Knowledge Modelling and Semantic Technologies

Credit: 3-0-0

Course Description

Knowledge modelling is a process of formalizing the knowledge of a domain through formal knowledge representation frameworks. Apart from many other knowledge driven systems, knowledge modelling through ontology has helped in realization of embedding semantics to current hypertext-based web. The semantic web vision has shown enormous promise to revolutionize current World Wide Web dramatically. This vision rides on the idea of embedding semantics of web data so that the contents become amenable to machine processiing. Driving technologies in semantic web vision include explicit metadata, ontologies, formal logic, inferencing and intelligent agents. Huge potential and advantages of semantic web have sparked significant interest in industry and government. Semantic web has shown great promise in eLearning domain.

This course aims at developing foundations in semantic web technology addressing web scale semantic knowledge modelling techniques and related programming paradigms and applications.

Course Objective

Upon completion of the course the students will be able to

- explain features, rational and advantages of semantic web technologies
- describe and compare features of markup languages for semantic web
- explain semantic data modelling through RDF and RDF schema
- analyse the requirements and features of web ontology language (OWL)
- explain description logic framework as semantics of OWL
- build and analyse ontologies with ontology editors
- use programming paradigms for working with RDF data model and OWL
- analyze application scenarios in data integration, data exchange, knowledge management, e-learning, and digital library

Course Content

Semantic Web Concepts

- **Introduction to Knowledge Modelling (3):** Knowledge-based systems, Knowledge representation formalisms, fundamentals of reasoning.
- **Semantic Web Vision (3):** Current web, current web to semantic web, semantic web technologies, standardization, semantic web layer cake

- **Foundations of Semantic Web (8):** Extensible Markup Language, Resource Description Framework (RDF), RDF Schema (RDFS), Semantics for RDF and RDFS, Inference system for RDF and RDFS, Querying RDF
- **Ontology for Semantic Web (10):** Semantic modelling through ontology, evolution of ontology languages, Web Ontology Language (OWL), OWL semantics with Description Logic, OWL reasoning, ontology engineering.
- **Sources of Semantic Data (3):** Friend of a Friend (FOAF) ontology, Simple Knowledge Organization System (SKOS), Dublin Core (DC), Linked Data Cloud

Semantic Web Programming

- **Programming with RDF (5):** RDF serialization, RDF querying with SPARQL, RDF inference with Jena and/or sesame, programming with DBpedia
- **Ontology engineering (5):** Ontology development with Protégé, Ontology visualization, OWL API

Semantic Web Applications

- **Applications (5):** Semantic web services, Social semantic web, Semantic search, e-learning, digital library

Books

1. Semantic Web for the Working Ontologist, Dean Allemang and James Hendler, Morgan Kaufmann
2. Programming the Semantic Web, Toby Segaran, Colin Evans and Jamie Taylor, O'Reilly
3. A Semantic Web Primer, Grigoris Antoniou and Frank van Harmelen, MIT Press

References

1. Education and the Semantic Web, Vladan Devedzic, International Journal of Artificial Intelligence in Education, 2004, 14
2. Ontologies and Semantic Web for E-Learning, D. Dicheva, Handbook on Information Technologies for Education and Training, 2008
3. Key Issues in Next-Generation Web-Based Education, Vladan B. Devedzic, IEEE Transactions on Systems, Man and Cybernetics, 2003, 33(3)
4. JeromeDL–adding semantic web technologies to digital libraries, SR Kruk, S Decker, L Zieborak, Database and Expert Systems, 2005
5. Defrosting the Digital Library: Bibliographic Tools for the Next Generation Web, Duncan Hull, Steve R. Pettifer, Douglas B. Kell, PLOS Biology, 2008