

Institute for Data, Process and Knowledge Management

Marta Sabou, Axel Polleres

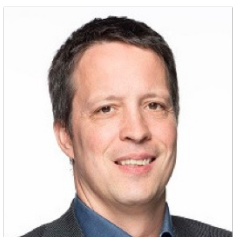
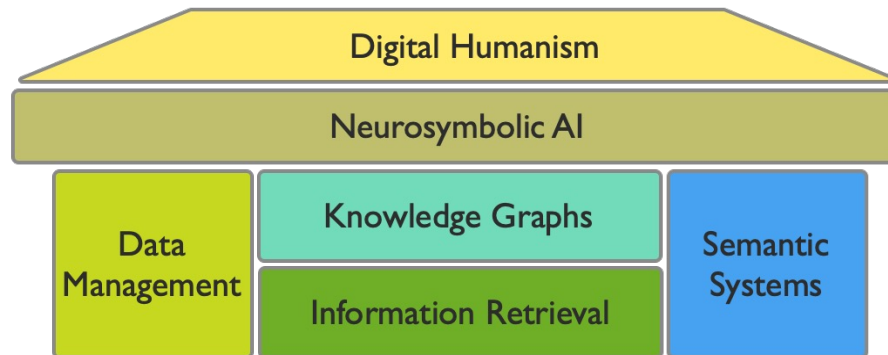


www.wu.ac.at/dpkm



DPKM – at a glance

Knowledge Management Group



Axel Polleres

Data Management Group



Svitlana Vakulenko

Information Retrieval Group



Marta Sabou

Semantic Systems Group

AI areas of interest:



Hybrid AI Systems
and Representations



Digital Humanism and AI

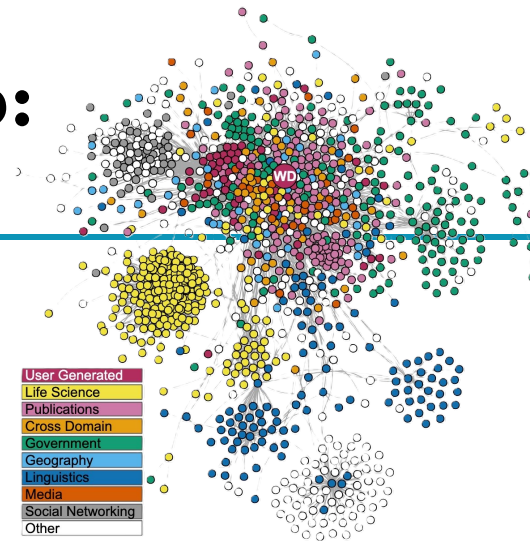


AI for Engineering



AI for Data Ecosystems/
Data Ecosystems for AI

DPKM/Data Management Group:



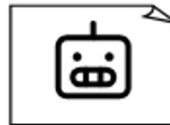
Efficient
Representations



Query Languages and
Benchmarking



Scalable RDF
archiving systems



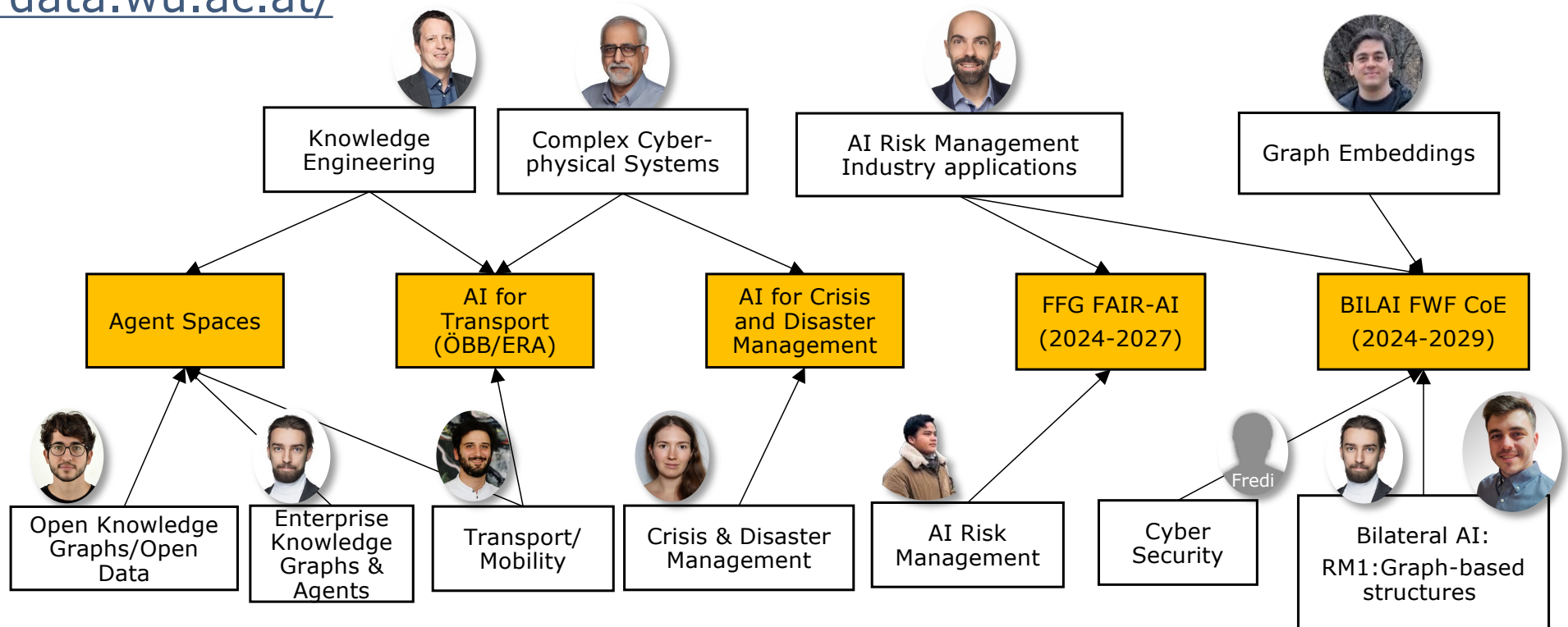
Agentic
LLMs

<https://data.wu.ac.at/>

Research
Topics

Research
Projects

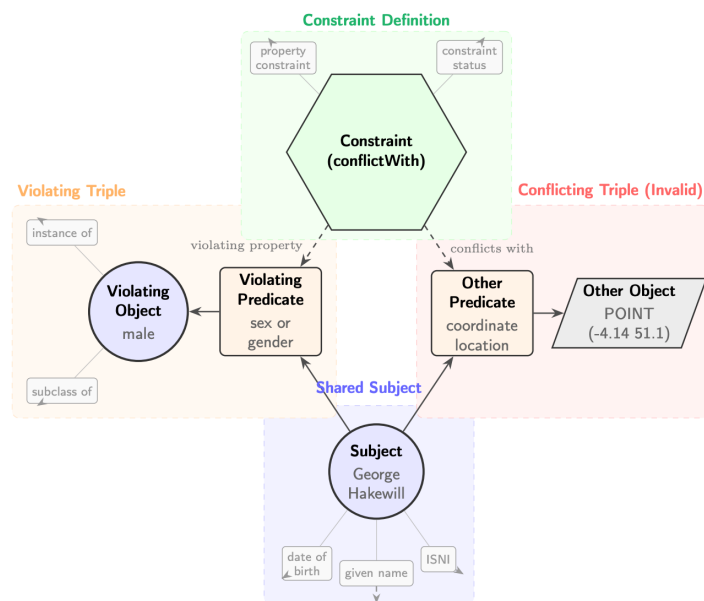
Application
Domains



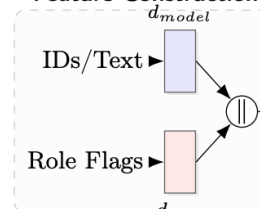
Neuro-Symbolic Repairs of Knowledge Graphs

ESWC2026 paper :

- Deploying GNNs to learn KG repairs:



Feature Construction



Structure is the Signal: Graph Encodings and GNNs for Constraint Repair in Collaborative KGs

Miguel Vázquez¹, Kevin Innerebner², Alexander Prock¹, Günter Klambauer^{3,4}, Elisabeth Lex², Johannes Schimunek⁴, and Axel Polleres^{1,5}

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² Graz University of Technology (TU Graz), Graz, Austria

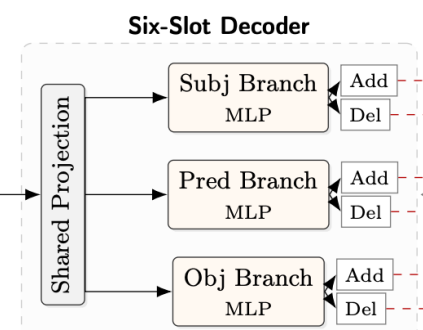
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³ Clinical Research Institute for Medical Artificial Intelligence, Johannes Kepler University Linz, Austria

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⁵ Complexity Science Hub Vienna, Austria



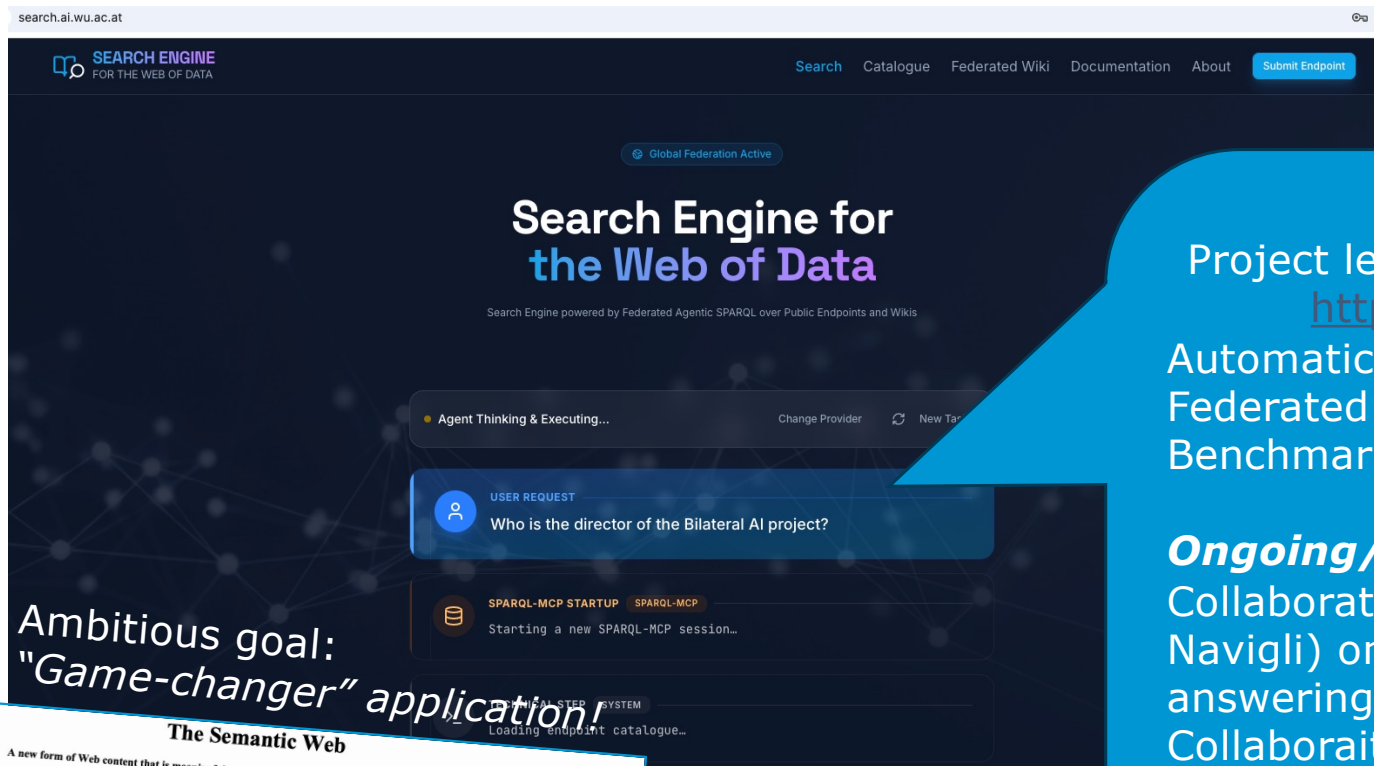
Loss Function

$\mathcal{L}_{CE}(\text{Slots}) + \mathcal{L}_{Fix}(\text{Constraint})$

Next steps:

- Combine Symbolic Repairs, GNNs, and LLMs for KG repairs

SPARQL-MCP



Project lead: Daniil Dobriy (BILAI PhD)
<https://search.ai.wu.ac.at/>

Automatic Catalog generation
Federated query generation/optimization
Benchmark, Search Engine

Ongoing/Planned:

Collaboration with La Sapienza (R. Navigli) on KG-based Question answering

Collaboration with UGhent (R. Taelman) on Federated query Optimization and reducing Server load

Ambitious goal:
"Game-changer" application!

