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Web Ontology Segmentation

Analysis, Classification and Use

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Ontology ?!

Definition:

An ontology describes concepts in a domain of interest and the relationships that hold between them.

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Use

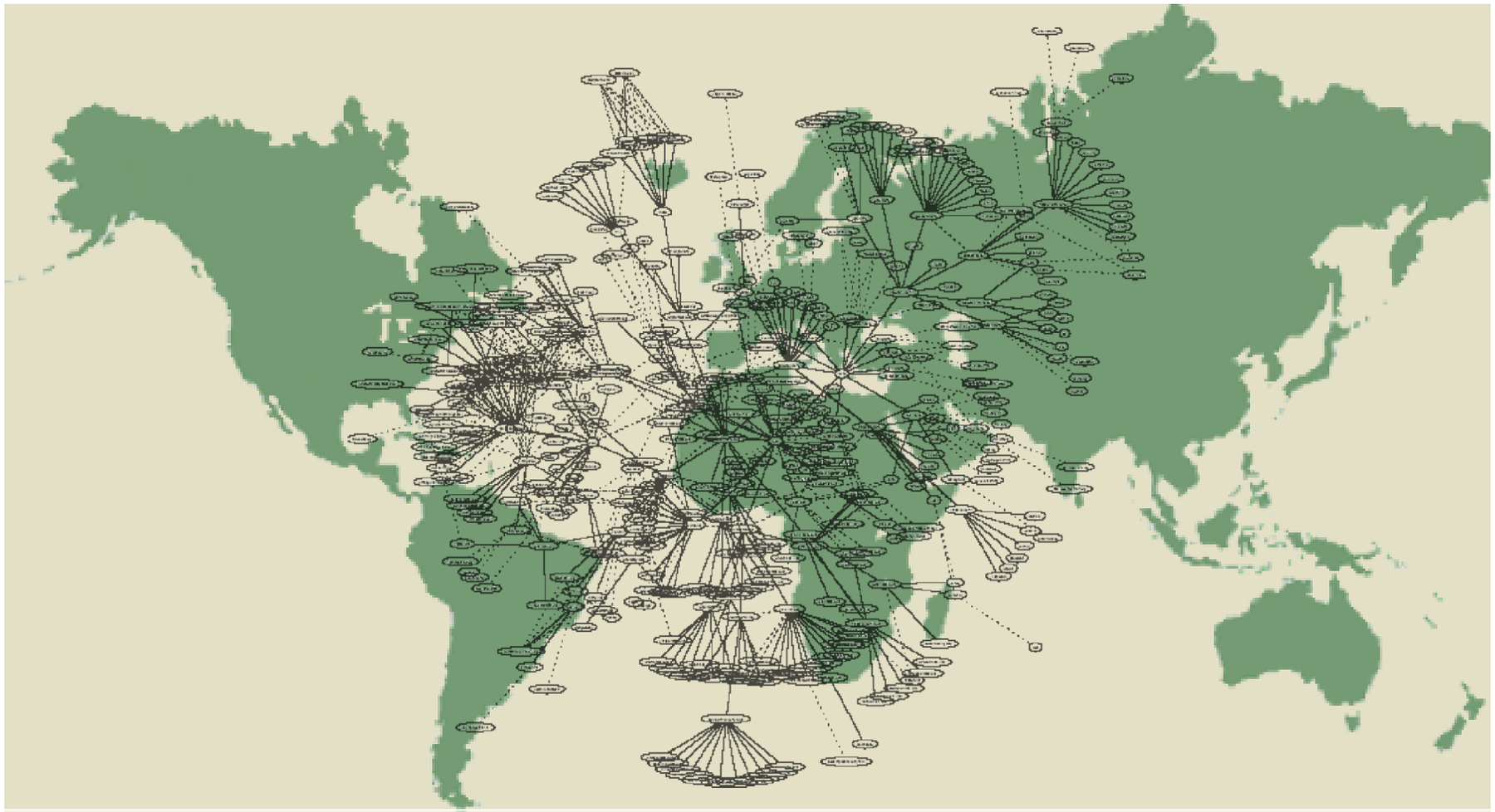
Schema mapping

Knowledge capture

Information inference

Intelligent user interfaces

and ...



global interoperability

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Social Science

Medicine

Biology

Astronomy

Ecology

Particle Physics

large domain ontologies

	number of concepts	time to classify
Gene Ontology	20,000	220 sec.
GALEN	23,000	stack overflow!
NCI-Thesaurus	42,000	815 sec.
FMA	70,000	stack overflow!
SNOMED-CT	364,000	stack overflow!

(reasoner: Racer 1.7)

4000 years ago ...

