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E-mail :
editor.ijpast@gmail.com
editor@ijpast.in

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Methods and instruments for developing domain ontologies

Dr.D.Saravana Priya [1], D.V.Subbarao [2],

Introduction

The Institute of Cognitive Sciences and Technology (part of the Italian National Research Council) operates the Laboratory for Applied Ontology (Onto Lab), which has locations in both Rome and Trento. It investigates the function of ontologies in several disciplines, including knowledge representation, knowledge engineering, database design, information retrieval, natural language processing, and the semantic web, via both fundamental and practical research. Nicola Guarino is the lab's coordinator, and in addition to himself and the author, the lab also has four other full-time research scientists (S. Borgo, C. Masolo, A. Oltramari, D.M. Pisanello, and G. Steve) on staff. The group takes a multidisciplinary approach that draws on logic to bring together computer science, philosophy, and language. Although OntoLab is primarily concerned with techniques and ideas, its work either directly addresses or makes use of artifacts generated in all the following fundamental subfields of ontology engineering:

• Ontology representation using logical languages

• Challenges in using computation to justify ontological claims.

• Techniques of constructing, analysing, and combining ontologies.

Methodology-supporting tools.

• Theories based on ontology.

• Lexicalization of ontologies by linguistic processing.

The use of languages and technologies that bridge ontological ideas with other software.

Initiatives and courses Current

The initiatives at Onto Lab include the thematic network Onto Web [9], with a focus on the Content Standard Harmonization Special Interest Group (SIG), and the 5thFP Won derWeb [10], in which we are establishing a library of fundamental (i.e. domain-independent) ontolo gies for the semantic web. EUREKA Intelligent Knowl edge Fusion (IKF) is another initiative that offers consultancy services to businesses on ontologies and helps software companies create new and useful applications for the financial services (including banking and insurance) and the service management (SLM) industries. Fis is a collaborative UN-FAO initiative.

FOS Ontology Service

aims to unify several fisheries vocabularies to facilitate ontology-based search and other online applications [6]. Several years ago, researchers began projects that would apply conceptual methods and tools to the fields of law (harmonizing existing core ontological frameworks), biomedicine (analysing and merging terminological frameworks), and planning (creating a novel core ontology for plans, guidelines, etc.). Another effort with a medium-term focus is focused to analysing and improving the WordNet lexical resource in tandem with the team from Princeton University that originally developed WordNet [4].

Associate Professor [1,2],
Department of CSE, SRK INSTITUTE OF TECHNOLOGY ENIKEPADU VIJAYAWADA
Mail Id : Vishnu dspriyapacet@gmail.com, Mail id : doddapanenivenkat@gmail.com

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Resources for Thinking

To create and maintain high-quality domain ontologies that can be evaluated against well-defined criteria, Onto Lab develops a variety of conceptual tools and methodologies. Our definition of a domain ontology is an axiomatic theory with concepts and relations that may serve as general references for the intended meaning of the words used by a community, with the goal of being as precise and clear as feasible.

To help individuals from diverse backgrounds get a feel for what someone has placed into their ontology, our tools give precise criteria for categorizing concepts and relations. The biological sciences have their own domain ontology, which may define such terms as "species," "organism," "pathway," "anatomical structure," "biological process," and so on. With the help of our tools, the ontology's encoder can determine whether the term "species" refers to individual organisms or to groups of organisms, whether "function" refers to substances or to processes involving substances, and whether "pathway" refers to actual biological processes or to theoretical reconstructions of processes, and so on. The meaning of the encoder will be obvious to anybody utilizing the ontology (or any software agent). Onto Lab's primary resources include the following tools and methods:

• DOLCE, a descriptive ontology for use in linguistic and cognitive engineering [10]. The Library of Foundational Ontologies of the future will have its initial module here. Process, object, time, portion, location, representation, etc. are all examples of entities and connections that make up a foundational ontology (Figure 1). DOLCE is a time- and space-based ontology with a focus on cognition.

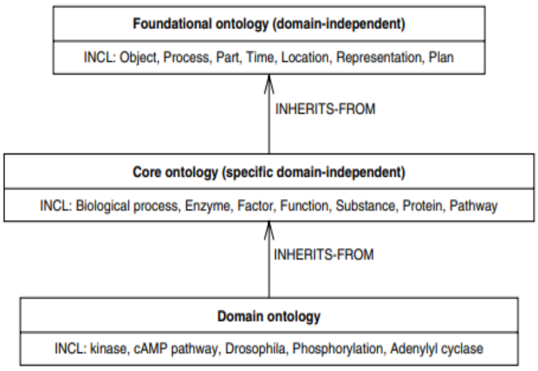

Figure 1. A simplified example of an ontology library: a foundational ontology contains domain-independent ontology elements; a core biological ontology contains general elements for a domain; a domain biological ontology contains the ontology elements needed for a domain to be conceptualized according to some tasks.

intuition on three dimensions (objects are different from processes), physical/mental object distinction, etc. DOLCE is a descriptive ontology since it aids in the categorization of a pre-existing conception; it does not claim to describe how things are, but rather how they might be represented in light of the information that already exists.

