Les portails d’accès aux ressources sémantiques
Tutorial: “How to use ontology repositories and ontology–based services”

DATA FAIRness International Summer School
Lecce, July 3rd 2019
Who am I?

- « Disclaimer »
  - Despite the availability of concrete platforms, this remains a research activity (in progress)
  - Excuse bugs, inconsistencies, misunderstanding, limits
  - We will not have an answer to everything

Clement Jonquet
Associate Professor, University of Montpellier, PI of AgroPortal, SIFR & D2KAB projects

With support of:
- ANR D2KAB
- H2020 SIFRm
Tutorial objectives

- Work with Bio/Agro/EcoPortal platform
- Describe your ontology using standard vocabularies
- Interconnect your ontology to the rest of the world
- Annotate text with ontologies
- Manipulate APIs (REST or SPARQL) to automate tasks
Ontology repository technology developed for the NCBO BioPortal project
Tutorial plan

Ontology selection
metadata search recommender

Drop & use an ontology
browsing visualization API

Semantic annotation of text
annotator

Ontology alignments management
create retrieve API

Automatize access with API
REST SPARQL
Who are you?

- Have you ever used ontologies (or terminologies in general)? BioPortal?
  - For which task?
  - Much interested in your feedback

- Your background?

- Why are you here today?
  - Super quickly

- Check: Access to slides?
General introduction
Data explosion
Our job is to structure these data

Linked Open Data create a « Web of data »
Big and open data is also happening in agriculture and biodiversity
The Semantic Web offers the technologies

The FAIR principles have established the importance of using standards vocabularies or ontologies to describe FAIR data and to facilitate interoperability and reuse:

12. (meta)data use vocabularies that follow FAIR principles
URL: identify what exists on the web.

http://my-site.fr

URI: identify, on the web, what exists.

http://animals.org/zebra#this

IRI: identify, on the web, what exists, in any language.

http://الحيوانات.tn/斑馬#this

Credit: F. Gandon (Inria)
The Semantic Web relies on RDF
Knowledge graphs
Ontologies
(small)

Credit: F. Gandon (Inria)
Ontologies (big)
Describe data
Why ontologies are important in science?

- To provide canonical **representation** and sharing of scientific knowledge

- To **annotate** experimental data to enable interpretation, comparison, and discovery across databases

- To facilitate **knowledge-based applications** for
  - Decision support, reasoning
  - Natural language-processing
  - Data integration

- But ontologies are: **spread out, in different formats, of different size, with different structures**
Other issues with ontologies

Number of ontologies in the NCBO BioPortal

Variety of representation languages
Ontology libraries defined as

“a library system that offers various functions for managing, adapting and standardizing groups of ontologies. It should fulfill the needs for re-use of ontologies. In this sense, an ontology library system should be easily accessible and offer efficient support for re-using existing relevant ontologies and standardizing them based on upper-level ontologies and ontology representation languages.” [Ding & Fensel, 2001]
Ontology repositories... a subject of study

- Defined by [Hartmann, Palma, Gomez-Perez, 2009] as:
  - “a structured collection of ontologies (...) by using an Ontology Metadata Vocabulary. References and relations between ontologies and their modules build the semantic model of an ontology repository. Access to resources is realized through semantically-enabled interfaces applicable for humans and machines. Therefore a repository provides a formal query language”

- Open Ontology Repository initiative (late 2000s)
- 2010 ORES workshop
- Review of ontology repositories
  - [Where to publish and find ontologies? D'Aquin & Noy, 2012]

- New platform in 2015 Aber-OWL
- OLS 3.0, AgroPortal release
Why ontology repositories are important?

- You’ve built an ontology, how do you let the world know?
- You need an ontology, where do you go to get it?
- How do you know whether an ontology is any good?
- How do you find data resources that are relevant to the domain of the ontology?
- How could you leverage your ontology to enable new science?
- How could you use ontologies without managing them?
Ontology repositories help to make ontologies FAIR

Findable
Accessible
Interoperable
Re-usable

SPARQL httpd server v1.1.5-122-1

KB ontologies_api

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT * WHERE {
  ?a rdfs:subClassOf ?b.
} LIMIT 10
Focus on NCBO BioPortal: a “one stop shop” for biomedical ontologies

- Web repository for biomedical ontologies

  - Make ontologies accessible and usable – abstraction on format, locations, structure, etc.

- Users can publish, download, browse, search, comment, align ontologies and use them for annotations both online and via a web services API.
- Online support for ontology
  - Peer review & notes
  - Versioning
  - Mapping
  - Search
  - Resources
  - Annotation

- Open source technology
  - Packaged in a “virtual appliance”
  - Set up your own “bioportal” in a few days

Who has been reusing NCBO technology so far?

- NCI term browser (BioPortal first, then LexEVS) (https://nciterms.nci.nih.gov)
- Open Ontology Repository (OOR) Initiative (http://www.oor.net)
- Marine Metadata Interoperability Ontology Registry and Repository (http://mmisw.org)
- Earth Science Information Partners ESIPPortal (then ORR) http://semanticportal.esipfed.org

- Stanford libraries https://biblio.ontoportal.org
- LifeWatch ERIC EcoPortal http://ecoportal.lifewatchitaly.eu/
- Chinese Academy of Medical Sciences http://medportal.bmicc.cn
- And a many hospitals, research labs, with private data and specific needs (often in-house annotation)
What are the ontology libraries out there?