The Semantic Web

A new form of Web content that is meaningful to computers will unleash a revolution of new possibilities
by TIM BERNERS-LEE, JAMES HENDLER and ORA LASSILA

The entertainment system was belting out the Beatles' "We Can Work It Out" when the phone rang. When Pete answered, his phone turned the sound down by sending a message to all the other local devices that had a volume control. His sister, Lucy, was on the line from the doctor's office: "Mom needs to see a specialist and then has to have a series of physical therapy sessions. Biweekly or something. I'm going to have my agent set up the appointments." Pete immediately agreed to share the chauffeur. At the doctor's office, Lucy instructed her Semantic Web agent through her handheld Web browser. The agent promptly retrieved information about Mom's prescribed treatment from the doctor's agent, looked up several lists of providers, and checked for the ones in-plan for Mom's insurance within a 20-mile radius of her home and with a rating of excellent or very good on trusted rating services. It then began trying to find a match between available appointment times (supplied by the agents of individual providers through their Web sites) and Pete's and Lucy's busy schedules. (The emphasized keywords indicate terms whose semantics, or meaning, were defined for the agent through the Semantic Web.)

Agentic SPARQL & Global Data Catalogues

Agentic SPARQL with SPARQL-MCP

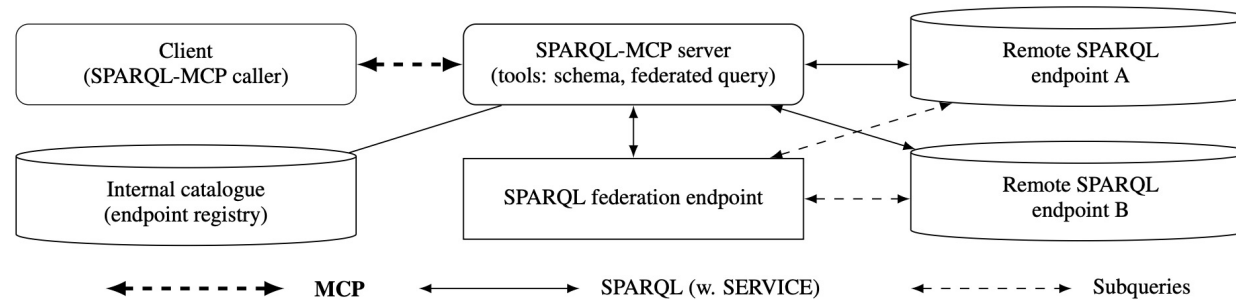
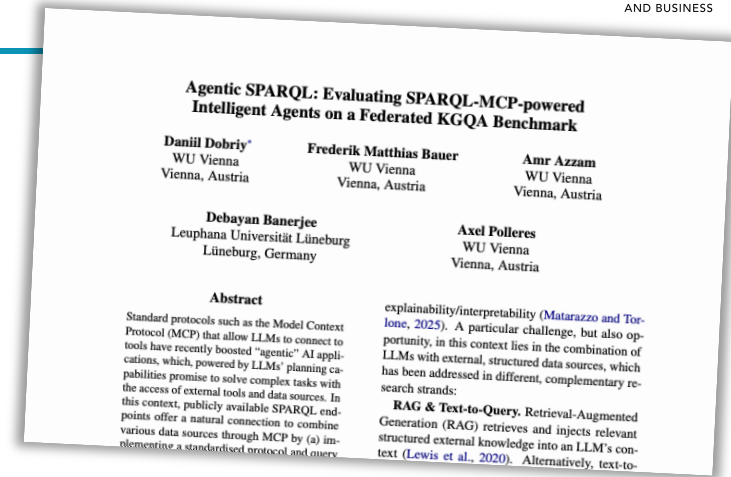
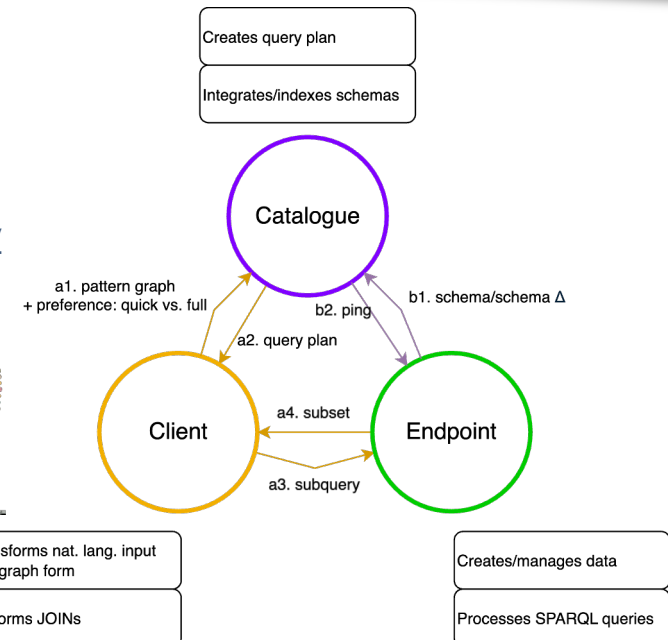
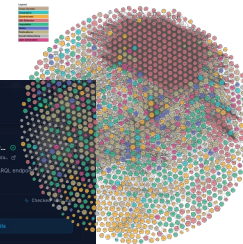
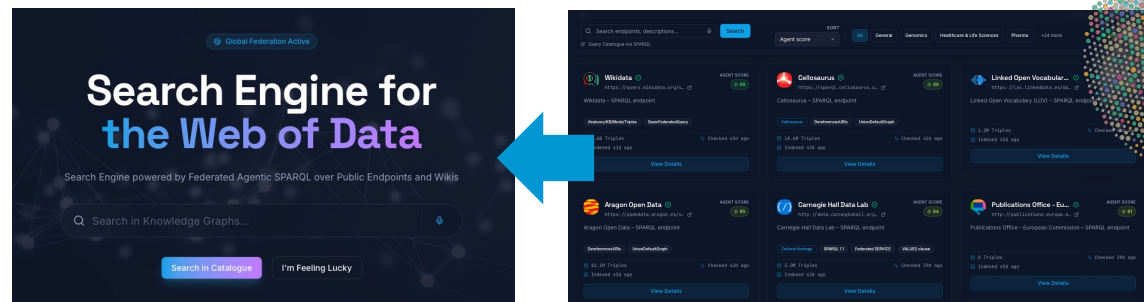


