Knowledge graphs in the field

The growing role of semantic technologies in the agri-food sector

Aaron Bradley

2 June 2022

1 result

Aaron Bradley • You

Knowledge Graph Strategist at Electronic Arts (EA)

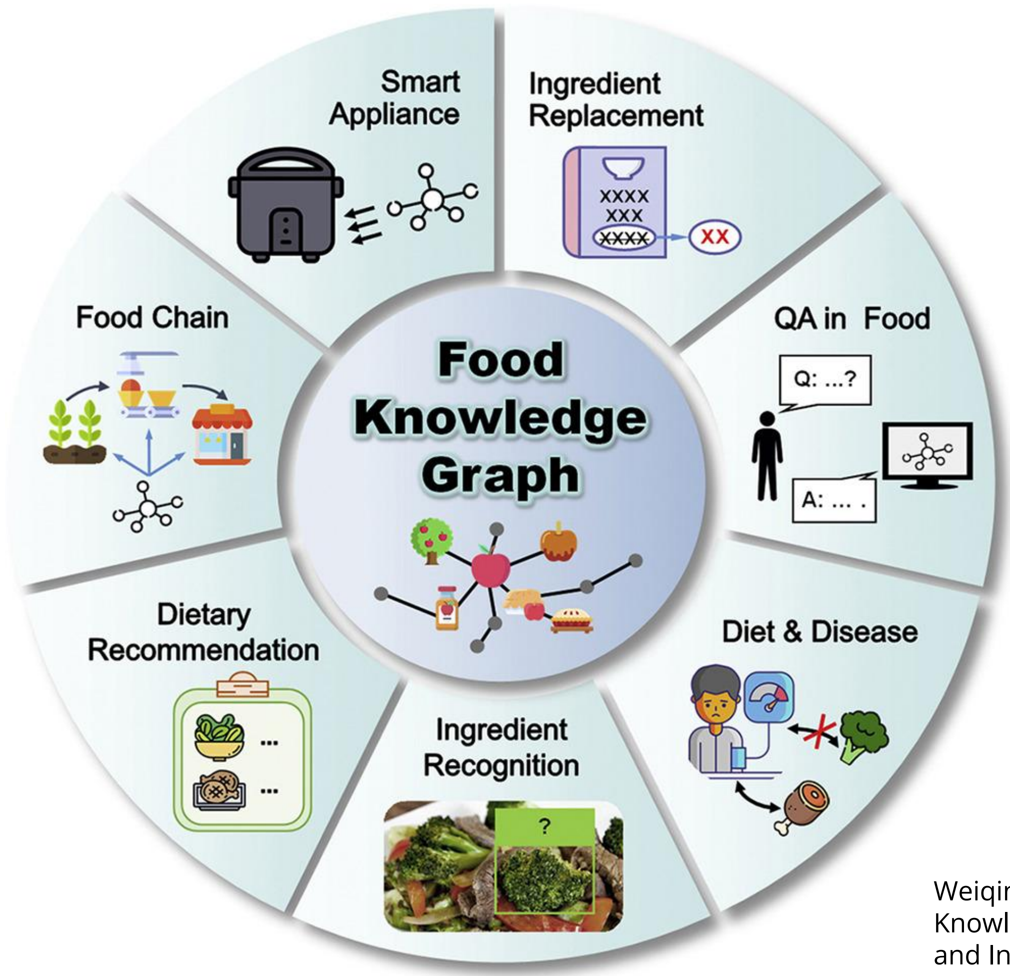
Gibsons, BC

Current: Knowledge Graph Strategist at Electronic Arts (EA) - Helping to build EA's content **knowledge graph** and to facilitate the growth of an intelligent...

Are these results helpful?

