Reflections on Modelling Vagueness in Description Logics

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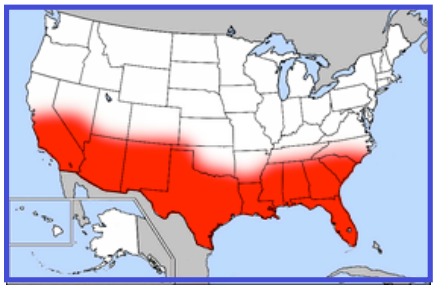
Vagueness in Ontologies

```
<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:Thing rdf:about="#Sweet" />
```

vague information

vague objects



List all cheap hotels close to UGA

flexible querying

Fuzzy Description Logics

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<owl:onProperty rdf:resource="#hasSugar" />
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      <owl:Thing rdf:about="#Sweet" />
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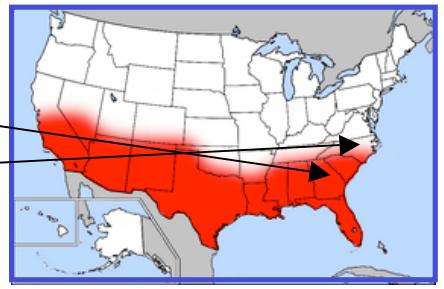
Zinfandel: DryWine ≥ 0.6

Georgia: SunbeltState ≥ 1

North Carolina: SunbeltState ≥ 0.4



List all cheap hotels close to UGA

InterestingHotel: Hotel ∏ Cheap ∏ CloseUGA

Hilton: InterestingHotel ≥ 0.4

Fuzzy Description Logics

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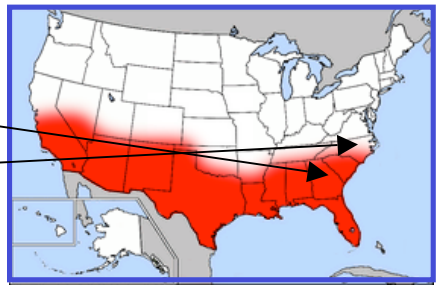


List all cheap hotels close to UGA

InterestingHotel: Hotel ∏ Cheap ∏ CloseUGA

Hilton: InterestingHotel ≥ 0.2

interoperability?

