CyclOps

DETAILED AGENDA

CyclOps Winter School

12-14 Jan

Legend of macro-areas: letters indicate the category of each session:

A. **THE THEORETICAL FOUNDATIONS**
Controlled Vocabularies, Taxonomies, Thesauri, and Ontologies.

B. **FROM THEORY TO ACTION**
Knowledge Representations and Reasoning (KRR) and Expert Systems.

C. **KNOWLEDGE FROM THE UNSTRUCTURED**
Natural Language Processing and LLMs.

D. **SEMANTICS IN THE EU**
Innovation in the European Union: EU values and the Data Spaces.

K. **KEYNOTE SPEECH**

Pr. **PRACTICAL SESSIONS**

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Day 1 Monday Jan 12			
Time	Session	Description	MA
09:00 – 09:30	Arrival and registration	*Main Entrance*	-
09:30 – 10:00	Welcome	*Seminar rooms 1-2-3*	-
10:00 – 11:00	**The Nature of Representation and Information** Stefano Borgo	*Representations are widely used in both scientific domains and everyday life. However, what they actually are is not always clear, nor is their relationship to information. Typically, we focus on the information we can extract from them—whether correct or incorrect, precise or imprecise, detailed or general. In philosophy, information is primarily discussed in relation to the notion of aboutness, while in application-oriented communities, it is linked to concepts such as data and knowledge. The traditional use of representation often suffers from the shortcomings of both perspectives.* *In this talk, we present a way to understand representations as pairs of form and content, without taking a stance on aboutness, and show how this leads to a different view of information. We will discuss how this approach answers questions such as "Ontologically speaking, what is a map?" and similarly for a painting, a piece of music, or a novel. The material presented is joint work with Riichiro Mizoguchi.*	**K**
11:00 – 11:30	*Break*		
11:30 – 12:30	**A Practical Journey through Taxonomies, Thesauri, and Ontologies** Cristine Griffo	*We will begin by demystifying the terminology, guiding you through the logical progression from simple to complex structures. We will start with Taxonomies, the foundational "family trees" of knowledge that enable intuitive browsing and consistent categorization. We will then explore Thesauri, which enrich taxonomies by mapping a web of relationships, including synonyms, broader and narrower terms, and related concepts, dramatically enhancing the power and precision of information retrieval. Finally, we will introduce Ontologies as the most expressive layer. Ontologies move beyond simple hierarchies and relationships to define formal, machine understandable models of a domain. They specify classes, properties, and logical rules, enabling intelligent reasoning, data integration across disparate sources, and unlocking new insights.*	**A**
12:30 – 13:30	**Virtual Knowledge Graphs for Data Access – Ontologies** Davide Lanti	*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*	**A**

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		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.	
13:30 – 15:00	*Lunch break*		
15:00 – 16:00	**Virtual Knowledge Graphs for Data Access – Data Mappings** Diego Calvanese	*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 layers that fully leverage the VKG approach for scalable, semantically enriched data access.*	**B**
16:00 – 17:00	**Understanding Embeddings: Foundations, Intuition, and the Bridge to Knowledge Graphs** Gerard Pons, Marc Maynou	*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.*	**B**
20:00 – *	**Social Dinner** Forsterbräu	*From virtual knowledge graphs to real social happening. Let us all know each other a bit better: discuss the lessons learnt from today's talks, or just decompress and practice chilled conversations with your meal mates.* *Meet at 20:00 (or a bit earlier) at the Forsterbräu landmark restaurant, in the very centre of the old town in Goethe street no.6. Prost!*	