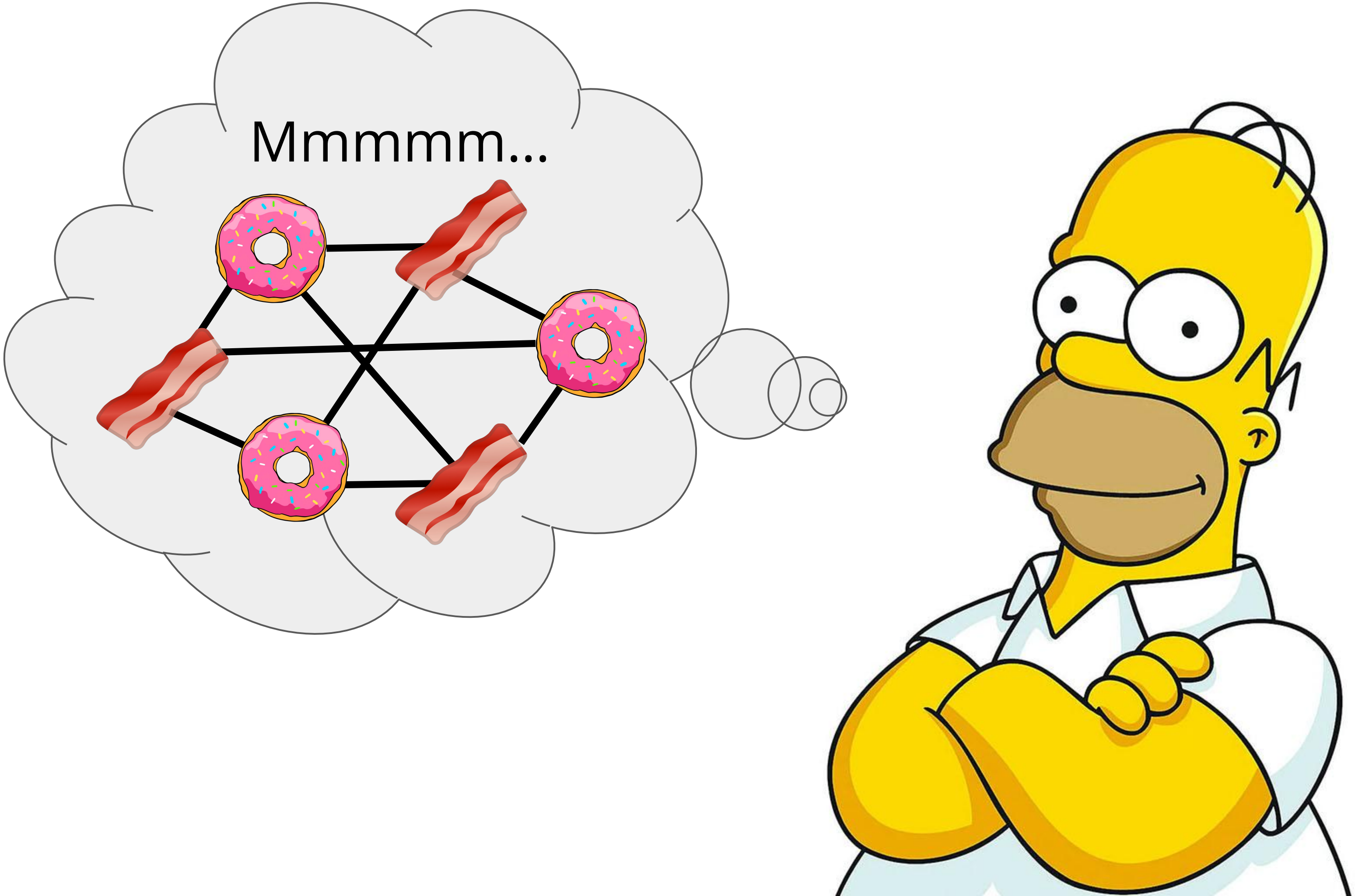
Your feedback helps us improve search results


SASKATCHEWAN
POOL
KINDERSLEY
B
USE
POOL
CO.OP
FLOUR
SASKATCHEWAN
POOL
KINDERSLEY



Weiqing Min et al., "Applications of Knowledge Graphs for Food Science and Industry"

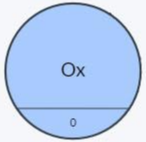
Food graph?

