Semantic Web – Tutorial #8

Isabelle Kuhlmann

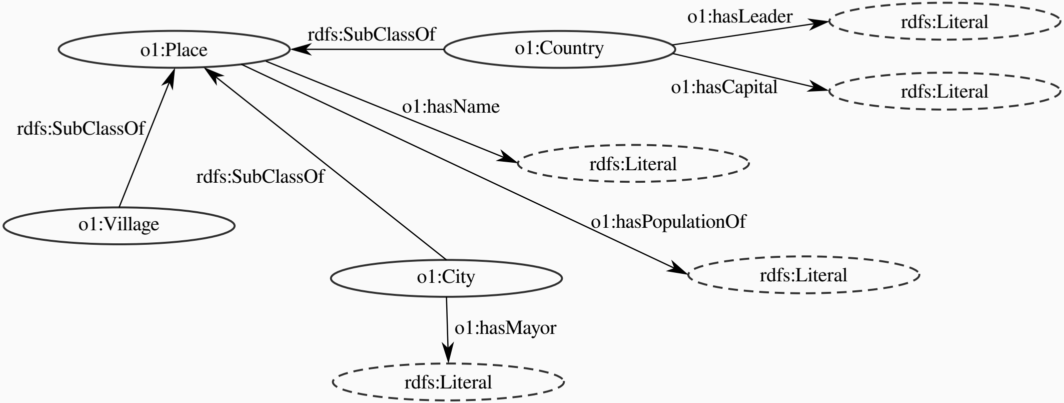
Institute for Web Science & Technologies
University of Koblenz-Landau

June 24, 2021 | Assignment 7

1: Ontology Matching

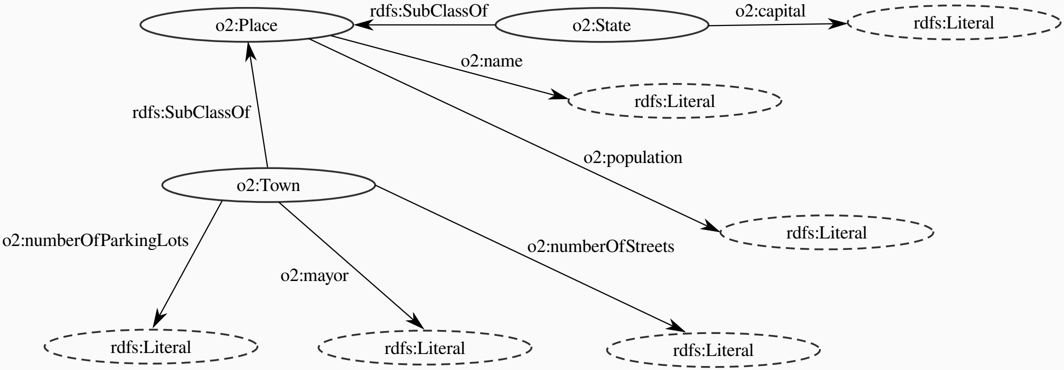
1: Ontology Matching

Ontology O1:



1: Ontology Matching

Ontology O2:



1: Ontology Matching | Levenshtein Distance

Task: What are the Levenshtein distances between all possible pairs of `o1:hasLeader`, `o1:hasMayor`, and `o1:hasCapital`?

Levenshtein Distance

The Levenshtein Distance, also referred to as *Edit Distance*, measures the difference between two sequences by counting the minimum number of edit operations required to transform one sequence into the other one.

Edit operations:

- **Replace:** “aa” → “ab”
- **Insert:** “aa” → “aab”
- **Delete:** “aa” → “a”

1: Ontology Matching | Levenshtein Distance

Example: Levenshtein Distance between *water* and *wine*:

We can perform the following three operations:

1. Replace the “a” in *water* with “i” → *witer*
2. Replace “t” with “n” → *winer*
3. Delete “r” → *wine*

Consequently: lev(*water*, *wine*) = 3

1: Ontology Matching | Levenshtein Distance

We can also use a table to compute the Levenshtein distance. The basic setup of such a table looks as follows:

	ε	w	a	t	e	r
ε						
w						
i						
n						
e						

If we are in cell x, we can use the following key:

replace	*insert*
delete	x

Now x is equal to:

- The minimum of the values in those three cells, if the two corresponding characters match
- The minimum of the values in those three cells **+ 1**, if the two corresponding characters **do not** match

1: Ontology Matching | Levenshtein Distance

Let us consider the example with *water* and *wine* once again.