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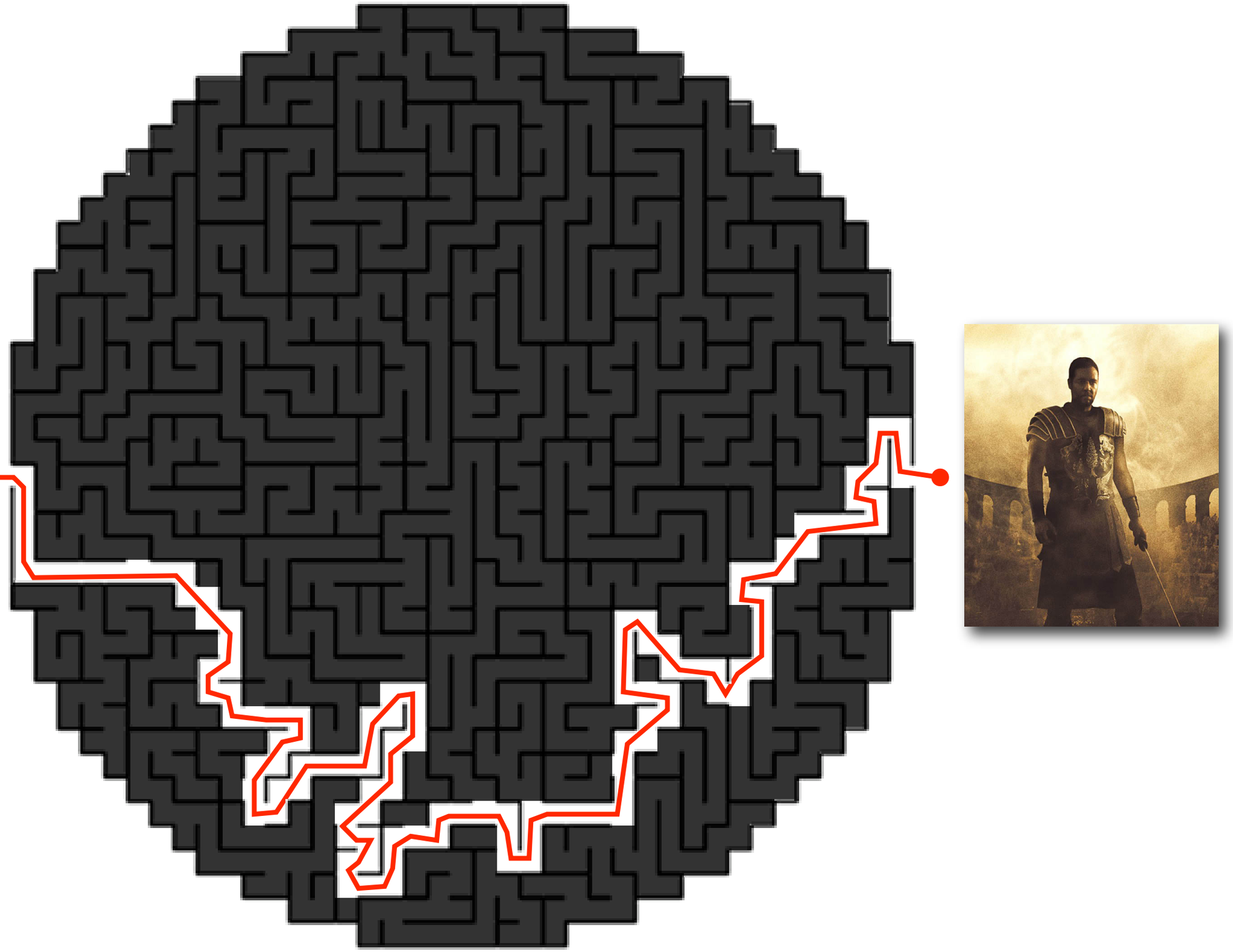
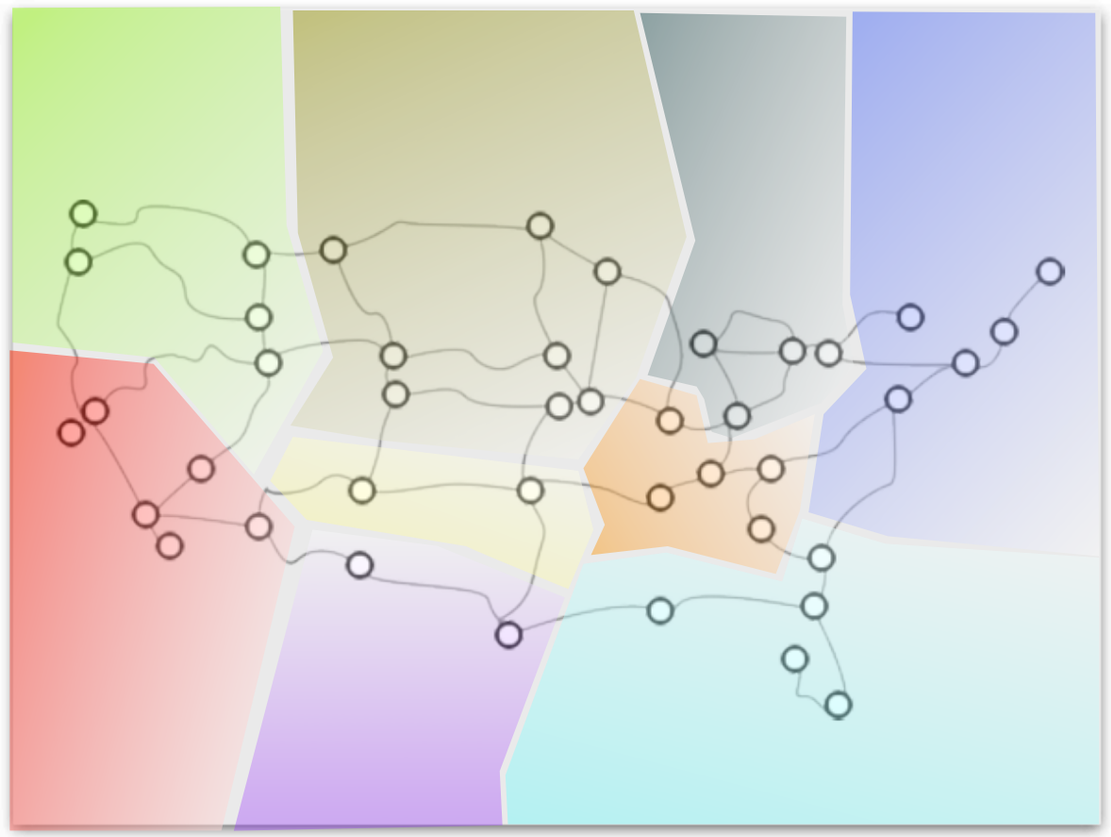
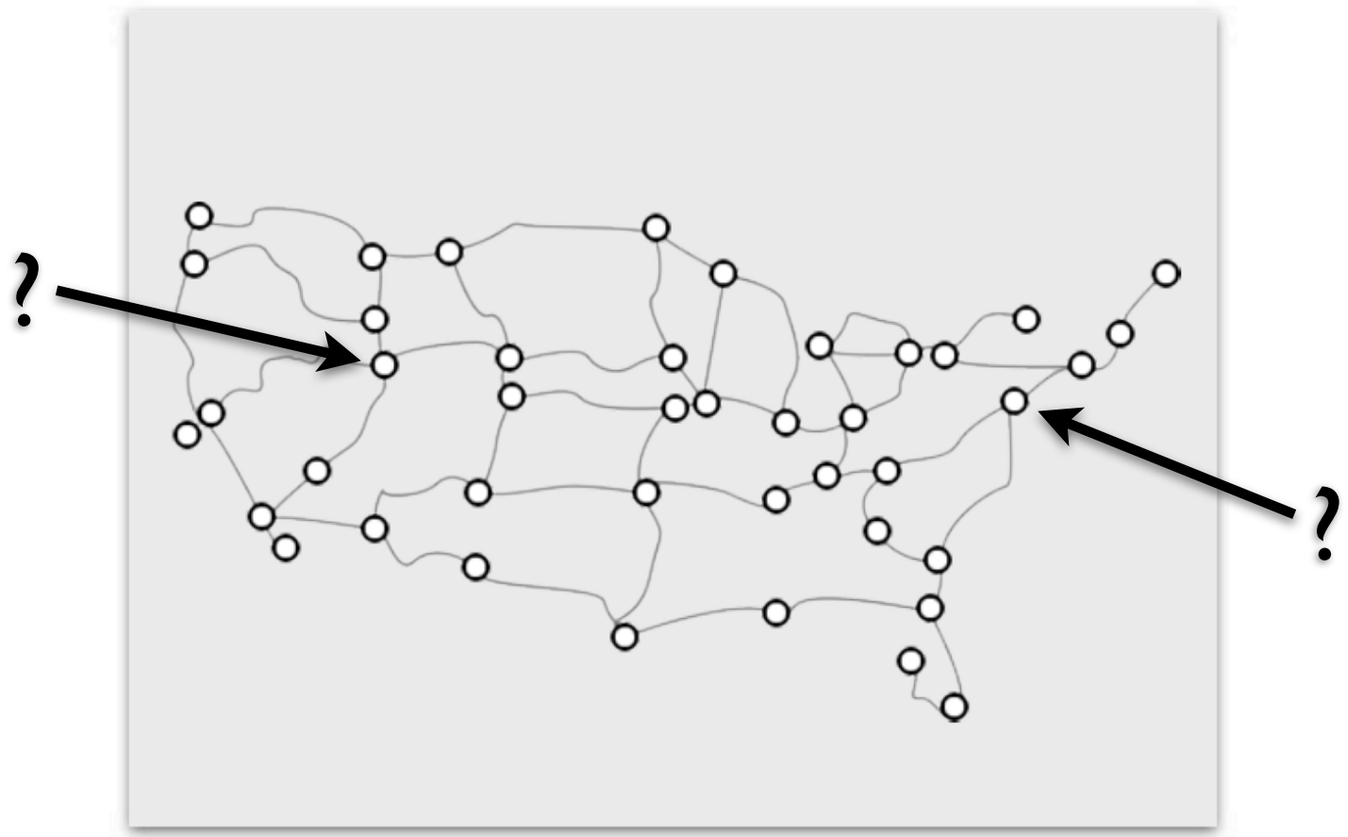