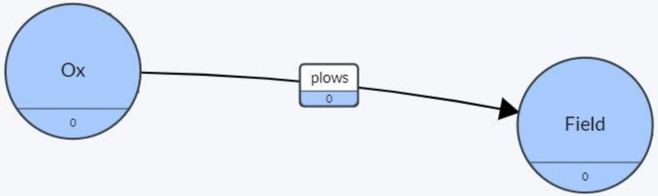

Mmmmm…

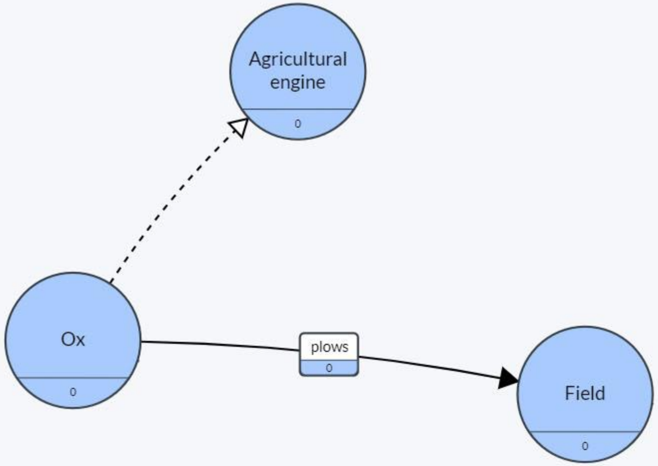
Agenda

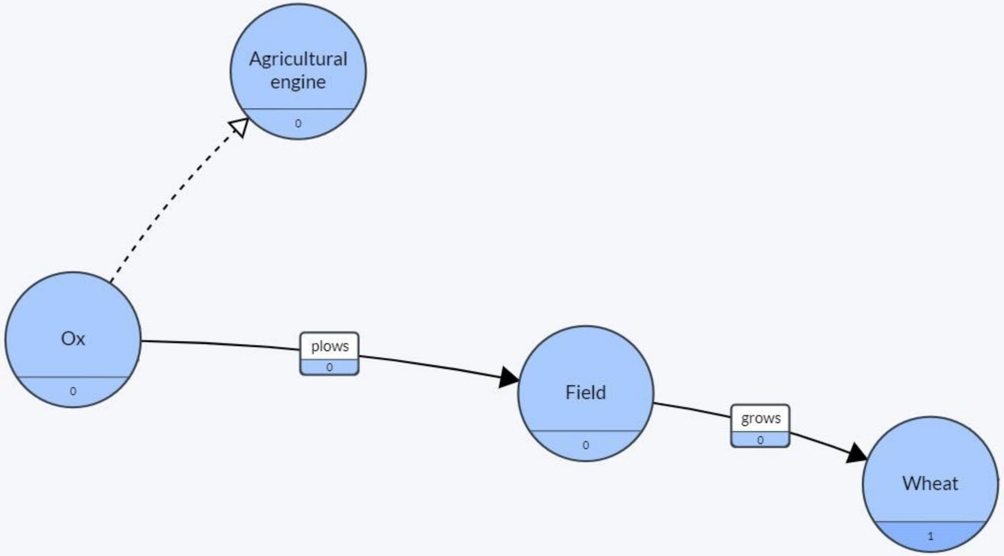
1. What’s a knowledge graph?
2. Knowledge graphs in agri-food
3. Preparing to connect

