A Method for Building Ontology Property Explanations

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Abstract. The lemon model has been developed to link lexical knowledge to ontology classes and properties. However, it is only possible to describe an ontology property with lexical senses. In our previous work, we found that there are relations between ontology properties and natural language predicates. We suggest a model for explaining ontology properties with not only lexical senses such as verb senses, but also arguments. In this paper, we proposed a method to build ontology property explanations to help linking ontology properties and predicates in natural languages.

Keywords: Ontology Property, PropBank, Knowledge Base.

1 Introduction

In order to utilize knowledge bases written in RDF in real world application, it is significant to link lexical entries to ontology vocabularies. The lemon model[1] has been developed to link lexical knowledge to ontology classes and properties. However, in lemon model, it is only possible to describe an ontology property with lexical senses.

Ontology properties in RDF based ontologies are binary relation that represents relationships between two entities. On the other hand, predicates in natural languages can be regarded as n-ary relation that represents relationships among its arguments. This structural gap often makes the property linking task very difficult. In order to narrows this gap, we introduced a model for explaining ontology property in our previous work[6].

In our previous work, we suggest a model for explaining, especially, ontology properties with not only lexical senses such as verb senses, but also arguments that are available for the given verb sense. In detail, we use PropBank[3] predicates and arguments to attach an explanation to ontology properties. In this paper, we propose a method to build property explanations for a given knowledge base written in RDF.

2 A Model for Explaining Ontology Property

In our previous work, we found that there are some relations between ontology properties and natural language predicates. For example, it is possible to link property

birthPlace and property birthDate to predicate bear.02. Both properties are describing relationships related to the predicate bear.02. However, while the property birthPlace is used to represent a relation between object and location of the predicate bear.02, the property birthDate represents a relation between object and time of the predicate bear.02. The model for explaining ontology property was proposed to captures these relations. In addition, PropBank was exploited as a Predicate-Argument model to explain properties.

In this model, a property can be explained with a verb sense called predicate and two arguments called source and target. For example, property birthPlace can be explained as a relation between ARG1 of predicate bear.02 and ARGM-LOC of predicate bear.02. In this case, ARG1 will be the source argument, and ARGM-LOC will be the target argument. While, property birthDate can be explained as a relation between ARG1 as a source argument and ARGM-TMP as a target argument of predicate bear.02.

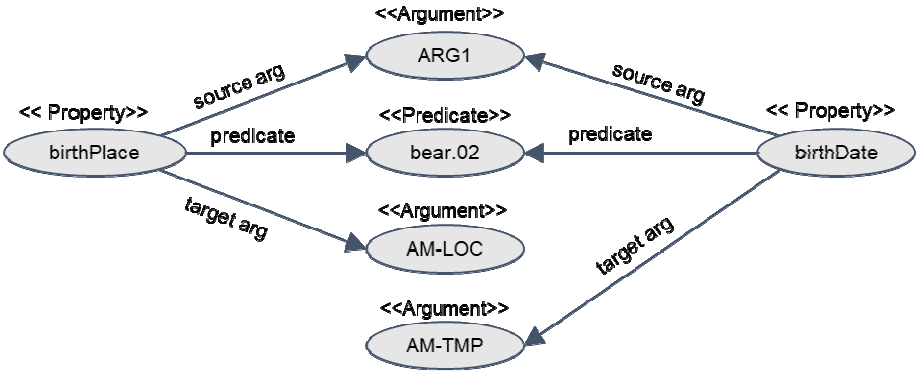

Fig. 1. An example of property explanation.

3 Building Ontology Property Explanations

The model for explaining ontology properties with Predicate-Argument patterns illustrates the potential of bridging the semantic gap between predicates in natural language sentences and ontology properties. In this paper, we propose a method that automatically constructs an explanation for a property based on a given knowledge base written in RDF. Our approach requires some textual corpora associated with given knowledge base in advance. Here, the relatedness between the textual corpora and knowledge base means that some natural language sentences that semantically corresponds to each statement in the knowledge base are expected. In our research, we utilize DBpedia[4] as a given knowledge base and Wikipedia article abstract paragraphs as corresponding textual corpora.

