

Exploitation of ontologies for the management of clinical archetypes in ArchMS

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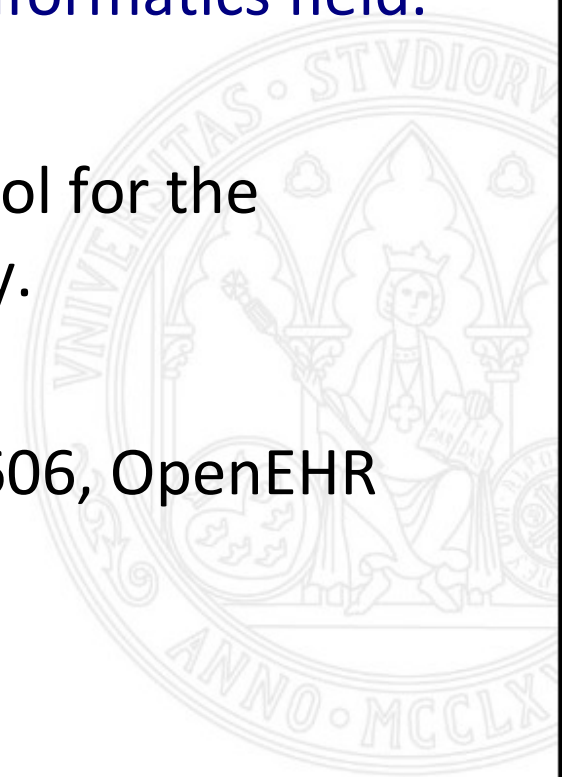


F	7th International Conference on Formal Ontology in Information Systems	July 24 – 27					
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S	3rd International Conference on Biomedical Ontology	July 21 – 25					

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July, 24th, 2012

- Semantic interoperability of clinical information
 - ◆ Major goal to achieve in the medical informatics field.
- Archetypes considered a fundamental tool for the achievement of semantic interoperability.
- Archetype-based EHR standards: ISO 13606, OpenEHR

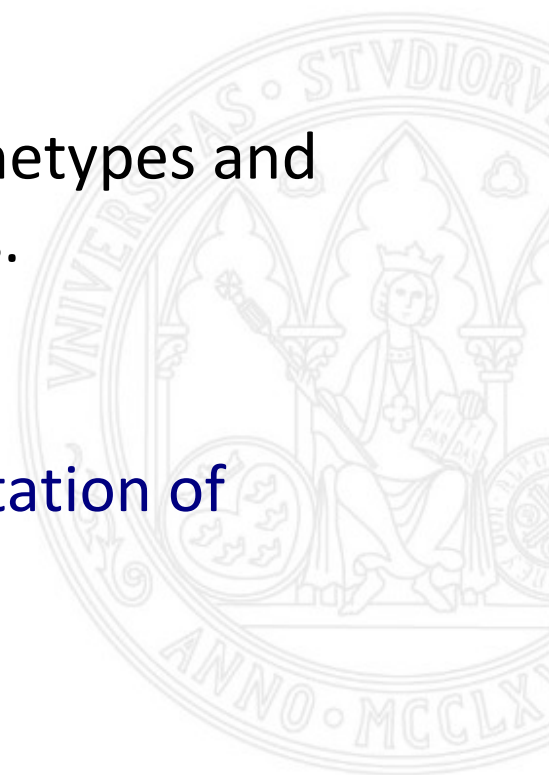


Introduction

```
archetype (adl version = 1.4)
openEHR-EHR-OBSERVATION.blood_pressure.v1
concept
  [at0000]  -- Blood Pressure
language
  original_language = <[ISO_639-1::en]>
description
  details = <
    keywords = <"observations", "measurement", "vital
signs", "mean arterial pressure", "systolic", "diastolic">  >
  >
definition
  OBSERVATION[at0000] matches {-- Blood Pressure
  data matches {
    HISTORY[at0001] matches {-- history
    events cardinality matches {1..*; unordered} matches {
    ...
ontology
  terminologies_available = <"SNOMED-CT", ...>
  term_definitions = < ["en"] = <
    items = <["at0000"] = <text = <"Blood Pressure">
    description = <"The local measurement of arterial
blood pressure which is ....>
  >
```

- Different ways of modeling the same clinical concept
- Variations due to institutional, political or legal reasons

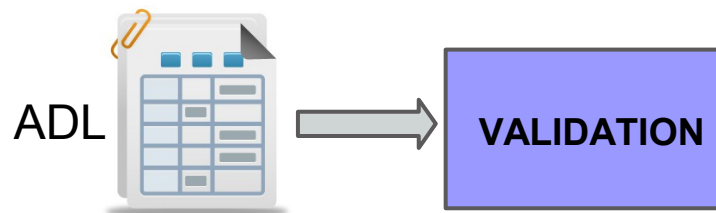
- Semantic Web technologies may be useful for managing archetypes.
- Useful to have an easy link between archetypes and biomedical terminologies and ontologies.
- ArchMS
 - ◆ OWL-based representation and exploitation of archetypes
 - ◆ Integration of Bioportal resources



