

An API for ontology alignment

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Who did it

Basically done at INRIA with some contributions from University of Montreal.

Related to Knowledge web.

Based on Java, OWL-API (for the implementation).

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Conceptual work

The API relies on the work done in Knowledge web [Alignment algebra to be based on categorical work].

The implementations can be based on other work (we have an aligner, OLA, based on our work with UoM).

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Functionality and limitation

Reads, generates, manipulates alignments;

Limitation of the API:

- Does not provides you with the alignments;

Limitation of the implementation:

- Currently limited to level 0;
- Currently limited to OWL-API.

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Architecture

- An API around objects;
- Fully embeddable;
- Can be extended and customized;

Outline

- 1 Format
- 2 API
- 3 Examples of the API use
- 4 Availability

What's in an alignment (container)

- Level indicator (0, 1, 2+);
- Description of the alignment: 1:1, 1:*, etc.;
- Pair of ontology URIs;
- Set of pairs;

What else?

generating algorithm, formal properties of the alignment, any kind of annotation...

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Format

- Format in RDF, in fact RDF/XML;
- Defined in DTD, OWL and RDFS;
- Entities are identified by URIs.

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RDF/XML Syntax

```
<Alignment>
  <xml>yes</xml>
  <level>0</level>
  <type>**</type>
  <uri1>http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#
    publication</uri1>
  <uri2>file://localhost/Volumes/Phata/JAVA/ontoalign/rdf/edu.mit
    .visus.bibtex.owl</uri2>
  <map>
    <Cell>
      <entity1
rdf:resource='http://ebiquity.umbc.edu/v2.1/ontology/publication.o
wl#volume' />
      <entity2
rdf:resource='file://localhost/Volumes/Phata/JAVA/ontoalign/rdf/ed
u.mit.visus.bibtex.owl#hasVolume' />
      <measure
rdf:datatype='http://www.w3.org/2001/XMLSchema#float'>0.8</measure
>
      <relation>=</relation>
    </Cell>
  </map>
</Alignment>
```

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What is an alignment for?

- Storing, finding, and floating around;
- Piping alignments algorithms (improving an existing alignment);
- Manipulating (thresholding and hardening);
- Generating processing output (transformations, axioms, rules);
- Comparing alignments.

API

Set of Java interfaces:

- Alignment

align(A,p), cut(t), harden(), render(s,v)

- Cell;

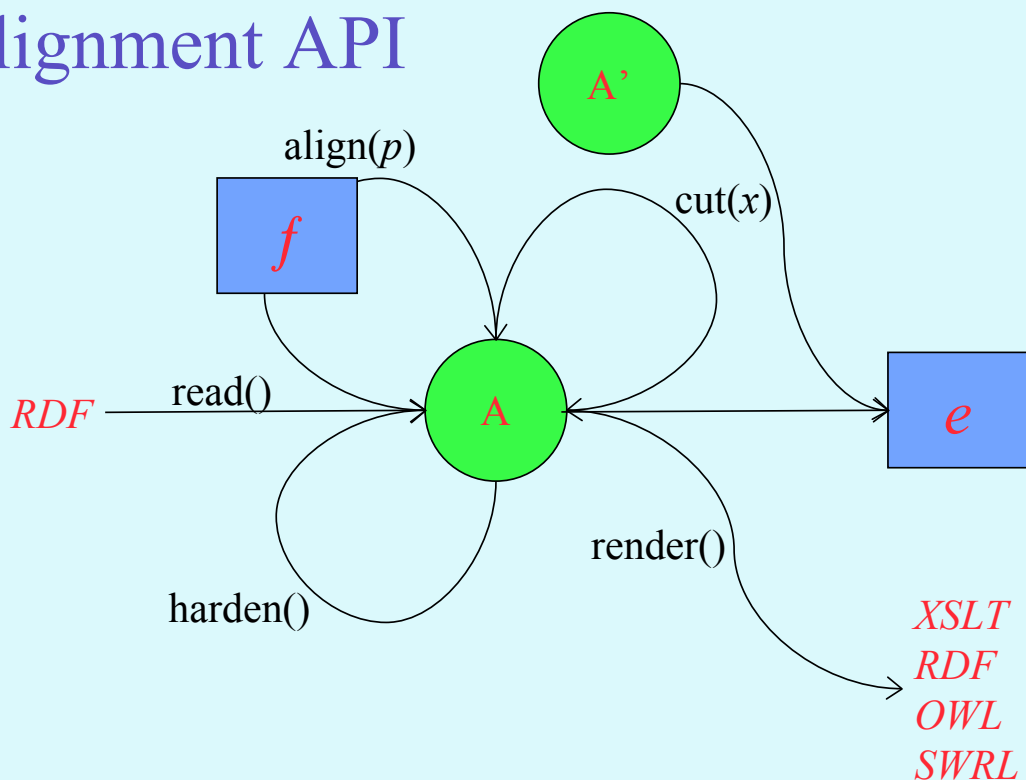
- Relation;

