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Ontology Mapping with R-GNN for IT Infrastructure: Enhancing Ontology Construction and Knowledge Graph Expansion

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Abstract : The rapid growth of unstructured data necessitates advanced methods for transforming raw information into structured knowledge, particularly in domain-specific contexts such as IT service management and outsourcing. This paper presents a methodology for automatically constructing domain ontologies using the DOLCE framework as the base ontology. The research focuses on expanding ITIL-based ontologies by integrating concepts from ITSMO, followed by the extraction of entities and relationships from domain-specific texts through transformers and statistical methods like formal concept analysis (FCA). In particular, this work introduces an R-GNN-based approach for ontology mapping, enabling more efficient entity extraction and ontology alignment with existing knowledge bases. Additionally, the research explores transfer learning techniques using pre-trained transformer models (e.g., DeBERTa-v3-large) fine-tuned on synthetic datasets generated via large language models such as LLaMA. The resulting ontology, termed IT Ontology (ITO), is evaluated against existing methodologies, highlighting significant improvements in precision and recall. This study advances the field of ontology engineering by automating the extraction, expansion, and refinement of ontologies tailored to the IT domain, thus bridging the gap between unstructured data and actionable knowledge.

Keywords : ontology mapping, knowledge graphs, R-GNN, ITIL, NER
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