

YEAR 4 HIGHLIGHTS

Enhancing and implementing Knowledge based ICT solutions within high **R**isk and **U**ncertain **C**onditions for **A**griculture **P**roduction **S**ystems
(**RUC-APS**)

WP 11

Agriculture Ontology



Presenter

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Secondments relating to the Ontology development



RUC-APS meeting

12/07/2018

UL

Nancy, France



RUC-APS meeting

15/04/2019

UNLP

La Plata, Argentine



RUC-APS Secondment

10/02/2020

UNPL

La Plata, Argentine

RUC-APS YEAR 4 HIGHLIGHTS



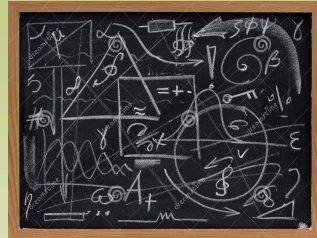
Horizon 2020
European Union funding
for Research & Innovation



THE RUC-APS TEAM who worked to the Ontology

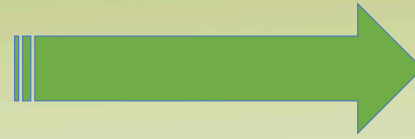
Name (alphabetical order)	Institution/Group	Expertise
Dr. Antonelli Leandro	UNLP	Requirement engineering
Prof. Fernandez Alejandro	UNLP	Knowledge management
Dr. Lezoche Mario	UL	Knowledge management and ontology
Prof. Panetto Hervé	UL	Interoperability of systems, cyber-physical systems
Dr. Torres Diego	UNLP	Social semantic web and linked data

What is an Ontology?

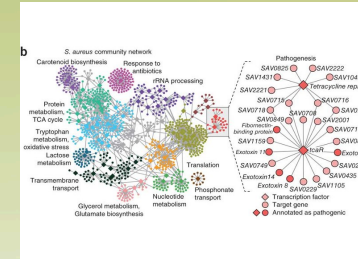


Real World Information

How to formally represent?



How to Inference and Query?



Ontology

This abstract and simplified view of the world is represented as “a set of **Concepts** and **Relationships** that can exist for an agent or a community of agents” by Tom Gruber

- The **Ontology** is a clear and detailed description of how to make this conceptualization, which
 - introduces the **Concepts** relevant to a domain of interest
 - and specifies the **Relationships** between those Concepts

What is an Ontology?

- Definitions (Information Science)
 - “An ontology is an explicit specification of a conceptualization”
Tom Gruber.

(1) What is an explicit specification?

Explicit: Stated clearly and in detail (leaving no room for confusion or doubt).

Specification: A detailed description of how to make something.

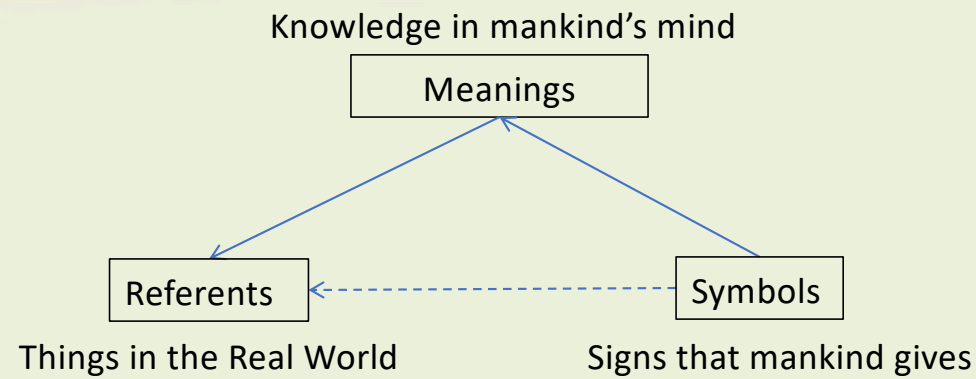
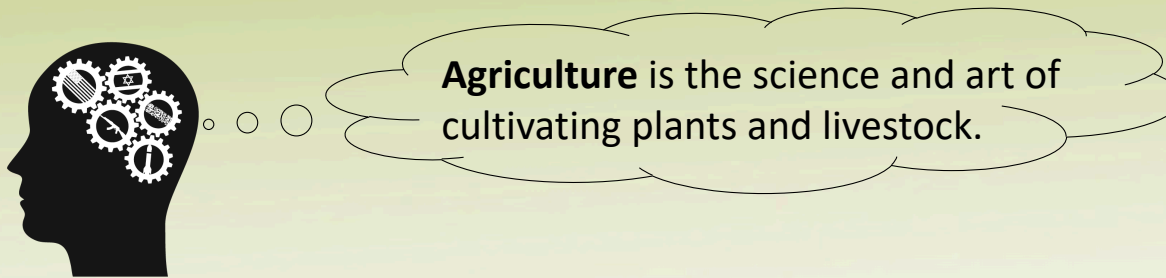
(2) What is a conceptualization?