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Day 2 Tuesday Jan 13			
Time	Session	Description	MA
09:00 – 10:00	**Knowledge Graphs at the Core of the Data Life Cycle** Anna Queralt	*Data Science and Artificial Intelligence are transforming the global economy by leveraging the unprecedented volume of available data. To fully realize this potential, data-centric systems must be systematized to automate repetitive, time-consuming, and error-prone tasks. This talk introduces knowledge graphs as a key technology for managing and automating multiple stages of the data life cycle.*	**B**
10:00 – 11:00	**Building Trustworthy Systems from the Inside Out** Julia Palma	*As knowledge-based technologies become deeply integrated into decision-making processes, trustworthiness becomes no longer optional. To fully harness their potential, these systems must be designed to operate reliably under uncertainty, communicate their reasoning, and inspire user confidence. This session introduces core principles and practices for building trust from the inside out, highlighting why trustworthiness matters, the aspects that define it, methodologies and tools that support it, and the role of transparency and explainability in creating robust, dependable knowledge-based systems.*	**B**
11:00 – 11:30	*Break*		
11:30 – 12:30	**From Unstructured Text to Dynamic Structured Knowledge: LLMs in Ontology-Driven Information Extraction** Simone Martin Marotta	*This lecture explores the integration of LLM-based agents with ontology-driven frameworks to transform unstructured documents into structured, explainable knowledge representations. 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.*	**C**
12:30 – 13:30	**From Attention to Adaptation: A Deep Dive into Transformers and LoRA** Marla Grunewald	*This lecture provides an overview on the building blocks of the Transformer model and how they align user input with the trained output.* *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 fine-tuning methods and explain how Low-Rank Adaptation works.*	**C**
13:30 – 15:00	*Lunch break*		
15:00 – 15:30	**Impactful and Future-proof Research** Julia Palma	*On the relevance of making developments resilient to guarantee funding, maximise impact and career development.*	**D**

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15:30 – 17:00	**EU Data Spaces and Semantic Interoperability** Alessio Carenini	*Introduction to dataspaces / semantics in dataspaces / the deploy EMDS case: semantics in data products discovery (with demo) / semantic data products via Chimera.*	**D**

Day 3
Wednesday Jan 14

Time	Session	Description	MA
09:00 – 09:20	Service communications	*Seminar rooms 1-2-3*	-
09:20 – 10:00	**Building and Consuming Virtual Knowledge Graphs with Ontopic Suite** Benjamin Cogrel	*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.*	**Pr**
10:00 – 10:40	**openEO Meets SPARQL** Alexander Jacob	*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 ontology based data models for the representation of knowledge of risks with earth observation data provided by the openEO API.*	**Pr**
10:40 – 11:10	*Break*		
11:10 – 11:50	**Building an Ontology-Guided Information Extraction Pipeline with LLMs** Gabriele Tassi	*This hands-on session guides participants through the design and implementation of a lightweight, ontology-guided information extraction pipeline powered by Large Language Models (LLMs). Starting from unstructured textual sources, attendees will learn how domain ontologies can be used to constrain, guide, and validate LLM-driven extraction, enabling the generation of structured, semantically consistent, and explainable knowledge representations. Through practical exercises, participants will experiment with ontology-aware prompting, structured output generation (e.g., JSON-LD or RDF), and traceability mechanisms linking extracted knowledge back to the source text. The session highlights the advantages and limitations of ontology-driven approaches compared to unconstrained extraction, with a particular focus on interoperability and trust in the context of Data Spaces. By the end of the lab, participants will have built a small but complete pipeline transforming unstructured documents into ontology-grounded knowledge graphs, gaining practical insights into how LLMs and semantic technologies can effectively complement each other.*	**Pr**

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11:50 – 12:30	**On the Manufacturing Data Space** Alexandros Nizamis	*The lecture will explore the Manufacturing Data Spaces landscape. It will also focus on semantic brokering approaches for metadata handling in manufacturing ecosystems.*	**Pr**
12:30 – 13:30	**Playing with Meanings #ontologygames** Greta Adamo, Max Willis	*Join us in this session of ontology-based group modelling, where we will engage in active learning through competitive and discursive fun. Ontology-based games are an innovation in participatory sense-making that leverages specially designed card games to discuss, negotiate, and model ontological notions. After a very brief introduction we will play Type Token "Space," a Unified Foundational Ontology (UFO) game about the qualities of planets, observations of stars, and consuming donuts. This will be followed by Particular Universes "Cats," a Basic Formal Ontology (BFO) game, which examines dogs chasing birds, humans embalming cats and types of art. Welcome to come and Play with Meanings!*	**Pr**

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