Remember:

replace	*insert*
delete	x

	ε	w	a	t	e	r
ε	0	1	2	3	4	5
w	1	0	1	2	3	4
i	2	1	1	2	3	4
n	3	2	2	2	3	4
e	4	3	3	3	2	**3**

1: Ontology Matching | Levenshtein Distance

Task: What are the Levenshtein distances between all possible pairs of `o1:hasLeader`, `o1:hasMayor`, and `o1:hasCapital`?

lev(`hasMayor`, `hasLeader`) = 4:

1. Insert: `hasMayor` → `hasMeayor`
2. Replace: `hasMeayor` → `hasLeayor`
3. Replace: `hasLeayor` → `hasLeador`
4. Replace: `hasLeador` → `hasLeader`

	ε	h	a	s	M	a	y	o	r
ε	0	1	2	3	4	5	6	7	8
h	1	0	1	2	3	4	5	6	7
a	2	1	0	1	2	2	3	4	5
s	3	2	1	0	1	2	3	4	5
L	4	3	2	1	1	2	3	4	5
e	5	4	3	2	2	2	3	4	5
a	6	5	3	3	3	2	3	4	5
d	7	6	4	4	4	3	3	4	5
e	8	7	5	5	5	4	4	4	5
r	9	8	6	6	6	5	5	5	**4**

WeST People and Knowledge Networks

1: Ontology Matching | Levenshtein Distance

lev(hasLeader, hasCapital) = 7:

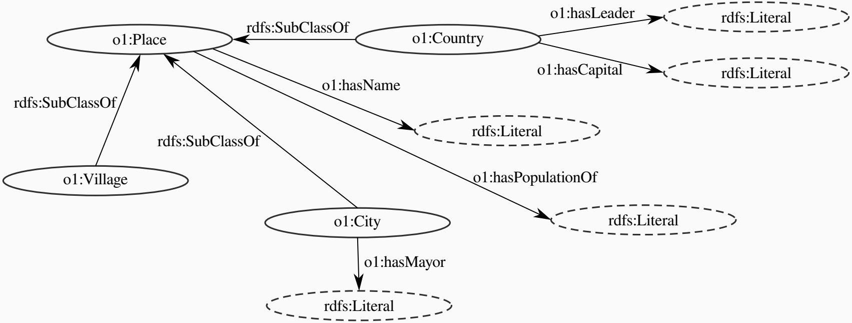
1. Replace: hasLeader → hasCeader
2. Replace: hasCeader → hasCaader
3. Replace: hasCaader → hasCapder
4. Replace: hasCapder → hasCapier
5. Replace: hasCapier → hasCapitr
6. Replace: hasCapitr → hasCapita
7. Insert: hasCapita → hasCapital

lev(hasMayor, hasCapital) = 6:

1. Replace: hasMayor → hasCayor
2. Replace: hasCayor → hasCapor
3. Replace: hasCapor → hasCapir
4. Replace: hasCapir → hasCapit
5. Insert: hasCapit → hasCapita
6. Insert: hasCapita → hasCapital

1: Ontology Matching | Suffix Similarity

Task: Calculate the suffix similarity for both `o2:mayor` and `o2:population` to elements in O1. Indicate the pair(s) with the confidence value higher than zero.

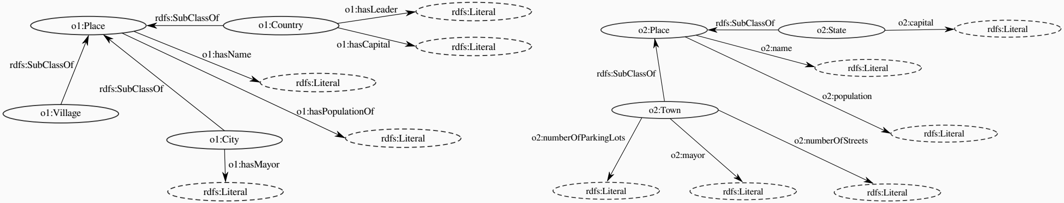


- The confidence value of `o2:mayor` and and `o1:hasMayor` is $\frac{5}{8}$.
- For `o2:population` there exists no suffix similarity with any element from O1 with a confidence level > 0.

WeST People and Knowledge Networks

1: Ontology Matching | Graph-based Techniques

Task: Using graph-based techniques, identify at least one pair of entities between non-leaf elements of O1 and O2 that are similar.



The following pairs are similar, from a graph-based perspective:

- (o1:City, o2:State)
- (o1:Place, o2:Place)

Alignment

Question 2 - Alignment

Given two strings $s1$ and $s2$, let N be the size of the longest string, and L be the Levenshtein distance between $s1$ and $s2$. The normalized Levenshtein distance is $(\underline{N} - \underline{L})/\underline{N}$.

			Conf.
http://example.org/places/Berlin,	http://dbpedia.org/page/Berlin	10	0.68
http://example.org/places/Berlin	http://www.geonames.org/2950159/berlin.html	23	0.46
http://example.org/institutions/Reichstag	http://dbpedia.org/page/Reichstag_building	28	0.34
http://example.org/institutions/Reichstag	http://dbpedia.org/page/Reichstag	19	0.53
http://example.org/people/JimRakete	https://en.wikipedia.org/Jim/Jim_Rakete	18	0.48
http://example.org/people/JimRakete	https://www.discogs.com/artist/1866244-Jim-Rakete	29	0.48
http://example.org/artwork/LaTrahisonDesImages	https://de.wikipedia.org/wiki/La_trahison_des_images	23	0.55
http://example.org/artwork/LaTrahisonDesImages	https://www.wikidata.org/wiki/Q1061035	35	0.24
http://example.org/places/Myanmar	https://en.wikipedia.org/wiki/Myanmar	17	0.54
http://example.org/places/Myanmar	http://dbpedia.org/page/Myanmar	10	0.70