Conceptualization: A conceptualization is an abstract, simplified view of the world that we wish to represent for some purposes.

Ontology → A clear and detailed specification of a conceptualization

What is an Ontology?

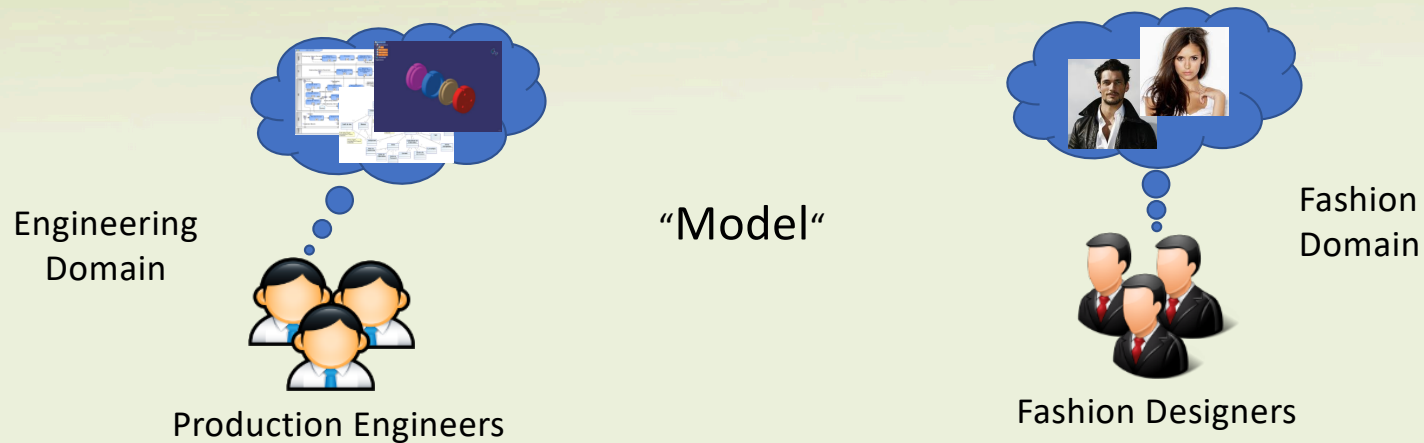