Figure 1: Architecture: the client communicates with the SPARQL-MCP server via the MCP protocol. The server includes the endpoint registry as a component, and issues SPARQL queries either directly to remote endpoints (A, B) or to a federation endpoint which decomposes and forwards subqueries to A and B for multi-SERVICE queries.



Data Search Engine & Data Catalogue

from <http://lod-cloud.net/>



Vision paper - Agent Spaces

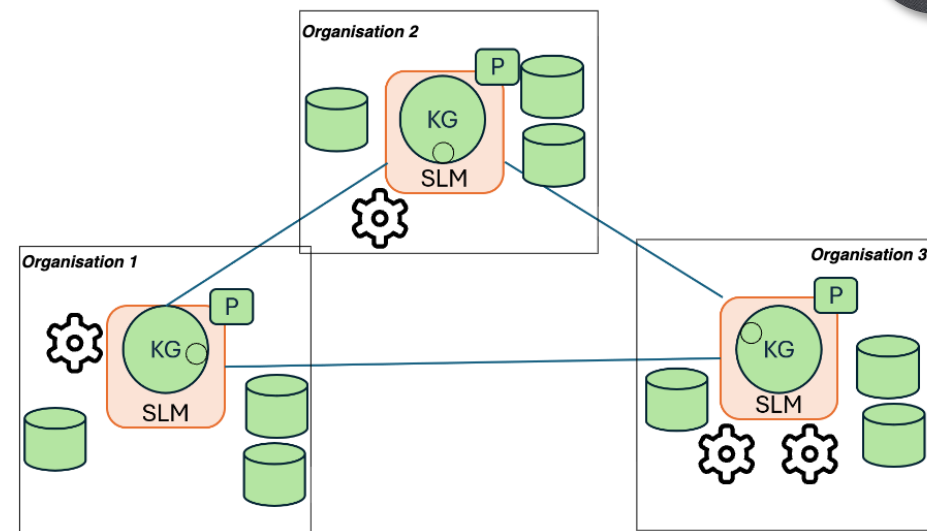
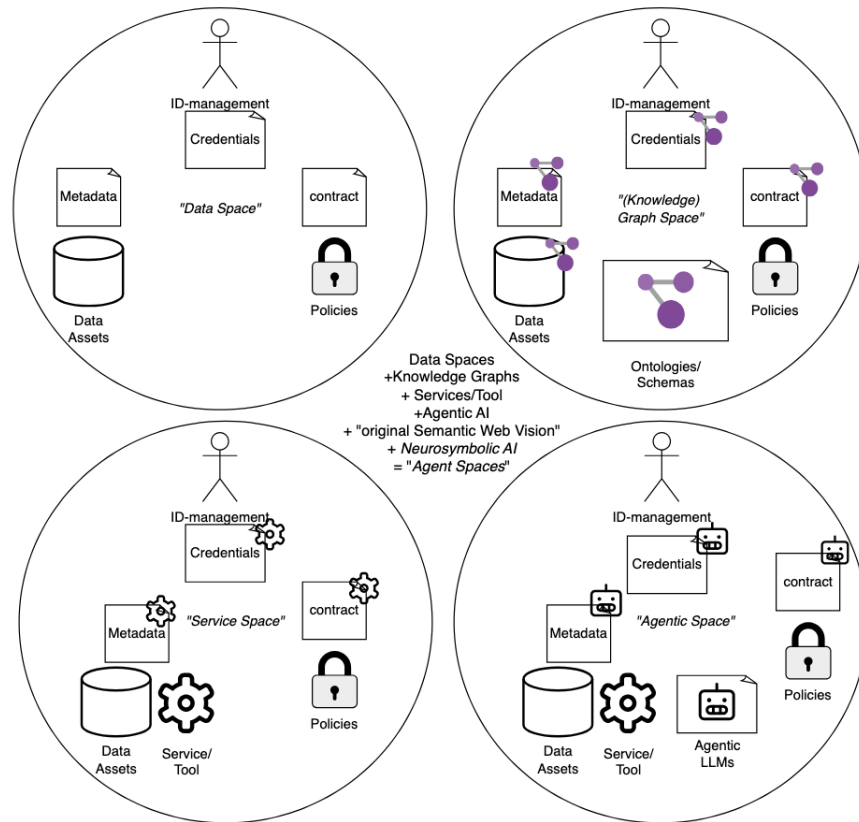