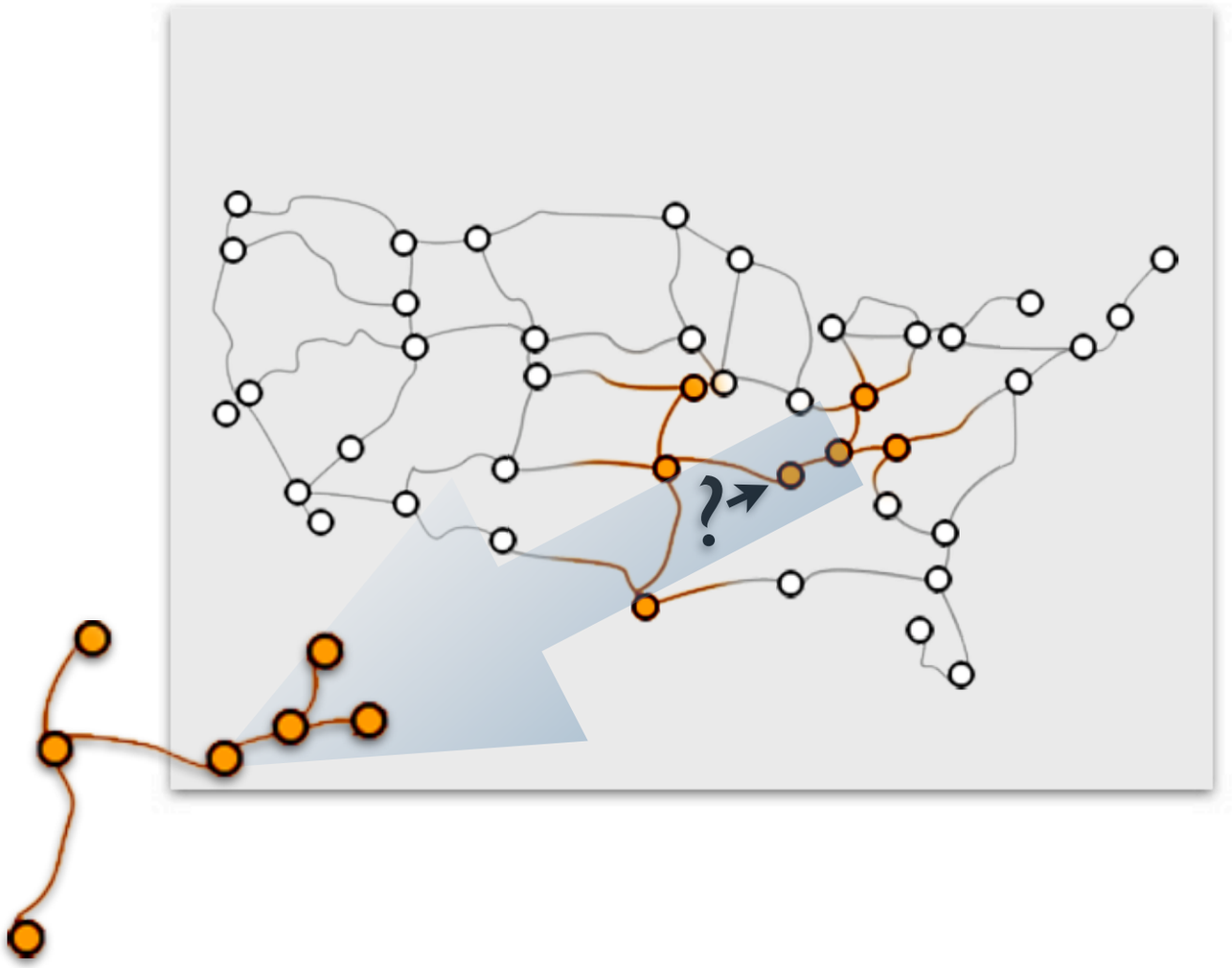
3 styles of segmentation



partitioning



querying



traversal

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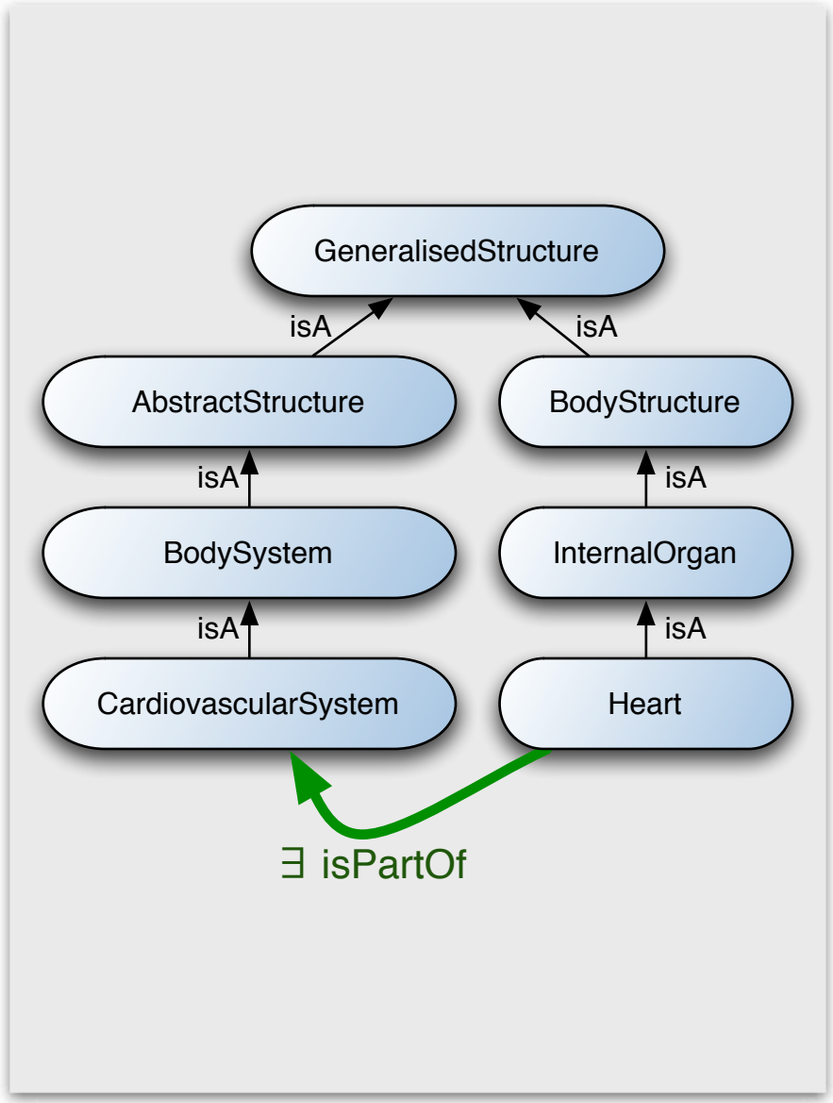
Background: superclasses as links