- The Semantic Triangle



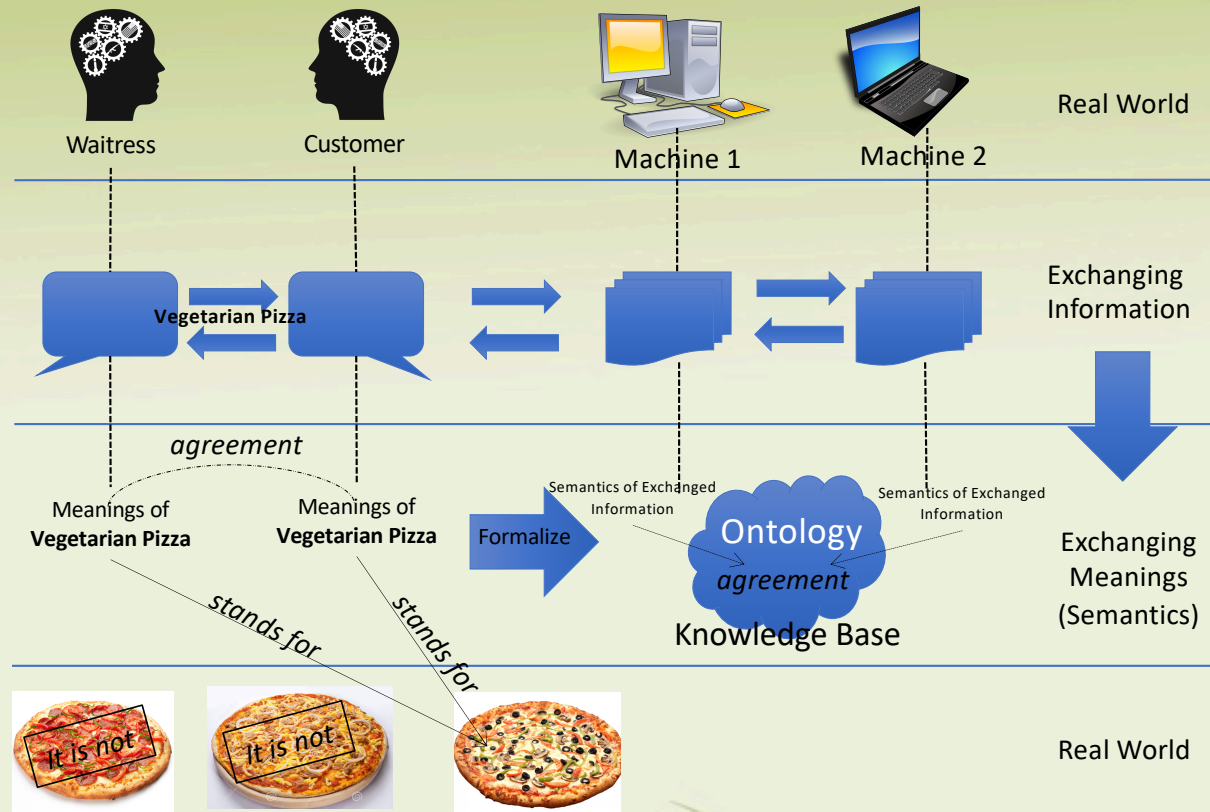
What is an Ontology?

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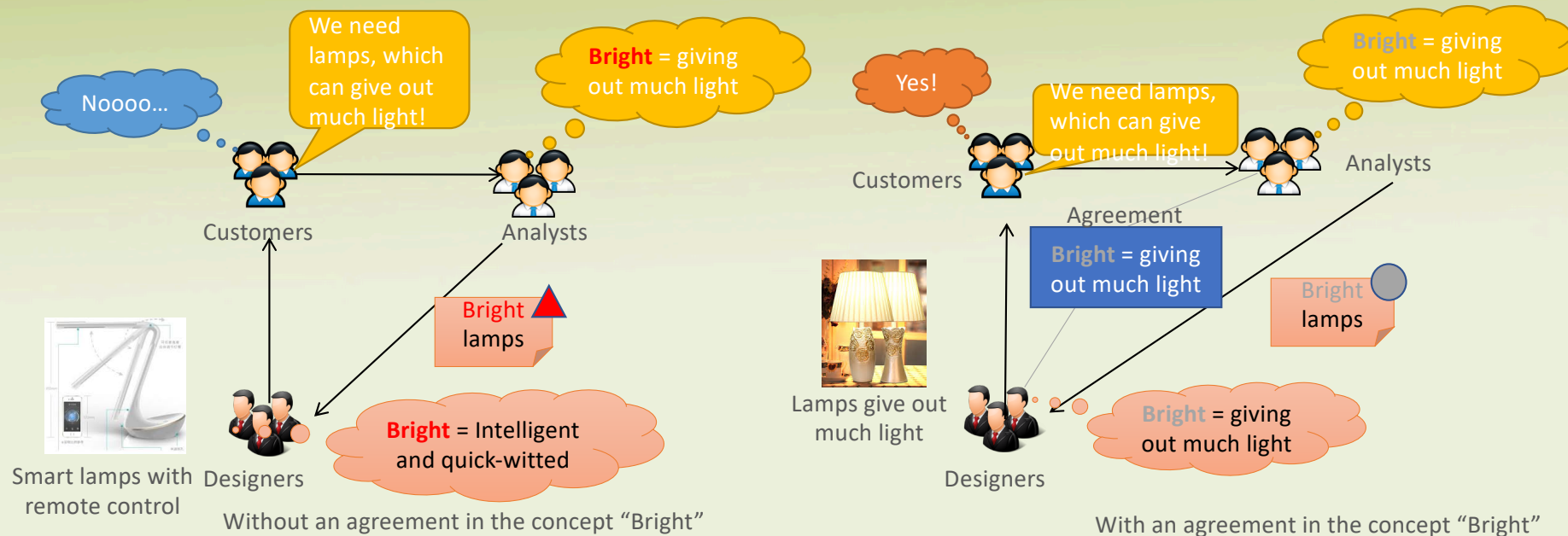
The one who commits to this conceptualization



