

Assignment 1

Introduction to Semantic Systems 2024W

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1 Task 1

1.1 Suggest a Semantic Application

I choose to design an application in the Tourism domain that focuses on providing data for vacations in a new city/area and also personalized travel recommendations based on user data and interests. It is also offering transportation information to make it easy for the user to navigate. By leveraging semantic technologies, specifically ontologies and knowledge graphs, the application will suggest points of interest (POIs) and transportation options to users based on their input, preferences and current location.

To achieve this, an ontology can model the application's knowledge structure, defining key concepts/classes and relationships within the tourism domain. An ontology is essentially a formal representation of a domain, consisting of classes (concepts), properties (relationships), and instances (which we don't focus on in this exercise). In this domain the ontology will include the basic essential concepts like Attractions/Sightseeing, Events, Restaurants, and Transportation, each with its attributes and relationships. For example, an Attraction might have properties like location, type, and opening hours, while a Transportation entity could have details about routes, stations, and types (e.g., bus, subway, tram, cab). By organizing information this way, my created ontology can give a better and structured understanding of the tourism domain, which would be essential to actually develop an application like the suggested one.

Building on this ontology a knowledge graph can later be developed to link data meaningfully. In my application a knowledge graph could connect user data (for example preferences for certain cuisines or interest in specific types of events) with relevant POIs and transportation options.

First I will formulate several competency questions:

1. Which attractions are within foot-traveling distance of the user ($\tilde{1}$ km)?
2. Based on the current or a chosen location what transportation is available to a chosen POI?
3. Are there any restaurants near the current or chosen location (of a POI) that serve vegan food?
4. Is a chosen attraction handicapped accessible?
5. What are the upcoming events nearby (that also match the users preferences)?
6. If the user puts in several attractions they want to visit, what is the best order timetable of doing so by minimizing traveling time/distance and also taking opening times in mind?
7. What is the weather going to be for the day and what activities are recommended based on that?

2 Task 2

Create an ontology that models the selected domain and enables the specified application The steps to create the ontology were following:

1. Determine the domain and scope of the ontology: The tourism domain was already specified in task 1 and the scope was given as at least 20 concepts, 20 relations (including both data and object properties) and extend it by at least 5 OWL constructs.
2. Enumerate important terms in the ontology: In this step after deciding on the domain I wrote down all the important terms that came to mind in regard to the functionality of the application. These were terms like Subway, User, Museum, etc..
3. Define the classes and the class hierarchy: In this step the terms are refined into concepts/classes. Terms like Museum are instances and got defined as their respective classes, like Point of Interest (POI). I did so in a top-down approach by first creating the really general concepts and then refining them with subclasses.
4. Define the properties of classes: In this step I started defining the object and data properties as the relations between concepts or in the case of data properties the ranges. An example for an object property is POI -*i* isLocatedAt -*j* Location. For the data property an example would be POI -*i* price -*j* xsd:double.
5. In this last step I added the OWL constructs, like cardinalities and disjointness in classes. An example from my ontology would be *train* | *disjointwith* | *bus*, since something can not be a train and a bus at the same time. Another would be *User* - $[1, *]$ - *> preferences*. This cardinality means a user must have at least one preference but can have unlimited ones.

2.1 Lessons learned

Creating the ontology for this tourism domain application provided new experiences and challenges. One key lesson was the importance of defining clear relationships between concepts early on. I had some problems with the relations and had to get into the Protege tool to understand why I couldn't create some things as I had created them in my mind. Also I first created way too many concepts and had to reduce them again but still needed to balance between very significant and necessary concepts and ones that weren't as crucial to the ontology. Since I also didn't want to create too big an ontology, some design choices had to be made. Following the aforementioned steps definitely helped the creation process, also in regard to Protege which I had never used before.

The following image shows the visualized WebVowl version of my ontology.