Archetype transformation



Archetype transformation



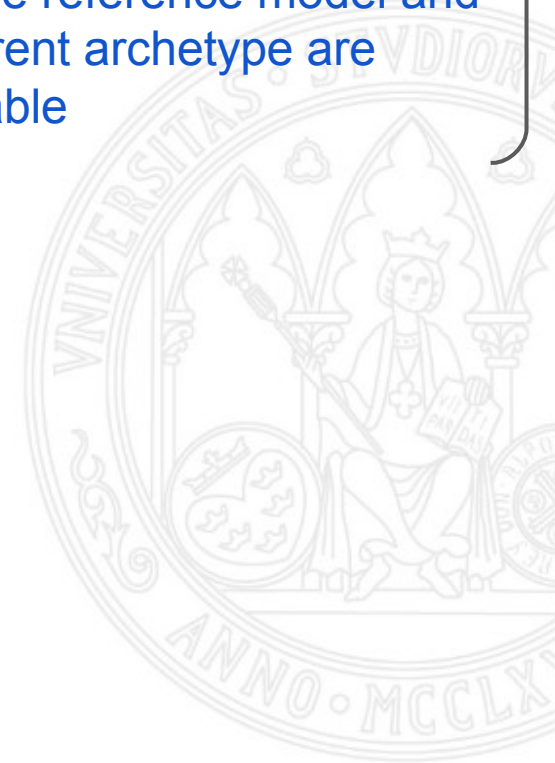
Archetype transformation



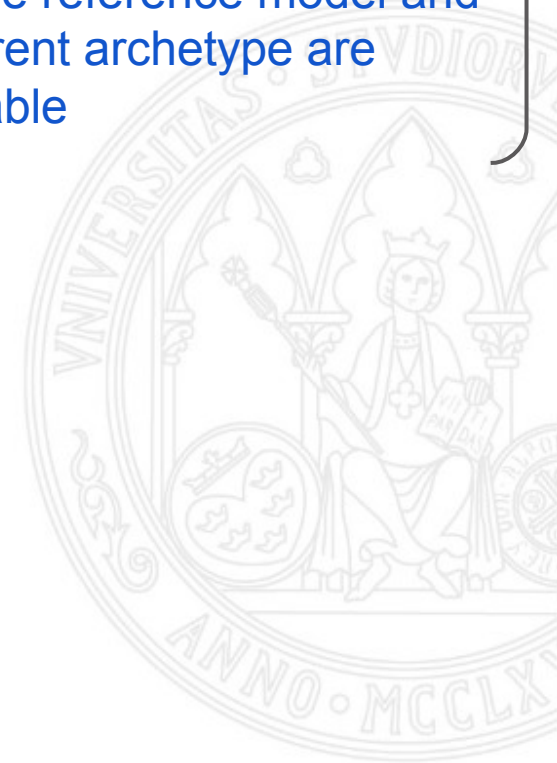
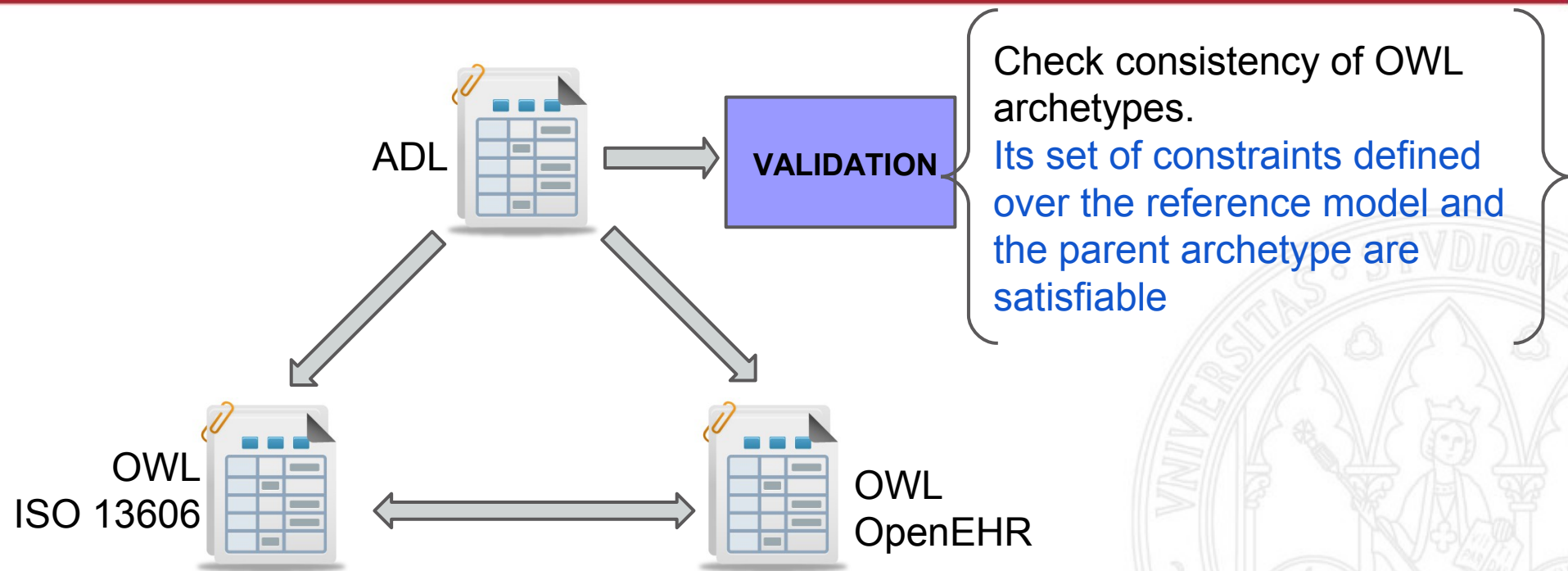
VALIDATION

Check consistency of OWL archetypes.

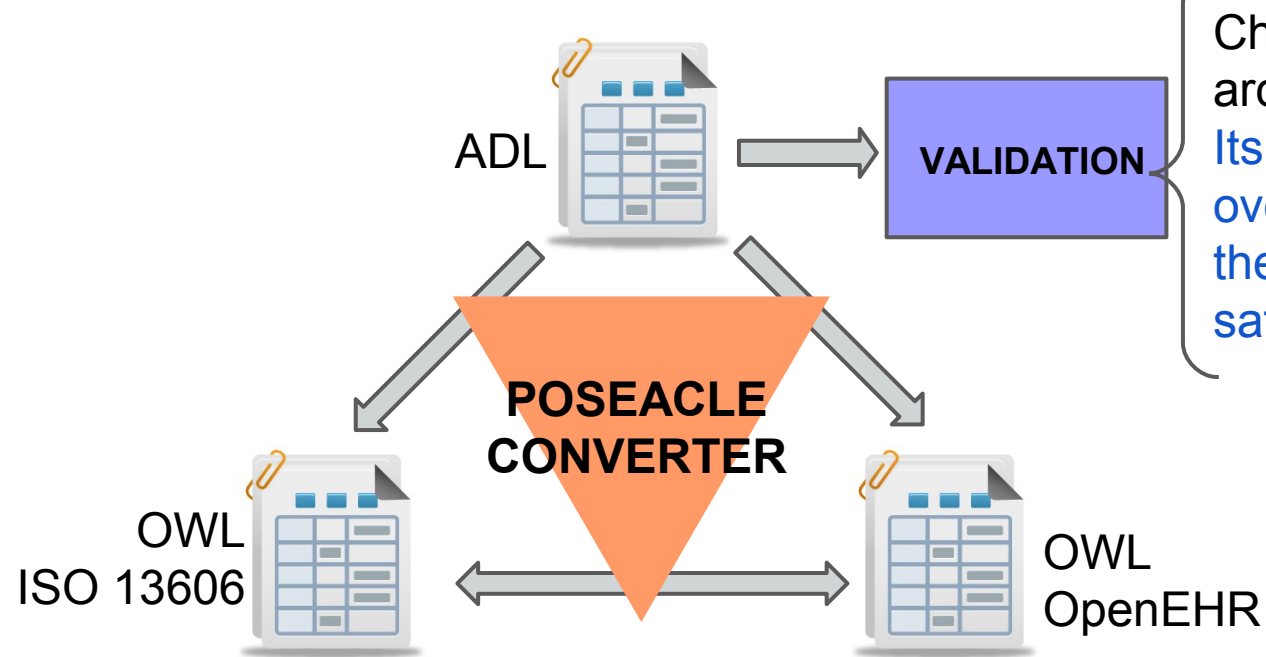
Its set of constraints defined over the reference model and the parent archetype are satisfiable