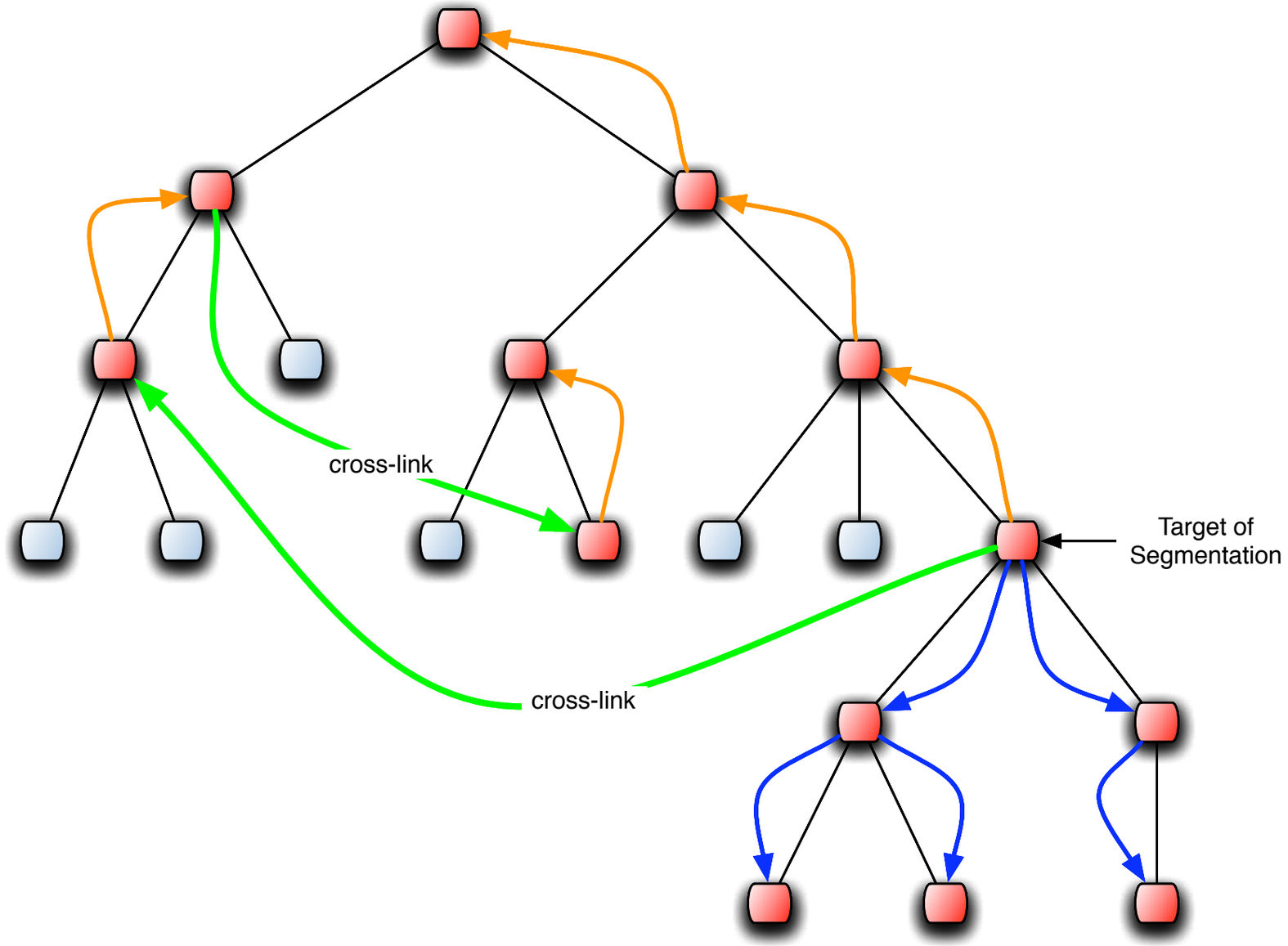
Heart ⊆

InternalOrgan

∃ isPartOf . CardiovascularSystem



Segmentation by Traversal

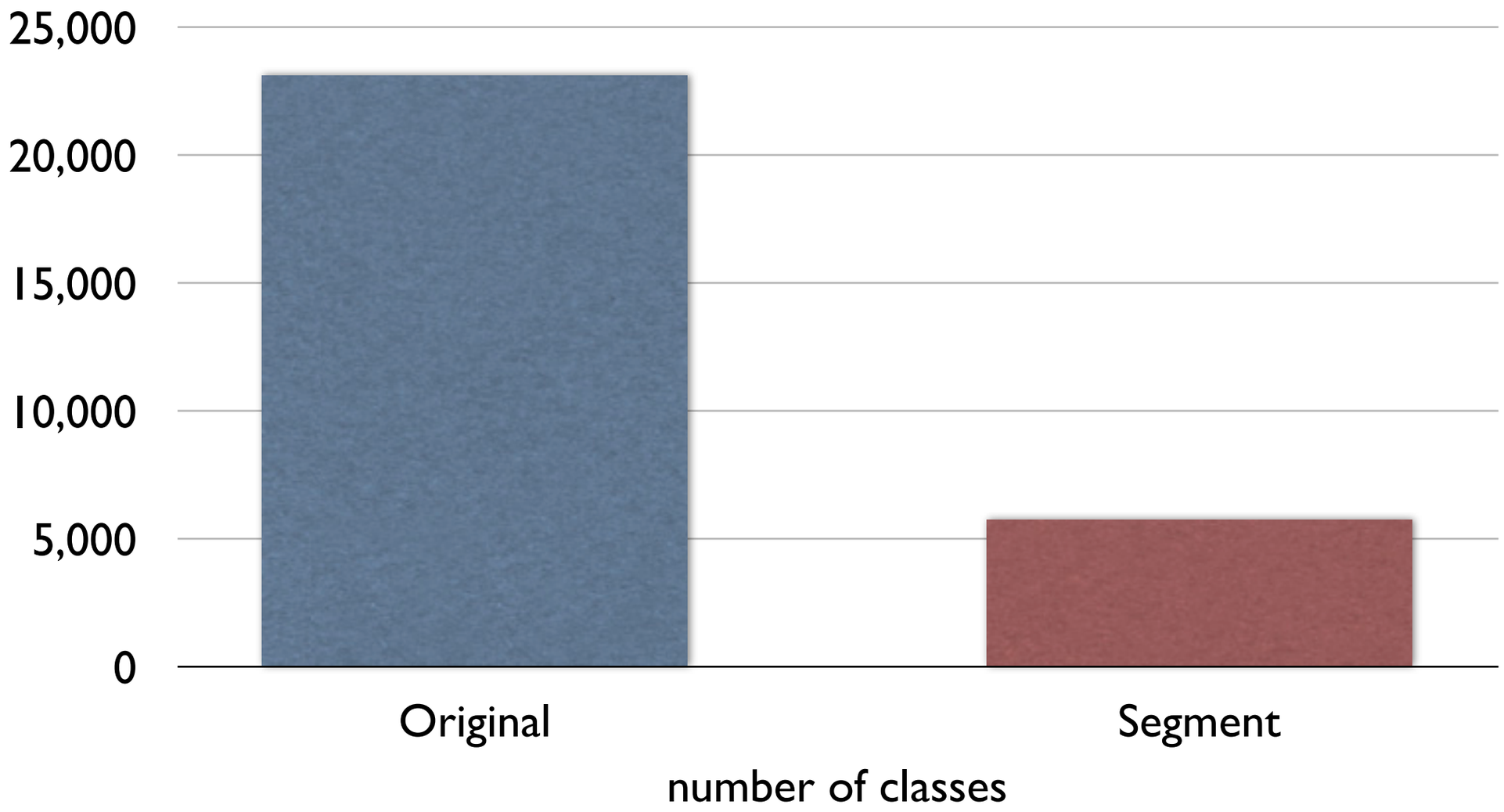


Test Case

- Big
  23,000 classes

