

Quality of an Ontology as a Dynamic Optimisation Problem

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Outline

Ontologies and their challenges

Current research directions

Future research directions



What is an ontology?

- ▶ One possible definition : “An ontology formally represents knowledge as
 - ▶ a set of concepts within a domain,
 - ▶ and the relationships between those concepts.”
- ▶ Goal : Enable the creation of interoperable and linked data.
- ▶ Ontologies are needed in the Semantic Web.

See also [1]



Some challenges for the Semantic Web

- ▶ Most data is not referring to an ontology
- ▶ Ontologies need to be
 - ▶ agreed
 - ▶ available
 - ▶ able to represent unclear information
 - ▶ scalable
 - ▶ robust (and allow change)
- ▶ These problems challenge the very core of the Semantic Web



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An example

```
http://maps.googleapis.com/maps/api/geocode/  
json?address=Kherson&sensor=false
```



How to solve the problems?

- ▶ Ontology alignment
- ▶ Ontology evolution and repair
- ▶ Automatically transform structured data to ontology
- ▶ ...



Our current research direction

- ▶ Dynamic approximation of the missing part of an ontology



Features of an Ontology

Only an abstract ontology is considered with features like

- ▶ Coverage
- ▶ Cohesion
- ▶ Coupling
- ▶ ...



Ontology in a context

- ▶ An ontology is used in a dynamic context
 - ▶ Application
 - ▶ Device
 - ▶ Software agent
 - ▶ ...
- ▶ Context consists of:
 - ▶ Data processed
 - ▶ Queries asked
 - ▶ Disk-space available
 - ▶ Time constraints
 - ▶ ...
 - ▶ State of machine and environment



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Quality of a new ontology for the system

Quality only makes sense in a context...

- ▶ More or less classes?
- ▶ Price of change (delta)
- ▶ Timing of change
- ▶ ...
- ▶ Re-usability
- ▶ Maintenance

Quality is a multi dimensional property.



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Quality of Ontology in a Context as a Dynamic Multi-objective Optimisation Problem

If we want a good ontology in the system, it needs to . . .

- ▶ allow dynamism in the context
- ▶ have an optimal quality in the context
 - ▶ Both are multi-dimensional

Thus the solution could be found by solving a context-dependent dynamic multi-objective optimisation problem.

That solution will give for each possible context an optimal ontology.



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Further directions

- ▶ Which parts of the context are relevant?
- ▶ Which quality indicators are relevant?
- ▶ Which concrete ontology should be used?
- ▶ Is the problem solvable?
- ▶ If solvable, in reasonable time?
- ▶ Can an approximate method lead to a satisfying result?
- ▶ Can trends in the ontology be used?



Thank you!

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Questions or comments?



For Further Reading



J. J. Carroll and G. Klyne, “Resource description framework (RDF): Concepts and abstract syntax,” W3C recommendation, W3C, Feb. 2004.

<http://www.w3.org/TR/2004/REC-rdf-concepts-20040210/>.

