CS6852: Theory and Applications of Ontologies (TAO)
2022 Edition

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Course Outline

Major components of the course

- Ontologies
  - Description Logics
- Semi-structured Data Models
  - XML
  - XML DTDs/ Schema
  - XPATH, XQuery
- Semantic-web Technology Standards
  - RDF/RDFS/OWL
  - SPARQL
- Applications
  - Linked-Data and
  - others - program analysis, word problem solving etc

Ontologies

- Machine processable knowledge
  - A range of options - possible
    - Vocabulary terms only - taxonomy
    - Vocabulary + additional axioms - richer descriptions
    - Appropriate choice - application systems
  - Possibility of reasoning
    - Inferring new knowledge
  - Mathematical Logic - based
    - Unambiguous semantics
  - Promotes interoperability of information systems
  - Details will unfold as we go along….

Semi-structured Data Models

Data that is neither structured - like relational DBs
nor unstructured - like images, audio etc

Extensible Markup Language (XML)

- A framework for creating markup languages
- Domain-specific tags for meta-data unlike HTML
- Can be used with or without schema
- Promotes data-exchange between autonomous information systems
- Can not represent “meanings”, semantics as in Ontologies

XML - Used as a particular syntax for Ontologies

Details will be discussed later..

Semantic Web Technologies

Set of W3C standards

- RDF - Resource Description Framework
  - Data Model for Assertions
  - URIs - universal resource identifiers
    - for representing things of interest
- RDFS - Resource Description Framework Schema
  - Framework for ontological knowledge
- OWL - Web Ontology Language
  - An expressive framework for ontologies
  - Founded on specific Description Logics
- Ontology Editors and APIs

Details would be discussed as we progress in the course..

Assignments and Tests

- Assignments
  - Groups of students
    - Designing Domain Ontologies
    - Designing XML DTDs
    - Querying Semi-structured Data
    - Implementing ontologies using Protege Ontology editor
    - Demonstrating ease of interoperability using semantic technologies
    - Etc…
  - Specifics to be worked out...
- Quizzes and End-Sem Examination Details
  - Yet to be decided

Books and References

1. An Introduction to Description Logics by Franz Baader, Ian Horrocks, Carsten Lutz, and Uli Sattler, Cambridge University Press, 2017.
2. Semantic Web Primer (2nd and 3rd Editions), Grigoris Antoniou and Frank van Harmelen, MIT Press, 2008.
3. Foundations of Semantic Web Technologies, Markus Kroetzsch, Pascal Hitzler, and Sebastian Rudolph, CRC Press, 2010.
4. Semantic Web for the Working Ontologist, Dean Allemang and Jim Hendler, Second Edition, Morgan Kaufmann, 2011.
5. Journal and Conference papers as and when required..