Intelligent Agents

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Concept Similarity

- When you want to refer to things approximately
  - Furniture similar to chair
  - Close relatives
- Need to evaluate how similar a concept is to a given concept
- Various metrics with various biases
Tversky's Similarity

• Designed for comparing similarity of two vectors
• Can be adopted for ontology concepts through measuring feature similarity
• Two concepts are identical if their features are the same

\[
S = \frac{\alpha(\text{common})}{\alpha(\text{common}) + \alpha(\text{different})}
\]
Wu and Palmer's Similarity

The similarity between $c_1$ and $c_2$ is estimated and $c_0$ is the most specific concept subsuming them

- $N_1$ is the number of edges between $c_1$ and $c_0$.
- $N_2$ is the number of edges between $c_2$ and $c_0$.
- $N_0$ is the number of IS-A links of $c_0$ from the root of the taxonomy.

$$S = \frac{2 * N_0}{N_1 + N_2 + 2 * N_0}$$
Examples

- Wine color can only be White, Rose, or Red.

```xml
<owl:Class rdf:ID="WineColor">
  <rdfs:subClassOf rdf:resource="#WineDescriptor" />
  <owl:oneOf rdf:parseType="Collection">
    <owl:Thing rdf:about="#White" />
    <owl:Thing rdf:about="#Rose" />
    <owl:Thing rdf:about="#Red" />
  </owl:oneOf>
</owl:Class>
```
• White Wine are wine that have color white.

<owl:Class rdf:ID="WhiteWine">
  <owl:intersectionOf rdf:parseType="Collection">
    <owl:Class rdf:about="#Wine" />
    <owl:Restriction>
      <owl:onProperty rdf:resource="#hasColor" />
      <owl:hasValue rdf:resource="#White" />
    </owl:Restriction>
  </owl:intersectionOf>
</owl:Class>
Examples

- All wines have color white.

```xml
<wowl:Class rdf:ID="Wine">  
  <rdfs:subClassOf>
    <owl:Restriction>
      <owl:onProperty rdf:resource="#hasColor" />
      <owl:hasValue rdf:resource="#White" />
    </owl:Restriction>
  </rdfs:subClassOf>
</owl:Class>
```
• **WhiteNonSweetWine** is WhiteWine with Dry or OffDry Sugar.

```xml
<owl:Class rdf:ID="WhiteNonSweetWine">
  <owl:intersectionOf rdf:parseType="Collection">
    <owl:Class rdf:about="#WhiteWine" />
    <owl:Restriction>
      <owl:onProperty rdf:resource="#hasSugar" />
      <owl:allValuesFrom>
        <owl:Class>
          <owl:oneOf rdf:parseType="Collection">
            <owl:Thing rdf:about="#Dry" />
            <owl:Thing rdf:about="#OffDry" />
          </owl:oneOf>
          <owl:Class>
            <owl:oneOf rdf:parseType="Collection">
              <owl:Thing rdf:about="#Dry" />
              <owl:Thing rdf:about="#OffDry" />
            </owl:oneOf>
            <owl:Class>
              <owl:allValuesFrom>
                <owl:Restriction>
                  <owl:intersectionOf>
                    <owl:Class>
                    </owl:Class>
                  </owl:intersectionOf>
                </owl:Restriction>
              </owl:allValuesFrom>
            </owl:Class>
          </owl:Class>
        </owl:oneOf>
        </owl:Class>
      </owl:allValuesFrom>
    </owl:Restriction>
  </owl:intersectionOf>
</owl:Class>
```
Examples

- Zinfandel is Wine that is made of at most 1 ZinfandelGrape.

```xml
<owl:Class rdf:ID="Zinfandel">
<owl:intersectionOf rdf:parseType="Collection">
  <owl:Class rdf:about="#Wine" />
  <owl:Restriction>
    <owl:onProperty rdf:resource="#madeFromGrape" />
    <owl:hasValue rdf:resource="#ZinfandelGrape" />
  </owl:Restriction>
  <owl:Restriction>
    <owl:onProperty rdf:resource="#madeFromGrape" />
    <owl:maxCardinality rdf:datatype="&xsd;nonNegativeInteger">1</owl:maxCardinality>
  </owl:Restriction>
</owl:intersectionOf>
</owl:Class>
```
• SaucelitoCanyonZinfandel is an instance of Zinfandel that is located in ArroyoGrandeRegion, has a maker named SaucelitoCanyon, is dry, has moderate flavor and has body medium.

  <Zinfandel rdf:ID="SaucelitoCanyonZinfandel">
    <locatedIn rdf:resource="#ArroyoGrandeRegion" />
    <hasMaker rdf:resource="#SaucelitoCanyon" />
    <hasSugar rdf:resource="#Dry" />
    <hasFlavor rdf:resource="#Moderate" />
    <hasBody rdf:resource="#Medium" />
  </Zinfandel>
Example Domain (1)

- Gender: Female/Male
- Person: Man or Woman
- Child: Person and (hasParent min 1 Thing)
  - Daughter: Child and Woman
  - Son: Child and Man
- Man: Person and (hasSex value Male)
  - Brother: Man and Sibling
  - Father: Man and Parent
  - Nephew: Man and ((hasAunt min 1 Thing) or (hasUncle min 1 Thing))
  - Son: Child and Man
  - Uncle: Man and ((hasNephew min 1 Thing) or (hasNiece min 1 Thing))
Example Domain (2)

- Woman: Person and (hasSex value Female)
  - Sister: Woman and Sibling
  - Mother: Woman and Parent
  - Niece: Woman and ((hasAunt min 1 Thing) or (hasUncle min 1 Thing))
  - Daughter: Child and Woman
  - Aunt: Woman and ((hasNephew min 1 Thing) or (hasNiece min 1 Thing))

- Sibling
  - Brother: Man and Sibling
  - Sister: Woman and Sibling

- Parent
  - Mother: Woman and Parent
  - Father: Man and Parent

- Relative: Aunt or Child or Nephew or Niece or Parent or Sibling or Uncle