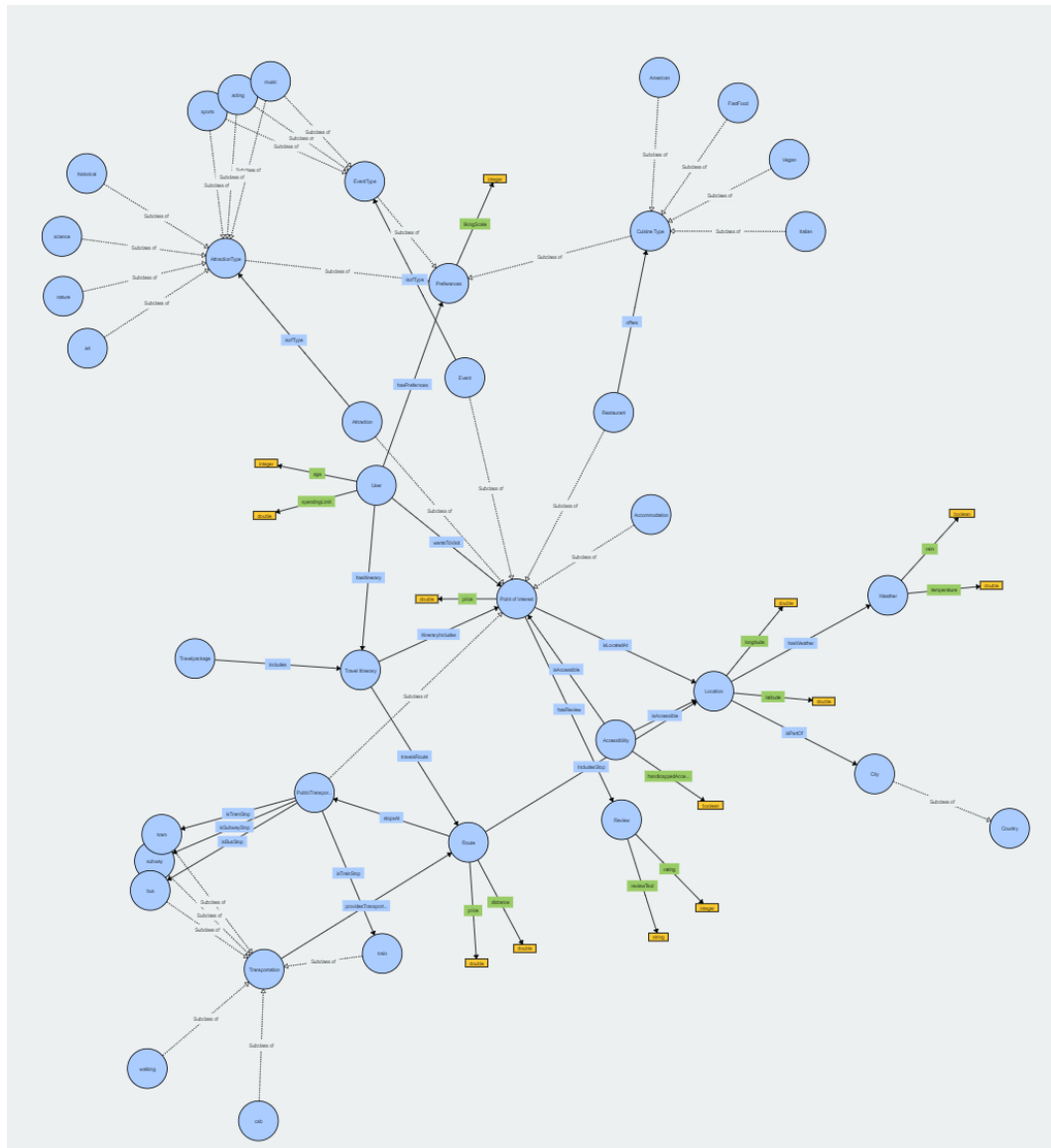


Abbildung 1: Visualized ontology. Source: <https://service.tib.eu/webvowl/>