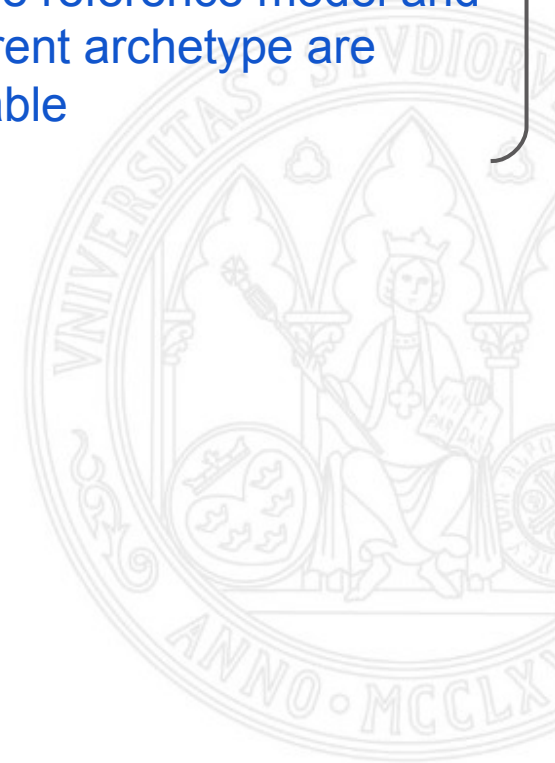
Archetype transformation



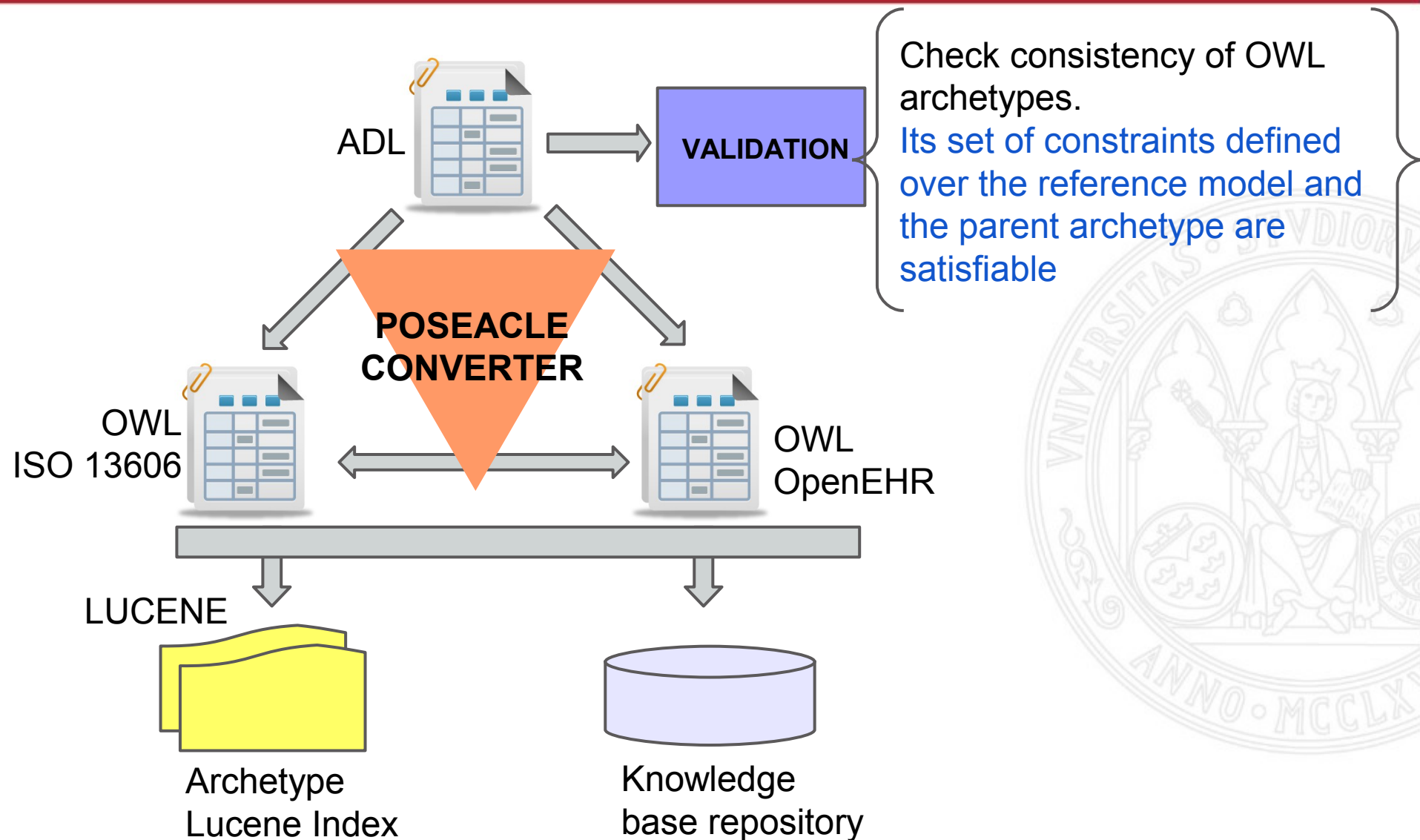
Archetype transformation



Check consistency of OWL archetypes.
Its set of constraints defined over the reference model and the parent archetype are satisfiable