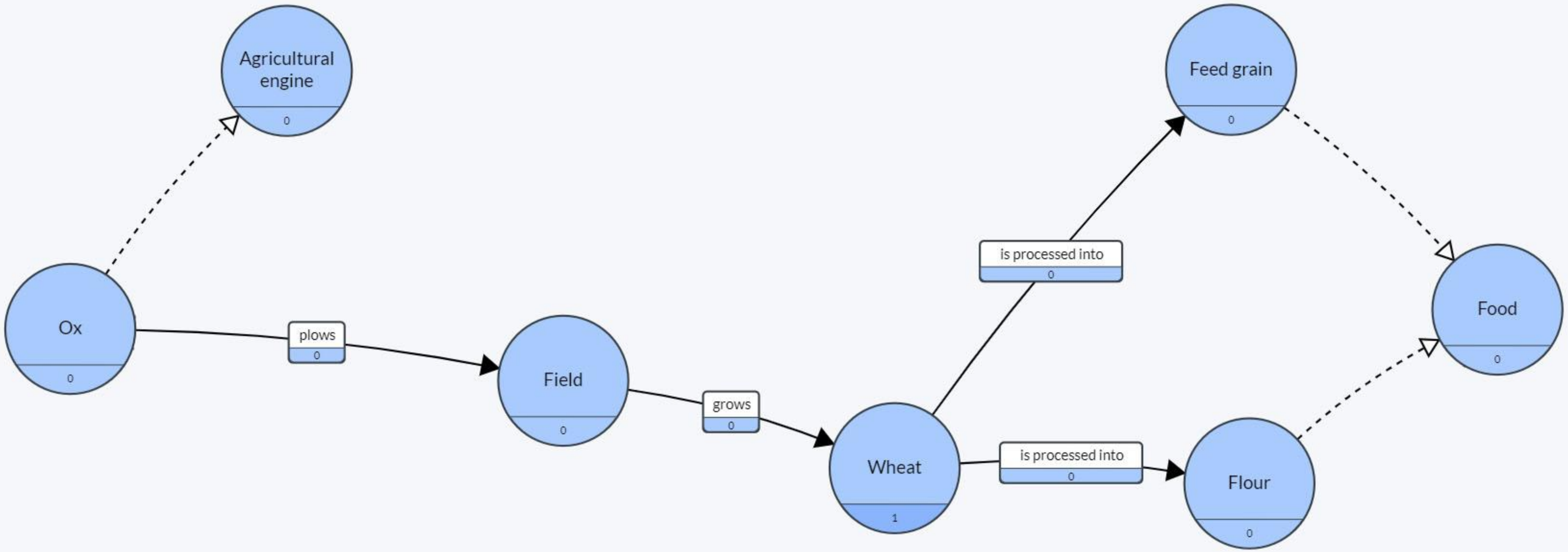
Decentralized knowledge graphs


Ox
0

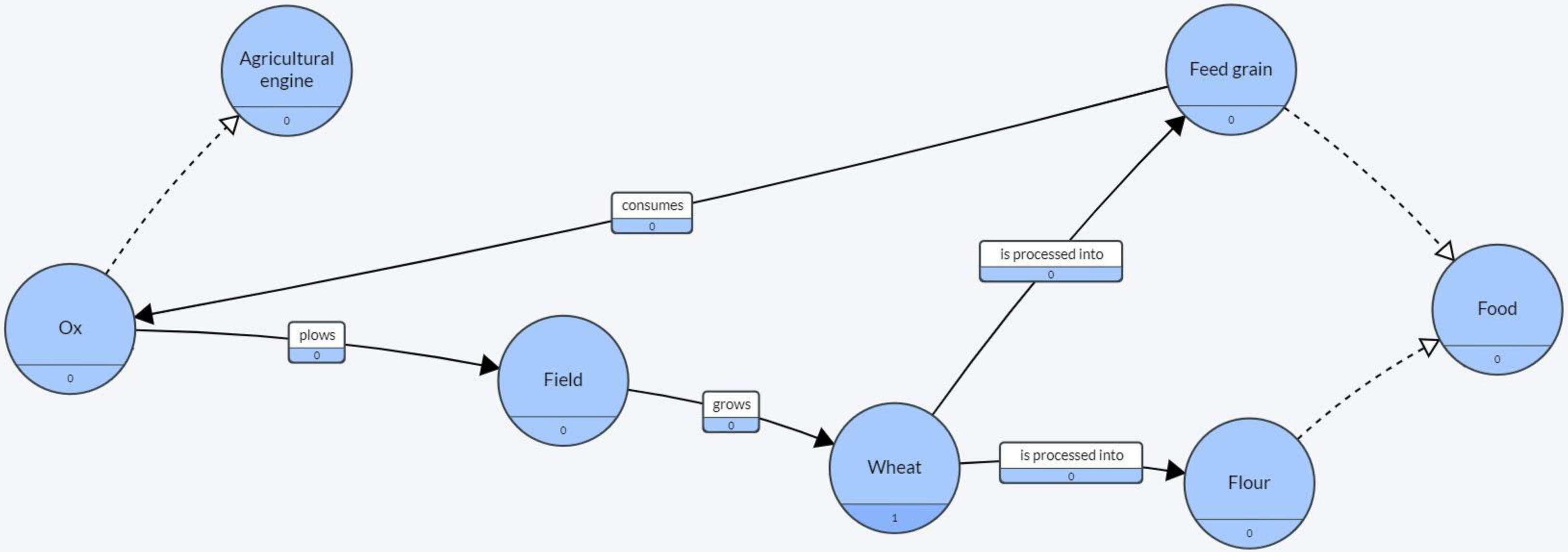

Ox
0
plows
0
Field