Meta-properties and the Onto Clean approach [8]. Existing ontologies may be redesigned using this feature, which is now standard in most ontology-building toolkits. It does this by decoupling the ontology's stable taxonomy from its access sory hierarchies.

Methodology for Ontologically Integrating Nave Sources (ONIONS) [2]. This stresses the re-use of domain terminology and gives guidelines for analyzing and merging existing ontologies. More information about this topic may be found below. A good example is the collection of materials available at OnionLeaves. The DOLCE Foundational Ontology [3] has a set of add-ons stored here, in the form of so-called core axiom schemata. Plans, communication, geographical location, and functional participation plug-ins are all already available.

Strategies and using the ONIONS

There are three primary categories of approach for building ontologies that have been identified in the research. The first approach (community ontology) makes no assumptions about underlying or central ontologies and instead seeks to broker an agreement among members of a shared interest group. The second, linguist tic ontology, is concerned with the lexicographic treatment of domain terminologies, often in an informal manner (most dictionaries and thesauri may be seen as outcomes of this activity). Domain analysis using axiomatic theories and philosophical concepts is required by the third approach (cognitive ontology). Conceptual analysis and the fusion of terms are the focus of the ONIONS technique. It combines the three types of approach by factoring in linguistic ontology findings and applying cognitive ontology methods to them in order to facilitate an intersubjective consensus amongst domain experts. Here, an intersubjective agreement is one that holds in several settings when the same language is used. The creation of ONIONS dates back to 1993. In that time, it has been used for things like constructing a medical core ontology (ON9 [2]), mining the UMLS repository for ontological insights [2], and incorporating clinical guideline standards [11]. Recently, it has been used in a variety of contexts, including online catalogues, legal restrictions, banking practices, a re-examination of WordNet, a synthesis of fisheries

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jargon, etc. The goal of ONIONS is to provide the domain terminologies that will be analysed, integrated, or merged a high level of axiomatization and ontological depth. By doing a conceptual study of the terminological sources and formalizing the results in a logical language, axiomatization may be attained. The subsequent step is to combine the many schools of logical thought. The OntologyintoGration Framework [1] is assumed for logical integration in ONIONS. This framework outlines the construction of a unified theory including the union of the names and axiom sets from the sources, as well as the design of mapping relations that permit unified queries to the sources. Reusing a collection of base ontologies, which the axiomatization relies on, provides the analysis with more ontological depth. Multiple, perhaps conflicting ontologies might be included in such a collection. In a nutshell, Table 1 outlines how ONIONS do its own terminological examination. After each vocabulary has been modernized in accordance with certain principles [2,6], they may be combined. In ONIONS, the 'core axiom schemata' are the most crucial tools for merging.

Axiomatic frameworks

An example of a core axiom schema is provided for domains dealing with descriptions and circumstances to round off this brief overview of certain domain ontology development methodologies created by Onto Lab (Figure 2). Clinical recommendations [11], banking laws and legal conventions [5], fishing tactics, service-level management, etc. have all benefited from domain-specific adaptations of this in order to construct core ontologies. The schema classifies elements of a scenario as either permutants ('actions, processes, or events') or endurant ('things that engage in the scenario').