Archetype transformation



Archetype Annotation



Archetype Annotation



Classified by
language
standard
terminological information



Archetype Annotation

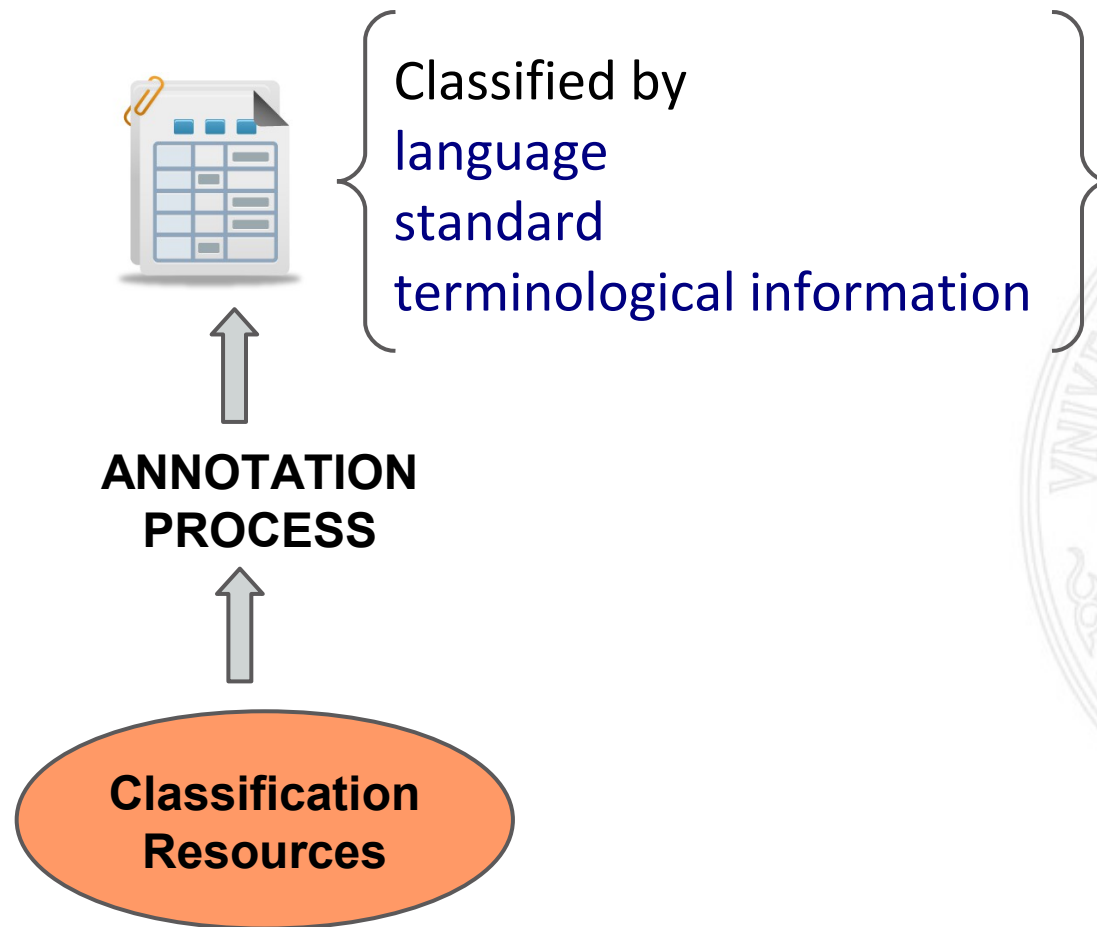


Classified by
language
standard
terminological information

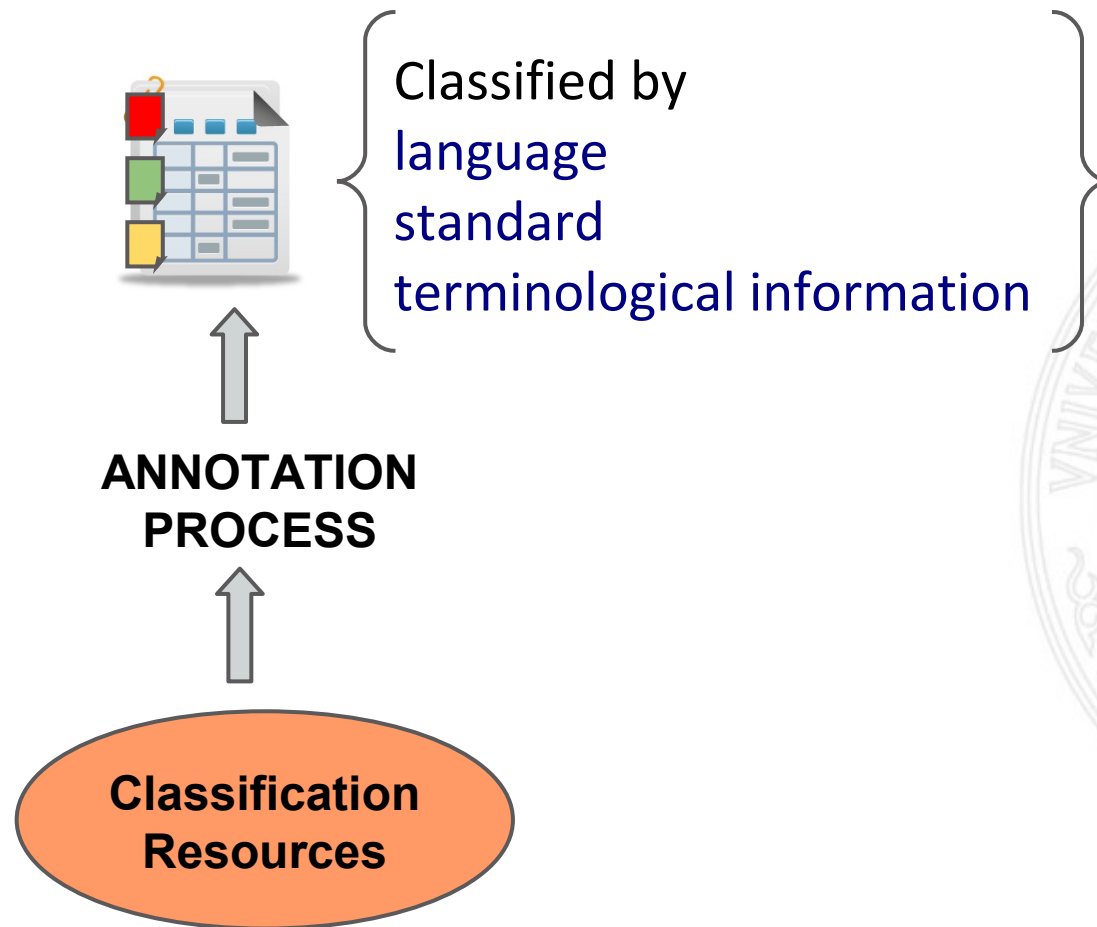
**Classification
Resources**



