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Module Descriptor

Knowledge Systems Engineering and the Semantic Web (Computing and Mathematics)

Knowledge Systems Engineering and the Semantic Web (A14025)

Short Title: Knowledge Systems Engineering
Department: Computing and Mathematics
Credits: 5 **Level:** Advanced

Description of Module / Aims

Sophisticated techniques are used to capture, model, discover and utilize knowledge generated within and across organisations wherever that knowledge is located in the form of data sources, pdf documents, audio, video or other digital content and formats. This knowledge-based ?semantic web?, sometimes called ?Web 4.0? or the ?Intelligent Web? is a human-machine environment which both incorporates and supersedes Web 2.0 (social web) and Web 3.0 (internet of things) systems. Using techniques unpacked in this module, software development teams define and reuse computer-based knowledge models to discover and access web services in a coherent, platform independent and integrated way. Product knowledge in Amazon?s system, R&D knowledge scattered across computers in the automative industry on an extranet system, shared digital content across a network of libraries: applications like these and the infrastructure on which they sit are now being deployed and managed by engineering knowledge-based systems using a model-driven approach. In this course the student will learn the fundamentals of these technologies and systems, appreciate how they are engineered in today?s systems development and systems management context. They will also learn how to represent knowledge using ontologies and how to access and benefit from semantic data standards on the web, and how this fits into the overall capability of an organisation?s digital systems in the emerging digital landscape.

Programmes

		stage/semester/status
COMP-0656	BSc (Hons) in Information Technology Management (WD_KITMA_B)	1 / 8 / E
COMP-0656	BSc (Hons) in Information Technology (WD_KINTE_B)	4 / 2 / E

Indicative Content

- What is “knowledge”: important distinctions between machine and human knowledge
- The Evolution of the Web: Limitations of current web technologies, platforms and systems, extending internet capabilities with the semantic web including formal knowledge representation and graph data structures
- Major Challenges for web-based systems e.g Interoperability and Semantic intelligence (including Knowledge Discovery/Reuse and Knowledge management issues)
- Knowledge Modelling Methodologies & Model-Driven Development using Ontologies and similar approaches; Languages for representing knowledge on the web (e.g. OWL/OWL 2, WSMO/WSML)
- Important Ontology Standards: Metadata (e.g Dublin Core/DCMI, METS), Domain Knowledge (e.g. UMLS, SNOMED, eCatalogs), others
- Engineering a semantic software system with graph databases and/or related technologies: web services as knowledge resources & Web Resource Description Languages (DL, RDF, RDFS etc.), knowledge systems standards
- Knowledge engineering tools and techniques (e.g Protege, WSMO/WSML (STI Innsbruck))

Learning Outcomes

On successful completion of this module, a student will be able to:

1. Appraise knowledge-based systems and how these systems enhance current web-systems and web-services.
2. Analyse current examples of deployed systems.
3. Appraise key ideas of knowledge-based web systems engineering.
4. Construct knowledge representations in a semantic web context.
5. Construct ontologies using tools and techniques for accessing and benefiting from semantic standards on the web, including web services.

Learning and Teaching Methods

- Lectures addressing important theoretical and practical issues relating to the emerging intelligent web.
- Practical, hands on experience using systems engineering tools and code generators (e.g. Protege) to build models which can be used to support software development and systems management in an organisation, and generating knowledge based systems which can map into web services and other web-based resources in a web-enabled enterprise.

Learning Modes

Learning Type	F/T Hours	P/T Hours
Lecture	24	
Lab	24	
Independent Learning	87	

Assessment Methods

	Weighting	Outcomes Assessed
Continuous Assessment	50%	
Assignment	50%	3,4,5
Final Written Examination	50%	1,2

Assessment Criteria

<40%: Unable to interpret and describe key concepts of the specific knowledge domain(s).

40%–49%: Be able to interpret and describe key concepts of the specific knowledge domain(s).

50%–59%: Ability to discuss key concepts of the specific knowledge domain and ability to discover and integrate related knowledge in other knowledge domains.

60%–69%: Be able to solve problems within the specific knowledge domain(s) by experimenting with the appropriate skills and tools.

70%–100%: All the above to an excellent level. Be able to analyse and design solutions to a high standard for a range of both complex and unforeseen problems through the use and modification of appropriate skills and tools.

Supplementary Material(s)

- Akerkar, R. A. and P. S. Sajja. *Knowledge Based Systems.* Toronto: Jones and Bartlett, 2010.
- Allemang, D. and J. Hendler. *Semantic Web for the Working Ontologist, Effective Modeling in RDFS and OWL.* 2nd ed. MA, USA: Morgan Kaufmann, 2011.
- Cure, O. and G. Blin. *RDF Database Systems: Triples Storage and SPARQL Query Processing.* North Holland: Elsevier, 2014.
- Parreiras, F.S. *Semantic Web and Model-Driven Engineering.* New York: Wiley/IEEE Press, 2012.
- Yu, Liyang. *A Developer's Guide to the Semantic Web.* 3rd. New York: Springer, 2015.

Requested Resources

- Room Type: Computer Lab