Adam Mickiewicz University in Poznań

Doctoral School of Exact Sciences AMU

Graph-based Representation of Data Semantics: Ontologies, Knowledge Graphs, and Language Models

dr hab. Marek Reformat

Scientific lectures

Field of science	Computer Science
Teaching method	Lectures
Language	English
Numbers of hours	20
Aims of the course	The course provides an introduction and fundamental knowledge of Semantic Web technologies, in particular: - basics of logic (including description logic) - ontology engineering (construction, utilization, and management) - knowledge graphs (RDF and property graphs, graph databases) - graph query language (SPARQL and Cypher) - novel technologies for graph embeddings and construction
Course contents	**Ontology** introduction to ontology (with historical perspective) ontology language (OWL) ontology 101 Protégé (ontology development tool) ontology engineering: integration, maintenance **Logic** from propositional logic to predicate logic (a very short introduction) description logic **Rules and Reasoning** Semantic Web Rule Language (SWRL) ontology reasoners **Knowledge Graphs** graph triples and their representations vocabularies graph databases and query languages construction and embeddings of graphs and their utilization (from traditional methods to deep networks and language models)
Prerequisites and	Programming in Phyton, Discrete Math, Principles of Databases

co-requisites	

Learning outcomes	
On completion of the course PhD candidates will be able to:	**Assessment mode**
• Grasp the fundamentals of logic, with a focus on description logic • Develop ontology in different domains • Implement conditional rules based on ontology, and execute reasoners on it • Build and query knowledge graphs • Use tools for ontology construction • Apply various methods, including language models, for constructing graphs • Utilize graph databases for storing knowledge graphs	E_W01 E_W02 E_U01 E_U02 E_U05

Literature	- D. Allemang J. Hendler, *Semantic Web for the Working Ontologist*, Second Edition, Elsevier, 2011 - G. Antoniou, F. van Harmelen, *A Semantic Web Primer*, Second Edition, MIT Press, 2008 - F. Basder, D. Calvanese, D.L. McGuinness, D. Nardi, P.F. Patel-Schneider, The Description Logic Handbook: Theory, implementation, and applications, Cambridge Press, 2008 - B. DuCharme, Learning SPARQL, O'Reilly, 2011 - other material (papers, weblinks)
Additional information	