From Mankind to Machine



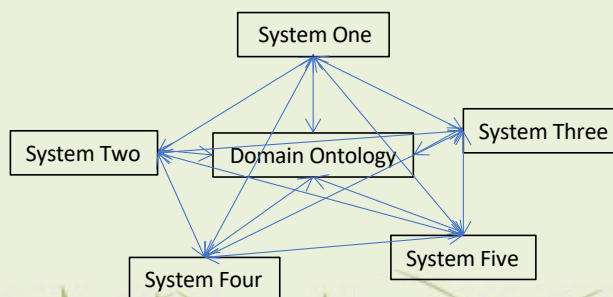
A Simple Example of using a concept with or without agreement



Oxford Dictionary=> Bright: (1) giving out much light
(2) Intelligent and quick-witted

Ontology Application Interoperability assessment

- Proposed Solution: Data Exchange based on Ontology

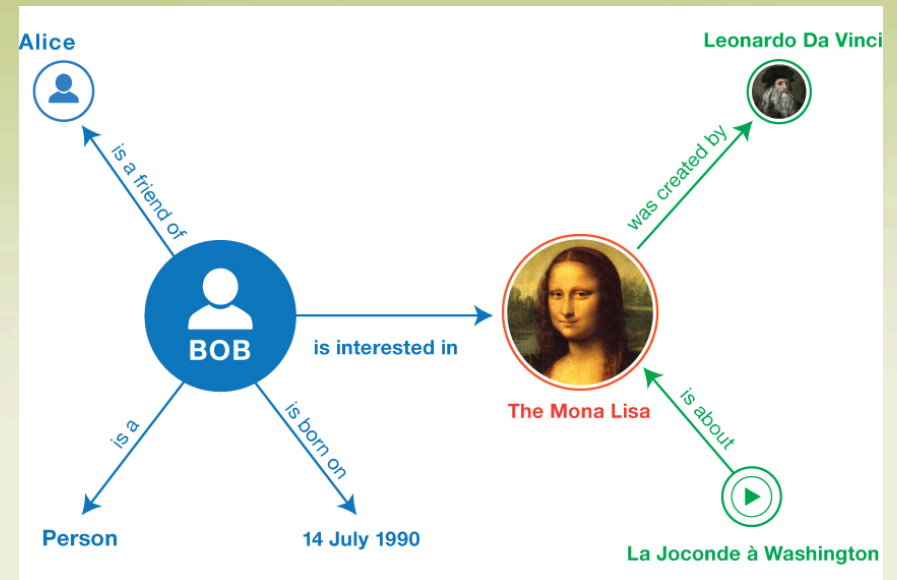


So, why an Ontology in the Agriculture?