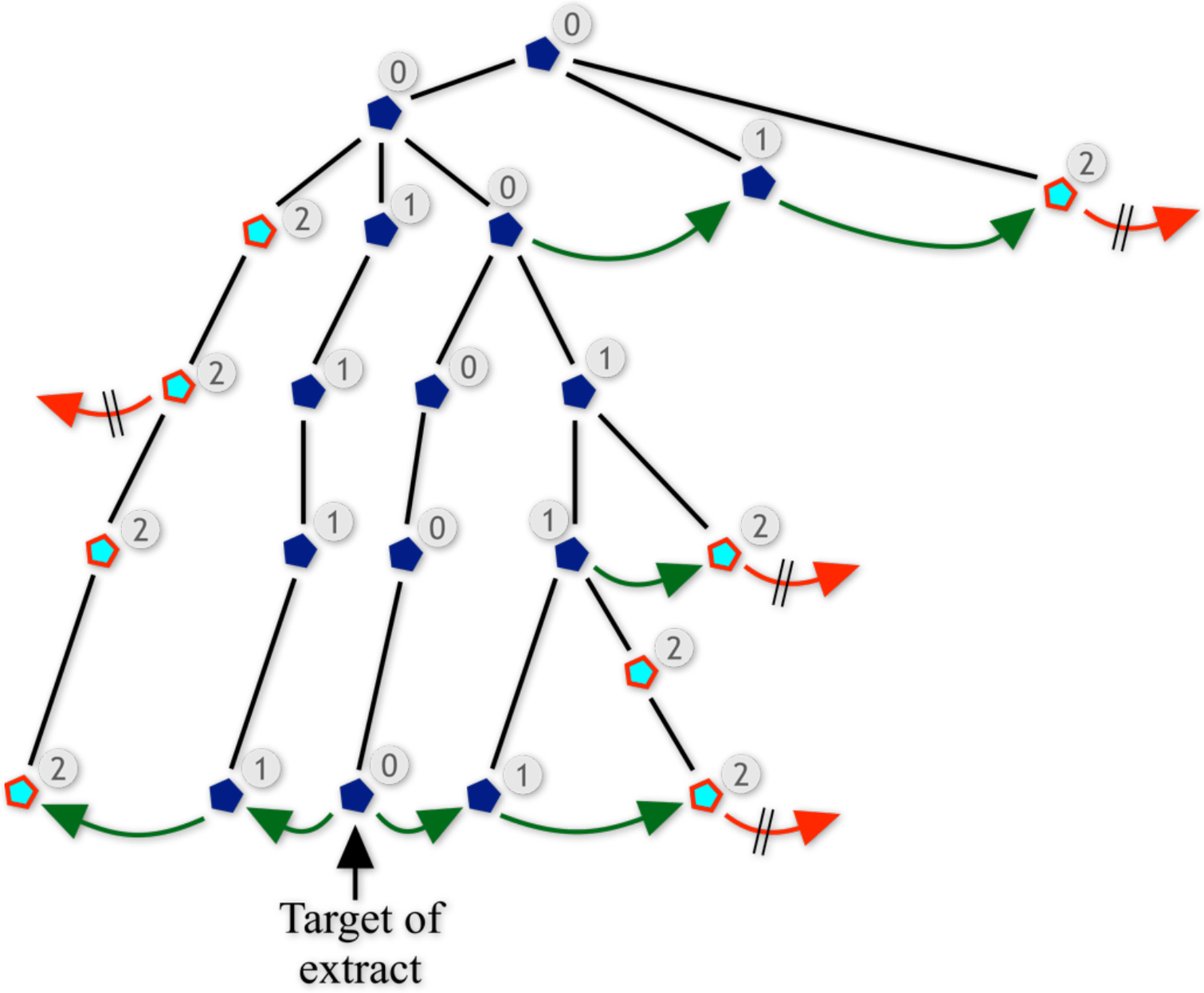
- Complex
  10,000 definitions
  30,000 relationships

- Representative
  basis of many future systems



segment of the ‘Heart’

Boundary Limiting



Limitation
(Boundary Limiting)