Description Logics with Concrete Domains

$$\mathcal{D} = (\Delta^{\mathcal{D}}, \Phi^{\mathcal{D}})$$

Domain: reals, integers, fuzzy sets, …

Predicate names: $=$,$\leq$, $=_a$, $\leq_a$, sim_a,…

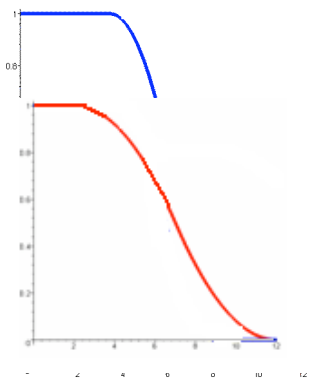
(Zinfandel,c): hasSugar

c: $(=_{6g/l})$

or c: $(=_{dry})$

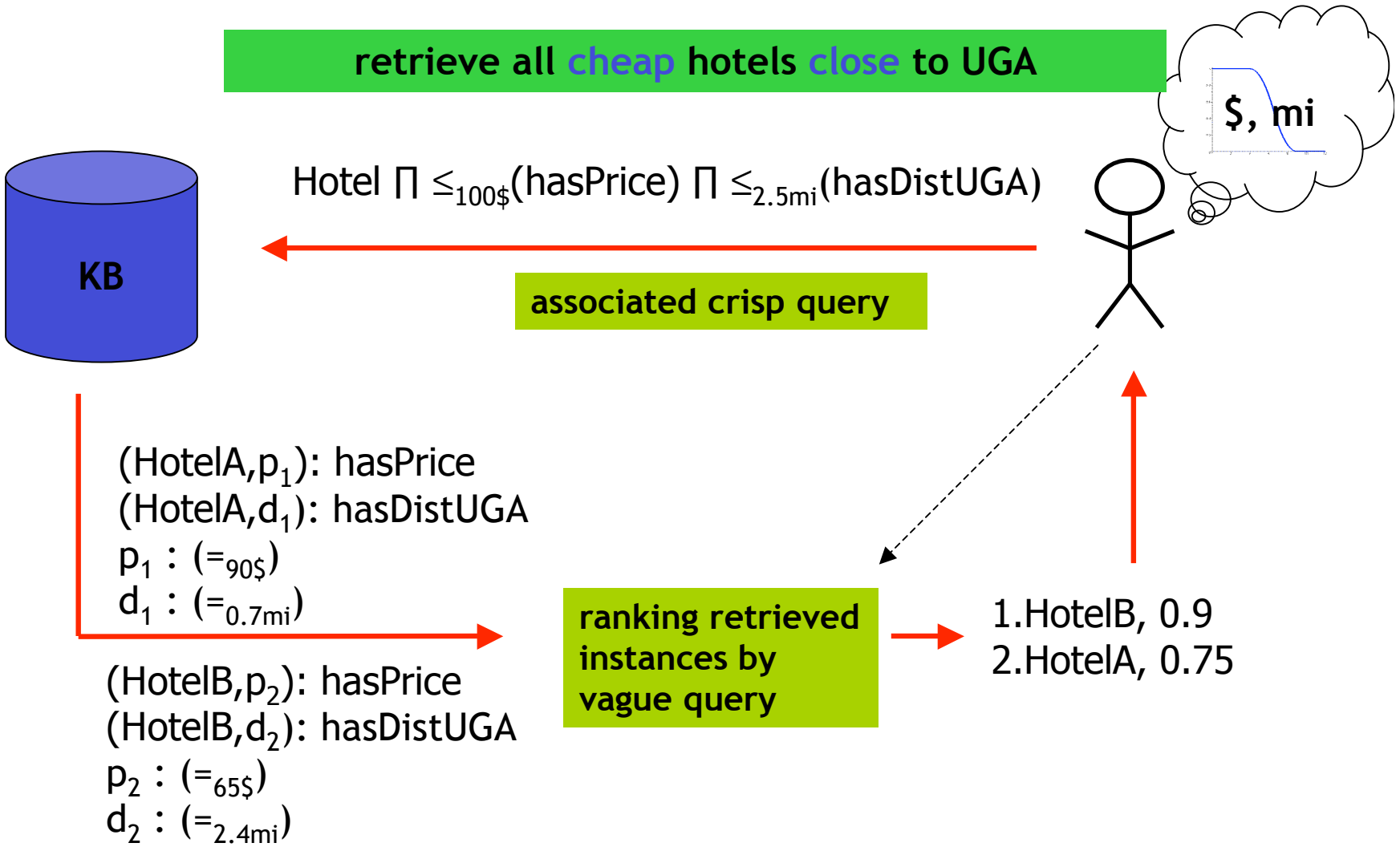
(Syrah,d): hasSugar

(c,d): $sim_{0.6}$



"similar to degree 0.6"

