A Quality Evaluation Framework for Bio-Ontologies

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Motivation

- Increasing number of bio-ontologies
  - Efforts for developing orthogonal collections of bio-ontologies: OBO Foundry (http://www.obofoundry.org)
  - There also exist independent efforts for developing other bio-ontologies
- Benefits of reusing existing knowledge

What to reuse

Watson results

Existing descriptions of the class Protein

http://kmi-web05.open.ac.uk:81/cache/4/07c/234d/e645f/331d0c24b4/deb9ceeb9d7792804#protein

subClassOf	kind
protein_group	**subClassOf**
protein_molecule	**subClassOf**

http://www.biopax.org/release/biopax-level1.owl#protein

disjointWith

subClassOf   http://paoli.open.ac.uk/watson-cache/7/b60/a487/18dcf/b3f943bf9d/protein

disjointWith   receptor_signalling_protein   **subClassOf**

disjointWith   http://kmi-web05.open.ac.uk:81/cache/0   http://www.biopax.org/Downloads/Level1v0.5.1/biopax-level1-v0.5.1.owl#protein

smallMolecule   **subClassOf**   **subClassOf**   physicalEntity

Complex   SEQUENCE   **comment**   "A protein (e.g. The EGFR ..."

na   ORGANISM   http://kmi-web05.open.ac.uk:81/cache/c/efa/37c0/ab39a/3b3a28bdc9/protein

comment   **comment**   gene-product   **equivalentTo**

http://www.w3.org/2005/04/swls/k http://kmi-web05.open.ac.uk:81/cache/1 http://paoli.open.ac.uk/watson-cache/6/d84/34ab/92063/f71752aa21/968a5ff6dda92c901#Protein

hasProperty   **subClassOf**   **subClassOf**   Transport

hasProperty   **subClassOf**   **isDefinedBy**   "Protein involved in the i..."

hasProperty   **subClassOf**   http://ontosem.org/#protein

hasProperty   **subClassOf**   **subClassOf**   biological-macromolecule

hasProperty   **subClassOf**   immunoglobulin   **subClassOf**

hasProperty   **intersectionOf**   hemoglobin   **subClassOf**

hasProperty   **subClassOf**   **label**   " "Any of a group of compl..."

hasProperty   **subClassOf**   http://lsdis.cs.uga.edu/projects/glycomics/propreo#protein

hasProperty   **subClassOf**   **subClassOf**   molecule

hasProperty   **subClassOf**   enzyme   **subClassOf**

hasProperty   **subClassOf**   has_parent_protein   **range**

hasProperty   gene-product   **label**   "polypeptide"

comment   anon972

Choosing a TV

Compare Prices | **Product Details** | **Expert Reviews**

Product Name :	Sony KDL-22S5500
Lowest Price :	£330 Show all prices »
Product Rating:	★★★★★ (0 Rating)
Category:	LCD TV
Brand:	Sony
Screen size:	22"
Aspect ratio:	16:9
Resolution:	1366 x 768
Display technology:	LCD
Frequency:	50 Hz
HD Support:	HD Ready
Tuner type:	NTSC , PAL , SECAM
Audio type:	BBE system
Number of speakers:	2
Text services:	teletext
AV Input/Output:	S-Video , VGA , HDMI
Auto tuning:	With Auto tuner
Sleep timer:	With sleep timer

Properties   **Values**

Home > Electronics > Televisions > LCD TVs > LCD TV Buyer's Guide

📖 LCD TV Buyer's Guide

Buyers guides providing up-to-date information on the latest products and technologies. Each buyers guide contains comprehensive impartial advice for consumers. Read our guides to help your decision making and to ensure you choose the best product to meet your needs. Individual guides are thoroughly researched and written by an independent expert.

With the amount of change going in TV technology it pays to understand at least a little about some of the most important developments. This guide to liquid crystal display TVs (LCD) concentrates on the particular advantages of the technology. Our guide gives you the facts on how to get the full picture and explains some of the key features to look out for.