0

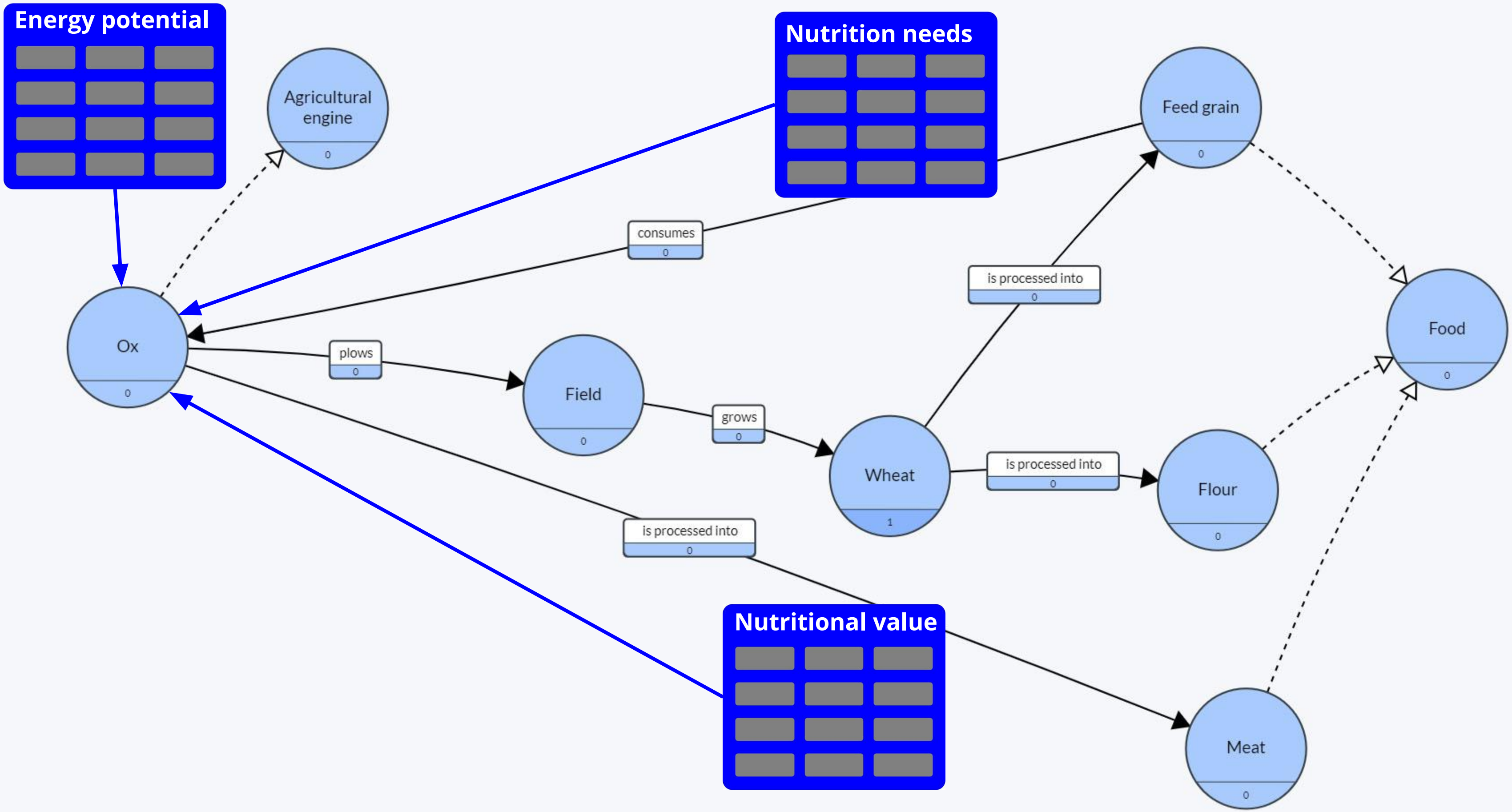

Agricultural engine
0
Ox
0
plows
0
Field
0


Agricultural engine
0
Ox
0
plows
0
Field
0
grows
0
Wheat
1



Agricultural engine
0
Ox
0
plows
0
Field
0
grows
0
Wheat
1
is processed into
0
Feed grain
0
is processed into
0
Flour
0
Food
0

