COMP62342

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What have we learnt?

• Intro to Knowledge Representation
  – Why do this?
• Knowledge Acquisition
  – What do we model?
• Formalisation, Ontology Patterns
  – How to represent things (in OWL)?
• Semantics and Reasoning
  – Models, entailments, tableau
  – What exactly is it we are saying and what are the consequences?
• OWL API
  – Using ontologies in applications.
• SKOS
  – An alternative to OWL using OWL
• Linked Data
  – Using OWL or RDF(S) for data on the Web
• …next & last: OBISs
What do we do with ontologies?

E.g., Ontology-Based MCQ Generation

• Given that
  – ontology captures rich domain knowledge
  – assessment/MCQ generation is costly & relevant
  – in particular for healthcare & medicine

• why not auto-generate MCQs from ontologies?

• Building on research we have done so far,
  • in particular on how to make good MCQs, e.g., control difficulty

• we are now exploring this further with Elsevier
  • towards more complex MCQs, e.g., patient cases

• interesting new app with new reasoning problems
  • similarity of concepts and cases
What do we do with ontologies?

- OBIS: Ontology-Based Information Systems
- Think MVC/Front-End Back-End
- IS needs to store some data, in:
  - relational database
  - no-SQL database
  - files
  - XML docs
  - ...
E.g.: Patient Documentation System

- Information System relies on Patient Data
  - recorded in different systems with possibly different structures
  - recorded by different clinicians with different styles

- Holding Data in DB:
  - many complex queries that need to change with changes in medicin
E.g.: Patient Documentation System

- Toy example: get all *Parents* from database - get
  - those who have a *known child*
  - those described as *Mother* or *Father*
  - those described as *Grandmother* or *Grandfather*
  - ...
Why basing ISs on Ontologies?

- Toy example: get all *Parents* from ontology:
  - use suitable TBox and
  - retrieve all those who are entailed to be an instance of *Parent*
  - ...
Why basing ISs on Ontologies?

- Separation of concerns:
  - background knowledge & terminology into ontology
  - data into DB or ABox
  - suitably linked/mapped
  - behaviour into program code

TBox
- Endocarditis = Inflammation and locatedIn Heart
- Inflammation = Disease and causedBy Bacteria

ABox
- Healthcare Record
  - Name: Bob
  - Demographic: Smoker
  - Sex: Male
  - History: Endocardities 1998
Why basing ISs on Ontologies?

- Separation of concerns
- ✓ flexible access to data can deal with
  - **incomplete** knowledge
  - data coded in different ways
  - complex expressions: post-coordination!
  - data coded & queries on varying levels of granularity
- ✓ via terms as appropriate to IS
  - same data can be linked to different ontologies
- ✓ maintainable
  - changes in background knowledge reflected in updated ontology
Ontology-Based ISs

- doesn’t require patients
- knowledge-heavy domains
- domains where knowledge changes
- Example:
  - restaurants & food properties: allergies, ethical,…
  - biochemistry
  - defence, intelligence
  - (nano) engineering
  - recruitment/skills management (later more)
Ontology-Based ISs

- doesn’t require ABox/Data
- sometimes only terminology
  - e.g., NCI Thesaurus

**TBox**
Endocarditis = Inflammation and locatedIn some Heart
Inflammation = Disease and causedBy some Bacteria
Building Ontology-Based ISs

- involves difficult design choices
  - which ontologies?
    - build own?
    - reuse/extend/combine others?
  - how to map?
  - what to put in OWL classes or Java classes?
  - how to make it scale?
  - which tools to use?
    - OWL API
    - reasoner

We tried to give you knowledge & understanding to answer these questions
E.g., Cerner Collaboration

- formerly Siemens Healthcare US
  - originally led by Alan Rector
- led by Bijan Parsia
- concerned with patient documentation systems:
  - given the information about patient we have so far
  - what should we ask/document next?
- fine example where
  - **behaviour** depends on but differs from
  - static knowledge captured in ontology
- led to development of Chiron, Hobo, Mekon,…
Demo
Exam

- Online Exam via Blackboard
- Two hours
- Multiple Choice Questions
- Short Essays
- Answer all questions

- …use Forum for questions!
Coursework this Week

• Core Task: Sushi Ontology (50% of your coursework mark)
  – Submit your report (individual) Monday, May 15 (65% of CT mark)
  – Submit your ontology (group) Thursday, May 11
  – Peer assess your ontologies (35% of CT mark)

• W5 Query application
  – use the OWL API to query an ontology

• W5 Postcoordination
  – a short essay
The Sushi Ontology

• An ontology of sushi
• Classes that enable us to represent sushi and answer competency questions like
  – Which sushi are suitable for vegetarians?
  – Which sushi have beef and are not spicy?
  – See BB for more CQs
• Class hierarchy organised using the PIMPS upper ontology.
• Peer assessed

• Plus a reflective report on how you built it, interesting aspects of the model