Figure 2 illustrates the process for building explanations of a property in the knowledge base. In our approach, it is required to pick a specific property in the

knowledge base to build its explanations. We choose the birthPlace property as an example in this paper.

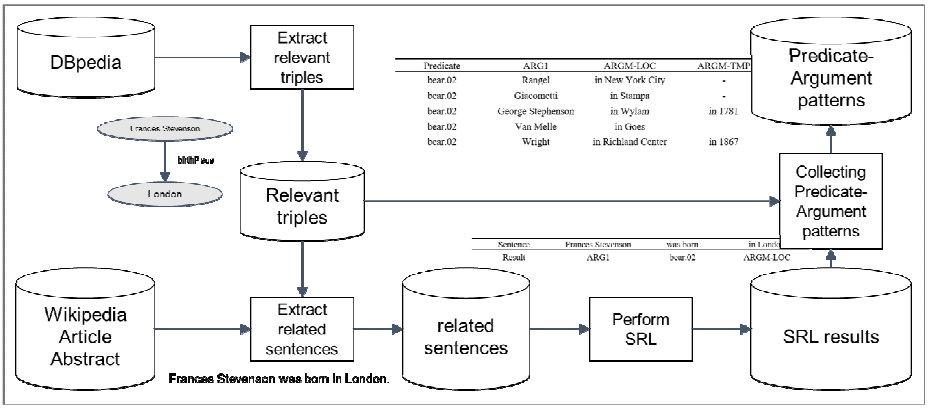

Fig. 2. The process for building property explanations.

In the first step of our method, relevant triples with the target property will be extracted. Relevant triples are the triples that uses the target property as a predicate. For example, a relevant triple for property birthPlace is <Frances Stevenson, birthPlace, London>.

Secondly, we extract related sentences from given textual corpora which contains both of subject and object of the relevant triples. For instance, a related sentence for triple <Frances Stevenson, birthPlace, London> is "Frances Stevenson was born in London".

After that we perform Semantic Role Labeling[5] over the related sentences to analyze Predicate-Argument structure of the sentences. Table 1. shows an example result of sentence "Frances Stevenson was born in London".

Table 1. An example result of Semantic Role Labeling.

Sentence	Frances Stevenson	was born	in London
Result	ARG1	bear.02	ARGM-LOC

Finally, we collect the Predicate-Argument patterns that are relevant to the triples that are extracted from the first step. Sometimes related sentences not only contain information related to the relevant triple, but also some other information. For example, sentence "Frances Stevenson was born in London and born on 1988" contains not only birth place information, but also birth year information. Therefore, in this step, we extract Predicate-Argument patterns related to the relevant triple. The relatedness between relevant triple and Predicate-Argument pattern means that both of the subject and object of the triple should be matched to the one of argument of the pattern individually.

The collected set of Predicate-Argument patterns are the final result of our approach. Each pattern can be regarded as an explanation of the given target. Table 2

illustrates a part of the collected set for property birthPlace. It is easy to catch that the property birthPlace can be explained with predicate bear.02, agument ARG1 and ARGM-LOC.

Table 2. A part of the collected set for property birthPlace.

Predicate	ARG1	ARGM-LOC	ARGM-TMP
bear.02	Rangel	in New York City	-
bear.02	Giacometti	in Stampa	-
bear.02	George Stephenson	in Wylam	in 1781
bear.02	Van Melle	in Goes	
bear.02	Wright	in Richland Center	in 1867

4 Conclusion

The model for explaining ontology properties with Predicate-Argument patterns illustrates the possibility of bridging the semantic gap between predicates in natural language sentences and ontology properties. In this paper, we proposed a method to build explanations of ontology properties in an automatic way. We believe that property explanations built from our approach could help to link properties in RDF and predicates in natural languages to extract triples from unstructured text data or answering natural language questions.

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