- Ontology repositories / portal
  - NCBO BioPortal
  - Ontobee
  - AberOWL
  - EBI Ontology Lookup Service
  - OKFN Linked Open Vocabularies
  - ONKI Ontology Library Service
  - MMI Ontology Registry and Repository
  - ESIpportal
  - AgroPortal
  - SIFR BioPortal
  - MedPortal
  - EcoPortal
  - CISMEF HeTOP
  - OntoHub
  - Ontoserver

- Web indexes
  - Watson, Swoogle, Sindice, Falcons

- Ontology libraries / listings (more or less updated)
  - OBO Foundry
  - WebProtégé
  - Romulus
  - DAML ontology library
  - Colore
  - FAO VEST Registry
  - FAIRsharing
  - DERI Vocabularies, OntologyDesignPatterns, Semanticweb.org, W3C Good ontologies
  - BARTOC

- Platform technology, Terminology Services
  - Mondeca ITM, LexEVS, ANDS, SKOSMOS, NERC-VS

- Abandoned projects
  - Cubboard, Knoodl, Schemapedia, SchemaWeb, OntoSelect, OntoSearch, TONES
28 ontologies/terminologies
- From the UMLS or CISMeF’s HeTOP or uploaded by users
- Cleaned and checked for annotation

107 ontologies, 80 candidates
5 driving use cases, ~90 registered users
SIFR: Semantic Indexing of French Biomedical Data Resources  
http://www.lirmm.fr/sifr

- Ontology-based services to index, mine and retrieve French biomedical data

- In France, there is already a reference repository for medical terminologies but nothing public for annotation

- Crucial need for tools & services for French biomedical data
A dedicated version of BioPortal for French ontologies

http://bioportal.lirmm.fr

28 monolingual ontologies/terminologies
- From the UMLS or HeTOP or uploaded by users
- Cleaned and checked for annotation
The SIFR BioPortal Annotator processes text submitted by users, recognizes relevant ontology terms in the text and returns the annotations to the user. Use the interface below to submit or get ontology-based annotations. Hover the mouse pointer on any button to see what it does.

Le mélanome est un cancer de la peau ou des muqueuses, développé aux alégres des mélanocytes (tumeur mélanocytaire).

Son siège initial est la peau dans l'immense majorité des cas. Il existe toutefois des mélanomes de l'œil (mélanome choroïdien), des muqueuses (bouche, canal anal, vagin), et plus rarement encore des organes internes.
AgroPortal: a vocabulary and ontology repository for agronomy
http://agroportal.lirmm.fr

- Develop and support a reference ontology repository
  - **Primary focus** on the agronomy & close related domains (plant sciences, food and biodiversity)

- Reusing the NCBO BioPortal technology
  - **Avoid to re-implement** what has been done, facilitate interoperability
  - **Reusing** the scientific outcomes, experience & methods of the biomedical domain

- **Enable straightforward use of agronomic related ontologies**
  - Respect the requirements & specificities of the agronomic community
  - Fully semantic web compliant infrastructure
  - Enable **new science**
AgroPortal: a vocabulary and ontology repository for agronomy, food, plant sciences & biodiversity

- Publish, search, download
- Browse, visualize
- Peer review
- Versioning
- Annotation
- Recommendation
- Mapping
- Notes
- Projects

http://agroportal.lirmm.fr

- 107 ontologies, 80 candidates
- 5 driving use cases
- ~90 registered users

Use AgroPortal to access and share ontologies. You can create ontology-based annotations for your own text, link your own project that uses ontologies to the description of those ontologies, find and create relations between terms in different ontologies, review and comment on ontologies and their components as you browse them. Sign in to AgroPortal to submit a new ontology or ontology-based project, provide comments on ontologies or add ontology mappings.

### Ontology Visits (July 2017)

<table>
<thead>
<tr>
<th>Ontology</th>
<th>Visits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANAFE Thesaurus (ANAEFETHS)</td>
<td>95</td>
</tr>
<tr>
<td>AGROVOC (AGROVOC)</td>
<td>94</td>
</tr>
<tr>
<td>National Agricultural Library Thesaurus (NALT)</td>
<td>41</td>
</tr>
<tr>
<td>Ontobiotheke (ONTOBIOTHEKE)</td>
<td>36</td>
</tr>
<tr>
<td>Wheat Trait Ontology (WHEATPHENOTYPE)</td>
<td>27</td>
</tr>
</tbody>
</table>

### Latest Notes

1. **Terms in double (IBF Wheat Trait Ontology)**
   - 5 months ago by jonquet
   - A bunch of the terms in this branch are in double. Is this normal?

2. **Un peu d'histoire (Banana Anatomy)**
   - Over 1 year ago by albert
   - Inflorescence est un mot d'origine latine qui signifie "fleuri". Il est le même en français et e...

3. **Can measure by mapped to another ontology? (biorefinery)**
   - Over 1 year ago by jonquet
   - Such as Unit of Measurement?

4. **Is spadix a kind of inflorescence for banana? (Banana Anatomy)**
   - Over 1 year ago by jonquet
   - Can we consider spadix an appropriate inflorescence for banana?

### Latest Mappings

- **zooplankton (ANAEFETHS) <-> CMIT_0015869**
  - External Mapping 04/25/2017 by jonquet
- **QTL (SO) <-> OTL**
  - External Mapping 04/04/2017 by Larmande

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**Supported by**

- ANR
- Inra

**Powered by NCIIO BioPortal**
5 Driving Agronomic Use Cases

- **IBC Rice Genomics & AgroLD project**
  - Data integration and knowledge management related to rice (P. Larmande)

- **RDA Wheat Data Interoperability working group**
  - Common framework for publishing wheat data (E. Dzalé-Yeumo)

- **LovInra : INRA Linked Open Vocabularies**
  - Vocabularies produced by INRA scientists (S. Aubin)

- **Crop Ontology project**
  - Ontologies for describing crop germplasm & traits (E. Arnaud)