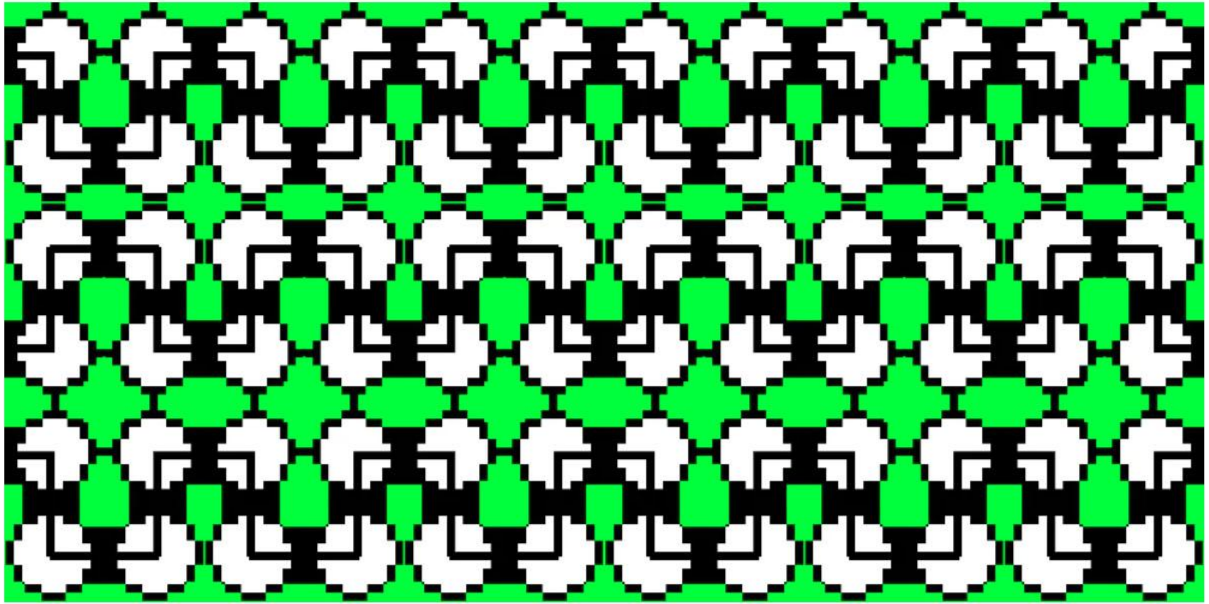

Agricultural engine
0
Feed grain
0
consumes
0
is processed into
0
Food
0
Ox
0
plows
0
Field
0
grows
0
Wheat
1
is processed into
0
Flour
0


Energy potential
Agricultural engine
0
Nutrition needs
Feed grain
0
consumes
0
is processed into
0
Food
0
Ox
0
plows
0
Field
0
grows
0
Wheat
1
is processed into
0
Flour
0
is processed into
0
Nutritional value
Meat
0

WTF is a knowledge graph?

April 26th 2017

TERMINAL >.IEW 5




Business Persons' Guide to: What is a Knowledge Graph? In 10 minutes or less
Sunshine
0:02 / 8:07

Definition	Source
"A knowledge graph (i) mainly describes real world entities and their interrelations, organized in a graph, (ii) defines possible classes and relations of entities in a schema, (iii) allows for potentially interrelating arbitrary entities with each other and (iv) covers various topical domains."	Paulheim [16]
"Knowledge graphs are large networks of entities, their semantic types, properties, and relationships between entities."	Journal of Web Semantics [12]
"Knowledge graphs could be envisaged as a network of all kind things which are relevant to a specific domain or to an organization. They are not limited to abstract concepts and relations but can also contain instances of things like documents and datasets."	Semantic Web Company [3]
"We define a Knowledge Graph as an RDF graph. An RDF graph consists of a set of RDF triples where each RDF triple (s, p, o) is an ordered set of the following RDF terms: a subject $s \in U \cup B$, a predicate $p \in U$, and an object $U \cup B \cup L$. An RDF term is either a URI $u \in U$, a blank node $b \in B$, or a literal $l \in L$."	Färber et al. [7]
"[...] systems exist, [...], which use a variety of techniques to extract new knowledge, in the form of facts, from the web. These facts are interrelated, and hence, recently this extracted knowledge has been referred to as a knowledge graph."	Pujara et al. [17]

Table 1: Selected definitions of knowledge graph

tion and do not even enforce a graph structure. In addition, size is highlighted as an essential characteristic, which is reflected by phrases such as "large networks" or "vast networks" [11], while it remains unclear what "large" means in this context. Färber et al. defined a knowledge graph as an Resource Description Framework (RDF) graph and stated that the term KG was coined by Google to describe any graph-based knowledge base (KB) [7]. Although this definition is the only formal one, it contradicts with more general definitions as it

In the 1980s, researchers from the University of Groningen and the University of Twente in the Netherlands initially introduced the term knowledge graph to formally describe their knowledge-based system that integrates knowledge from different sources for represen
The authors proposed KGs wi
focus on qualitative modeling
which clearly contrasts with
widely discussed in recent years.

Lisa Ehrlinger and Wolfram Wöß, "Towards a Definition of Knowledge Graphs"