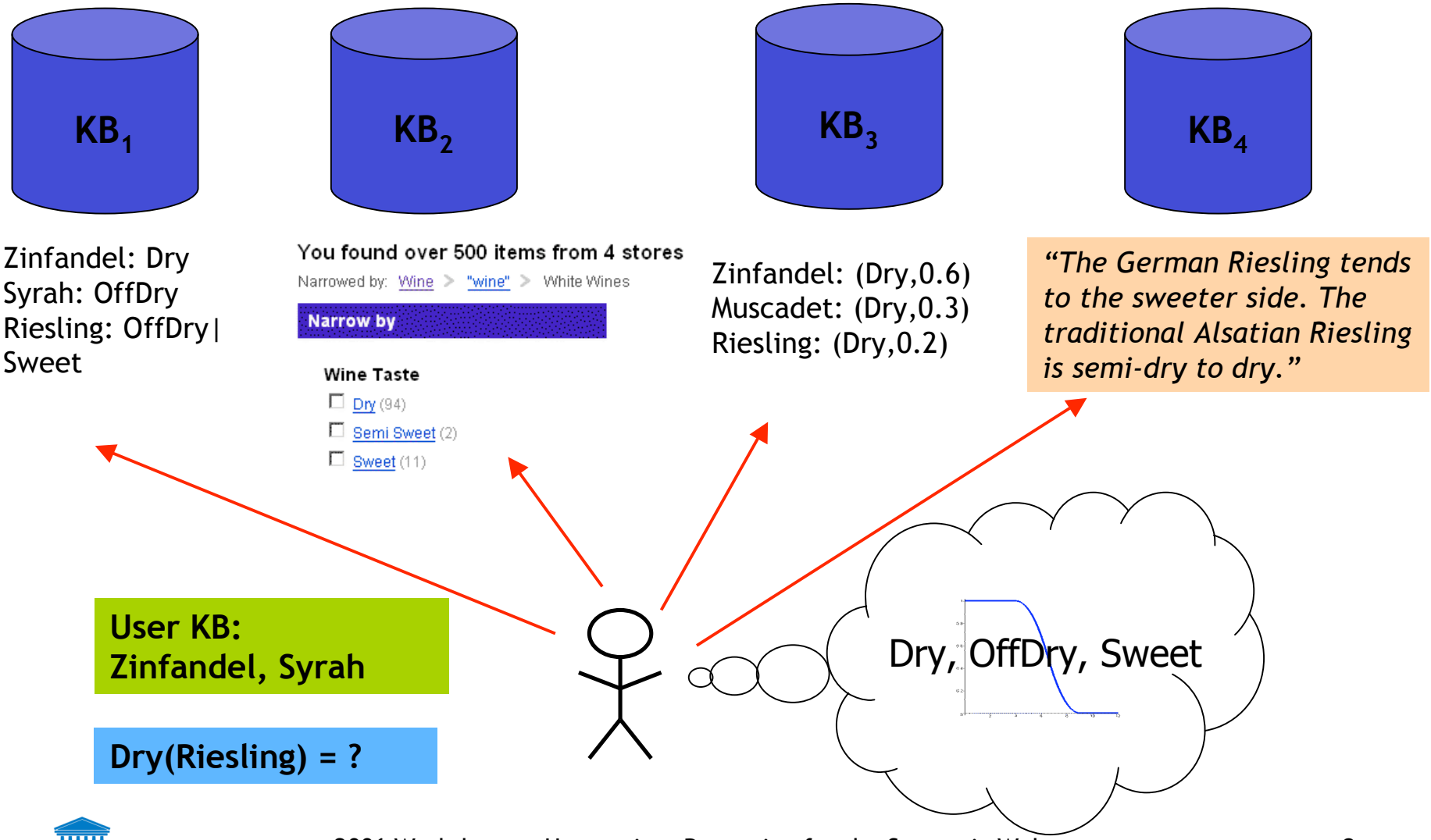
Semantic Search with Concrete Domains



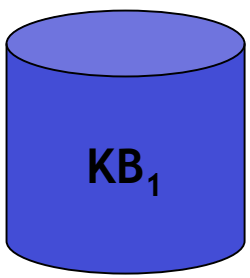
Position

- Vagueness in ontologies can not (always) be ignored
- Fuzzy DLs come some way to meet this demand, but limit interoperability
- Instead, we propose to
  - use concrete domains to describe vague attributes exactly
  - relegate vagueness processing as much as possible to query level

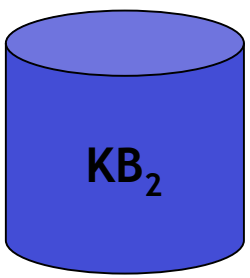
Use case scenario: wine sweetness (1)

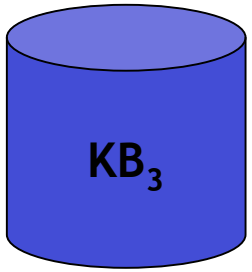


Use case scenario: wine sweetness (2)

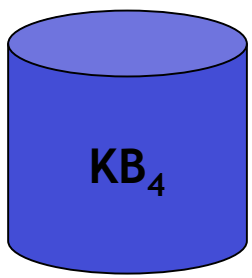


Zinfandel: Dry
Syrah: OffDry
Riesling: OffDry|Sweet





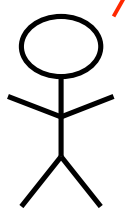
Zinfandel: (Dry,0.6)
Muscadet: (Dry,0.3)
Riesling: (Dry,0.2)



"The German Riesling tends to the sweeter side. The traditional Alsatian Riesling is semi-dry to dry."