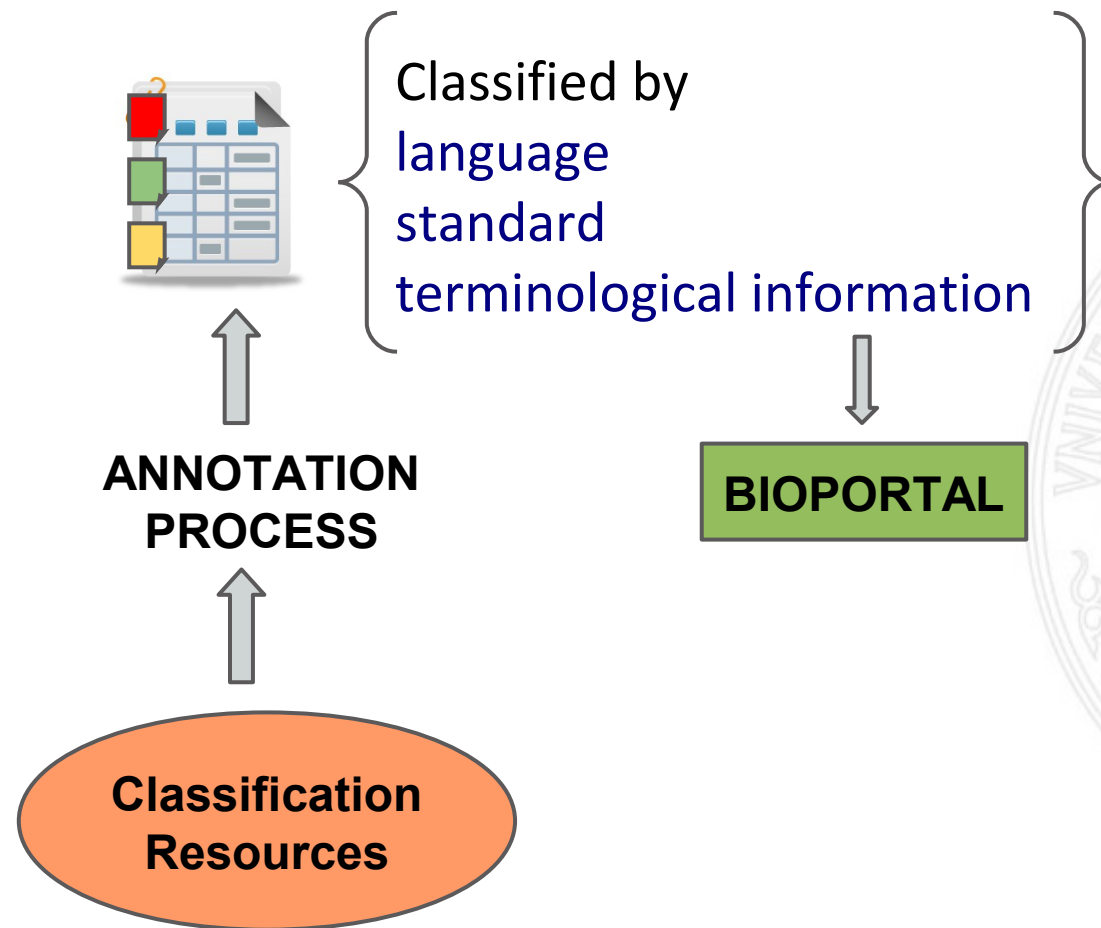
Archetype Annotation



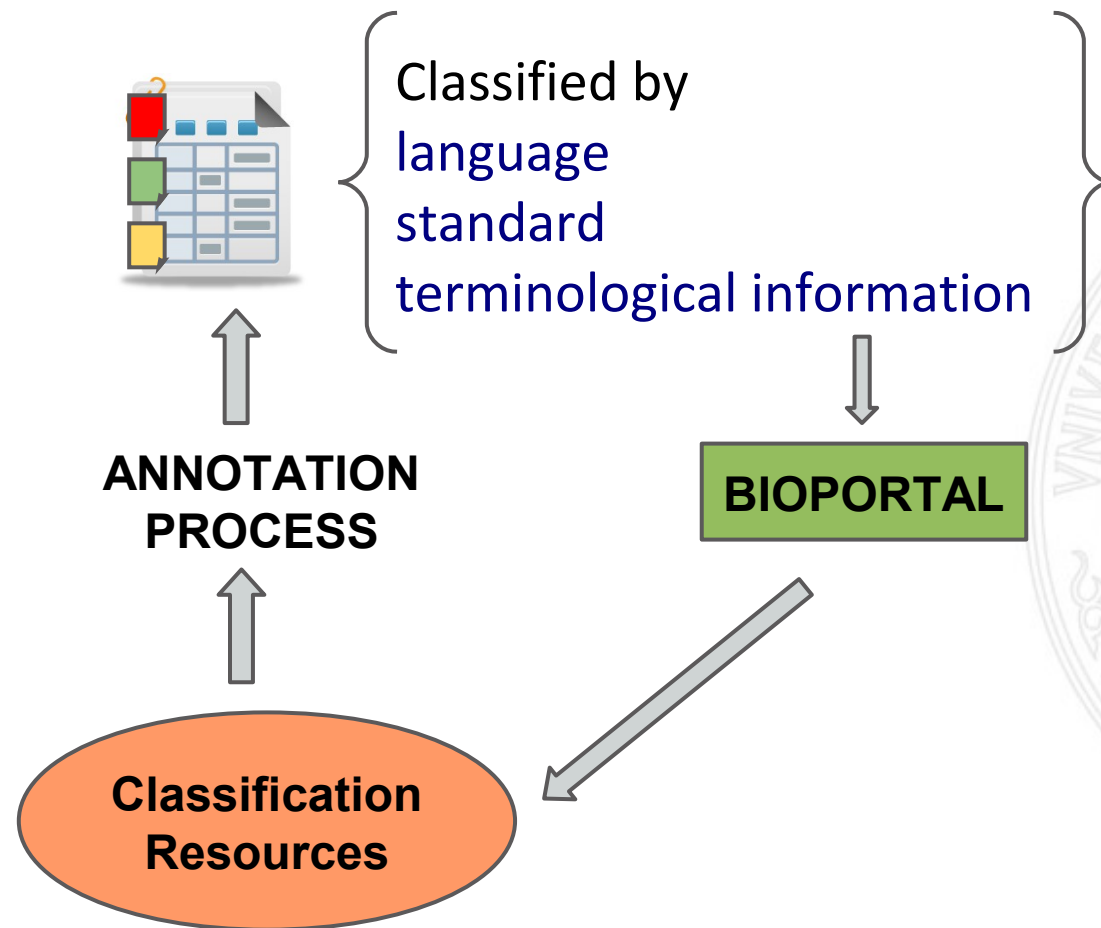
Archetype Annotation



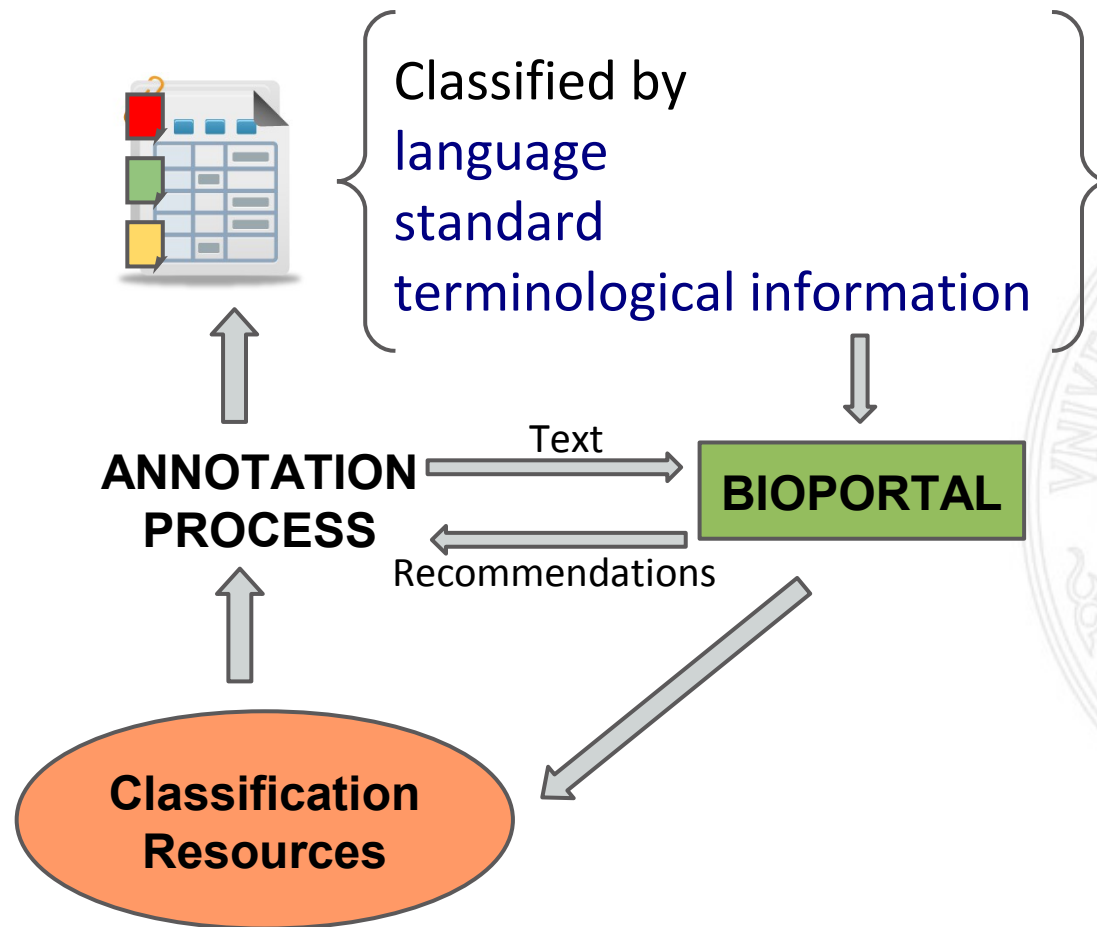
Archetype Annotation



Archetype Annotation



Archetype Annotation



Semantic Search

Textual Search Advanced Search **Semantic Search**

Search for
ARCHETYPE [0]