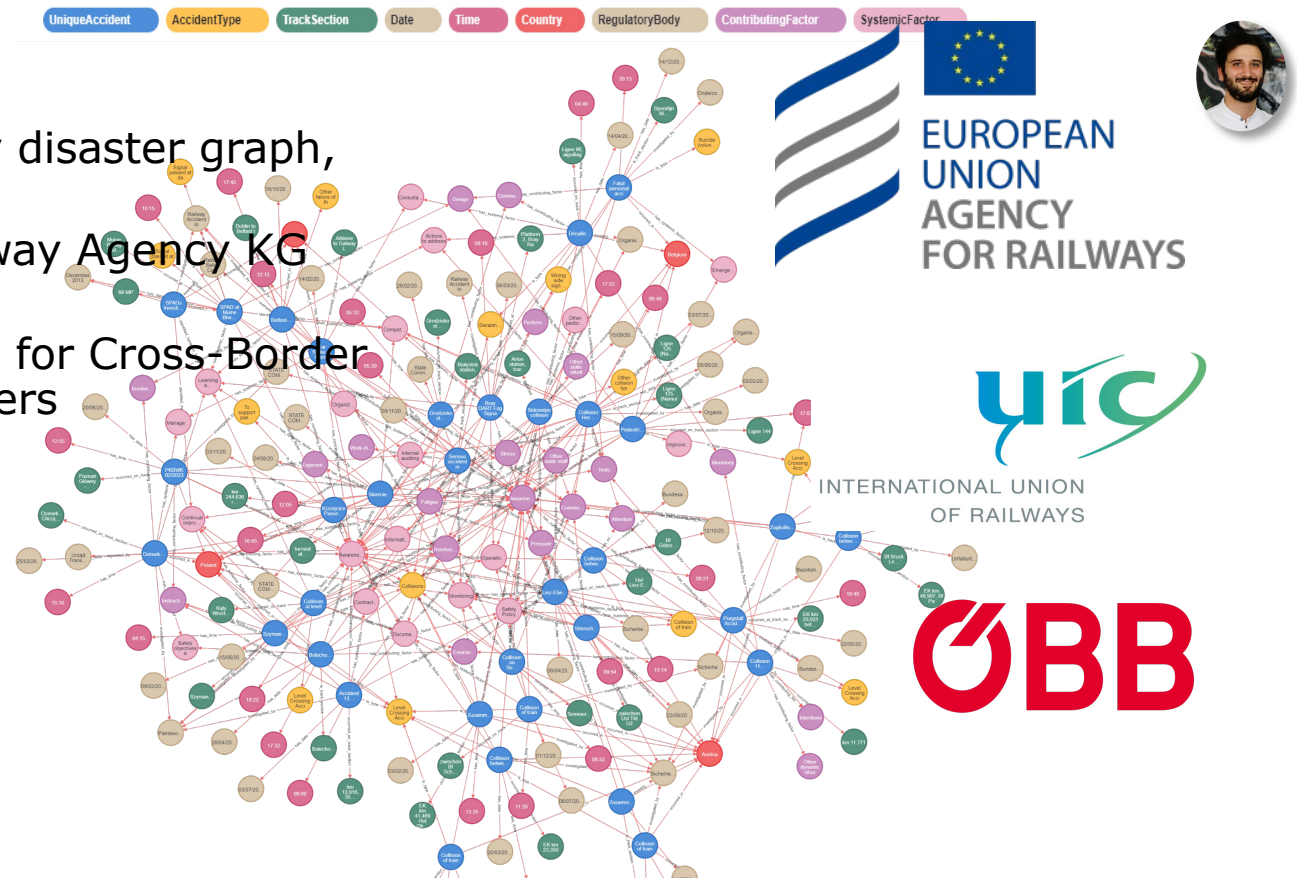
Figure 2: An **Agent Space** with Linked Knowledge Graphs (**KGs**), wrapped by a sovereign, agentic language model (**SLM**), that is governed by symbolic policy guardrails (**P**).

From Data Spaces to Agent Spaces*

Axel Polleres^{1,2,*,†}, Diego Rincon-Yanez^{1,*,†}, Amin Anjomshoa^{1,†}, Daniel Dobriy^{1,*,†} and Emanuel Sallinger^{3,†}