- **GODAN global map of agri-food data standards**
  - VEST/AgroPortal MAP of standards (V. Pesce)
<table>
<thead>
<tr>
<th>Title</th>
<th>Format</th>
<th>Groups</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBP Rice Trait Ontology (CO_320)</td>
<td>OWL</td>
<td>CROP, RICE</td>
<td>~2K</td>
</tr>
<tr>
<td>IBP Wheat Trait Ontology (CO_321)</td>
<td>OWL</td>
<td>CROP, WHEAT</td>
<td>~1K</td>
</tr>
<tr>
<td>IBP Wheat Anatomy Ontology (CO_121)</td>
<td>OBO</td>
<td>CROP, WHEAT</td>
<td>~80</td>
</tr>
<tr>
<td>IBP Crop Research (CO_715)</td>
<td>OBO</td>
<td>CROP</td>
<td>~250</td>
</tr>
<tr>
<td>Multi-Crop Passport Ontology (CO_020)</td>
<td>OBO</td>
<td>CROP</td>
<td>~90</td>
</tr>
<tr>
<td>Biorefinery (BIOREFINERY)</td>
<td>OWL</td>
<td>LOVINRA</td>
<td>~300</td>
</tr>
<tr>
<td>Matter Transfer (TRANSMAT)</td>
<td>OWL</td>
<td>LOVINRA</td>
<td>~1.1K</td>
</tr>
<tr>
<td>Plant Ontology (PO)</td>
<td>OWL</td>
<td>WHEAT, RICE, OBOF</td>
<td>~2K</td>
</tr>
<tr>
<td>Plant Trait Ontology (TO)</td>
<td>OWL</td>
<td>WHEAT, RICE, OBOF</td>
<td>~4.4K</td>
</tr>
<tr>
<td>Durum Wheat (DURUM_WHEAT)</td>
<td>OWL</td>
<td>LOVINRA</td>
<td>~130</td>
</tr>
<tr>
<td>Agricultural Experiments (AEO)</td>
<td>OWL</td>
<td>LOVINRA</td>
<td>~60</td>
</tr>
<tr>
<td>Environment Ontology (ENVO)</td>
<td>OWL</td>
<td>WHEAT, OBOF</td>
<td>~6.3K</td>
</tr>
<tr>
<td>NCBI Organismal Classification (NCBITAXON)</td>
<td>RRF</td>
<td>WHEAT</td>
<td>~900K</td>
</tr>
<tr>
<td>AnaEE Thesaurus (ANAEE)</td>
<td>SKOS</td>
<td>LOVINRA</td>
<td>~3.3K</td>
</tr>
<tr>
<td>French Crop Usage (CROPUSAGE)</td>
<td>SKOS</td>
<td>none</td>
<td>~300</td>
</tr>
<tr>
<td>Agrovoc (AGROVOC)</td>
<td>SKOS</td>
<td>none</td>
<td>~32K</td>
</tr>
<tr>
<td>Food Ontology (FOODON)</td>
<td>OWL</td>
<td>OBOF</td>
<td>~10K</td>
</tr>
<tr>
<td>National Agriculture Library Thesaurus (NALT)</td>
<td>SKOS</td>
<td>none</td>
<td>~67K</td>
</tr>
<tr>
<td>Global Agricultural Concept Scheme (GACS)</td>
<td>SKOS</td>
<td>none</td>
<td>~585K</td>
</tr>
</tbody>
</table>
Tutorial material
Use of NCBO BioPortal or another instance of the technology

NCBO BioPortal
http://bioportal.bioontology.org

AgroPortal
http://agroportal.lirmm.fr

EcoPortal
http://ecoportal.lifewatchitaly.eu/
Matériel nécessaire

- A web browser to use the web application
- A REST client for advanced REST web service calls (DHC, cURL, etc.)
- A text editor
- One ontology (preferably in OWL or SKOS)
During the tutorial

- Demo
- Exercise
Examples will be given with AgroPortal but (most of the time) equivalent action or queries can be done on one of the other portal.

For API, by changing the base URL
- http://data.agroportal.lirmm.fr/
- http://data.bioontology.org/
- http://193.204.79.110:8080 (for EcoPortal)

Documentation
- AgroPortal: https://github.com/agroportal/documentation/wiki/
- NCBO BioPortal: NCBO wiki
Create an account and get an APIkey

- Sign in > Create account
- Copy/paste your APIKey somewhere
For those who would like to see the code a little closer

1. Ontology selection

- Use metadata
- Search within an ontology
- Use the Recommender
- Define metadata for your ontology
Why ontology selection and evaluation is hard?

- Large number and variety of ontologies (versions, platforms, formats, etc.), different complexity level (from terminology to ontologies)

- Automation of the selection process?

- Diversity of user requirements and expectations
  - Pick up an ontology for reuse in a knowledge based system
  - Ontology extension
  - Automatic substitution of an ontology by another one

- What’s the risk of a bad choice?
  - Miss a relevant ontology
  - Miss connection/integration with other data that use the right ontologies
  - Miss possible reuse and start a new ontology
Browse

Access all ontologies that are available in IBC AgroPortal. You can filter this list by category to display ontologies relevant for a certain domain. You can also filter ontologies that belong to a certain group. Subscribe to the IBC AgroPortal RSS feed to receive alerts for submissions of new ontologies, new versions of ontologies, new notes, and new projects. You can subscribe to feeds for a specific ontology at the individual ontology page.

Add a new ontology to IBC AgroPortal using the Submit New Ontology link (you need to sign in to see this link).

---

**Biorefinery (BIOREFINERY)**
This vocabulary describes characteristics of biomass relevant for bio-refinery and unitary operations to transform a biomass in glucose.

- **Uploaded**: 10/24/15

---

**Plant Trait Ontology (PTO)**
A controlled vocabulary to describe phenotypic traits in plants

- **Uploaded**: 6/23/15

---

**IBP Rice Trait Ontology (CO_320)**
CGIAR rice trait ontology version 3

- **Uploaded**: 6/26/15

---

**Wheat Trait Ontology (WHEATPHENOTYPE)**
WheatPhenotype is an ontology of wheat traits and environmental factors that affect these traits

- **Uploaded**: 7/1/15

---

**Banana Anatomy (CO_125)**
Ontology of the Banana Anatomy

- **Uploaded**: 6/24/15

---
## Ontology groups and categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Phenotypes and Traits</td>
<td>31</td>
</tr>
<tr>
<td>Plant Anatomy and Development</td>
<td>4</td>
</tr>
<tr>
<td>Natural Resources, Earth and Environment</td>
<td>12</td>
</tr>
<tr>
<td>Animal Science and Animal Products</td>
<td>6</td>
</tr>
<tr>
<td>Agricultural Research, Technology and Engineering</td>
<td>15</td>
</tr>
<tr>
<td>Breeding and Genetic Improvement</td>
<td>1</td>
</tr>
<tr>
<td>Plant Science and Plant Products</td>
<td>7</td>
</tr>
<tr>
<td>Plant Genetic Resources</td>
<td>2</td>
</tr>
<tr>
<td>Food and Human Nutrition</td>
<td>7</td>
</tr>
<tr>
<td>Food Security</td>
<td>2</td>
</tr>
<tr>
<td>Taxonomic Classifications of Organisms</td>
<td>6</td>
</tr>
<tr>
<td>Farms and Farming Systems</td>
<td>5</td>
</tr>
<tr>
<td>Fisheries and Aquaculture</td>
<td>2</td>
</tr>
<tr>
<td>Forest Science and Forest Products</td>
<td>2</td>
</tr>
<tr>
<td>Biodiversity and Ecology</td>
<td>14</td>
</tr>
</tbody>
</table>

### Specific slices display to use only the ontologies of a group

Your turn!