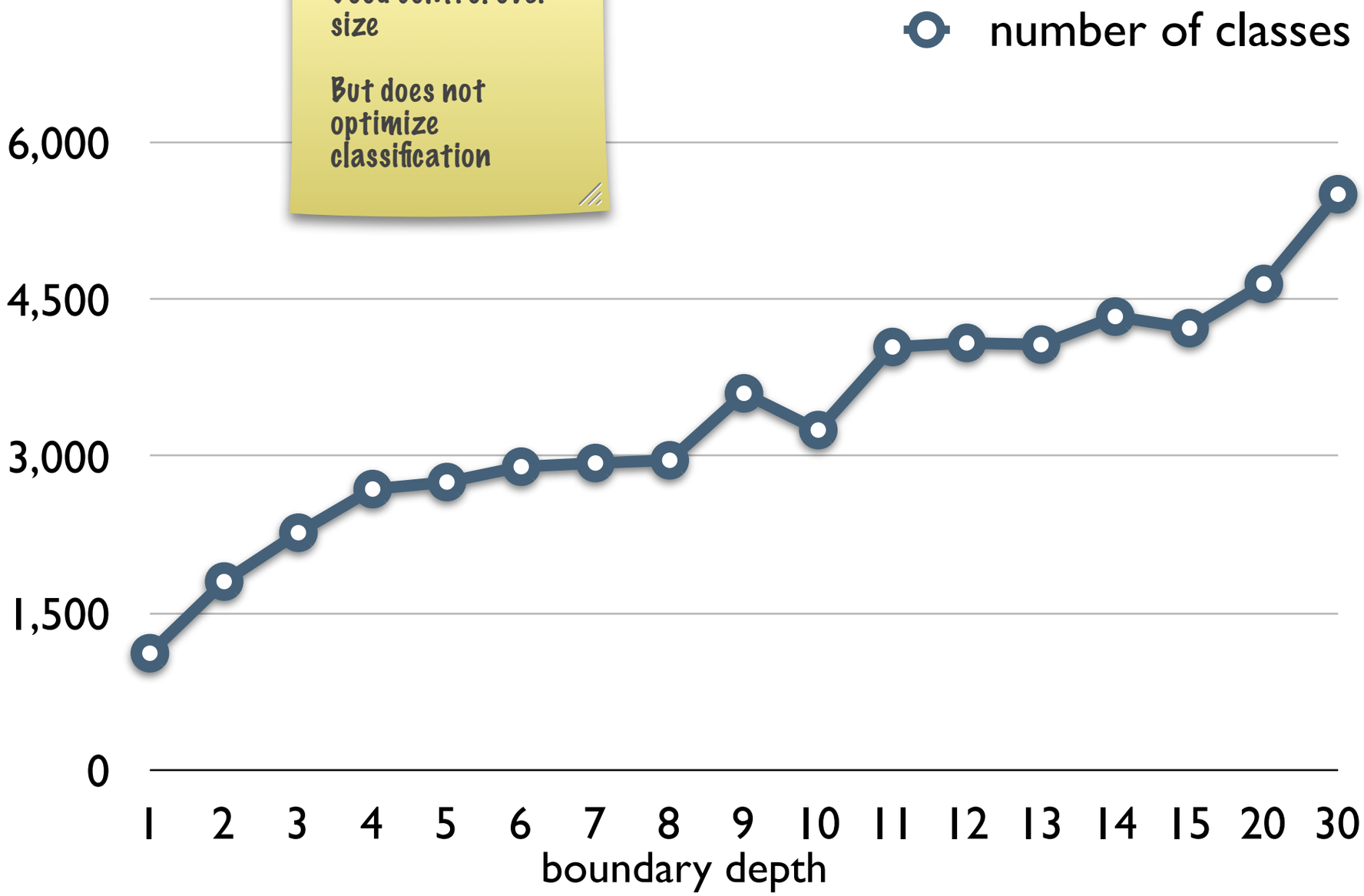
missing information

↓

lost inferences

Good control over size

But does not optimize classification



boundary limit vs. size

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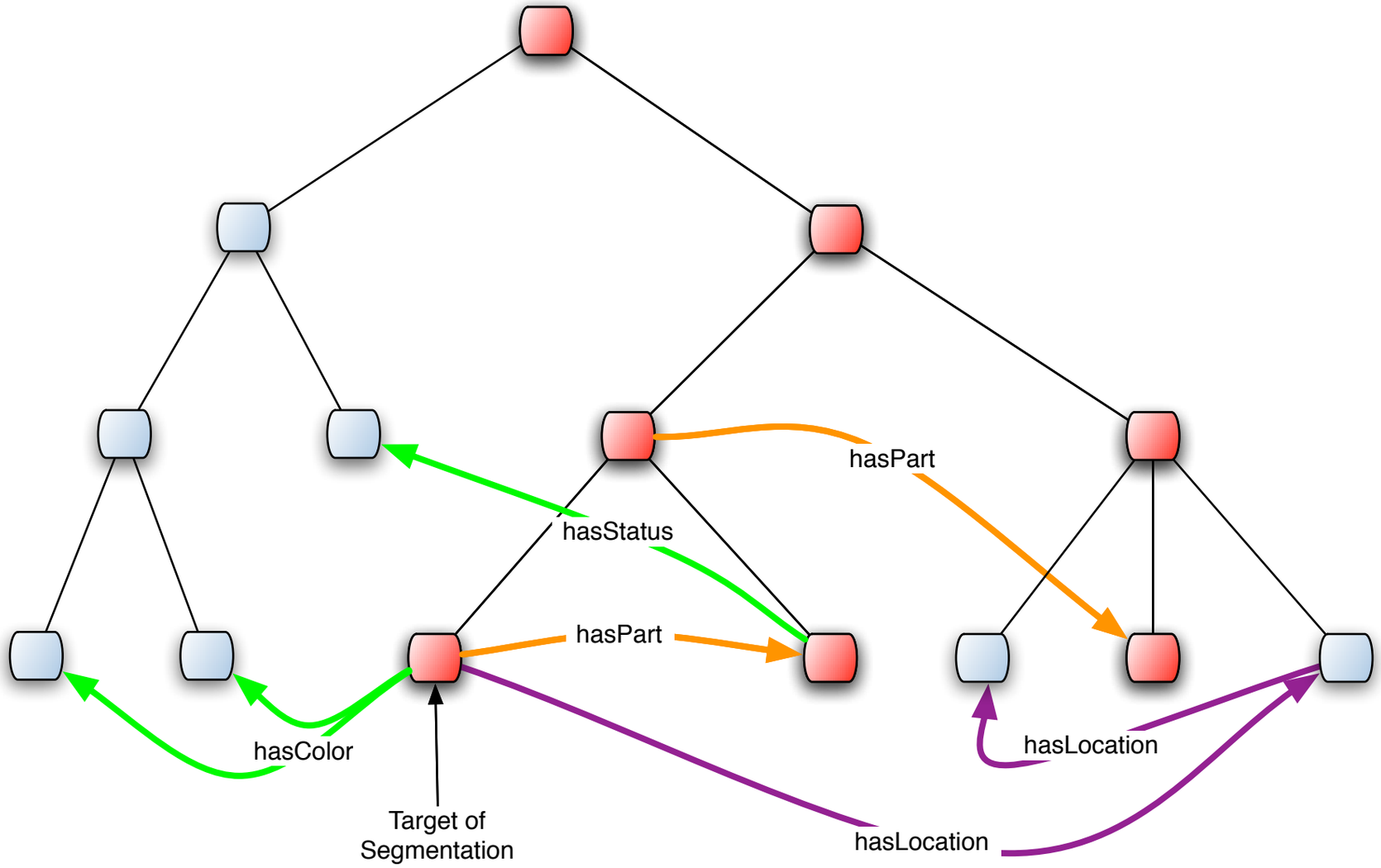
Property Filtering