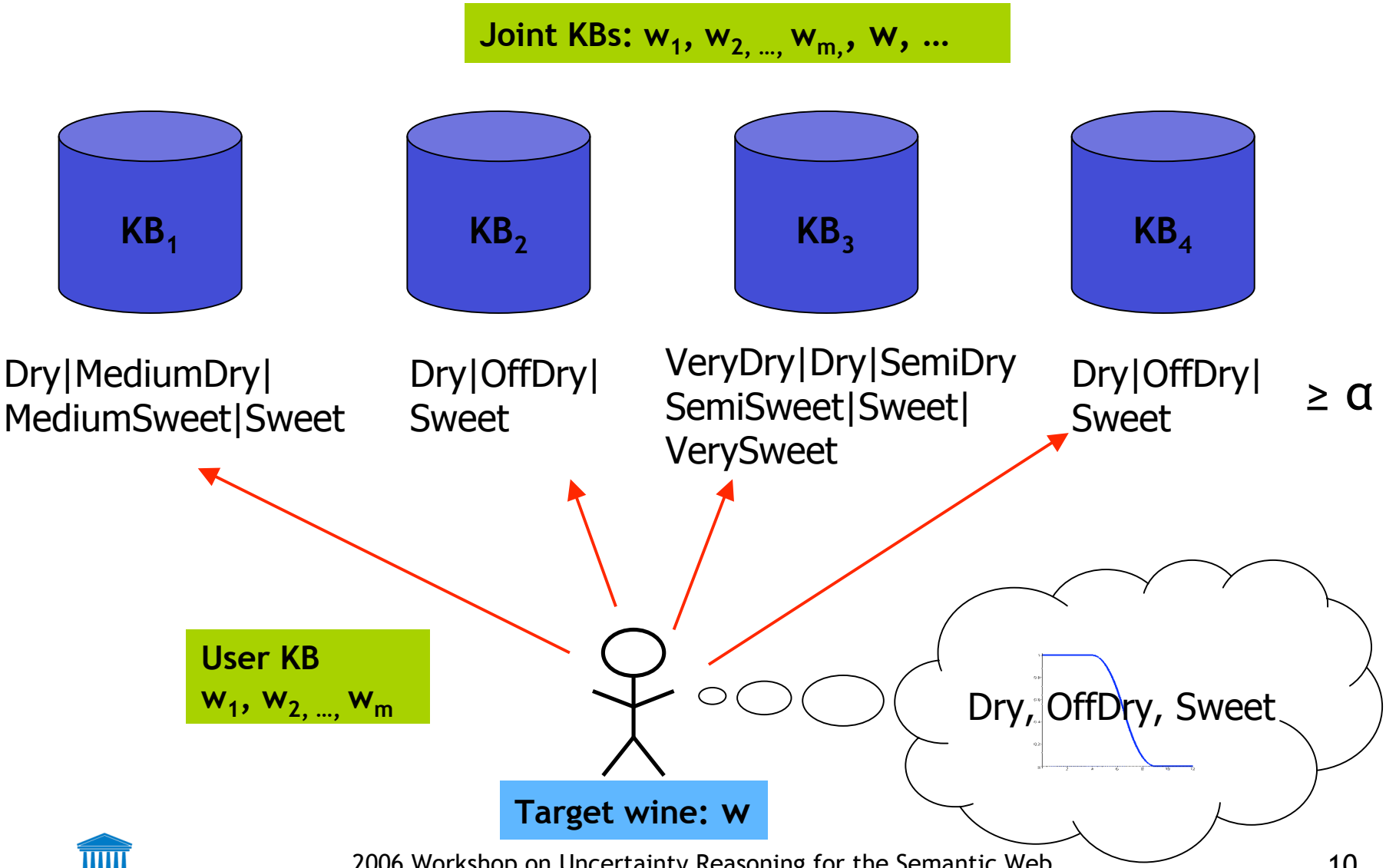
User KB:
Zinfandel, Syrah

Dry German whites around 15$?