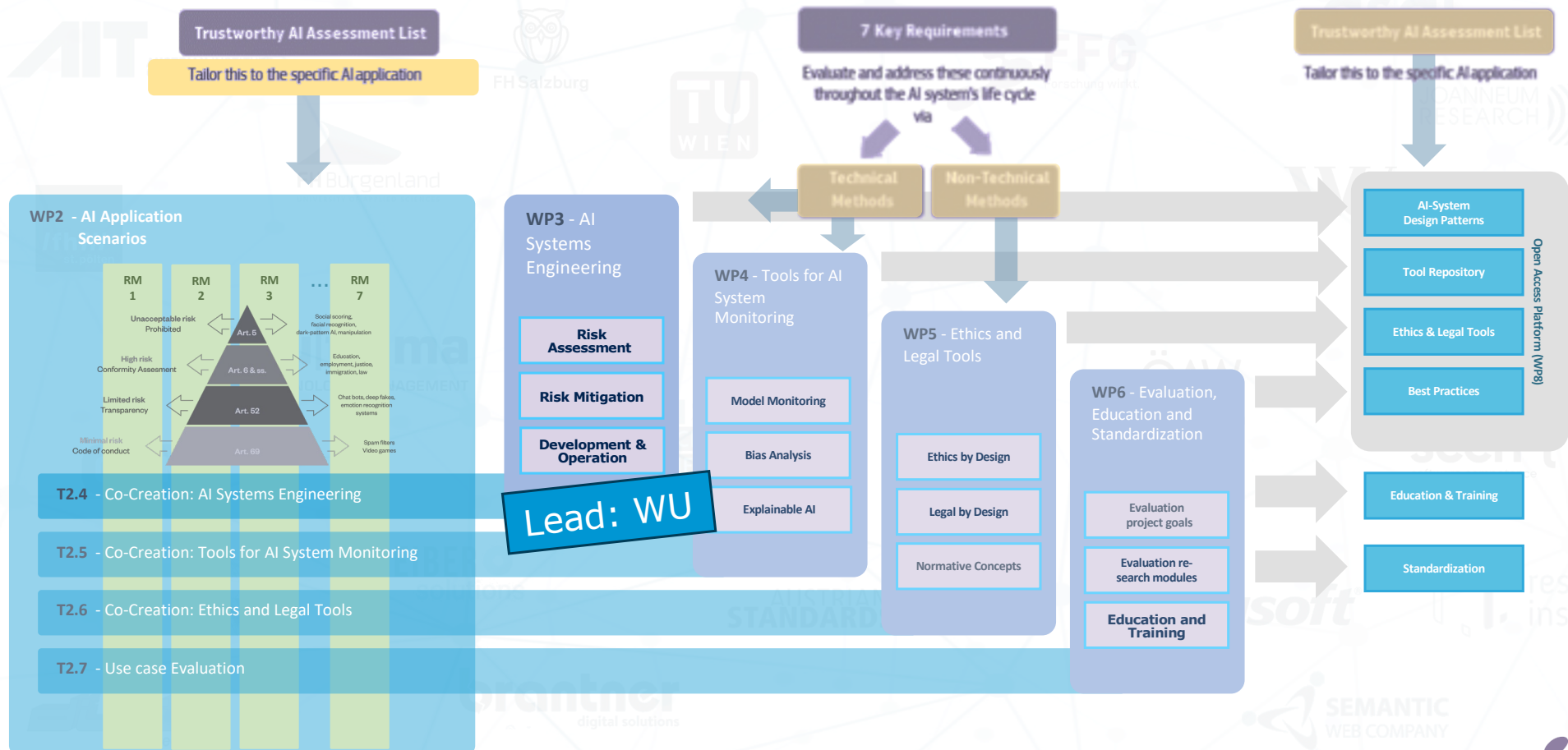
AI for Transport

- Extraction and linking railway disaster graph,
- Integrate it in European Railway Agency KG
- Experiment Language Models for Cross-Border Messages of Locomotive Drivers

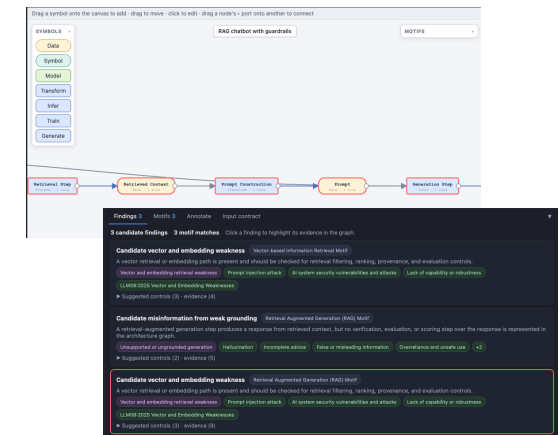
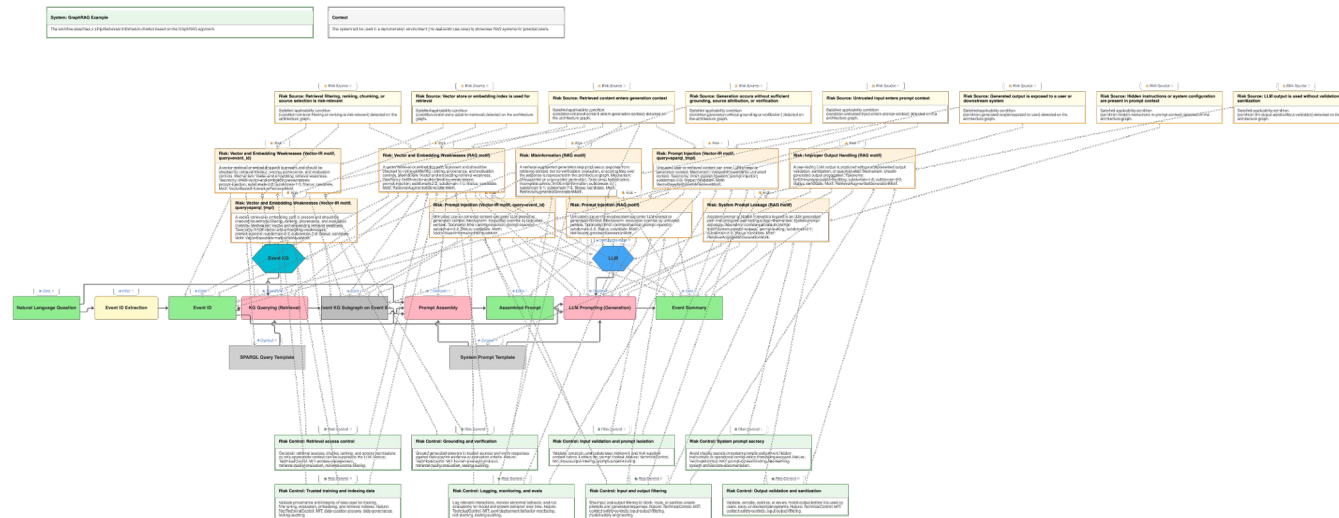


Sohi, S. (2025). "Semantic Technologies for Harmonising European Railway: Improving Interoperability, Data Integration, and Operational Efficiency." In The Semantic Web: ESWC 2025 Satellite Events. Springer.

Sohi, S., Balan, D., Anjomshoaa, A., & Polleres, A. (2025). "Towards Harmonised Rail Safety Knowledge: LLM Techniques for EU Accident Report Processing." In Proceedings of the RAGE-KG Workshop at ISWC 2025, 169–174.