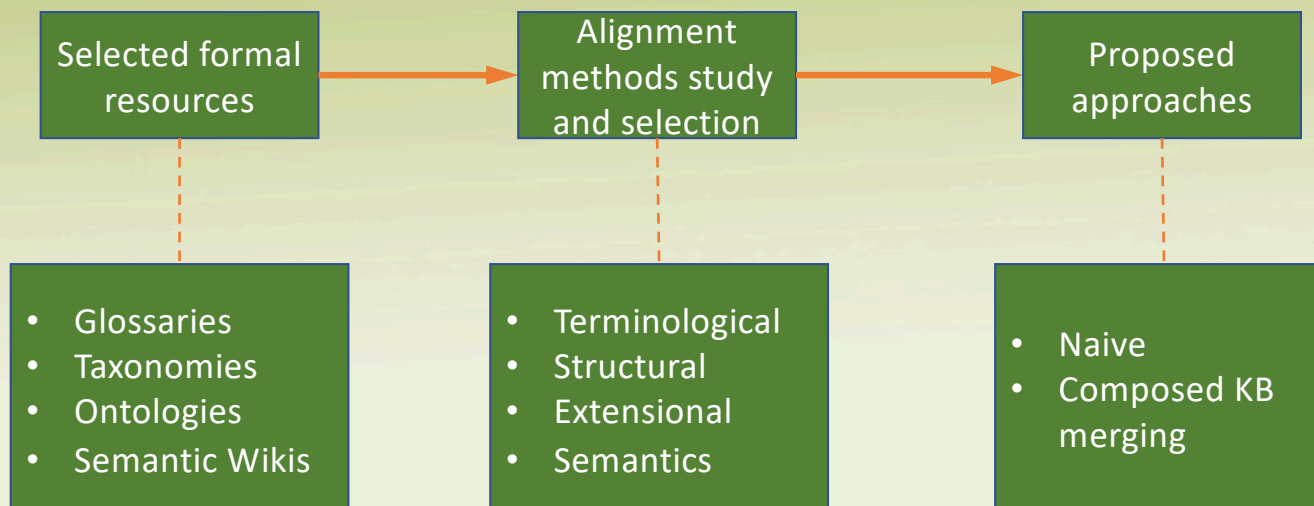
- Ontology can :
 - Formally Represent Knowledge
 - Support the Reuse and Sharing of that Knowledge
 - Assist the Identification of Inconsistencies
 - Support the Interoperability
 - Discover New Knowledge (through the help of inference engines)

Resource Description Framework

- Most popular syntax is turtle, historically though started with XML
- The syntax covers :
 - Defining prefixes using namespaces
 - Representing a resource or an anonymous resource (blank node)
 - Documenting links between resources
 - Values of triples in different literal possibilities : Strings, integers, special datatypes like dates...
 - Representing types/datatypes to identify the type of a resource.
- Defining groups:
 - simple groups with/without order
 - alternatives, e.g. The same word in different languages
 - collections/ ordered lists
- The possibility of naming graphs : Grouping triples in subgraphs identified by URIs



Adopted Process



Glossaries

- **Palette** could have different meanings



It is extremely important to define the language used in the application domain.

Symbol definition template

Term / expression

- Notion: description of the term, as in a regular dictionary.
- Behavioural responses: relation with other terms.

Palette

- Notion: Platform designed to allow handling by elevators
- Behavioural responses:

The farmer stacks the plastic boxes on the palettes

The truck driver loads the palettes in the truck

Symbol categorization

Category	Notion	Behavioural Responses
Subject	Who is he?	What does he do?
Object	What is it?	What actions does it receive?
Verb	What goal does it pursue?	How is the goal achieved?
State	What situation does it represent?	What other situations can be reached?