There are two compelling advantages with an LCD TV. The first is that they can be much easier to watch than a cathode ray tube (CRT) model. This is because screen displays are significantly brighter with a high contrast and the flicker free picture. LCD TVs will work effectively in almost any kind of room lighting from bright to ambient. Secondly, LCDs have a higher native resolution than plasma TVs of the same size making them ideal for high-definition output. While plasma TVs are currently better at the moment for sheer screen size, as more and more television output becomes high-definition TV (HDTV), LCD technology will come to the fore.

SUMMARY

Purpose | Key features
Accessories | Related products

Making the decision

- Selection based on properties desired by the customer

- No metrics nor formal quality criteria for selecting the best TV

- Differences between choosing a TV and an ontology
  - Set of properties to evaluate
  - Controls of quality

Related work

- Ranking and selecting ontologies.
  - From generic ontology rankings (by metrics or users) to selection of the most appropriate ontology for a particular task
  - Combination of quantitative and qualitative criteria

- Correctness
  - Formal correctness of the ontological knowledge and the primitives used

- Quality
  - Flat or structured frameworks based on qualitative criteria, quantitative criteria or both

- Claims for maturity models and certified ontologies

OBO Foundry principles
(http://www.obofoundry.org/crit.shtml)

2006	2009
• Open	• Single is_a inheritance ?
• Common shared syntax	• Textual definitions will use the genus-species form ?
• Unique Identifier Space	• Instantiability ?
• Versioning and tracker	• Use of BFO ?
• Clearly delineated content	
• Textual definitions	
• Uses relation ontology	
• Documentation	
• Plurality of users	
• Collaborative	

Our approach

- Relation between Software Engineering standards and practices and Ontology Engineering
  - Methontology
  - Ontology Design Patterns

- Software quality measures the quality of software design, and to which extent the software conforms to that design

Our approach: why ISO 9126?

ISO 9126

- Functionality
- Reliability
- Usability
- Maintainability
- Efficiency
- Productivity
- Quality in use

- Objective and systematic evaluation

- Quality of products
  - Ontology as product
    - Software artefact
    - Tool

The quality framework (I)

Structural

- Formalisation
- Formal relations support
- Cohesion
- Tangledness
- Redundancy
- Consistency
- Cycles
- Accuracy
- Domain coverage

Functionality

- Interoperability

Competence adequacy

- Reference Ontology
- Controlled Vocabulary
- Schema and Value Reconciliation
- Consistent Search and Query
- Knowledge Acquisition
- Clustering and Similarity
- Indexing and Linking
- Results Representation
- Classifying Instances
- Text Analysis
- Guidance and Decision Trees
- Knowledge Reuse
- Inferencing

Reliability

- Technical maturity
- Knowledge maturity
- Robustness
- Authority

The quality framework (II)

Usability

- Readability

- Reusability

Maintainability

- Stability

- Analyzability

- Changeability

- Testability

Quality in use

- Effectiveness

- User satisfaction
  - Popularity
  - Engagement

Efficiency

Case study

- Evaluation of two versions of the Cell Type Ontology (CTO)

  – Ontology 1: Original CTO (oCTO)
    - The OWL version http://www.berkeleybop.org/ontologies/owl/CL

  – Ontology 2: Normalised CTO (nCTO)
    - OWL ontology built by applying normalisation:
    - http://www.gong.manchester.ac.uk/CTON.html

Muscle cell

oCTO

- SubclassOf
  - Contractile cell
  - Electrically responsive cell
- Properties
  - derives from some myoblast

nCTO

- SubclassOf
  - Cell
- Properties
  - Has ploidy some diploid
  - derives from some myoblast
  - participates in some muscle contraction

The experiment

- Evaluation of the quality of both ontologies by applying the framework
  - Evaluators: 8 MSc students of the Semantic Web course- University of Murcia.
  - The process:
    - Training of the students
    - Evaluation of the ontologies
      - They had to give a score between 1 and 5 to each quality criterion to each ontology

The results

oCTO: Strengths and weaknesses
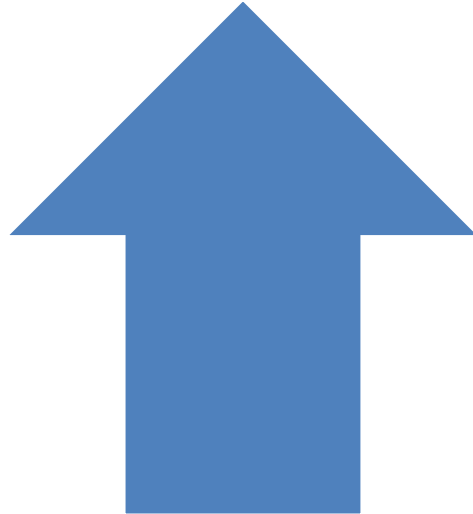
Consistency

