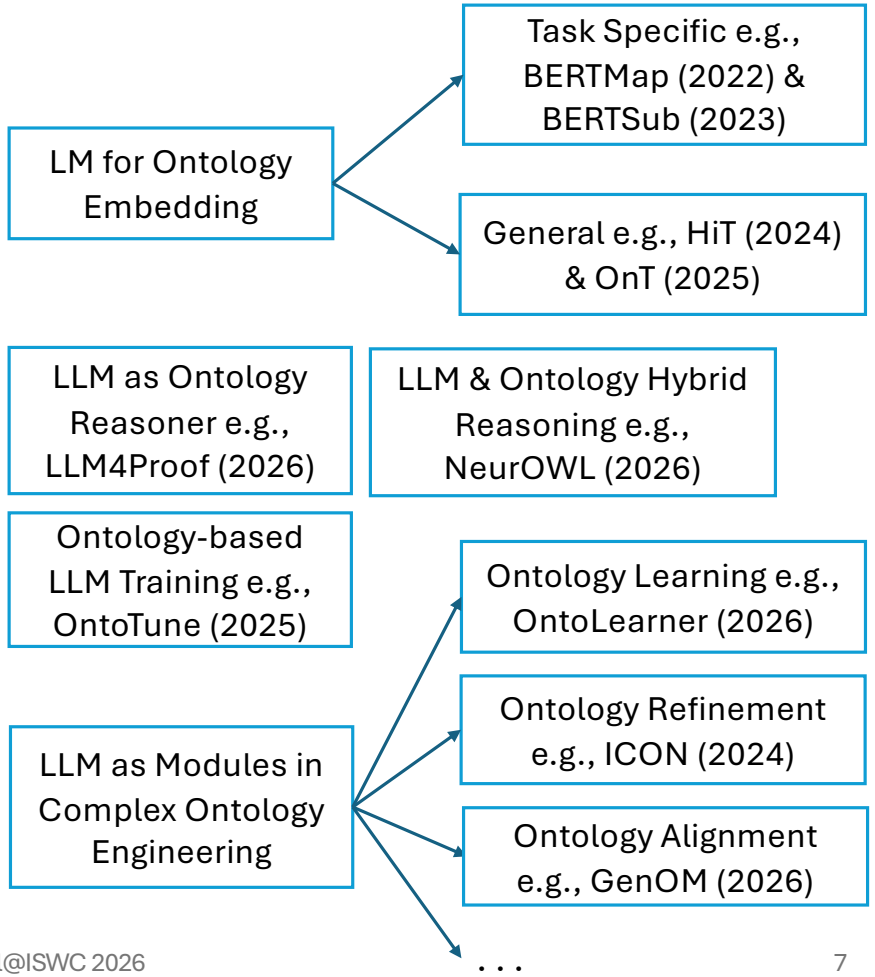
Why This Tutorial?

- (Large) Language Models
  - Transformer-based architecture: contextual embedding (**encoder**) of sequences
  - Pre-trained with large-scale corpus (**internal memory**)
  - Generation (**decoder**)
  - Natural language understanding and inference (**performance**)
  - Agentic AI (**thinking**, **planning**, **acting / tool-using**, **adaption**)

Yang, Hui, et al. "Ontology Construction and Reasoning with LLMs: Survey and Perspective." 2026.

Why This Tutorial?

- (Large) Language Models for ontology



Yang, Hui, et al. "Ontology Construction and Reasoning with LLMs: Survey and Perspective." 2026.

What in This Tutorial?

Part I - Ontology Embeddings			
1	15 mins	Introduction and roadmap	Jiaoyan Chen
2	40 mins	Geometric embeddings: from hierarchies to axioms	Hui Yang
3	45 mins	Language model-based embeddings	Hui Yang
30 mins - Conference break			
Part II - Ontology Reasoning and Construction			
4	30 mins	Ontology alignment with DeepOnto	Jiaoyan Chen
5	30 mins	Complex ontology reasoning with LLMs	Hui Yang
6	30 mins	New concept placement in ontologies	Hang Dong
7	10 mins	Discussion and Q&A	All