Select Concept
Delete Concept

Query Requirements

Add new Requirements
Delete Requirements

Search Clear Query

- TERMINOLOGY
- TRANSLATION_DETAIL
- ARCHETYPE**
- TERM_BINDING
- ASSERTION
- ⊕ ARCHETYPE_TERM
- VALIDITY_KIND
- TERM_DEFINITION
- ARCHETYPE_DESCRIPTION_ITEM
- ⊕ CONSTRAINT
- ⊕ EXPR_ITEM
- ARCHETYPE_DESCRIPTION
- ⊕ TERM_DATATYPE
- StringDictionaryItem
- OPERATOR_KIND
- ASSERTION_VARIABLE
- FEEDER_AUDIT
- FEEDER_AUDIT_DETAILS
- ⊕ AUDIT_DETAILS
- LINK



Semantic Search

Textual Search Advanced Search **Semantic Search**

Search for

ARCHETYPE [0]

Select Concept

Delete Concept

Query Requirements

ARCHETYPE [0] -> has_description -> ARCHETYPE_DESCRIPTION [3]

Add new Requirements

Delete Requirements

Search Clear Query

Select a Requirement

- ARCHETYPE [0]
 - concept_code RANGE string
 - is_controlled RANGE boolean
 - archetype_id RANGE string
 - parent_archetype RANGE string
 - adl_version RANGE string
 - uid RANGE string
 - invariants RANGE ASSERTION
 - terminologies_available RANGE TERMINOLOGY
 - original_language RANGE CODE PHRASE
 - has_description RANGE ARCHETYPE_DESCRIPTION**
 - languages_available RANGE CODE PHRASE
 - translations RANGE TRANSLATION_DETAIL
 - defines RANGE CLINICAL_TERM

Semantic Search

Textual Search

Advanced Search

Semantic Search

Search for

ARCHETYPE [0]

Select
ConceptDelete
Concept

Query Requirements

```
ARCHETYPE_DESCRIPTION_ITEM[3]->keywords->cancer  
ARCHETYPE[0]->has_description->ARCHETYPE_DESCRIPTION[2  
]  
ARCHETYPE_DESCRIPTION[2]->details->ARCHETYPE_DESCRIPTOR  
ON_ITEM[3]
```

Add new
RequirementsDelete
Requirements

Search

Clear Query



Semantic Search

Textual Search

Advanced Search

Semantic Search

Search for

ARCHETYPE [0]

Select

ARCHETYPE[0]

ARCHETYPE_openEHR-EHR-CLUSTER.microscopy_lymphoma.v1

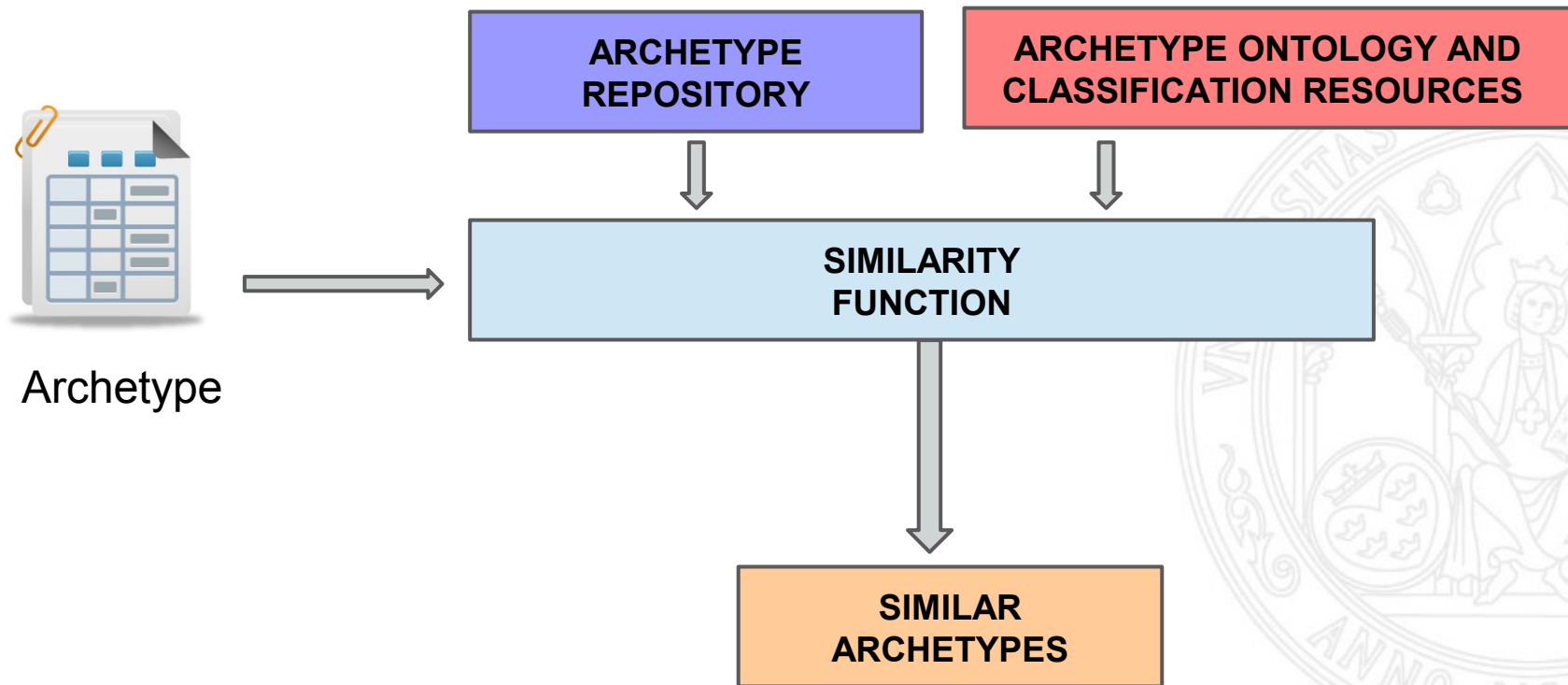
ARCHETYPE_openEHR-EHR-CLUSTER.tnm_staging_7th-breast.v1