Authority

Domain Coverage

Controlled vocabulary

Popularity
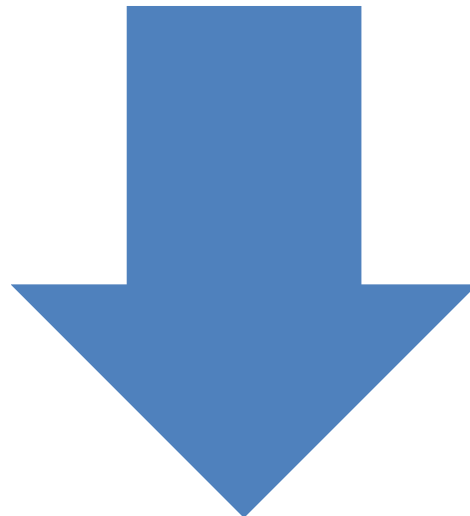
Robustness

Inferencing

Formal relations support

Tangledness

Reusability

The results

nCTO: Strengths and weaknesses
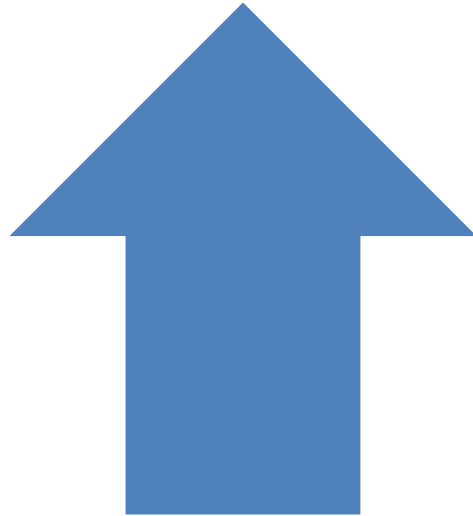
Formalisation