AI Systems Engineering: Risk Assessment

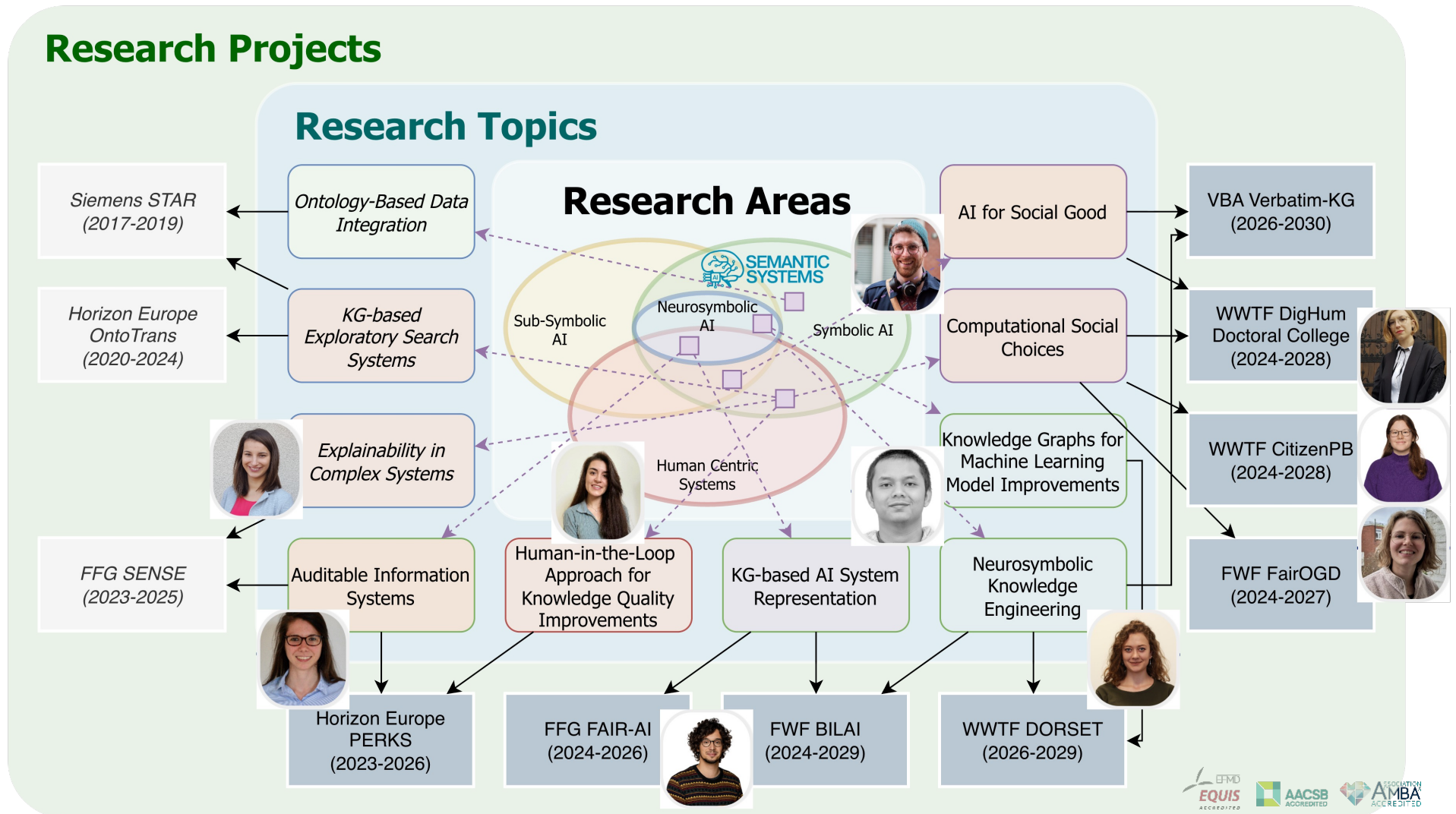


- Systematic methodology for designing *trustworthy* AI systems
- Semantic foundations for KG-supported risk assessment
- Aligned with state-of-the-art standards, guidelines, lists and tools (e.g., MIT Risk Repository, IBM Risk Atlas, ISO/IEC 23894, ISO/IEC 42001, DPVCG, AIRO etc.)

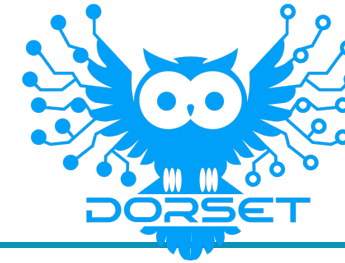
- Ekaputra, F. J., Prock, A., & Kiesling, E. (2025). "Towards Supporting AI System Engineering with an Extended Boxology Notation." Proceedings of the 2nd International Workshop on Knowledge Graphs for Responsible AI (KG-STAR) @ ESWC 2025.
- Ikhsan, M., Kiesling, E., Mahmoud, S., Prock, A., Revenko, A., & Ekaputra, F. J. (2025). "Pattern-based AI Risk Assessment: A Taxonomy Expansion Use Case." In D. Chaves-Fraga, I. Heibi, D. Garjo, D. Collarana, A. Salatino, & S. Vahdati (Hrsg.), The Second Workshop on Knowledge Graphs and Neurosymbolic AI (KG-NeSy): co-located with SEMANTICS'25: International Conference on Semantic Systems (vol. 4064). CEUR Workshop Proceedings. <https://ceur-ws.org/Vol-4064/>
- Ikhsan, M. (2026). "AI Risk Management for System Design: An Ontology-Driven Approach Integrating Engineering Principles and Ethical Insights." In: Curry, E., et al. The Semantic Web: ESWC 2025 Satellite Events. ESWC 2025. Lecture Notes in Computer Science, vol 15832. Springer, Cham. https://doi.org/10.1007/978-3-031-99554-5_39 [nominated for Best PhD Symposium Paper]
- Kubesch, J., Kiesling, E., Ekaputra, F.J., Serles, U., Toma, I., Havas, C. (2025). "Exploring the Benefits of Iterative Retrieval-Augmented Generation for Risk Mitigation in LLM Responses." In: Fischer, L., et al. Database and Expert Systems Applications - DEXA 2025 Workshops. DEXA 2025. Communications in Computer and Information Science, vol 2615. Springer, Cham. https://doi.org/10.1007/978-3-032-02003-1_1



