

DETAILED AGENDA

CyclOps Autumn School

15-16 October

Overview

DAY 1

09:45 – 10:00 · WELCOME

BUILDING KNOWLEDGE: From Knowledge Graphs to Virtual Knowledge Graphs (10:00 – 13:00)

10:00 – 10:45 Introduction to Knowledge Graphs (45') — Davide Lanti, UNIBZ

10:45 – 11:45 Virtual Knowledge Graphs for Data Access – Ontologies (1h)
Davide Lanti, UNIBZ

11:45 – 12:00 BREAK

12:00 – 13:00 Virtual Knowledge Graphs for Data Access – Data Mappings (1h)
Diego Calvanese, UNIBZ

13:00 – 14:30 LUNCH BREAK

USING KNOWLEDGE: From Semantic Access to Representation Learning (14:30 – 17:00)

14:30 – 15:15 Building and Consuming Virtual Knowledge Graphs with Ontopic Suite (45')
Benjamin Cogrel, ONTOPIE

15:15 – 16:00 openEO Meets SPARQL (45')
Alexander Jacob, EURAC

16:00 – 17:00 Connecting Vectors and Knowledge: An Introduction to Representation Learning with Knowledge Graphs (1h)
Gerard Pons, Marc Maynou, UPC

DAY 2

EXPANDING KNOWLEDGE: From Latent Representations to Knowledge-Driven AI (09:00 – 13:00)

09:00 – 09:45 Latent Spaces: From Explicit Knowledge Representation to Geometric Intelligence (45')
Gabriele Tassi, EXAI

09:45 – 10:45 From Attention to Adaptation: A Deep Dive into Transformers and LoRA (1h)
Marla Grunewald, TUBS

10:45 – 11:00 BREAK

11:00 – 12:00 From Unstructured Text to Dynamic Structured Knowledge: LLMs in Ontology-Driven Information Extraction (1h)
Simone Martin Marotta, EXAI

12:00 – 12:45 Putting It All Together: Knowledge-Driven Data and AI Workflows in CyclOps (45')
Dimitrios Valsamis, CERTH

12:45 – 13:00 CLOSING

Details

BUILDING KNOWLEDGE: From Knowledge Graphs to Virtual Knowledge Graphs

Title	Abstract	Speaker	Duration
Introduction to Knowledge Graphs		Davide Lanti (UNIBZ)	00:45
Virtual Knowledge Graphs for Data Access – Ontologies	<i>Accessing and integrating heterogeneous data sources remains a major challenge in complex data processing tasks, such as data analytics and machine or deep learning pipelines. Virtual Knowledge Graphs (VKGs) offer a powerful solution by providing a uniform, ontology-driven view over disparate datasets without requiring data replication. In this first part of the tutorial, we introduce the foundations of the VKG paradigm, focusing on the role of domain ontologies in enabling coherent, semantically rich data access. We describe how ontologies define the conceptual layer of a VKG, how they guide query formulation and interpretation, and how they contribute to flexibility and domain awareness in downstream applications. Attendees will gain a clear understanding of the ontology-centric principles behind VKGs and how these principles support effective integration of legacy and modern data sources.</i>	Davide Lanti (UNIBZ)	01:00
Virtual Knowledge Graphs for Data Access – Data Mappings	<i>While ontologies provide the conceptual backbone of a Virtual Knowledge Graph, the mapping layer is what connects real-world data to this conceptual view. In this second part of the tutorial, we focus on the design and implementation of data mappings that expose heterogeneous legacy data sources as coherent knowledge graphs. We discuss the main challenges that arise in complex VKG scenarios, including heterogeneity, implicit domain knowledge, and structural mismatches between data and ontology. Emphasis is placed on mapping patterns—reusable, declarative modeling structures that help manage complexity, improve maintainability, and ensure alignment between data sources and domain ontologies. Through examples and best practices, this lecture equips participants with practical strategies for building robust mapping</i>	Diego Calvanese (UNIBZ)	01:00

	<i>layers that fully leverage the VKG approach for scalable, semantically enriched data access.</i>		
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USING KNOWLEDGE: From Semantic Access to Representation Learning

Title	Abstract	Speaker	Duration
Building and Consuming Virtual Knowledge Graphs with Ontopic Suite	<i>This interactive demonstration will present how to build a virtual knowledge graph from a relational source and then how to consume using the SPARQL and semantic SQL interfaces.</i>	Benjamin Cogrel (ONTOPIC)	00:45
openEO Meets SPARQL	<i>Talk about the ongoing CRIMA project, which aims at offering ontology based decision support systems that integrates information from scientific literature with quantitative data. This novel solution will support analysis to reduce the impact of climate risks and allows for better adaptive measures, combining the flexibility of semantic data models for the representation of knowledge of risks with earth observation data provided by the openEO API.</i>	Alexander Jacob (EURAC)	00:45
Understanding Embeddings: Foundations, Intuition, and the Bridge to Knowledge Graphs	<i>Embeddings have become crucial in modern machine learning, enabling models to represent complex objects (e.g., words, images, and entities) in compact vector form. This talk introduces the main idea behind embeddings, explains why they are powerful, and explores how they extend beyond text to Knowledge Graphs.</i>	Gerard Pons, Marc Maynou (UPC)	01:00

EXPANDING KNOWLEDGE: From Latent Representations to Knowledge-Driven AI

Title	Abstract	Speaker	Duration
Latent Spaces: From Explicit Knowledge Representation to Geometric Intelligence		Gabriele Tassi (EXAI)	00:45
From Attention to Adaptation: A Deep Dive into Transformers and LoRA	<i>This lecture provides an overview on the building blocks of the Transformer model and how they align user input with the trained output.</i> <i>We will discuss the core elements of the model and talk about the processes involved during training and inference. Additionally, we will introduce the concept of parameter efficient</i>	Marla Grunewald (TUBS)	01:00

	<i>fine-tuning methods and explain how Low-Rank Adaptation works.</i>		
From Unstructured Text to Dynamic Structured Knowledge: LLMs in Ontology-Driven Information Extraction	<i>This lecture explores the integration of LLM-based agents with ontology-driven frameworks to transform unstructured documents into structured, explainable knowledge representations.</i> <i>We will discuss how ontologies can guide and constrain the interpretative space of LLMs, improving both semantic consistency and domain adaptability. The talk will outline the conceptual pipeline, from text segmentation and semantic summarization to ontology-grounded extraction, as well as traceability mechanisms.</i>	Simone Martin Marotta (EXAI)	01:00
Putting It All Together: Knowledge-Driven Data and AI Workflows in CyclOps	<i>This session brings together the concepts presented during the school and shows how they are applied in the CyclOps platform. We first show how the DataOps components ingest and profile data from heterogeneous sources and data spaces and integrate it into the Integrated Knowledge Base (IKB) as a Virtual Knowledge Graph. We then show how AIOps tools, such as the AI Marketplace, Feature Engineering, the Optimization Functions Repository and the AI Models Repository, use this knowledge to select, build and deploy AI models, with every step traced as metadata in the IKB. Finally, we introduce the CyclOps Lab, a collaborative workspace combining JupyterLab, a visual drag-and-drop pipeline editor, the Decentralised Algorithms Repository and federated learning support. We demonstrate how users can build AI pipelines manually or start from pipelines generated automatically from their natural-language intents, and how these pipelines are executed at scale over distributed environments through the Data and Execution Abstraction (DEA) module.</i>	Dimitrios Valsamis (CERTH)	00:45