Changeability

Inferencing

Reuse

Controlled vocabulary
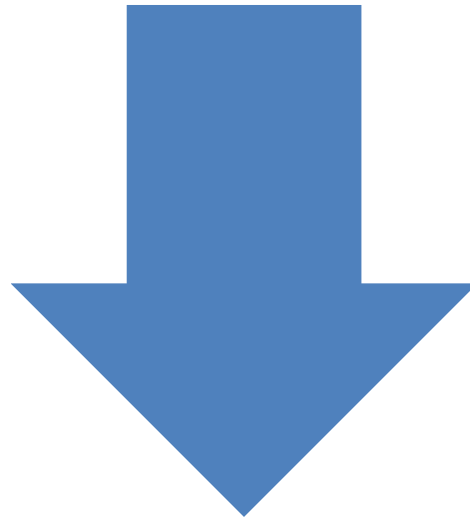
Readability

Efficiency

Popularity

Engagement

Knowledge reference

The results

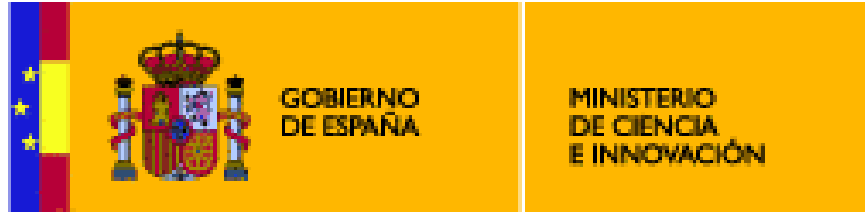http://dis.um.es/~jfernand/icbo/
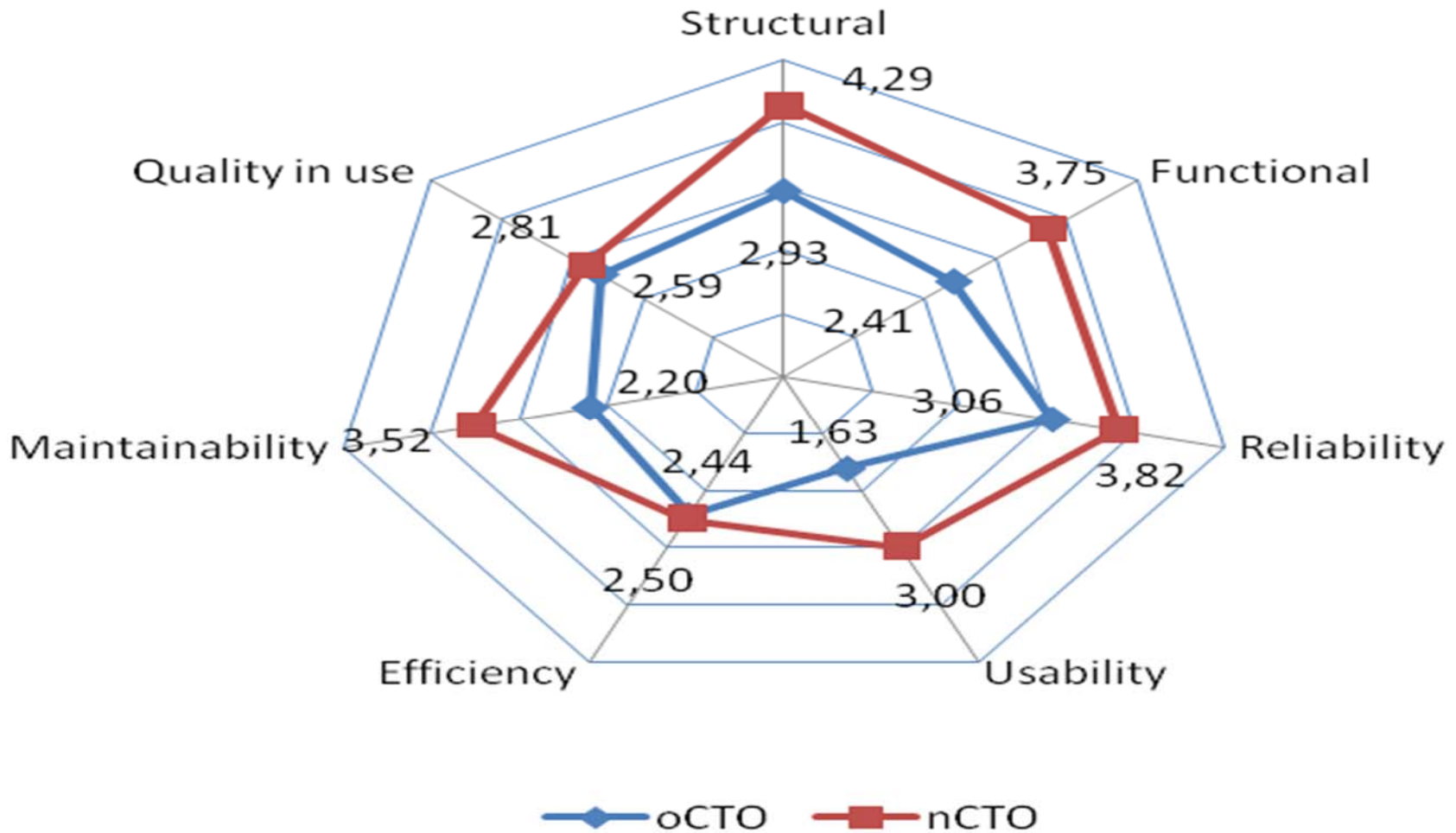
Conclusions (I)

- No support for choosing what to reuse

- The quality of an ontology is related to the degree of excellence

- Quality frameworks as a guide, the user makes the final decision

Conclusions (II)

- Framework inspired in ISO 9126
  - Need for automatic metrics for some criteria

- Application of the framework to two ontologies
  - The evaluators did not report problems in the application of the framework
  - Most experienced ontologists would probably give different scores to the ontologies
  - Evaluate the ontologies!!
    - http://dis.um.es/~jfernand/icbo/

Acknowledgements

Thanks for your attention