M2R Exam – Semantic web: from XML to OWL
Semantic and social web part

Duration : 2h30
Any document allowed – no communication device allowed

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Note: Please, carefully read all the questions before answering.

1 Recommendations

Consider the following two expressions:

$$relevance(u,i) = \Sigma_{i' \in I} ItemSim(i,i') \times rating(u,i')$$
$$relevance(u,i) = \Sigma_{u' \in U} UserSim(u,u') \times rating(u',i)$$

1. What does each expression represent in recommendations?
2. Describe an example $ItemSim(i,i')$ function discussed in class.
3. Describe an example of $UserSim(u,u')$ in Delicious.

2 Social Top-K Processing

Top-K processing algorithms rely on a pruning condition also called threshold condition. Consider a query $Q = t_1\ t_2$ and the following two scoring functions on Delicious datasets:

$$score(u,i,t) = |Network(u) \cap taggers(i,t)|$$
$$score(u,i,Q) = \Sigma_{t \in Q} score(u,i,t)$$
$$score(u,i,Q) = score(u,i,t_1) - score(u,i,t_2)$$

1. Give an example of $Network(u)$
2. Which one of the two scoring functions enables early pruning and why?
3. Using that scoring function, how many sequential accesses are required to compute the top-1 answer for Q using the No-Random-Access (NRA) algorithm with a total of 2 users and 3 items all having the same scores for query terms? Develop a complete example with inverted lists)
4. How many random accesses are required for the same example?

Consider the following group consensus function:

$$score(G,i) = w_1 \times relevance(G,i) + w_2 \times (1 - disagreement(G,i))$$

5. What are the two components of the consensus function above?
6. What property does that function need to satisfy in order to find group recommendations efficiently?
7. Give an example of $disagreement(G,i)$ (a formula or a clear description are acceptable)

3 User Studies

1. What is the purpose of a qualification test in Amazon Mechanical Turk?

4 OWL 2 qualified cardinality restrictions

OWL 2 introduced qualified cardinality restrictions (`owl:qualifiedCardinality`, `owl:maxQualifiedCardinality`, and `owl:minQualifiedCardinality`, whose interpretation is obtained by extending the E_C function of Definition 19:

$$E_C(\texttt{restriction}(p, \texttt{minQualifiedCardinality}(n, C))) = \{x \in O; |\{\langle x, y\rangle \in E_R(p); y \in E_C(C)\}| \geq n\}$$
$$E_C(\texttt{restriction}(p, \texttt{maxQualifiedCardinality}(n, C))) = \{x \in O; |\{\langle x, y\rangle \in E_R(p); y \in E_C(C)\}| \leq n\}$$
$$E_C(\texttt{restriction}(p, \texttt{qualifiedCardinality}(n, C))) = \{x \in O; |\{\langle x, y\rangle \in E_R(p); y \in E_C(C)\}| = n\}$$

Consider the following expressions (in OWL 2):

```
ex:SmallTeam rdfs:subClassOf _:a .
_:a rdf:type owl:Restriction .
_:a owl:onProperty ex:member .
_:a owl:maxCardinality 5 .
ex:ModernTeam2 rdfs:subClassOf ex:SmallTeam .
ex:ModernTeam2 rdfs:subClassOf _:b .
_:b rdf:type owl:Restriction .
_:b owl:onProperty ex:member .
_:b owl:minQualifiedCardinality 4 .
_:b owl:onClass ex:Woman .
```

1. Draw the graph corresponding to this set of triples.
2. Express it in OWL/XML.
3. Explain the meaning of this graph (paraphrase it in English)
4. What would happen if we exchange the 5 and the 4?

Consider the following statements:

```
ex:MyTeam rdf:type ex:ModernTeam2 .
ex:Kay ex:member ex:MyTeam .
ex:Kay rdf:type ex:Man .
ex:Jo ex:member ex:MyTeam .
```

5. If one queries this graph with `SELECT ?x WHERE ?x rdf:type ex:Woman .`, what would be the answer?
6. What would be necessary for `ex:Jo` to be an answer?

5 From OWL 2 to OWL 1 and back

1. How is it possible to rewrite `qualifiedCardinality` in function of the minimal and maximal qualified cardinality restrictions? Explain it with the semantics.
2. Is it possible to express `minCardinality`, `maxCardinality`, `cardinality`, `someValuesFrom` with these new qualified cardinality restrictions? Explain how.

Consider, in addition to the previous RDF graphs, the following statements (expressed in OWL 1):

```
ex:womanmember owl:subPropertyOf ex:member .
ex:womanmember rdfs:range ex:Woman .
ex:ModernTeam1 rdfs:subClassOf ex:SmallTeam .
ex:ModernTeam1 rdfs:subClassOf _:b .
_:b rdf:type owl:Restriction .
_:b owl:onProperty ex:womanmember .
_:b owl:minCardinality 4 .
```

3. Does `ex:ModernTeam1` subsume `ex:ModernTeam2` or the other way around? Justify.
4. Does this suggest that it is also possible to express qualified cardinality constraints in OWL 1? Explain.
5. Does qualified cardinality restrictions provide additional expressivity to OWL 1?