- Evaluator

eval(p), write()

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Alignment API



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API implementation

- Grounded on the OWL-API + [0 1] measures;
- Base implementation of the interfaces with all useful facilities;
- Library of sample aligners;
- Library of renderers (XSLT, SWRL, OWL, C-OWL...);
- Couple of evaluators (P/R);
- Parser.

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Examples of the API use

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Demonstration

- Use as command line;
- Show how to embed (skeleton example);
- Show how to extend (create new object);
- Show Anna's JSP.

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Example

I have two ontologies

I align the property names + the properties

see what I got to do in the API

I align classes and the class names

see what I got to do in the API or the command line

I threshold

see what I got to do in the API or the command line

I compare with something

again...

I render in some format

show it, prove it!

See the result of the contest actually

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Example of API use

```

OWLontology O1 = loadOntology(...);
OWLontology O2 = loadOntology(...);
Alignment A1 =
    new SubsDistNameAlignment(O1, O2);
Alignment A2 =
    new PropSubsDistAlignment(O1,O2);
Alignment A3 =
    new NameAndPropertyAlignment(O1,O2);
A1.align(); A1.cut("prop",.5);
A2.align(); A3.align(A2);
Evaluator E = new PRecEvaluator(A1, A3);
E.eval(A1,A3);
if ( E.getPrecision() > .6)
    A3.render(...,SWRLRendererVisitor);

```

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Results of the EON Ontology Alignment Contest

file:///localhost/Volumes/Phata/Web/html/co4/align/Contest/results/index

Appendice 3: Complementary results

This first table displays, together with the results of the participants of the contests, those obtained by the demonstration aligners provided with the Alignment API and the first results obtained by Karlsruhe.

```
java -cp /Volumes/Phata/JAVA/ontoalign/lib/procalign.jar fr.inrialpes.exmo.align.util.GroupEval -l "std,nea
```