Symbol definition template

Palette (Object)

- Notion:

Platform designed to allow handling by elevators

- Behavioural responses:

The farmer (*subject*) stacks (*Verb*) the plastic boxes (*object*) on the palettes

The truck driver (*subject*) loads (*Verb*) the palettes in the truck (*Object*)

Scenario: an example



- Title: Transportation of products
- Goal: Deliver the products to destination without alteration of their qualities
- Context: From Spain to France by truck
- Actors: The farmer, truck driver
- Resources: Palette, Plastic box, Water, Truck, ...
- Episodes:
 - Wash the palettes with water
 - Buy plastic boxes
 - Package the products in the plastic boxes
 - Stack the plastic boxes on the palettes
 - Load the palettes in the truck
 - Drive to destination



Scenario: template

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Name

Conditions and restrictions to be reached at the end of the scenario

Active agents

Conditions and restrictions of the initial situation of the scenario

Steps executed by the actors, using the resources, beginning at the context to reach the goal

Products and elements used by the actors

Glossary and Scenario relation

- Title: Transportation of products
- Goal: Deliver the products to destination without alteration of their qualities
- Context: From Spain to France by truck
- Actors: The farmer, truck driver
- Resources: Palette, Plastic box, Water, Truck
- Episodes:

Wash the palettes with water

Buy plastic boxes

Package the products in the plastic boxes

Stack the plastic boxes on the palettes

Load the palette in the truck

Drive to destination

Subjects

Objects

Verbs

Other
Scenarios?

Selected formal representation for the Knowledge bases:

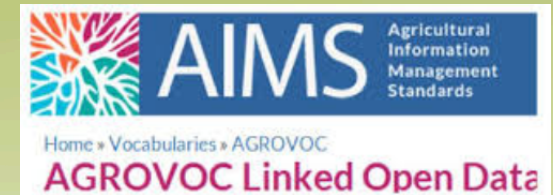
SKOS

- The Simple Knowledge Organization System (SKOS) is a common data model for sharing and linking knowledge organization systems via the Semantic Web. **SKOS** is a [W3C recommendation](#) designed for representation of [thesauri](#), [classification schemes](#), [taxonomies](#), [subject-heading systems](#), or any other type of structured [controlled vocabulary](#). SKOS is part of the [Semantic Web](#) family of standards built upon [RDF](#) and [RDFS](#), and its main objective is to enable easy publication and use of such vocabularies as [linked data](#).
- There are several possible situations in which we might want to use both SKOS and OWL. For example, we might want to migrate from a semi-formal thesaurus-like structure to a formal ontology, to enable "richer" queries and new types of inference. This last is our case.
-

Selected knowledge bases

- Agrovoc (SKOS based taxonomy)
- Agrontology (Real ontology)
- General purpose formalized knowledge such as DBpedia or Wikidata.

What is AGROVOC?



- AGROVOC is a multilingual structured *thesaurus** created by FAO (Food and Agriculture Organisation) and the Commission of the European Communities since 1980 covering the fields of food, agriculture, forestry, fisheries, and other related domains.