ARCHETYPE_openEHR-EHR-CLUSTER.tnm_staging_7th-colorectal.v1

Search

Clear Query

Similarity between archetypes



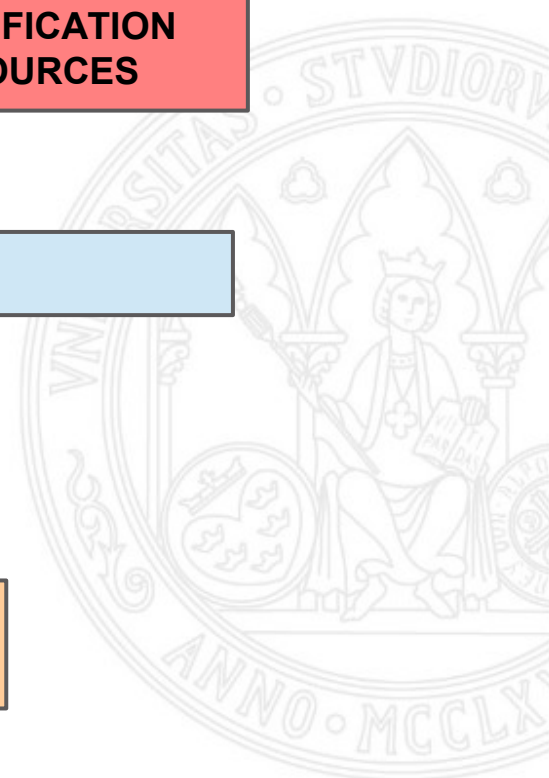
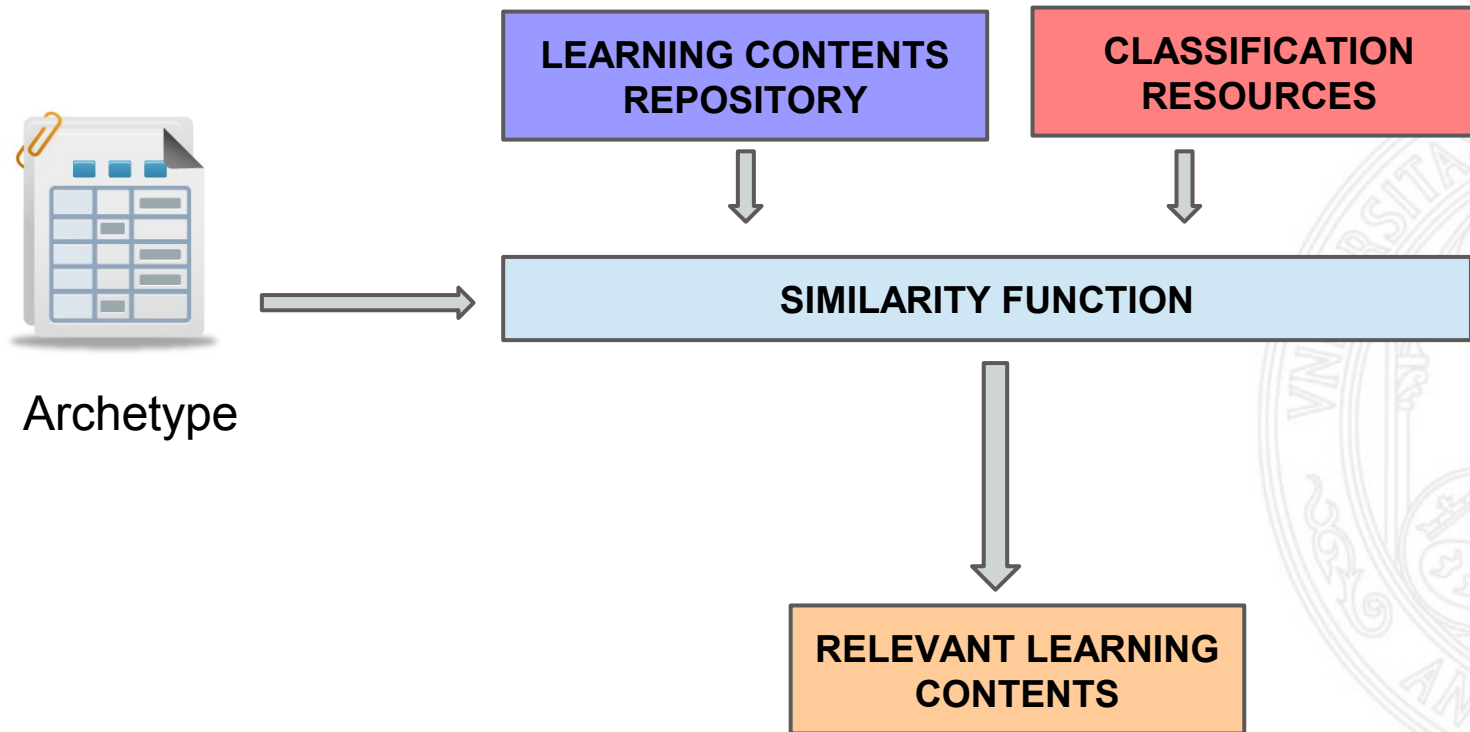
Example

Similarity for openEHR-EHR-CLUSTER.tnm_staging_7th-breast.v1

ARCHETYPE ID	▼ SIMILARITY VALUE
openEHR-EHR-CLUSTER.tnm_staging_7th-colorectal.v1	0.555
openEHR-EHR-CLUSTER.microscopy_lymphoma.v1	0.512
openEHR-EHR-OBSERVATION.audiogram.v1	0.204
openEHR-EHR-INSTRUCTION.non_drug_therapy.v1	0.2048
openEHR-EHR-OBSERVATION.blood_match.v1	0.2027



Archetype-based content recommendation



Example: SNOMED CT annotations

Archetype annotations

Colon and rectum (combined site)