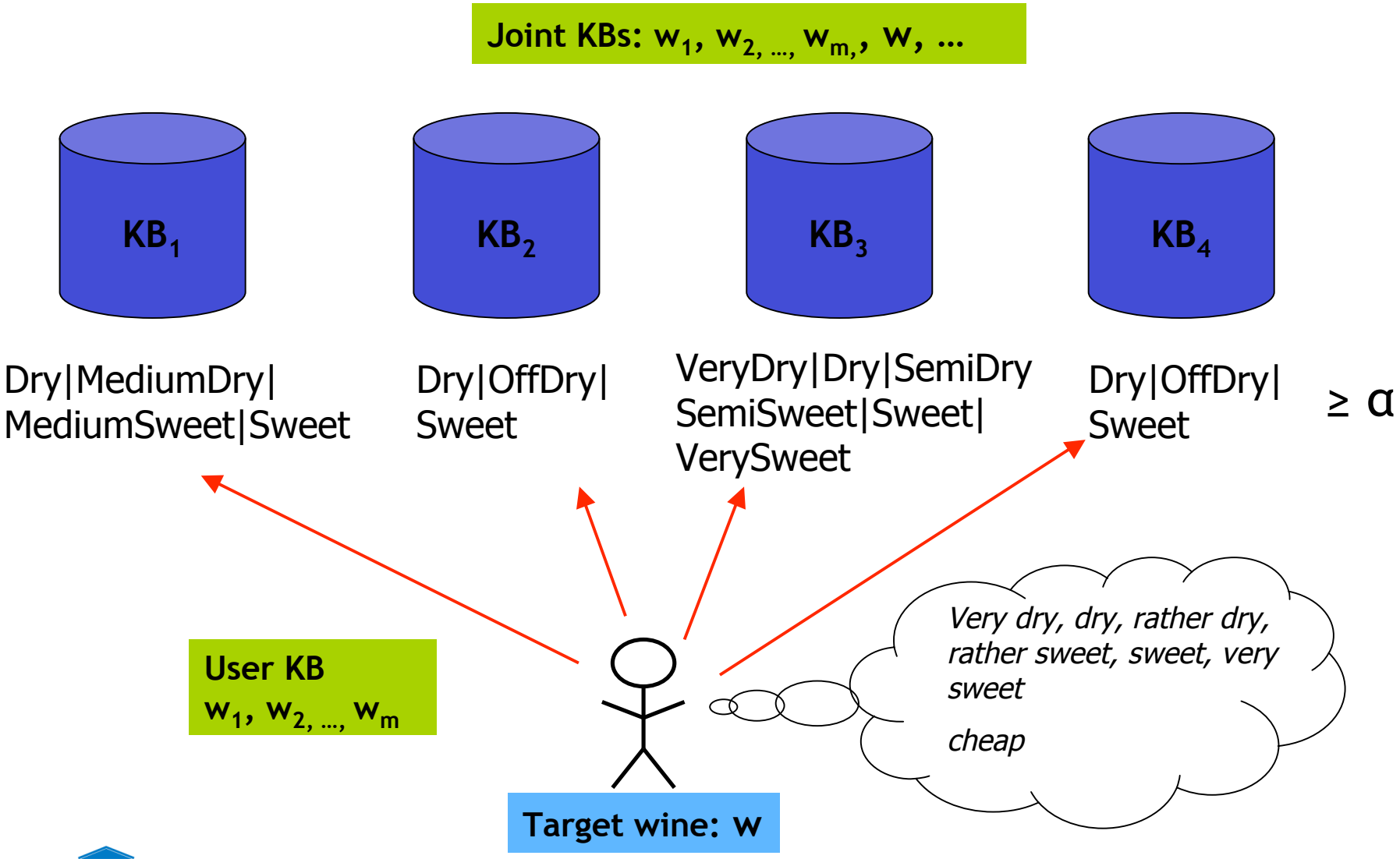


Very Dry, Dry,
Rather Dry,
Rather Sweet,
Sweet, Very Sweet

Use case scenario: wine expert



Use case scenario: wine novice



The Computational Web Intelligence Team specializes in the development and the use of computational intelligent methods for next generation web applications. We use techniques from fuzzy and rough set theory for the enhancement of recommender systems, question-answering systems, and trust systems, as well as for the enrichment of ontologies.

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Web & Information Systems Engineering

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There is a strong emphasis on usability aspects of web applications; conceptual modeling and design of web sites and web applications; describing semantics of web sites; the use of frameworks and patterns in web design; re-use of web designs; tool support for web design; use of Semantic Web Technology; adaptive hypermedia; e-learning; personalization and semantic interoperability.