Select an ontology by browsing or searching
OntoBiotope is an ontology of microorganism habitats. Its modeling principle and its lexicon reflect the biotope classification used by biologists to describe microorganism isolation sites (e.g. GenBank, GOLD, ATCC). OntoBiotope is developed and maintained by the Meta-omics of Microbial Ecosystems (MEM) network in which 30 microbiologists from INRA (French National Institute for Agricultural Research) from all fields of applied microbiology participate. The relevance of OntoBiotope terms is evaluated through the PubMedBiotope semantic search engine. It identifies and categorizes microbial biotopes in all PubMed abstracts by applying the ToMap method (Text to Ontology Mapping) to the OntoBiotope ontology. It also indexes 3.35 millions relations between taxa and their habitats.

**ACRONYM:** ONTOBIOTOPE

**VISIBILITY:** Public

**DESCRIPTION:**
OntoBiotope is an ontology of microorganism habitats. Its modeling principle and its lexicon reflect the biotope classification used by biologists to describe microorganism isolation sites (e.g. GenBank, GOLD, ATCC). OntoBiotope is developed and maintained by the Meta-omics of Microbial Ecosystems (MEM) network in which 30 microbiologists from INRA (French National Institute for Agricultural Research) from all fields of applied microbiology participate. The relevance of OntoBiotope terms is evaluated through the PubMedBiotope semantic search engine. It identifies and categorizes microbial biotopes in all PubMed abstracts by applying the ToMap method (Text to Ontology Mapping) to the OntoBiotope ontology. It also indexes 3.35 millions relations between taxa and their habitats.

**STATUS:** Production

**FORMAT:** OBO

**CONTACT:** Claire Nédélec, claire.nedelec@inra.fr

**HOME PAGE:** http://lovinra.inra.fr/

**PUBLICATIONS PAGE:** https://doi.org/10.1186/1471-2105-16-S10-S1

**DOCUMENTATION PAGE:** http://lovinra.inra.fr/

**CATEGORIES:** Biodiversity and Ecology, Natural Resources, Earth and Environment

**GROUPS:** GDR SemanDiv, INRA Linked Open Vocabularies

**Additional Metadata**

- **URI:** http://purl.obolibrary.org/obo/TEMP
- **NATURAL LANGUAGE:** English
- **VERSION:** 1.2
- **RELEASE DATE:** 2018-07-24T18:02:31+02:00
So much things to say about an ontology

Intrinsic
• names, acronym, language, ids, version, status, license, syntaxe, type, guidelines

People
• creator, contributor, publisher, contact, curator

Grouping
• domain, group

Relation
• imports, versions, views, related to, aligned to, used by, translation, generalization, specialization

Content
• key classes, dumps, partitions, example, changes

Community
• endorsements, reviews, notes, projects, analytics, support, audience

Date
• creation, modification, released, validation

Metrics
• classes, properties, individuals, depth, etc.

Provenance
• Source, generated by, invalidated by

Description
• documentation, abstract, reference, notes, methods, tools, logo, property used, homepage
Describe ontologies with semantic metadata

- Display “per ontology”
  - Ontology specific properties => viewable and editable within the ontology specific page

- Everything you need to know about an ontology

- URIs used in the backend to store the information
  - e.g., CC-BY => https://creativecommons.org/licenses/by-nd/4.0/

- “Get my metadata back” buttons
Browse and select ontologies

• Allows to search, order and select ontologies using a **facetted search** approach, based on the metadata

• 4 additional ways to filter ontologies in the list

• 2 new options to sort this list (name, released date).
Display “per property”

- Explore the agronomical ontology landscape by automatically aggregating the metadata fields of each ontologies in explicit visualizations
There are many, many metadata vocabularies to describe your ontology...

<table>
<thead>
<tr>
<th>Name</th>
<th>Space</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>rdfs</td>
<td></td>
<td>RDF Schema</td>
</tr>
<tr>
<td>omv</td>
<td></td>
<td>Ontology Metadata Vocabulary</td>
</tr>
<tr>
<td>owl</td>
<td></td>
<td>OWL 2 Web Ontology Language</td>
</tr>
<tr>
<td>dc</td>
<td></td>
<td>Dublin Core Metadata Element Set</td>
</tr>
<tr>
<td>dct</td>
<td></td>
<td>DC qualified</td>
</tr>
<tr>
<td>foaf</td>
<td></td>
<td>Friend of a Friend Vocabulary</td>
</tr>
<tr>
<td>void</td>
<td></td>
<td>Vocabulary of Interlinked Datasets</td>
</tr>
<tr>
<td>door</td>
<td></td>
<td>Descriptive Ontology of Ontology Relations</td>
</tr>
<tr>
<td>vann</td>
<td></td>
<td>Vocabulary for annotating vocabulary descriptions</td>
</tr>
<tr>
<td>adms</td>
<td></td>
<td>Asset Description Metadata Schema</td>
</tr>
<tr>
<td>voaf</td>
<td></td>
<td>Vocabulary of a Friend</td>
</tr>
<tr>
<td>dcat</td>
<td></td>
<td>Data Catalog Vocabulary</td>
</tr>
<tr>
<td>prov</td>
<td></td>
<td>Provenance Ontology</td>
</tr>
<tr>
<td>cc</td>
<td></td>
<td>Creative Commons Rights Expression Language</td>
</tr>
<tr>
<td>schema</td>
<td></td>
<td>Schema.org</td>
</tr>
<tr>
<td>skos</td>
<td></td>
<td>Simple Knowledge Organization System</td>
</tr>
</tbody>
</table>