(partitive filter)



Limitation
(Property Filtering)

modified definitions

↓

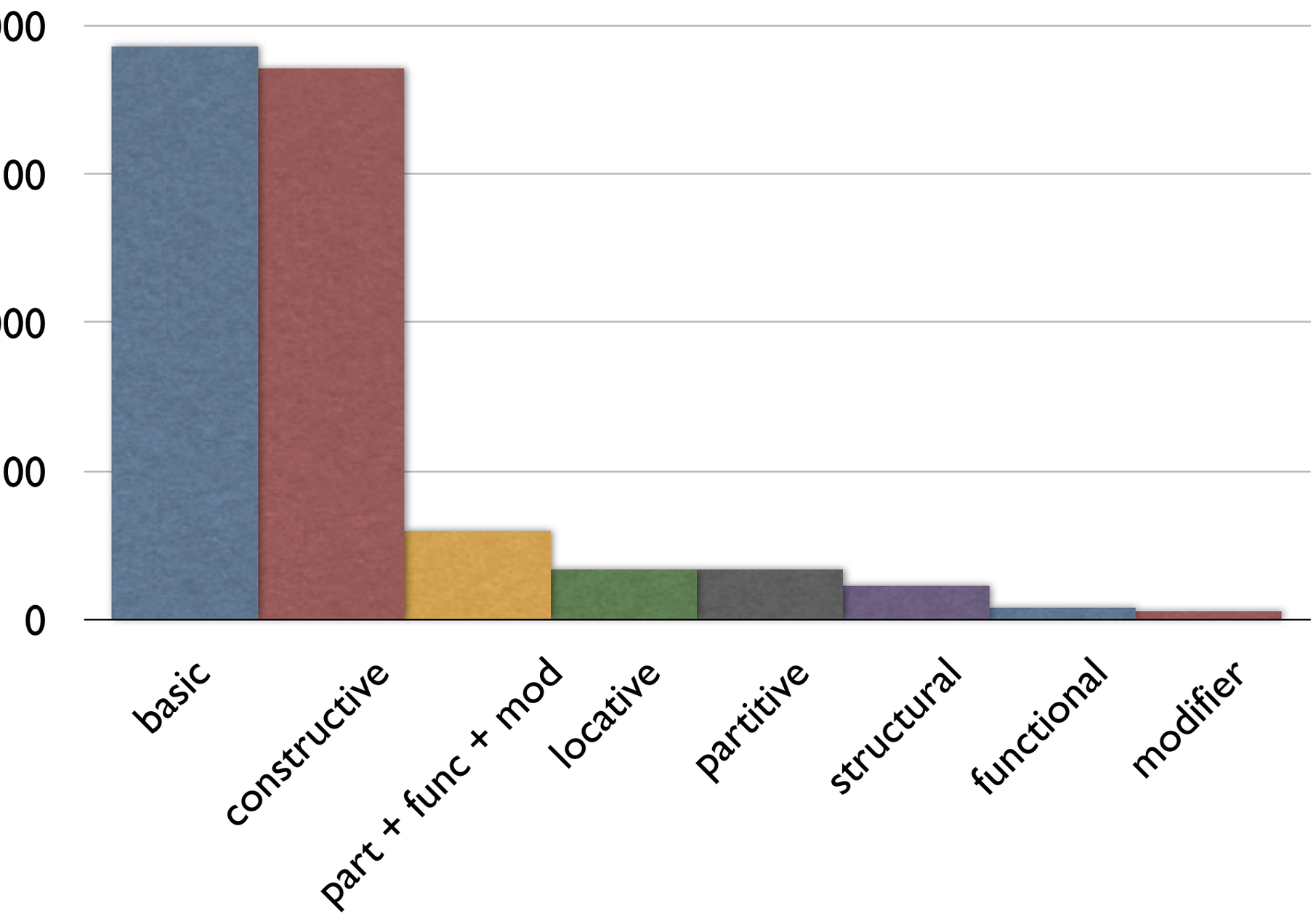
unexpected inferences

Definition Transformation

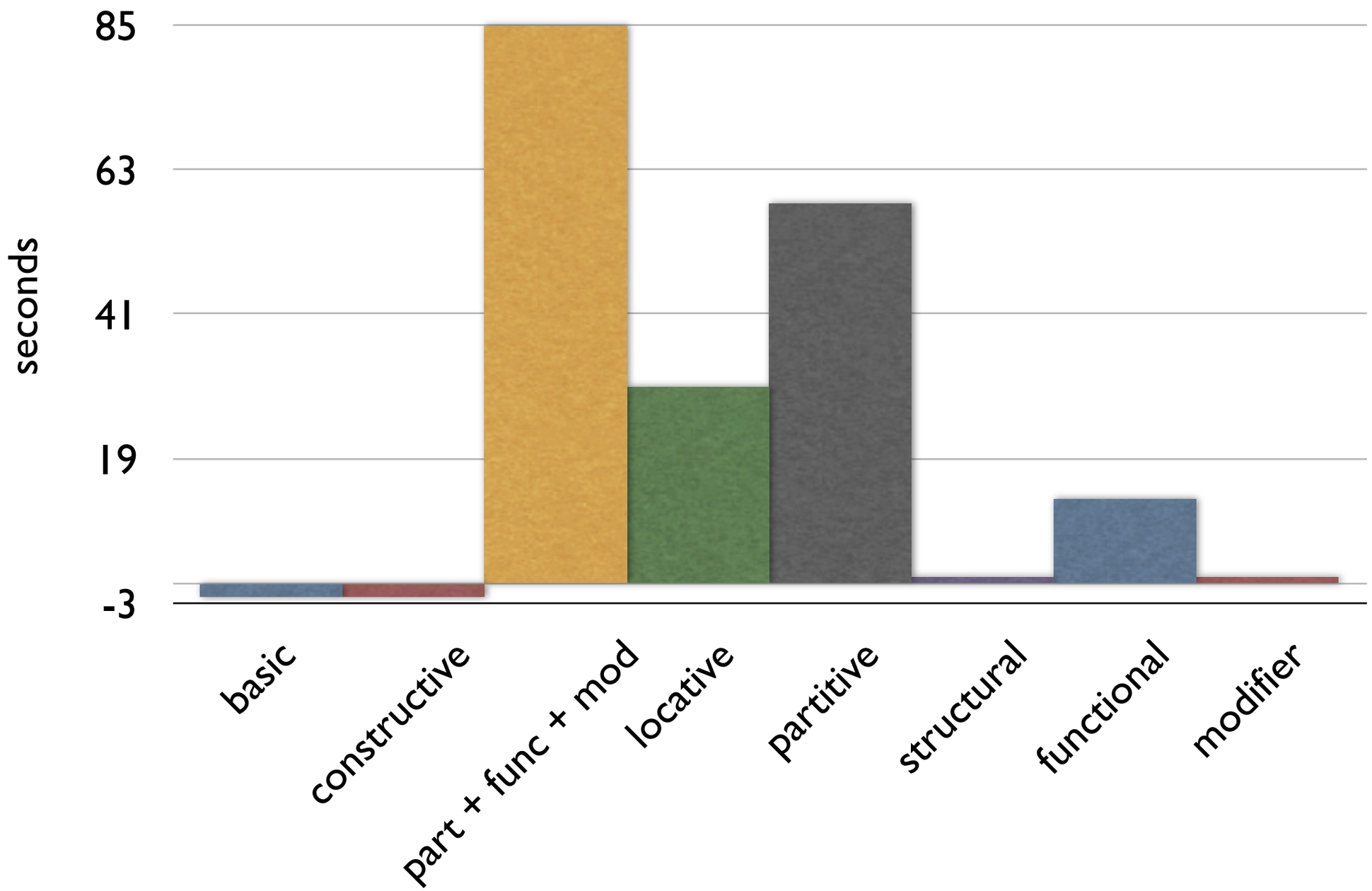
$$\text{SkinOfFrontalScalp} \equiv (\text{SkinOfScalp} \cap \exists\ \text{hasProximity}\ .\ \text{FrontalBone})$$

$$\text{SkinOfFrontalScalp} \equiv \text{SkinOfScalp}$$

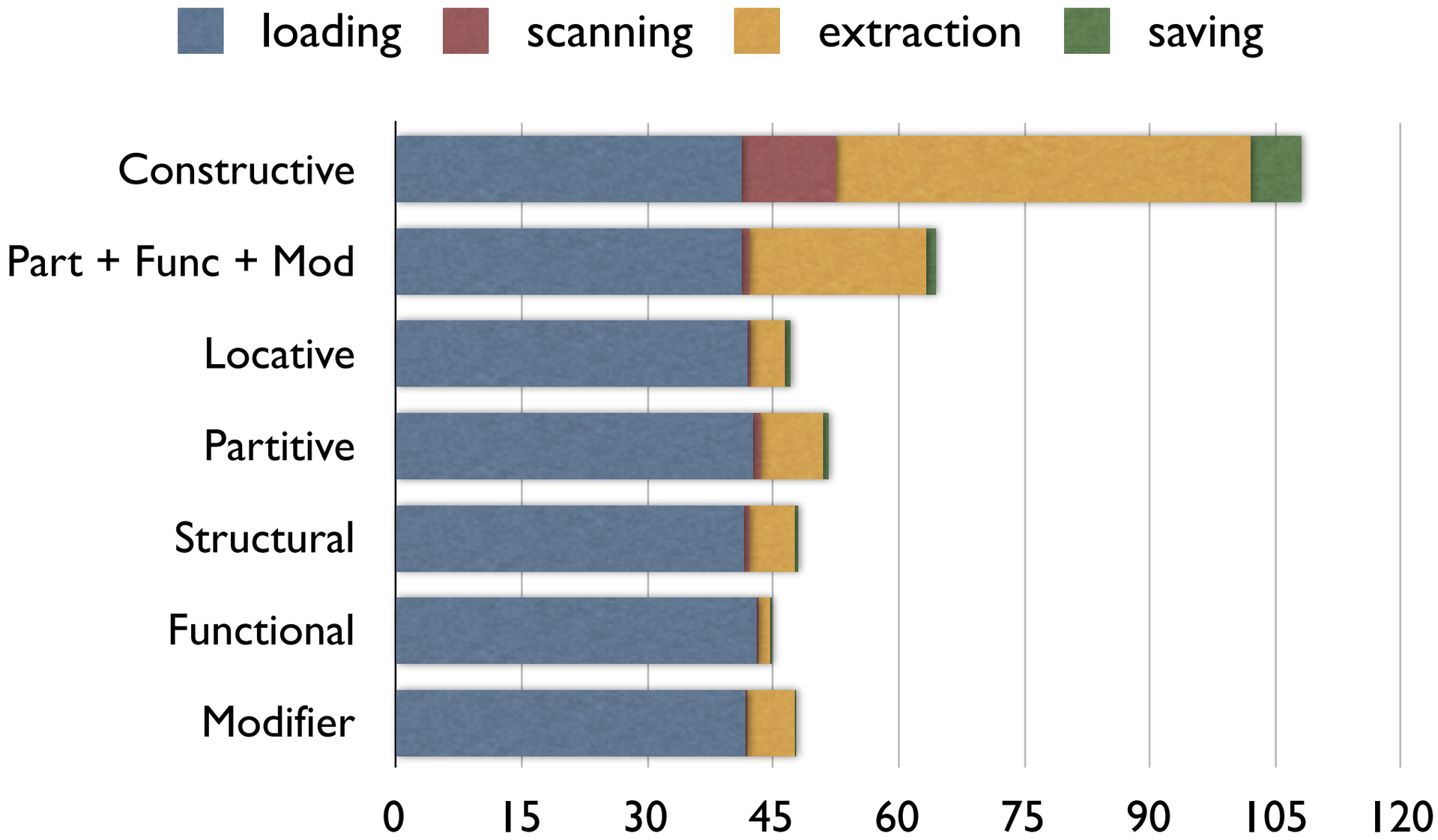
$$\text{SkinOfFrontalScalp} \sqsubseteq \text{SkinOfScalp}$$



number of class



classification time



seconds to create segment

Summary

- 3 different styles of segmentation
  - Partitioning, querying, & traversal
- Segmentation by traversal
  - Semi-automatic
  - Works well with densely interconnected ontologies
  - Independently coherent subset (not simply a view)
- Boundary limiting
  - Accurately controls size
- Property filtering
  - Significantly increases tractability
  - Facilitates ontology profiling

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Questions ?

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