algo	std	nea	ssda5	edna5	sdna5	karlsruhe	karlsruhe2	umontreal	fujitsu	stanford
	Prec. Rec.	Prec. Rec.	Prec. Rec.	Prec. Rec.	Prec. Rec.	Prec. Rec.	Prec. Rec.	Prec. Rec.	Prec. Rec.	Prec. Rec.
101	0.89 0.36	0.89 0.98	0.87 0.99	0.87 0.99	0.87 0.99	n/a n/a	n/a n/a	0.59 0.97	0.99 1.00	0.99 1.00
102	0.00 NaN	0.00 NaN	0.00 NaN	0.00 NaN	0.00 NaN	n/a n/a	NaN NaN	0.00 NaN	NaN NaN	NaN NaN
103	0.89 0.36	0.90 0.99	0.87 0.99	0.87 0.99	0.87 0.99	n/a n/a	n/a n/a	0.55 0.90	0.99 1.00	0.99 1.00
104	0.89 0.36	0.89 0.98	0.86 0.98	0.86 0.98	0.87 0.99	n/a n/a	n/a n/a	0.56 0.91	0.99 1.00	0.99 1.00
201	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.43 0.51	0.43 0.51	0.44 0.71	0.98 0.92	1.00 0.11
202	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	n/a n/a	n/a n/a	0.38 0.63	0.95 0.42	1.00 0.11
204	0.83 0.22	0.85 0.66	0.71 0.78	0.84 0.96	0.70 0.77	0.00 0.00	0.62 1.00	0.55 0.90	0.95 0.91	0.99 1.00
205	0.60 0.07	0.61 0.21	0.36 0.34	0.39 0.32	0.40 0.34	0.00 0.00	0.47 0.60	0.49 0.80	0.79 0.63	0.95 0.43
221	0.89 0.36	0.89 0.98	0.86 0.98	0.86 0.98	0.86 0.98	n/a n/a	n/a n/a	0.61 1.00	0.98 0.88	0.99 1.00
222	0.85 0.31	0.89 0.93	0.82 0.93	0.84 0.93	0.83 0.93	n/a n/a	n/a n/a	0.55 0.90	0.99 0.92	0.98 0.95
223	0.78 0.32	0.85 0.93	0.83 0.95	0.82 0.93	0.83 0.95	0.59 0.96	0.59 0.96	0.59 0.97	0.95 0.87	0.95 0.96
224	0.89 0.36	0.89 0.98	0.87 0.99	0.87 0.99	0.86 0.98	0.97 0.98	0.97 0.97	0.97 1.00	0.99 1.00	0.99 1.00
225	0.89 0.36	0.90 0.99	0.86 0.98	0.86 0.98	0.87 0.99	n/a n/a	n/a n/a	0.59 0.97	0.99 1.00	0.99 1.00
228	0.92 1.00	0.79 1.00	0.67 1.00	0.63 1.00	0.69 1.00	n/a n/a	n/a n/a	0.38 1.00	0.91 0.97	1.00 1.00
230	0.86 0.33	0.87 0.92	0.70 0.97	0.77 0.97	0.76 0.99	0.60 0.95	0.60 0.95	0.46 0.92	0.97 0.95	0.99 0.93
301	0.93 0.21	0.94 0.25	0.60 0.80	0.76 0.79	0.75 0.79	n/a n/a	0.85 0.36	0.49 0.61	0.89 0.66	0.93 0.44
302	0.91 0.21	0.97 0.58	0.41 0.65	0.57 0.60	0.54 0.65	0.67 0.21	1.00 0.23	0.23 0.50	0.39 0.60	0.94 0.65
303	0.87 0.27	0.81 0.46	0.43 0.79	0.52 0.81	0.46 0.79	n/a n/a	0.85 0.73	0.31 0.50	0.51 0.50	0.85 0.81
304	0.87 0.36	0.85 0.61	0.77 0.96	0.77 0.95	0.79 0.95	n/a n/a	0.91 0.92	0.44 0.62	0.85 0.92	0.97 0.97

The following table presents the F-measure and overall results for the same set of algorithms.

Document: Done

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Welcome to the People's portal!

http://align.deri.org:8080/deri/align.jsp

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OWL Ontology Aligner

Powered by the API for ontology alignment (INRIA), OWL API, Jena 2 and The People's portal: a Semantic Web portal and metaportal

Please input URIs of the two OWL ontologies that you want to align. The input can be URIs of ontology files located on the Web or URIs of ontology files located on your computer.

The following URIs may serve for examples/tests.

1st URI: <http://c703-deri03.uibk.ac.at:8080/external/onto1.owl>
 2nd URI: <http://c703-deri03.uibk.ac.at:8080/external/onto2.owl>

or

1st URI: <http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#publication>
 2nd URI: <http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl>

URI of the first ontology

URI of the second ontology

Ontology alignment method

Algorithms supported:
NameEqAlignment Simply compares the equality of class and property names (once downcased) and align those objects with the same name;
EditDistNameAlignment Uses an editing (or Levenstein) distance between (downcased) entity names. It thus have to build a matrix of distance and to choose the alignment from the distance;
SubsDistNameAlignment Computes a substring distance on the (downcased) entity name;
StrucSubsDistNameAlignment Computes a substring distance on the (downcased) entity names and uses and aggregates this distance with the symmetric difference of properties in classes.