- [https://github.com/agroportal/documentation/tree/master/metadata](https://github.com/agroportal/documentation/tree/master/metadata)
One example: SIO

The semanticscience integrated ontology (SIO) provides a simple (...) website: http://semanticscience.orgemail: sio-ontology@googlegroups.commailing list: http://groups.google.com/group/sio-ontology


dct:issued rdf:type: "http://www.w3.org/2001/XMLSchema#date">2010-03-29</dct:issued>

dc:creator xml:lang="en">Michel Dumontier</dc:creator>


schema:comment rdf:type: "http://www.w3.org/2001/XMLSchema#string">general class inclusion axioms:'is part of' some 'physical entity'
subClassOf 'is located in' some 'physical entity'role chains:'has capability' o 'is realized in' -&gt; 'is participant in'</schema:comment>

dc:contributor rdf:type: "http://www.w3.org/2001/XMLSchema#string">Contributors are those that engage in discussions in the context of SIO
(in alphabetical order):christopher baker, joachim baran, (...)</dc:contributor>

dct:rights rdf:type: "http://www.w3.org/2001/XMLSchema#string">free to use,share,modify. modify with attribution
[http://creativecommons.org/licenses/by/4.0/]</dct:rights>

protege:defaultLanguage en proprotege:defaultLanguage>


Your turn!

Take your ontology and add 3 metadata fields

Tell us what you want to say about your ontology we’ll tell you which property to use

Check out Dublin Core, DCAT, Schema.org ...
A scoring algorithm for recommending ontologies

- (1) coverage, or the extent to which the ontology covers the input data;
- (2) the acceptance of the ontology in the community;
- (3) the level of detail of the ontology classes that cover the input data;
- (4) the specialization of the ontology to the domain of the input data.

\[
\text{score}(o, t) = w_c \times \text{coverage}(o, t) + w_a \times \text{acceptance}(o) \\
+ w_d \times \text{detail}(o, t) + w_s \times \text{specialization}(o, t)
\]
Your turn!

Take the summary of your last article and get a recommendation for that content

Enter a list of terms that you would like to find in an ontology to identify the one that offers the best coverage
Drop and use an ontology

- Submit an ontology in the repository
- Browse and visualize an ontology
- Access the API for an ontology
Upload an ontology in AgroPortal (1/2)

- 1. Creation of the skeleton
2. Submission description
Community based functionalities

Latest Mappings

tissue (RT) <-> tissue (CL)
REST Mapping 06/24/2015 by jonquet

tissue (CL) <-> tissue (RT)
REST Mapping 06/24/2015 by jonquet

Latest Notes

Object quality (Phenotypic Quality Ontology)
about 19 hours ago by emonet
What is the difference with object quality or process quality? To which object those this quality...

Quality vs trait (Phenotypic Quality Ontology)
about 20 hours ago by jonquet
Is this ok in PATO to have ‘trait’ as a synonym of quality?
Use an ontology via the API

- Ontology metadata

- Ontology classes
  - http://data.agroportal.lirmm.fr/ontologies/ONTO/classes/?apikey=**

- More calls: http://data.agroportal.lirmm.fr/documentation
Your turn!

Eventually submit an ontology (if it is not already done) but it is not mandatory.

For the ontology of your choice, navigate, visualize, leave some comments.

Enter a project that uses one or more ontology(s).
Semantic annotation of text

- Identify ontology concepts in text
Why semantic annotation is hard?

- Annotation is not an easy task
  - Lack of annotation tools (convenient, simple to use and easily integrated into automatic processes)
  - Boring additional task without immediate reward for the user

- Automatically process a piece of raw text to annotate it with relevant ontologies
  - Large scale – to scale up for many resources and ontologies
  - Automatic – to offer good precision and recall
  - Easy to use and to access – to enlarge the possible use cases
  - Customizable – to fit very specific needs
  - Smart – to leverage the knowledge contained in ontologies
  - Evolutive – both ontologies and data change everyday
- First, direct annotations are created by recognizing concepts in raw text,
- Second, annotations are semantically expanded using knowledge of the ontologies,
- Third, all annotations are scored according to the context in which they have been created.
Sprouting
Initial Vigor
Color of unexpanded apical root leaves
Color of first fully expanded leaf
Leaf vein color
Apical Pubescence
Length of stipules
Number of leaf lobes
Leaf lobe position
Angle of petiole insertion
Petiole length
Petiole color
Anthocyanin pigmentation
Growth habit of young stem
Pubescence of young stem
Stem color
Leaf scar prominence
Apical branching
Branching levels
Branching Angle
Height of first apical branch
Height of plant
Total fresh weight foliage and stems
Total fresh weight foliage and stems
Number harvested
Root number
Fresh weight of storage
Fresh root yield
Harvest index
Leaf color
Plant architecture
Flowers (50%)
Sepal Color
Disc Color
Ovary color
Female stamenoids
Male Sterile
Days to Flower
Fruit set
Fruit Exocarp
Ploidy
Seed color
Caruncle Color
Storage root peduncle
Storage root form
Storage root constrictions
Root Position
Root surface color
Root surface texture
Anther color
Proportion of lodged plants
Leaf retention
Anthocyanin pigmentation
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Height of plant
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Total fresh weight foliage and stems
Number harvested
Annotator

The BC AgroPortal Annotator processes text submitted by users, recognizes relevant ontology terms in the text, and returns the annotations to the user. Use the interface below to submit sample text to get ontology-based annotations. Hover the mouse pointer on any button to see what it does. Click on the (?) to see a detailed help panel.

Subscribe to the NCBO Annotator Users Google group to learn more about who and how the Annotator is being used.