Multiple malignancy

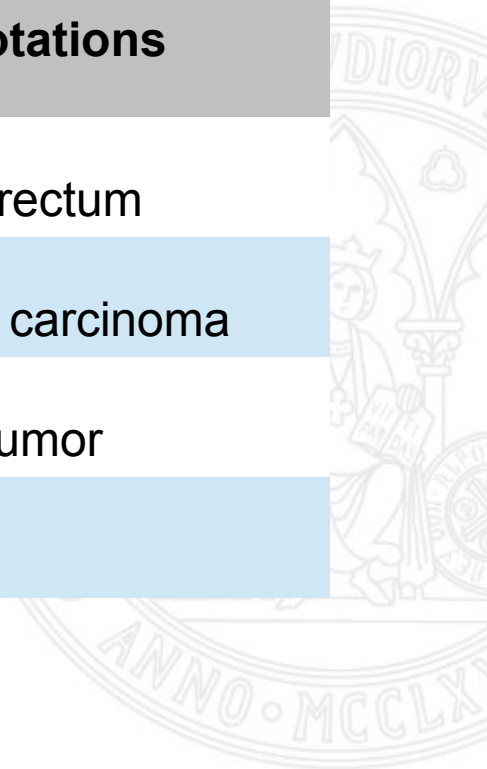
Content annotations

Adenoma of rectum

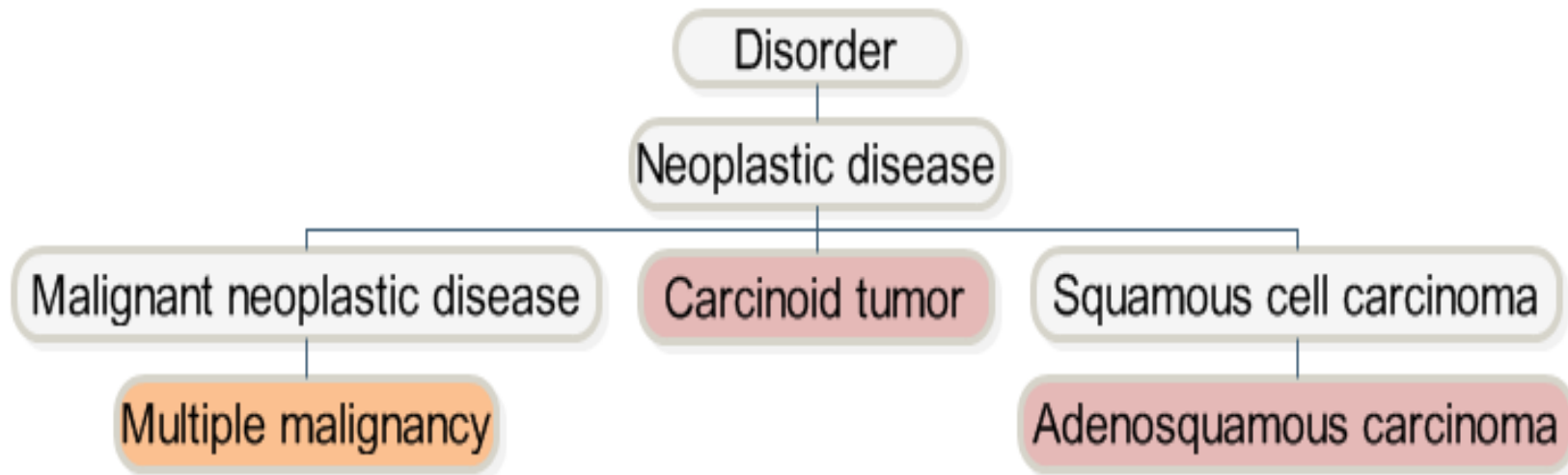
Adenosquamous carcinoma

Carcinoid tumor

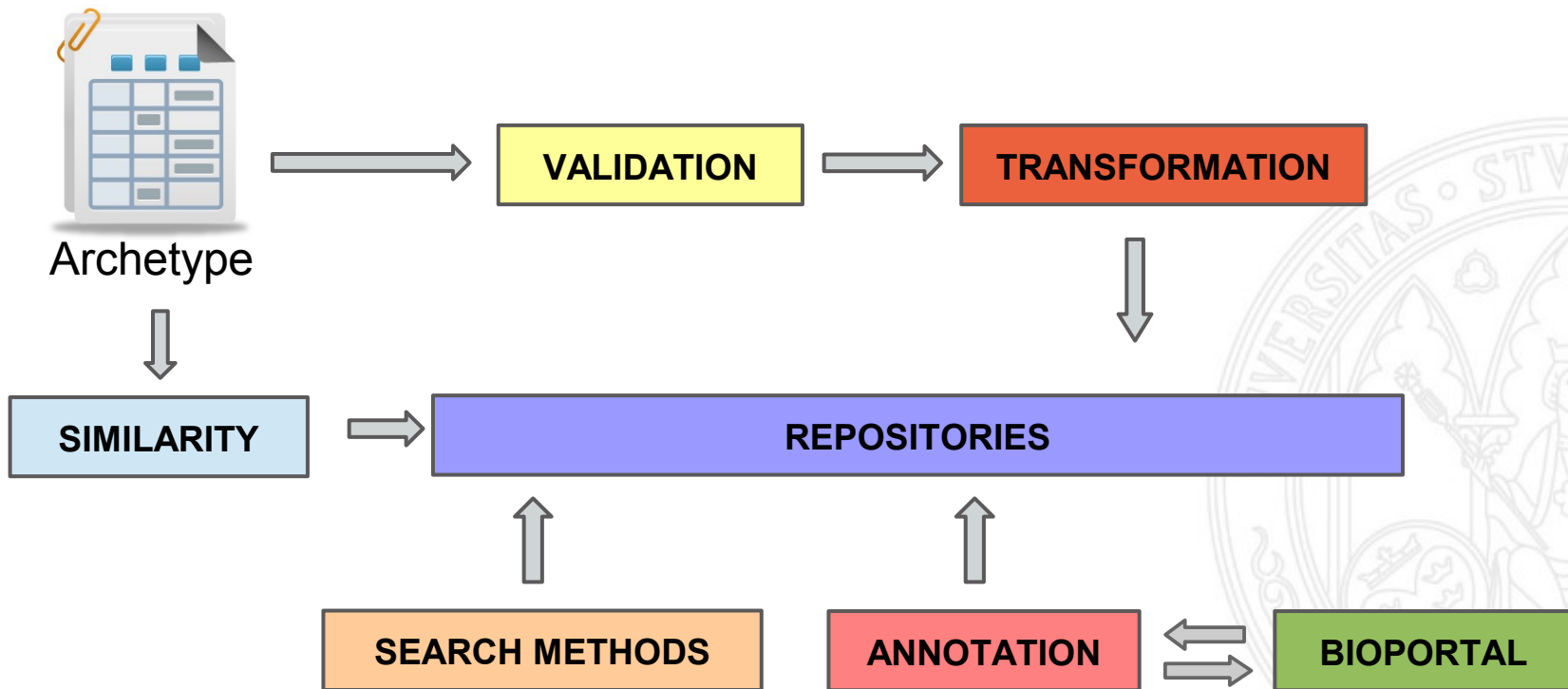
...



Example: taxonomic proximity

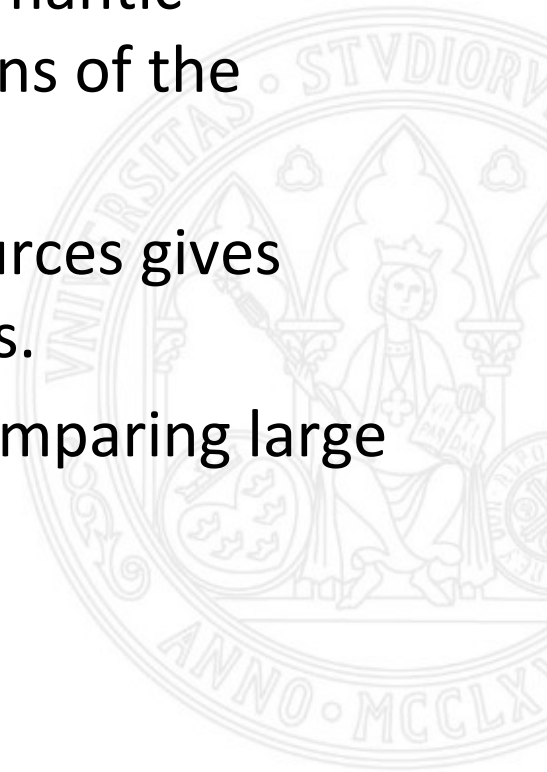


ArchMS overview



Conclusions

- The system uses OWL representation for archetypes.
- This representation allows to perform semantic activities exploiting the semantics relations of the archetype.
- The annotation methods with OWL resources gives more complete methods of classifications.
- The similarity methods has limitations comparing large ontologies.



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f SéNeCa (+)

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