Structure of data

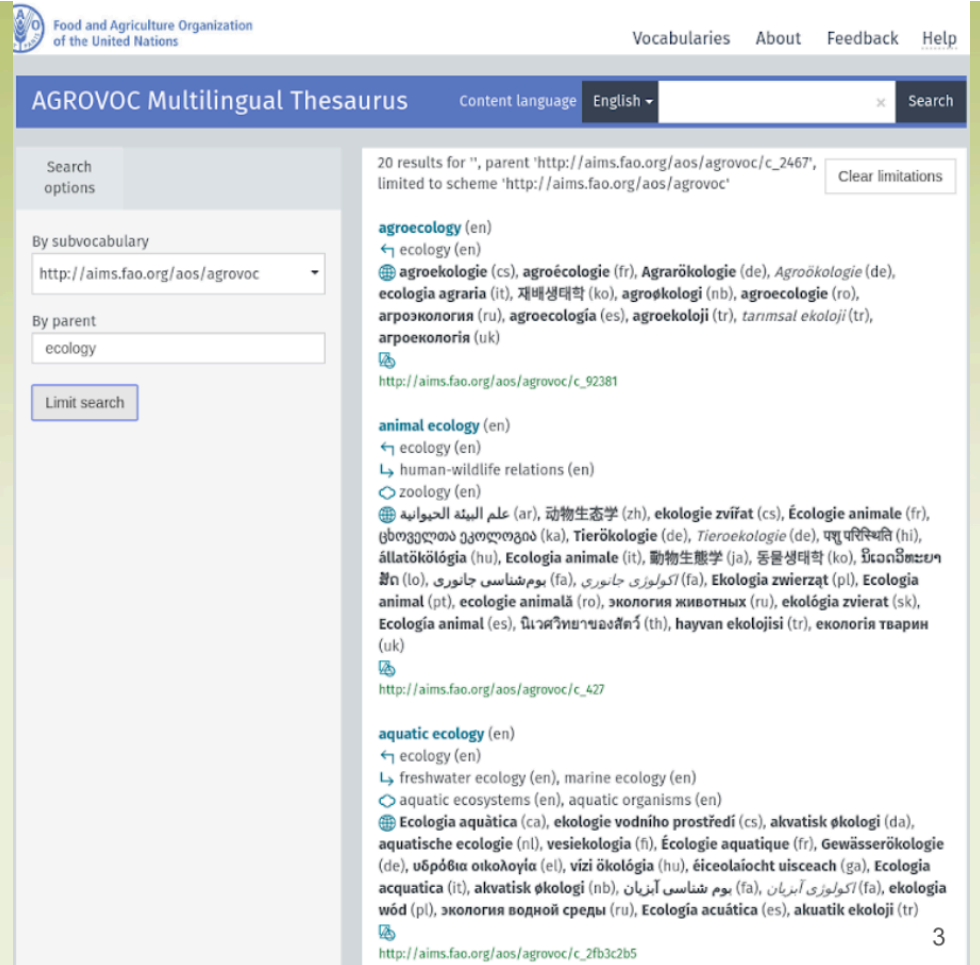
- Multiple languages
- organized using the following relationships
 - Semantic Equivalence*
 - Broader term (BT)
 - Narrower term (NT)
 - Related term (RT)

Thesaurus, noun

dictionary or encyclopedia.

Semantic Equivalence

Two data elements from different vocabularies contain data that has similar meaning.



Food and Agriculture Organization of the United Nations

Vocabularies About Feedback Help

AGROVOC Multilingual Thesaurus Content language English Search

Search options

By subvocabulary

By parent

Limit search

20 results for "", parent 'http://aims.fao.org/aos/agrovoc/c_2467', limited to scheme 'http://aims.fao.org/aos/agrovoc' [Clear limitations](#)

agroecology (en)
 ecology (en)
 agroekologie (cs), agroécologie (fr), Agrarökologie (de), Agroökologie (de), ecologia agraria (it), 재배생태학 (ko), agroøkologi (nb), agroecologia (ro), агроэкология (ru), agroecologia (es), agroekoloji (tr), tarmsal ekoloji (tr), агроэкологія (uk)
http://aims.fao.org/aos/agrovoc/c_92381

animal ecology (en)
 ecology (en)
 human-wildlife relations (en)
 zoology (en)
 علم البيئة الحيوانية (ar), 动物生态学 (zh), ekologie zvířat (cs), Écologie animale (fr), ცხოველთა ეკოლოგია (ka), Tierökologie (de), Tieroekologie (de), पशु परिस्थिति (hi), állatökológia (hu), Ecologia animale (it), 動物生態学 (ja), 동물생태학 (ko), மீனவியல் (lo), بوم‌شناسی جانوری (fa), اکولوژی جانوری (fa), Ekologia zwierząt (pl), Ecologia animal (pt), ecologie animală (ro), экология животных (ru), ekológia zvierat (sk), Ecología animal (es), 環境生物學 (th), hayvan ekolojisi (tr), екологія тварин (uk)
http://aims.fao.org/aos/agrovoc/c_427