Research Projects

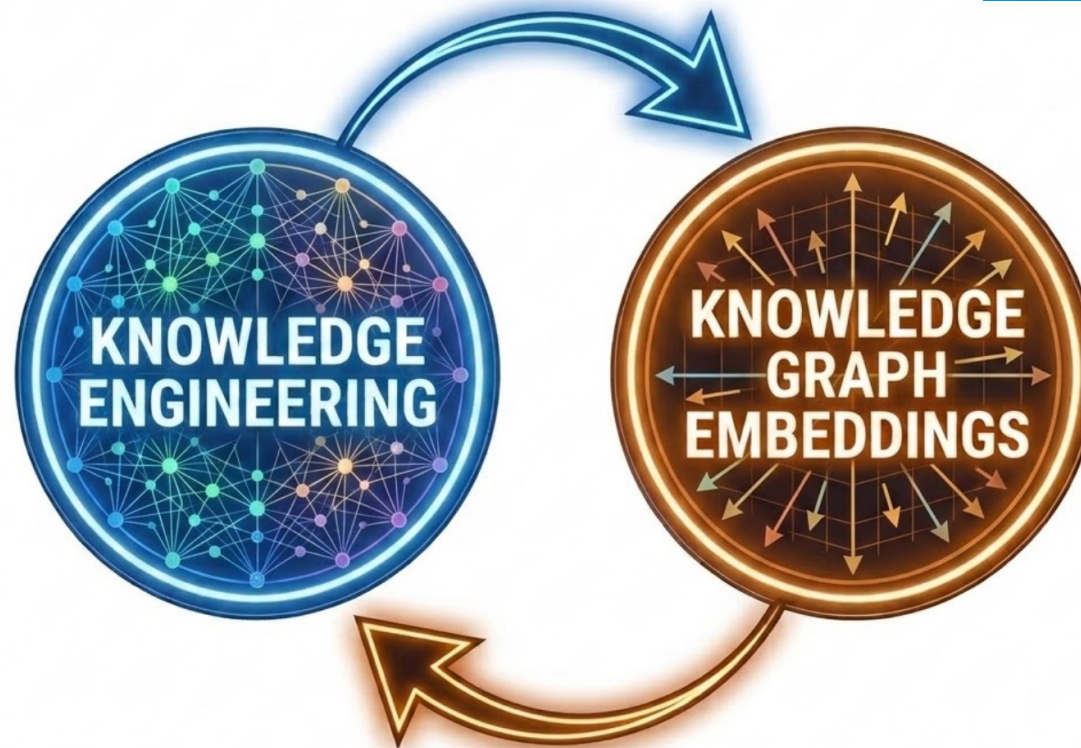


From Structures to Vectors: Decoding How **Knowledge Graph** Characteristics Shape **Embedding Strategies**



Which **KG**
characteristics
impact embedding
performance, and
how?

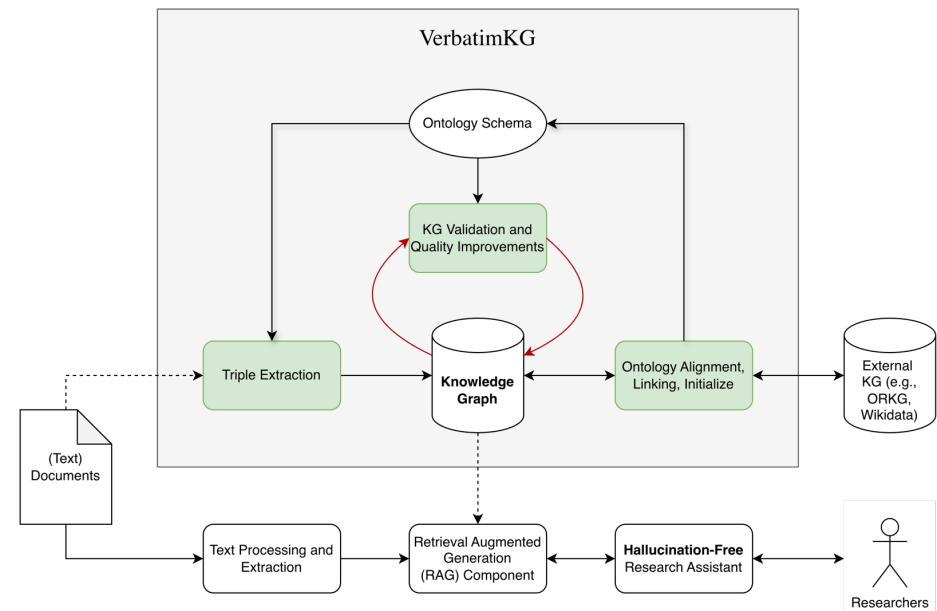
Do we need to
rethink KG
creation and
evaluation?



How to design **KGE**
benchmarks and
methods that are
aware of KG
characteristics?

Project: VBA VerbatimKG

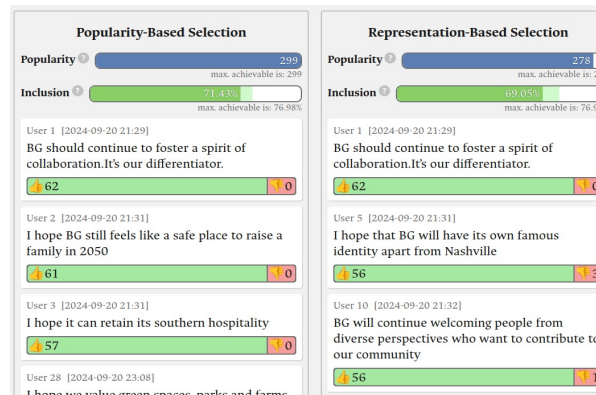
- Verbatim (<https://verbatim.krlabs.eu/>) is an AI research platform for hallucination-free question-answering (QA) based on text documents.
- **Core hypothesis:** Extraction, re-use of and alignment to structured scholarly knowledge will enhance the trustworthiness of (LLM-based) research assistant, such as Verbatim platform.
- The VerbatimKG project focus on the following RQs:
 - To what extent can we improve information extraction by considering a domain ontology?
 - How can we improve the trustworthiness of the system's knowledge by aligning to external sources?
 - How can we improve the quality of the extracted knowledge?





- Interdisciplinary Doctoral College with 18 PhD students across WU Wien, TU Wien and Uni Wien.
- The college is dedicated to critically examining and shaping the digital transformation of society.-
- Marta Sabou and Jan Maly act as Scientific Coordinators on the side of WU

Fair Online Decision Making



Leveraging recent advances in our understanding of fairness and proportionality to provide a novel tool-box for fair group decision making in online applications.



Citizen-Centered Participatory Budgeting

- Joint project with Carolina Plescia from the Department of Government, Uni Wien
- Understanding citizens' preferences for the voting rules used in Participatory Budgeting
- Developing algorithms respecting these preferences as much



Wiener Wissenschafts-,
Forschungs- und Technologiefonds

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<https://keos.ai.wu.ac.at/>



Research
Topics

Information
Retrieval

Representation
Learning

Reasoning for LLMs

Conversational AI

Research
Projects

WWTF VRG
(2025-2033)

FWF BILAI
(2025-2029)

WU Jubiläumsfonds
(2026-2027)

Application
Domains

Legal Tech

Web Search

Graph-based
structures

Cultural Heritage

