

CSI5180 Topics in AI - Ontologies and Semantic Web
Winter 2019

Assignment 2 - Ontology Design

Objective	Become familiar with ontology design principles, with OWL (Web Ontology Language), as well as the ontology editor Protégé.
Due date	February 25th, 11:30pm.
What to submit ?	Submit a report, in pdf format, which will include a title page (name, student number) as well as answers and bits of OWL, as asked for each of the questions below. Also submit a file containing your full ontology (.owl file).
How to submit ?	In Brightspace, through the link provided under the Assignment module.
Penalty	-10% per day late
Percentage	20% of overall semester grade
Software Requirement	This assignment will make use of Protégé https://protege.stanford.edu/

1. Learning about Protégé

Your first step is to learn more about Protégé <https://protege.stanford.edu/>.

After you've downloaded Protégé, when you open the application, you can go in File, and it allows you to find an ontology from a URL. The pizza one is there, the wine one is there too. You can load it and add classes, properties, etc. It's a good way to explore.

There are many tutorials online, so please explore. Often, the pizza ontology (pizza.owl) is used in the tutorials. Here is one reference, but there are other references, as well as videos online.
<http://owl.cs.manchester.ac.uk/publications/talks-and-tutorials/protg-owl-tutorial/>

You'll see how Protégé easily lets you define classes as subclasses of other classes, as well as specify domain/range of properties, and define disjointness, etc. It makes it easy to build the ontology without directly writing in an OWL syntax. You'll be able to export your ontology in a OWL format.

2. Learning about the Web Ontology Language (OWL)

Even if you don't need to directly write in OWL, since we're using Protégé, it's still nice to know about OWL semantic expressiveness. You can explore this through Protégé (with the various options available in the editor), or you can also explore this directly by reading through the official OWL 2 primer document from W3C <https://www.w3.org/TR/2012/REC-owl2-primer-20121211/>.

You can also review the slides shown in class during the Ontology Design lecture to see examples of OWL (turtle syntax).

3. Decide on your ontology topic

An ontology is a *formal, explicit specialization of a shared conceptualization*. And I would add, "... shared *conceptualization of a circumscribed subject matter*".

Top-level ontologies might be nice for philosophical debates, but in computer science, we want ontologies to define (and therefore help understand) a specific subject, by making its concepts, properties and instances, explicit, as well as interrelated in a way to both describe what is possible and what is constrained.

I let you choose the subject you want! Sport, art, event, place (like NAC or another presenter), movies, a city, a university, a library, recipes, olympic games, roads, OC transpo, real estate,

Choose a subject that would benefit "outsiders" to better understand that subject. You will act as the subject matter expert here, and make explicit your understanding of the subject.

IN YOUR REPORT: Mention the chosen topic, and why it interests you.

4. Follow the Ontology Design 101 approach

We have talked in class about a simple ontology design approach.

There is a reference here:

<https://protege.wiki.stanford.edu/wiki/Ontology101>

Knowing that ontology building is an iterative process, you should write here your FIRST try. Not the final version.

STEP 1 - Domain Definition and Competency Questions

The best way to circumscribe your ontology is to think of 10 questions it should be able to answer.

IN YOUR REPORT: List your 10 questions.

STEP 2 - If possible use an existing ontology

We'll skip this part :) as the purpose of this assignment is to make your own ontology. But, if one exists already, say how your ontology will be different, and how the existing one does not correspond to your competency questions.

IN YOUR REPORT: Discuss if there is a related ontology existing.

STEP 3 - Define the terms important in your domain

Think of the nouns and verbs. To help you, write down some sentences in which you describe the subject matter (or find paragraphs on the web that talk about it).

For example, in an ontology about the National Art Center (NAC), I would make up sentences like: NAC presents some shows. There are concerts, dance, theater. NAC sells tickets. It has a parking facility. etc. People attend concerts, and buy tickets. This helps me define terms.

IN YOUR REPORT: Provide the set of terms (let say around 30) which will later be transformed into classes, properties, restrictions, etc.

STEP 4 - Define the classes and subclasses

Among the terms from STEP 3, which ones are classes? Is "ticket" a class for example? Do I want different kinds of tickets? Do I want to say more about them (they can be exchanged, they have a price) ? Am I really selling "tickets" or "seats" ? Is there a difference? What about parking, is that a class? Or concert? Are there different kinds of concerts ?

IN YOUR REPORT: Show this first attempt at a taxonomy of classes. This might be refined later. But it's your first view of the organization of knowledge.

STEP 5 - Define the properties

Looking at the classes of Step 4, are there object properties that would link them? For example a property linking a concert to an NAC hall. Are there data properties defining classes, for example a ticket has a price, an event has a date, etc.

IN YOUR REPORT: Show this first attempt at defining a set of properties.

STEP 6 - Define the property restrictions

Can you see how some properties will have specific domain and range? What about specific restrictions, such as being transitive or symmetric.

IN YOUR REPORT: Show this first attempt at defining a few restrictions.

STEP 7 - Define some instances

Can you think of 5 instances ? For NAC for example, I could list 5 specific concerts or dance shows.

IN YOUR REPORT: Show the 5 instances, and say which class are instantiated from.

5. Build your ontology

The previous question lead you to a first design, but you will definitely want to refine such design, so using an iterative process, continue working on your ontology until you feel it well represents your subject matter, and that it would have the potential of answering the competency questions defined earlier. I would like your ontology to not be "trivial". It should contain around 50 classes and properties, as well as some individuals.

IN YOUR REPORT: For this step, it's rather the OWL file that I would like to have. I should be able to load it into Protégé on my side. Save your ontology in Turtle format for me....

6. Explore many of OWL possibilities.

To make sure you experience the full extent of OWL, please provide an example from your ontology for each type of class, or property or restriction, asked below. If you cannot find an example, explain why.

1. Class / Subclass (rdfs:subClassOf)
2. Domain / Range (rdfs:domain, rdfs:range)
3. Object property linking two classes (owl:ObjectProperty)
4. Data property linking a class to a literal (owl:DatatypeProperty)
5. Many disjoint classes (owl:AllDisjointClasses)
6. Different individuals (owl:differentFrom)
7. Closes classes (owl:oneOf)
8. Complex class construction with intersection (owl:intersectionOf)
9. Property restriction: specific value (owl:hasValue)
10. Property restriction: existential (owl:someValuesFrom)
11. Property restriction: universal (owl:allValuesFrom)
12. Cardinality restriction (owl:cardinality OR owl:minCardinality OR owl:maxCardinality)
13. Transitive property (owl:TransitiveProperty)
14. Symmetric property (owl:SymmetricProperty)
15. Functional property (owl:FunctionalProperty)

IN YOUR REPORT: For each element 1 to 15, show an example from your ontology.