Table 1. ONIONS life cycle for domain analysis

Steps	Activities	Example
1.	*Terminological source collection*	UMLS sources, scientific articles, etc. To demonstrate the principle, a sample term is singled out, e.g. *viral hepatitis, type B*
2.	*Ontology architecture design*. The application domain that the sources are about is investigated in order to create a preliminary graph of ontology modules (*ontology library*) and context types (*context typology*)	Graph including at least some ontologies (besides a foundational one): anatomy, morphology, functions, diagnosis (cf. SNOMED nomenclature) The context types for a certain task (clinical, epidemiological, research, administrative ...)
3.	*Source analysis*. All data from any source that are relevant for conceptual analysis (terms, lexical relations, synonyms, etc.) are collected and generically described	Taxonomies including *inflammation*-related knowledge, and how they are structured
4.	*Term extraction*. When data are structured in a plain text, relevant domain terms have to be extracted according to available heuristics	*Inflammation*-related terms extracted from free text.
5.	*Data are imported and translated* to a common format.	Taxonomies and other data on *inflammations* are wrapped into a logical format
6.	*Core ontology formation*. Additional ontologies can be reused according to the preliminary ontology library, and the requirements that come from source analysis. Usually these ontologies are *merged* in order to build a preliminary *core* ontology for the domain. ONIONS merging guidelines are described in Gangemi *et al.* 1999 [2]	A core ontology for *inflammation* according to different contexts is built, e.g. it contains concepts for *inflammation conditions, inflammation processes, inflamed areas, inflammation morphologies, inflammation diagnoses, clinical costs for inflammation, inflammation aetiologies, symptomatic forms, detected antigens*, etc., and the relations between them
6.1.	If no existing ontology can be retrieved, or if they are inadequate to build the core ontology, some additional ontology elicitation is performed from experts and basic manuals	The development of some parts of the *inflammation* core ontology has needed experts' advice.
6.2.	The core ontology should be integrated with a *foundational ontology*, providing a set of domain-independent criteria that are capable of justifying the conceptual structure of the domain	The *inflammation* core ontology has been built according to DOLCE concepts and relations [10]
6.3.	The basic ingredients of a core ontology are the so-called *core axiom schemata*, that formalize the dependencies among the basic concept and relations used in a domain application	Systematic relations between some of the multiple meanings for *inflammation* are used to build a *core axiom schema*. Such a schema is used to model all kinds of inflammations from the sources. An example of the schema is provided in Figure 2
7.	*Terminological analysis*. The terms found in the sources receive *plain text descriptions* if not available, and they are analysed according to *linguistic rules*. Plain text descriptions are built according to an accessory set of guidelines	Analysis of sample term: *viral hepatitis type B*: * descriptions: 'inflammation of the liver', 'an acute illness caused by hepatitis B virus', etc. * dependency rules: *inflammation* ⇒ *liver*, *illness* ⇒ *acute*, *virus* ⇒ *hepatitis*, *hepatitis* ⇒ B, etc.
8.	*Ontology data type assignment*. Once all the terms (or other useful data) from sources and descriptions have been analysed, the resulting components are assigned to some *ontology data type*: individual, concept, relation, etc. Concepts can also receive a metaproperty assignment [8]	inflammation ∈ concept (*rigid*) liver ∈ concept (*rigid*) virus ∈ concept (*rigid*) acute ∈ concept (*non-rigid*) caused by ∈ relation patient#John_Hepaticus ∈ individual, etc.

Table 1. Continued

Steps	Activities	Example
9.	*Vertical integration*. Ontology data are integrated with the core ontology. The core ontology provides the concepts and relations that subsume those assigned in 8	*inflammation* → {diagnosis|condition|process|*morphology*|anatomical *feature*}liver → organ → body part → biological object*HBVirus* → organism → biological object*acute* → condition quality → quality*causedby* → depends on, etc.
10.	*Formalization*. The ontology data obtained are put into a logical form and checked for consistency. If terminological analysis is carried out with an ontology editor that implements a logical language, vertical integration in step 9 already provides the formalization step (formal subsumption, axioms, rules, etc.)	Viral-Hepatitis-B(x) → [Condition(x) ∧ ∃$y, z, w, k, m, p, f, d, h, s, a$. Liver($y$) ∧ HBVirus($z$) ∧ Acute($k$) ∧ Morphology($m$) ∧ Process($p$) ∧ Feature($f$) ∧ Diagnosis($d$) ∧ HBAntigen($h$) ∧ Symptom($s$) ∧ Patient($a$) ∧ involves($x, y$) ∧ inheres-in($k, x$) ∧ caused-by($x, z$) ∧ host($f, y$) ∧ inheres-in($m, f$) ∧ involves($x, p$) ∧ participant($p, y$) ∧ participant($p, h$) ∧ part($a, y$) ∧ references($d, x$) ∧ conceives($a, s$) ∧ ...]
11.	*Lexicalization*. Ontology data are lexicalized by re-assigning the original terms to them, and adding standard synonyms for that domain.	LEX (Viral-Hepatitis-B, {viral hepatitis, type B| ...}) LEX (HBVirus, {hepatitis B virus| ...}) etc.
12.	The preliminary ontology library is refined with *context assignments* that 'modulate' concepts, axioms and terms	A research context could be interested mainly in an antigen-based view, a clinical context mainly in a patient-based view, etc.
13.	Ontology data that are used in previous steps, but were not in the core or other ontologies, should be treated as in 6–13	*Antigen* (subsumer for *HBAntigen*) and *conceives* might be lacking in the core ontology and are added to it

