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Ontology VS ODP

**Ontology** is the description of knowledge as a set of concepts and the relationship that holds between them.

**ODPs** are the re-usable patterns that are used to improve quality of an ontology and make it more modular.
Why use ODP in an Ontology

- Ontologies are non-modular
- Difficult to comprehend
- High maintenance cost
Approach

ODPReco analyzes the lexical, structural and behavioural aspects of an ontology and compares it with that of the ODPs in order to recommend an ODP.
DATASET

Dataset referred as **Collection**. It includes:

- ODPs from the ODP repository (220 ODPs)
- MODL: Modular Ontology Design Library
## ODP Repository

220 ODPs:

<table>
<thead>
<tr>
<th>Type of ODP</th>
<th>Catalogue</th>
<th>Submissions</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content ODPs</td>
<td>0</td>
<td>157</td>
<td>157</td>
</tr>
<tr>
<td>Reengineering ODPs</td>
<td>0</td>
<td>12</td>
<td>12</td>
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<tr>
<td>Alignment ODPs</td>
<td>0</td>
<td>14</td>
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</tr>
<tr>
<td>Logical ODPs</td>
<td>0</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Architectural ODPs</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Lexico-Syntactic ODPs</td>
<td>0</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>
MODL

- Well-Documented ODPs.
- Collection of annotated OWL files with complete description of each pattern.
Ontology Analysis

- **Lexical**- Description along with the names of classes, properties and individuals of an ontology compared against the collection.
- **Behavioural**- Competency questions being compared.
- **Structural**- Axioms being compared
Ontology Analysis

- Combining the scores of three and setting a threshold above which the list of ODPs can be recommended.
Machine Learning on existing ODPs

Features considered are:

Lexical, Structural and behavioural.
Machine Learning on existing ODPs

Some drawbacks with this approach are:

- Training data is limited
- Feature Selection is cumbersome
- Prediction might not be accurate
Work Done so far

Lexical Analysis:

- Description of Ontology
- Stop Word Removal
- Comparing with ODP by implementing Doc2Vec
- Obtaining the similarity
beAWARE ontology an "all-around" lightweight crisis management ontology climate-related
This pattern represents a flexible schema for linked data querying of chess games. Players
To formally represent a conceptualization or a descriptive context. This CP allows the design
The hazardous situation ontology design pattern provides a building block for modelling
This pattern is a basic one, which allows to talk about attributes/parameters/dimensions,
The intent of the pattern is to be able to represent climatic zones for aquatic resources
Lexical Analysis

Extracting the signature

1. Signature of Ontology using OWL api
2. IRI Removal
3. Comparing with ODP signature using Doc2Vec
4. Obtaining the Similarity
[<beAware_ontology#Agriculture>, <beAware_ontology#Animal>, <beAware_ontology#Asset>, <beAware_ontology#Activity>
[<actingfor.owl#Agent>, <actingfor.owl#SocialAgent>, <actingfor.owl#actsFor>, <actingfor.owl#actsWith>,
[<ActingPlayerRole>, <Agent>, <AgentRole>, <AuthorRole>, <BlackPlayerRole>, <ChessCompetition>
[<climaticzone.owl#AquaticResource>, <climaticzone.owl#AquaticResourceObservation>, <climaticzone.owl#AquaticResourceState>,
[<description.owl#Concept>, <description.owl#Description>, owl:Thing, <description.owl#define>,
[<HazardousSituation#Cause>, <HazardousSituation#Consequence>, <HazardousSituation#Event>,
[<region.owl#Region>, owl:Thing, <region.owl#hasRegion>, <region.owl#isRegionFor>, <region.owl#inRegion>,
Work Done so Far

Behavioural Analysis:

- Competency Questions of Ontology
- Stop Word Removal
- Comparing with ODP by implementing Doc2Vec
- Obtaining the similarity
1. Natural disasters may lead to natural disasters? Are impacts caused by natural disaster. Which child?
2. Who is working for which organization? Who is representing the company?
3. List all moves in a Fools Mate game where black wins after 2 moves by both players. What did I say?
4. Which are the assumptions under which a certain thing is described? Which are the concepts involved?
5. What object (person or organization or equipment etc.) is exposed to a hazard? To which hazard?
6. What is the value for the attribute of that entity? Which entities have a certain value on that attribute?
7. What resource has what climatic zone?
Work Done so Far

Structural Analysis:

- Axioms of Ontology using the OWL api
- IRI Removal
- Comparing with ODP by implementing Doc2Vec
- Obtaining the similarity
ObjectPropertyRange(bernardo_ontology#CharacterizesDisasterType) ObjectPropertyRange(bernardo_ontology#NaturalDisasterType) ObjectPropertyRange(bernardo_ontology#RelatesToMediaItem) bernardo_ontology

ObjectPropertyRange(actingfor.owl#actsFor) ObjectPropertyRange(actingfor.owl#SocialAgent) ObjectPropertyRange(actingfor.owl#actsThrough) actingfor.owl#Agent

ObjectPropertyRange(climaticzone.owl#isResourceOf) climaticzone.owl#AquaticResourceObservation ObjectPropertyRange(climaticzone.owl#isClimaticZoneOf) climaticzone.owl#AquaticResourceObservation

ObjectPropertyRange(description.owl#defines) description.owl#Concept ObjectPropertyRange(description.owl#usesConcept) description.owl#Concept

ObjectPropertyRange(HazardousSituation#exposedTo) HazardousSituation#Hazard ObjectPropertyRange(HazardousSituation#exposedTo) HazardousSituation#Hazard

ObjectPropertyRange(region.owl#hasRegion) region.owl#Region ObjectPropertyRange(region.owl#isRegionFor) owl:Thing
Conclusion

Using this tool, ODPs can be recommended for bulk ontologies and hence, can help in improving the quality of the ontology.
Questions to the community

1. Are there a set of ontologies that have the “before applying ODPs” and “after applying ODPs” versions?
2. Apart from the three features that are discussed, are there any other aspects that could be used as features in the ML algorithm?
3. Apart from user study, are there any other mechanisms to validate this tool?
4. What other features would you like to see in this tool?
THANK YOU

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