Document: Done

work done by Anna Zhdanova (DERI Innsbruck)

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http://align.deri.org:8080/deri/showMappings.jsp

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OWL Ontology Aligner - Verify a Proposal

Powered by the KnowledgeWeb (INRIA) ontology aligner, OWL API, Jena 2 and The People's portal: a Semantic Web portal and metaportal

Ontologies aligned: <http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#publication> and <http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl>

The following alignment algorithm is used: `fr.inrialpes.exmo.align.impl.SubsDistNameAlignment`

Please tick beside the correctly aligned items.

http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#Article	=, 1.0	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#Article	<input checked="" type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#volume	=, 0.8	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#hasVolume	<input checked="" type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#note	=, 0.72727272727273	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#hasNote	<input checked="" type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#type	=, 0.72727272727273	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#hasType	<input checked="" type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#address	=, 0.8235294117647058	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#hasAddress	<input checked="" type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#TechReport	=, 1.0	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#Techreport	<input checked="" type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#SoftCopy	=, 0.222222222222222	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#Conference	<input checked="" type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#InBook	=, 1.0	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#Inbook	<input checked="" type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#chapter	=, 0.8235294117647058	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#hasChapter	<input checked="" type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#series	=, 0.8	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#hasSeries	<input checked="" type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#Misc	=, 1.0	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#Misc	<input checked="" type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#author	=, 0.8	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#hasAuthor	<input checked="" type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#Book	=, 1.0	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#Book	<input checked="" type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#publishedOn	=, 0.782608695652174	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#howPublished	<input type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#firstAuthor	=, 0.6	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#hasAuthor	<input type="checkbox"/>
http://ebiquity.umbc.edu/v2.1/ontology/publication.owl#InCollection	=, 1.0	http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#Incollection	<input checked="" type="checkbox"/>

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http://align.deri.org:8080/deri/saveMappings.jsp

OWL Ontology Aligner - Mappings are Saved

Powered by the the API for ontology alignment (INRIA), OWL API, Jena 2 and The People's portal: a Semantic Web portal and metaportal

The following mappings are identified:

```
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:owl="http://www.w3.org/2002/07/owl#" >
  <rdf:Description
    rdf:about="http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#Inbook">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class" />
  </rdf:Description>
  <rdf:Description rdf:about="http://eiquity.umbc.edu/v2.1/ontology/publication.owl#address">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class" />
    <owl:equivalentClass
      rdf:resource="http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#hasAddress" />
  </rdf:Description>
  <rdf:Description
    rdf:about="http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#hasAddress">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class" />
  </rdf:Description>
  <rdf:Description rdf:about="http://eiquity.umbc.edu/v2.1/ontology/publication.owl#Misc">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class" />
    <owl:equivalentClass
      rdf:resource="http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#Misc" />
  </rdf:Description>
  <rdf:Description rdf:about="http://eiquity.umbc.edu/v2.1/ontology/publication.owl#chapter">
    <rdf:type rdf:resource="http://www.w3.org/2002/07/owl#Class" />
    <owl:equivalentClass
      rdf:resource="http://c703-deri03.uibk.ac.at:8080/external/edu.mit.visus.bibtex.owl#hasChapter" />
  </rdf:Description>
  <rdf:Description rdf:about="http://eiquity.umbc.edu/v2.1/ontology/publication.owl#BookReport">
```

Return to ontology alignment start

Document: Done

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Summary

We have:

- Proposed a general format for expressing alignments among ontologies;
- Produced an API and an implementation;
- Provide a number of services and example.

Focusing on usability and reusability.

Current state of the alignment API

- API as a set of Java interfaces (Alignment, Cell, Relation, Evaluator...);
- Unique rendering format in RDF/XML described by DTD, RDF(S) and OWL ontology;
- Implementation with the OWL API (available with many examples);
- Used in the EON contest.

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Current status

- Available under LGPL;
- Stable, still under development (implementation);
<http://co4.inrialpes.fr/align>
- CVS archive open for read-only, write access possible: ask me;
- Few documentation, no tests currently;
- Used in the EON contest and several projects.

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Future plan

Improve this! This is by no way a definitive solution...

Build a complete alignment evaluation tool on top of this API.

We need to hear from you what is wrong, what is needed, how it is useful.

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<http://co4.inrialpes.fr/align>

?

<http://www.inrialpes.fr/exmo>

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Definition 29 (Triangular norm). A triangular norm T is a function from $D \times D \rightarrow D$ (with D a set ordered by \leq and provided with an upper bound \top) satisfying:

$$\begin{aligned} T(x, \top) &= x && \text{(boundary condition)} \\ x \leq y \implies T(x, z) &\leq T(y, z) && \text{(monotonicity)} \\ T(x, y) &= T(y, x) && \text{(commutativity)} \\ T(x, T(y, z)) &= T(T(x, y), z) && \text{(associativity)} \end{aligned}$$