in permutants, and areas (spaces, often accompanied with metrics) that stand in for the 'qualities' of the remaining parts. Plans, standards, ideas, diagnoses, procedures, recipes, and so on are all examples of descriptions. Courses for activities, functional roles for participants, and parameters for areas are all examples of situational components that have analogy in the description layer. Everything that makes up a description is assumed to be a non-physical thing that helps agents talk to one another and make sense of their shared understandings of the world in terms of commitments, objectives, and expectations [7]. The schema for generating axioms regarding descriptions and circumstances related to inflammation is shown in Figure 2 as a UML diagram. Inflammation can be thought of as a situation (a condition) that entails an activity (a biological process), has some participants (e.g., inflamed tissues, antigens, antibodies), and has an abstract region (a morphology), and the schema uses specialized situation components to disambiguate the various meanings of the term inflammation.

The diagnosis of inflammation may also be analysed using specialized description components. In this

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context, a diagnostic (of inflammation) refers to an inflammatory state, a course is the trajectory of a biological process, actors fulfil functional roles, and morphologies provide values to parameters.

Conclusions

Onto Lab's conceptual tools and methodology have found widespread application across a variety of fields, including, for example, the uniform extraction of information available only via heterogeneous systems (the semantic web being an example) and the construction of models of control systems. For example, in molecular biology, a preliminary proposal may be made to utilize our methods to extract and index biological information and to find or confirm new links across dispersed data sources. If we suppose that enzymes or factors are func tonal roles, proteins are players in biological processes, activation values are areas, etc., then applying the 'descriptions and circumstances' fundamental axiom schema to the depiction of pathways is an example of discovery or verification.

References

[1]. Calvanese D, De Giacomo G, Lenzerini M. 2001. A framework for ontology integration. In Proceedings of the 2001 International Semantic Web Working Symposium (SWWS 2001) CA, USA.

[2]. Gangemi A, Pisanelli DM, Steve G. 1999. An overview of the ONIONS project: Applying ontologies to the integration of medical terminologies. Data Knowl Eng 31: 183–220.

[3]. Gangemi A, Pisanelli DM, Steve G. 2000. Understanding systematic conceptual structures in polysemous medical terms. In Converging Information, Technology and Health Care: Proceedings of the 2000 AMIA Annual Symposium, Overhage JM (ed.). Los Angeles, CA, USA.

[4]. Gangemi A, Guarino N, Oltramari A. 2001. Conceptual analysis of lexical taxonomies: the case of WordNet top-level. In Proceedings of the 2001 Conference on Formal Ontology and Information Systems, Welty C, Smith B (eds). IOS Press: Amsterdam.

[5]. Gangemi A, Pisanelli DM, Steve G. 2001. An ontological framework to represent norm dynamics. In Proceedings of the 2001 Jurix Conference, Workshop on Legal Ontologies, Winkels R (ed.). University of Amsterdam.

[6]. Gangemi A, Fisseha F, Pettman I, et al. 2002. A formal ontological framework for semantic interoperability in the fishery domain. In ECAI02 Workshop on Semantic Interoperability Stuckenschmidt H (ed). Lyon, France.

[7]. Gangemi A, Pisanelli DM, Steve G. 2002. Description-Duper Ontology, Technical Report of the Laboratory for Applied Ontology. Available from: http://ontology.ip.rm.cnr.it/Papers/TR-DDO.pdf.

[8]. Guarino N, Welty C. 2002. Evaluating ontological decisions with OntoClean. Commun ACM 45(2): 61–65.

[9]. Guarino N, Doerr M, Gangemi A 2002. OntoWeb Deliverable 3.4: harmonisation perspectives of some promising contentstandards. Downloadable from: http://www.ontoweb.org/ download/deliverables/D3.4.pdf.

[10]. Masolo C, Gangemi A, Guarino N, Oltramari A, Schneider L. 2002. WonderWeb Deliverable D17. The WonderWeb library of foundational ontologies: http://wonderweb.semanticweb. org/deliverables/D17.shtml.

[11]. Pisanelli DM, Gangemi A, Steve G. 2000. The role of ontologies for an effective and unambiguous dissemination of clinical guidelines. In Knowledge Engineering and Knowledge Management. Methods, Models, and Tools, Dieng R, Corby O (eds). Springer-Verlag: Berlin; 129–139.