

ICT25-032 - From Structures to Vectors: Decoding How Knowledge Graph Characteristics Shape Embedding Strategies

Abstract

Applications with far-reaching societal impact, such as drug discovery and repurposing, are enabled by an emerging trend in Artificial Intelligence (AI) that combines the complementary strengths of two AI branches. From the symbolic branch, Knowledge Graphs (KG) capture complex domain data in formal graph structures. From the sub-symbolic side, KG Embeddings (KGE) transform KGs into low-dimensional vector spaces thus enabling the discovery of latent knowledge through sub-symbolic techniques.

By transforming structures to vectors, KGEs play a pivotal role in AI. Yet, there is a sub-optimal synchronisation between KGs and KGEs, which hampers this technology in reaching its full potential. Indeed, while recent literature shows that KG characteristics (e.g., semantic richness) have an impact on the performance of KGE-enabled tasks, this aspect is not considered in related communities: (1) in KGE, we lack benchmarks that capture diverse KG characteristics and KGE methods that are aware of those; (2) in Knowledge Engineering (KE), we lack principled methodologies and tools that allow engineering KGs with given characteristics. Overall, a critical gap exists in understanding the interplay between KG characteristics and KGE performance. This drastically reduces the practical applicability of KGEs especially in specialised domains (e.g., medicine) where KGs have particular characteristics.

DORSET aims to improve this sub-optimal synchronisation by strengthening the bridge between KGs and KGEs. For that, we will (1) provide a systematic and experimentally derived understanding of how KG characteristics influence KGEs and build on it to (2) advance research in KGE and KE with novel benchmarks, robust KG-characteristic aware KGEs and KG creation methodologies. To that end, we bring together top experts in these areas through a collaborative methodology. In this way, we aim for a high impact on AI that will enable the use of KGEs in many more areas of major societal interest.

Scientific disciplines:

Knowledge engineering (40%) | Artificial intelligence (30%) | Semantic technologies (30%)

Keywords:

Knowledge Engineering, Knowledge Graphs, Knowledge Graph Embeddings

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Further links to the persons involved and to the project can be found under
<https://www.gmbh.wwtf.at/funding/programmes/ict/ICT25-032/>