aquatic ecology (en)
 ecology (en)
 freshwater ecology (en), marine ecology (en)
 aquatic ecosystems (en), aquatic organisms (en)
 Ecologia aquática (ca), ekologie vodního prostředí (cs), akvatisk økologi (da), aquatische ecologie (nl), vesiekologia (fi), Écologie aquatique (fr), Gewässerökologie (de), υδρόβια οικολογία (el), vízi ökológia (hu), éiceolaíocht uisceach (ga), Ecologia acquatrica (it), akvatisk økologi (nb), بوم‌شناسی آبیان (fa), اکولوژی آبیان (fa), ekologia wod (pl), экология водной среды (ru), Ecologia acuática (es), akuatik ekoloji (tr)
http://aims.fao.org/aos/agrovoc/c_2fb3c2b5

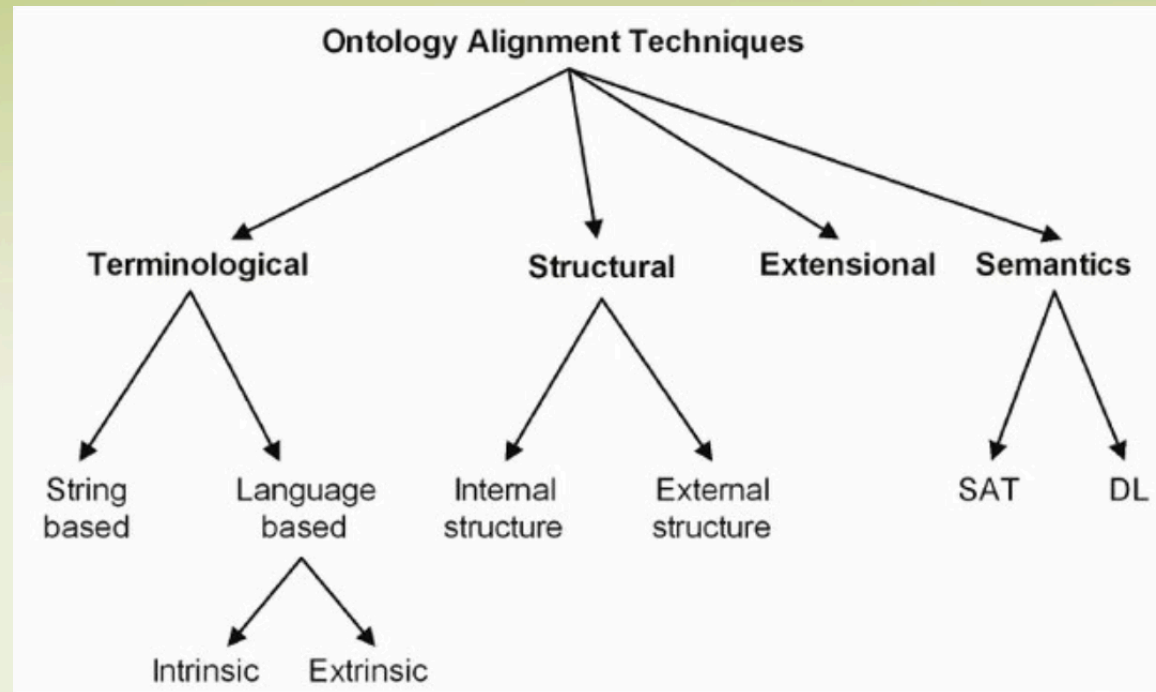
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Research on the term: Ecology

For each concept in the research result, we can see :

- Broader concept
- Narrower concept
- Concepts related to this concept
- Translation into multiple languages
- URI of the type of the concept

Alignment methods of formal knowledge repositories



Proposed approaches

- Approach
 - First naive: Using DBpedia to detect relevant concepts and then detect in agrovoc synonyms and related concepts.
 - A semantic middleware Wikidata to be augmented with concepts from agrovoc and other datasources using sameAs or other properties.
 - RCA (relation concept analysis).

THANK YOU !

Q&A

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