**Annotations**

<table>
<thead>
<tr>
<th>CLASS</th>
<th>ONTOLOGY</th>
<th>TYPE</th>
<th>CONTEXT</th>
<th>MATCHED CLASS</th>
<th>MATCHED ONTOLOGY</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>phenotype</td>
<td>Semanticscience Integrated Ontology</td>
<td>direct</td>
<td>BACKGROUND: Plant phenotype datasets include many...</td>
<td>phenotype</td>
<td>Semanticscience Integrated Ontology</td>
<td>4.322</td>
</tr>
<tr>
<td>phenotype</td>
<td>Semanticscience Integrated Ontology</td>
<td>direct</td>
<td>... backgrounds. Although phenotype comparisons across datasets...</td>
<td>phenotype</td>
<td>Semanticscience Integrated Ontology</td>
<td>4.322</td>
</tr>
<tr>
<td>phenotype</td>
<td>Experimental Factor Ontology</td>
<td>direct</td>
<td>BACKGROUND: Plant phenotype datasets include many...</td>
<td>phenotype</td>
<td>Experimental Factor Ontology</td>
<td>4.322</td>
</tr>
<tr>
<td>phenotype</td>
<td>Experimental Factor Ontology</td>
<td>direct</td>
<td>... backgrounds. Although phenotype comparisons across datasets...</td>
<td>phenotype</td>
<td>Experimental Factor Ontology</td>
<td>4.322</td>
</tr>
<tr>
<td>Plant</td>
<td>National Center for Biotechnology Information (NCBI)</td>
<td>direct</td>
<td>BACKGROUND: Plant phenotype datasets include many...</td>
<td>Plant</td>
<td>National Center for Biotechnology Information (NCBI) Organizational Classification</td>
<td>3.322</td>
</tr>
<tr>
<td>Data</td>
<td>National Center for Biotechnology Information (NCBI)</td>
<td>direct</td>
<td>... types of data, formats, and terms...</td>
<td>Data</td>
<td>National Center for Biotechnology Information (NCBI) Organizational Classification</td>
<td>3.322</td>
</tr>
<tr>
<td>Language</td>
<td>National Center for Biotechnology Information (NCBI)</td>
<td>direct</td>
<td>... frequently contains language and details tailored...</td>
<td>Language</td>
<td>National Center for Biotechnology Information (NCBI) Organizational Classification</td>
<td>3.322</td>
</tr>
<tr>
<td>language</td>
<td>Semanticscience Integrated Ontology</td>
<td>direct</td>
<td>... frequently contains language and details tailored...</td>
<td>language</td>
<td>Semanticscience Integrated Ontology</td>
<td>3.322</td>
</tr>
<tr>
<td>Scale</td>
<td>Bioinformatics</td>
<td>direct</td>
<td>... a small scale, comprehensive queries...</td>
<td>Scale</td>
<td>Bioinformatics</td>
<td>3.322</td>
</tr>
<tr>
<td>scale</td>
<td>Experimental Factor Ontology</td>
<td>direct</td>
<td>... a small scale, comprehensive queries...</td>
<td>scale</td>
<td>Experimental Factor Ontology</td>
<td>3.322</td>
</tr>
<tr>
<td>set</td>
<td>Semanticscience Integrated Ontology</td>
<td>direct</td>
<td>... a broad set of reference species...</td>
<td>set</td>
<td>Semanticscience Integrated Ontology</td>
<td>3.322</td>
</tr>
<tr>
<td>reference</td>
<td>Semanticscience Integrated Ontology</td>
<td>direct</td>
<td>... set of reference species, research disciplines, ...</td>
<td>reference</td>
<td>Semanticscience Integrated Ontology</td>
<td>3.322</td>
</tr>
<tr>
<td>trait</td>
<td>Plant Ontology</td>
<td>direct</td>
<td>... a small scale, comprehensive queries...</td>
<td>trait</td>
<td>Plant Ontology</td>
<td>3.000</td>
</tr>
<tr>
<td>trait</td>
<td>Plant Ontology</td>
<td>direct</td>
<td>... a small scale, comprehensive queries...</td>
<td>trait</td>
<td>Plant Ontology</td>
<td>3.000</td>
</tr>
</tbody>
</table>

**Format Results As:** JSON

76
<table>
<thead>
<tr>
<th>population</th>
<th>Agriculture and Forestry Ontology</th>
<th>direct ... rapidly growing human population, there is a ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>population</td>
<td>Agriculture and Forestry Ontology</td>
<td>direct ... growing human population, there is a ...</td>
</tr>
</tbody>
</table>

Format Results As: JSON

To reproduce these results:
Corresponding REST web service call

Additional parameters are documented at Annotator Web Service
But we did not just “translate” the Annotator

• Most of our new features are developed within a proxy
  • E.g., we can call either the AgroPortal, SIFR BioPortal or even the NCBO BioPortal Annotator and use the same code to score annotations


- Project SIFR & PractiKPharma
- Detecting Negation, Temporality and Experiencer
- Implementation using NegEx/ConText
  - Inclusion in the French/SIFR Annotator
  - Proxy architecture to plug this the NCBO Annotator
- Very good performance results
  - e.g., negation F1 between 0.8 and 0.9

Annotating and contextualizing clinical text

Le patient ne montre aucun signe de fièvre. Son père a déjà eu de l’arthrose. Il a des antécédents de dépression.

<table>
<thead>
<tr>
<th>CLASS</th>
<th>filter</th>
<th>ONTOLOGY filter</th>
<th>TYPE</th>
<th>UMLS SEM TYPE</th>
<th>CONTEXT</th>
<th>MATCHED CLASS</th>
<th>filter</th>
<th>MATCHED ONTOLOGY</th>
<th>filter</th>
<th>NEGATION</th>
<th>EXPERIENCER</th>
<th>TEMPORALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fièvre</td>
<td></td>
<td>Medical Subject Headings, version francaise</td>
<td>direct</td>
<td></td>
<td>... signe de fièvre. Son père a ...</td>
<td>Fièvre</td>
<td>Medical Subject Headings, version francaise</td>
<td></td>
<td>NEGATED</td>
<td>PATIENT</td>
<td>RECENT</td>
<td></td>
</tr>
<tr>
<td>Arthrose</td>
<td></td>
<td>Medical Subject Headings, version francaise</td>
<td>direct</td>
<td></td>
<td>... eu de l’arthrose. Il a des ...</td>
<td>Arthrose</td>
<td>Medical Subject Headings, version francaise</td>
<td></td>
<td>AFFIRMED</td>
<td>OTHER</td>
<td>RECENT</td>
<td></td>
</tr>
<tr>
<td>Dépression</td>
<td></td>
<td>Medical Subject Headings, version francaise</td>
<td>direct</td>
<td></td>
<td>... antécédents de dépression.</td>
<td>Dépression</td>
<td>Medical Subject Headings, version francaise</td>
<td></td>
<td>AFFIRMED</td>
<td>PATIENT</td>
<td>HISTORICAL</td>
<td></td>
</tr>
</tbody>
</table>
Your turn!

Take a summary of your last article and get annotations

Test the score and other advance parameters

Get same results with the API
Ontology alignments management

- Retrieve or enter alignments
- Format of alignments
- Import alignments generated with external tools
Differences between theory...
... and reality.
Ontology alignment

- Ontologies, vocabularies, and terminologies inevitably overlap in coverage

- Mappings do not always belong to an ontology
  - The community needs a place to store and retrieve them
  - That’s the role of the ontology repository

- Dealing with mappings is a technical, data and scientific challenge
  - Capture the whole mapping lifecycle
  - Semantically described with plenty of provenance information
All aspects of ontology alignments
Different types of mappings

- Mappings uploaded (and stored within the portal)
  - *RestBackupMapping* - A mapping added by a user using the REST API (or the UI).
  - Materialized into the triple-store.

- Mappings created (automatically by the portal)
  - *SameURI* - Created between 2 concepts with the same URI.
  - *LOOM* - Lexical mappings created between 2 concepts with equivalent labels (preferred name): removing accents, spaces and special characters.
  - *CUI* - Created between 2 concepts that have the same CUI (Concept Unique Identifiers). The CUI is an unique identifier used by UMLS.
  - Not materialized in the triple-store, generated on-the-fly.
Representation of mappings inside AgroPortal

[Diagram showing relationships and URNs]
Example with translation mappings

- Mappings between 2 ontologies hosted in different « bioportal » instances
- Tagged with different mapping properties

```json
{"creator": "http://data.stageportal.lirmm.fr/users/AAmina",
 "source_contact_info": "a_annane@esi.dz",
 "relation": ["http://www.w3.org/2004/02/skos/core#exactMatch",
              "http://purl.org/linguistics/gold/freeTranslation"],
 "source": "REST",
 "source_name": "Reconciliation of multilingual mapping",
 "comment": "Multilingual mapping",
 "classes": [{"http://chu-rouen.fr/cismef/SNOMED_int.#A-01020": "SNMIFRE",
              "http://purl.bioontology.org/ontology/SNMI/A-01020": "ncbo:SNMI"}]
```
- When browsing an ontology, one can retrieve mappings for the whole ontology hosted in the repository.

- When browsing a concept, one can retrieve mappings for this specific concept.
Alignments in AgroPortal

concept by concept

Mappings

<table>
<thead>
<tr>
<th>ONTOLOGY</th>
<th>MAPPINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agri-Food Experiment Ontology</td>
<td>1</td>
</tr>
<tr>
<td>Agricultural Experiments Ontology</td>
<td>5</td>
</tr>
<tr>
<td>Banana Anatomy</td>
<td>2</td>
</tr>
<tr>
<td>Basic Formal Ontology</td>
<td>1</td>
</tr>
<tr>
<td>Biomedical</td>
<td>13</td>
</tr>
<tr>
<td>Cell Ontology</td>
<td>4</td>
</tr>
<tr>
<td>Chickpea Ontology</td>
<td>14</td>
</tr>
<tr>
<td>Comparative Data Analysis Ontology</td>
<td>3</td>
</tr>
<tr>
<td>Durum Wheat</td>
<td>2</td>
</tr>
<tr>
<td>EDAM bioinformatics operations, data types, formats, identifiers and topics</td>
<td>25</td>
</tr>
<tr>
<td>Environment Ontology</td>
<td>72</td>
</tr>
<tr>
<td>Environment Ontology for Livestock</td>
<td>10</td>
</tr>
<tr>
<td>Experimental Factor Ontology</td>
<td>93</td>
</tr>
<tr>
<td>Gene Ontology</td>
<td>5</td>
</tr>
<tr>
<td>GENO Ontology</td>
<td>5</td>
</tr>
<tr>
<td>Genomic Feature and Variation Ontology</td>
<td>6</td>
</tr>
<tr>
<td>Gramene Taxonomy Ontology</td>
<td>3</td>
</tr>
<tr>
<td>Groundnut Ontology</td>
<td>16</td>
</tr>
<tr>
<td>IBP Cassava TAIL Ontology</td>
<td>23</td>
</tr>
<tr>
<td>IBP Cowpea TAIL Ontology</td>
<td>25</td>
</tr>
<tr>
<td>IBP Crop Research Ontology</td>
<td>22</td>
</tr>
</tbody>
</table>
Enable to store external mappings  
i.e., mappings with only one concept in AgroPortal

<table>
<thead>
<tr>
<th>Mapping To</th>
<th>Ontology</th>
<th>Source</th>
<th>Relations</th>
</tr>
</thead>
<tbody>
<tr>
<td>inflorescence</td>
<td>Experimental Factor Ontology</td>
<td>LOOM</td>
<td></td>
</tr>
<tr>
<td>inflorescence</td>
<td>Plant Trait Ontology</td>
<td>LOOM</td>
<td></td>
</tr>
<tr>
<td>inflorescence</td>
<td>Plant Trait Ontology</td>
<td>LOOM</td>
<td></td>
</tr>
</tbody>
</table>

### Interportal mappings

There are currently no interportal mappings for this class.

### External mappings

<table>
<thead>
<tr>
<th>Mapping To</th>
<th>Ontology</th>
<th>Source</th>
<th>Relations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spadice</td>
<td><a href="http://dbpedia.org/ontology/">http://dbpedia.org/ontology/</a></td>
<td>REST</td>
<td>skos:broadmatch</td>
</tr>
</tbody>
</table>
Mappings to external resources were also extracted

- e.g.,

What to do now: analysis and feedback to community to improve the dataset
Mappings entre ontologies: a few exemples


Your turn!

Retrieve all the alignments generated by the portal for your favorite ontology

Enter (relevant) alignments between classes of different ontologies

Enter alignments to classes that are not in portal e.g., DBPedia (AgroPortal only)
Automatize access with API

- REST
- SPARQL
REST Web Service API:
http://data.agroportal.lirmm.fr/documentation

SPARQL endpoint:
What’s a REST API?

- Uses HTTP protocol to access web resource
- Access to a resource via its URL
- Native HTTP operations:
  - GET (retrieve a resource)
  - POST/PUT (create)
  - PATCH (modify)
  - DELETE (delete)
BioPortal/AgroPortal/EcoPortal REST API

- Data are exposed in JSON or XML with the following base URLs:
  - [http://193.204.79.110:8080](http://193.204.79.110:8080) (for EcoPortal)

- Operations are applied on these data with HTTP queries
  - [http://data.agroportal.lirmm.fr/documentation](http://data.agroportal.lirmm.fr/documentation)
    - GET queries retrieve objects (ontologies, classes, mappings, users, project, slice, etc.)
    - PUT queries create objects
    - PATCH queries modify objects
    - DELETE queries delete objects

Access to data via REST API

---

```
{
  - administeredBy: {
    http://data.agroportal.lirmm.fr/users/admin
  },
  acronym: "STO",
  name: "Semantic Integrated Ontology",
  summaryOnly: null,
  ontotype: {
    http://data.agroportal.lirmm.fr/ontologies?apikey=***
  },
  gid: {
    http://data.agroportal.lirmm.fr/ontologies/STO
  },
  @type: {
    http://data.bioontology.org/metadata/Ontology
  },
  links: {
    {
      submissions: {
        http://data.agroportal.lirmm.fr/ontologies/STO/submissions
      },
      properties: {
        http://data.agroportal.lirmm.fr/ontologies/STO/properties
      },
      classes: {
        http://data.agroportal.lirmm.fr/ontologies/STO/classes
      },
      single_class: {
        http://data.agroportal.lirmm.fr/ontologies/STO/classes/classId
      },
      roots: {
        http://data.agroportal.lirmm.fr/ontologies/STO/classes/roots
      },
      instances: {
        http://data.agroportal.lirmm.fr/ontologies/STO/classes/instances
      },
      metrics: {
        http://data.agroportal.lirmm.fr/ontologies/STO/metrics
      },
      reviews: {
        http://data.agroportal.lirmm.fr/ontologies/STO/reviews
      },
      notes: {
        http://data.agroportal.lirmm.fr/ontologies/STO/notes
      },
      groups: {
        http://data.agroportal.lirmm.fr/ontologies/STO/groups
      },
      categories: {
        http://data.agroportal.lirmm.fr/ontologies/STO/categories
      },
      latest_submission: {
        http://data.agroportal.lirmm.fr/ontologies/STO/latest_submission
      },
      projects: {
        http://data.agroportal.lirmm.fr/ontologies/STO/projects
      },
      download: {
        http://data.agroportal.lirmm.fr/ontologies/STO/download
      },
      views: {
        http://data.agroportal.lirmm.fr/ontologies/STO/views
      },
      analytics: {
        http://data.agroportal.lirmm.fr/ontologies/STO/analytics
      }
    }
  }
}
```

---

data.agroportal.lirmm.fr/ontologies?apikey=***
Access to services via REST API

AgroPortal provides access to annotated knowledge about agro-ontologies through the REST API. The base URL is `http://agroportal.lirmm.fr/annotator` with additional endpoints for specific operations.

### Example Request

```
fetch('http://services.agroportal.lirmm.fr/annotator/?text=banana&apikey=***',
  { headers: { 'Accept': 'application/json' } }).then(response =>
  response.json()).then(data =>
  console.log(data));
```

This URL structure allows for querying agro-ontologies with specific text patterns and an API key for authentication.

---

**Resources**

- `agroportal.lirmm.fr/annotator` (base URL for AgroPortal's REST API)
- `services.agroportal.lirmm.fr/annotator/?text=banana&apikey=***` (example URL for accessing AgroPortal's API with text search)
Examples of REST calls

- Get information about a user
  - http://data.agroportal.lirmm.fr/users/jonquet

- Get information about a group
  - http://data.agroportal.lirmm.fr/groups/LOVINRA

- Retrieve information about an ontology
  - http://data.agroportal.lirmm.fr/ontologies/CO_125

- Get information about a project
  - http://data.agroportal.lirmm.fr/projects/SIFR
Examples of REST calls for mappings

- Retrieve a specific mapping by id
  - http://data.agroportal.lirmm.fr/mappings/fd709e40-fcab-0132-77e3-525400026749

- Retrieve mappings btw 2 ontologies

- Get all the mappings for a given ontology

- Get all the mappings of a given class
Examples of SPARQL queries (1/2)

// all triples about ontologies

SELECT ?s ?p ?o WHERE {
  GRAPH <http://data.bioontology.org/ontologies/ANAEETHE/submit/sions/3>{
  }
}
LIMIT 30

// list of all username

PREFIX meta: <http://data.bioontology.org/metadata/>

SELECT DISTINCT ?user WHERE {
  GRAPH <http://data.bioontology.org/metadata/User> {
    ?user meta:username ?o .
  }
}

// liste des graphes dans 4stores

SELECT DISTINCT ?g WHERE {
  GRAPH ?g {
  }
}
Examples of SPARQL queries (2/2)

```sparql
//Get 20 first concept labels from the ANAETHES thesaurus.

PREFIX skos: <http://www.w3.org/2004/02/skos/core#>

SELECT DISTINCT ?s ?label WHERE {
  GRAPH <http://data.bioontology.org/ontologies/ANAEETHES/submissions/3> {
    ?s a skos:Concept .
  }
}
ORDER BY DESC(?label)
LIMIT 20
```
Your turn!

Fire a few REST calls

... and SPARQL queries
Voilà, it’s the end

• Questions & remarks
• Feedback
• Exchanges
Thank you!

jonquet@lirmm.fr