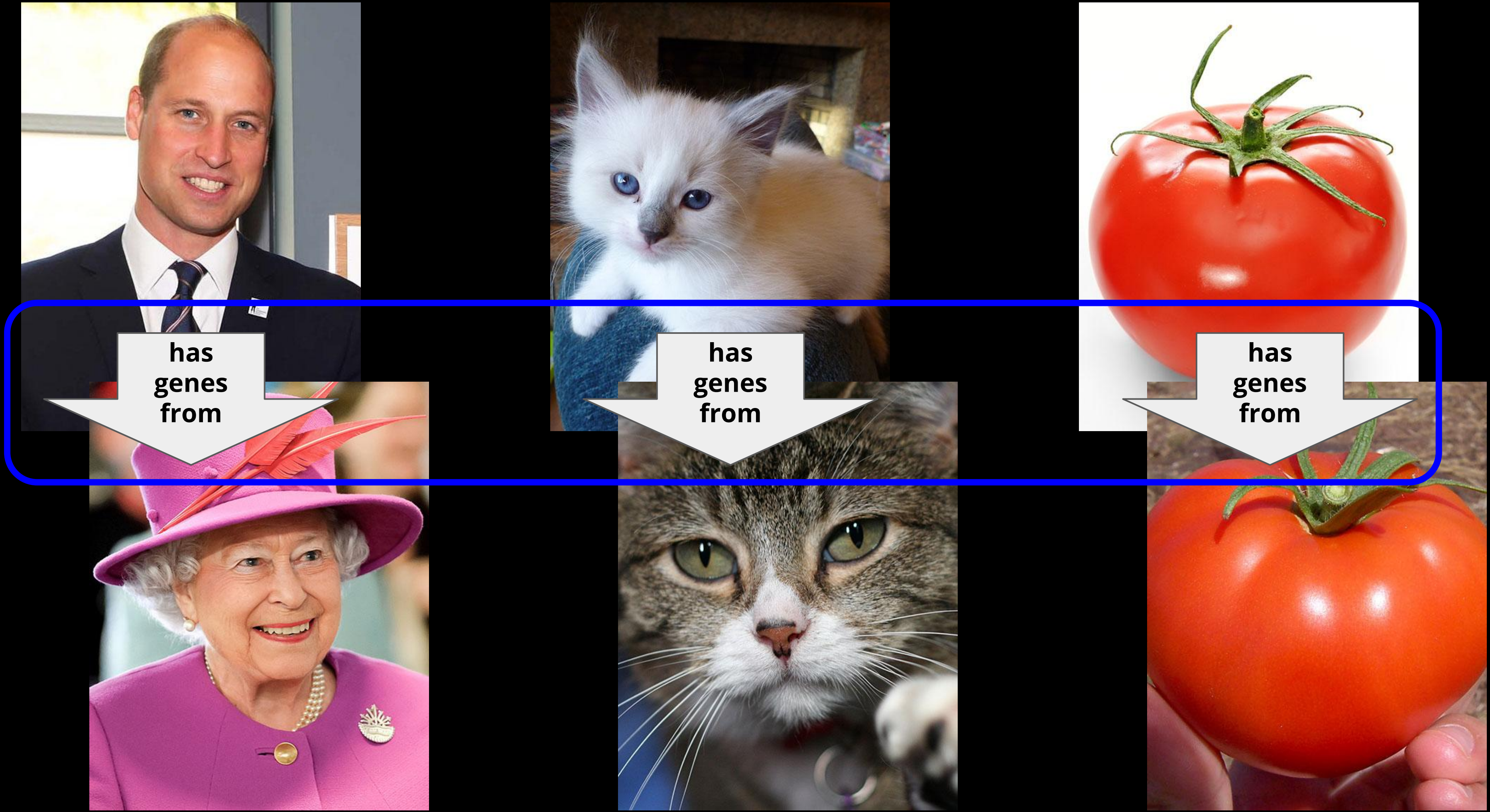
A knowledge graph is a knowledge base of intelligently connected facts about things, from one or more sources.

A knowledge graph is a knowledge base of intelligently connected facts about things, from one or more sources.

A knowledge graph is a knowledge base of intelligently connected facts about things, from one or more sources.

A knowledge graph is a knowledge base of intelligently connected facts about things, from one or more sources.

A knowledge graph is a knowledge base of intelligently connected facts about things, from one or more sources.


has genes from
has genes from
has genes from

A knowledge graph is a knowledge base of intelligently connected facts about things, from one or more sources.

A knowledge graph is a knowledge base of intelligently connected facts about things, from one or more sources.

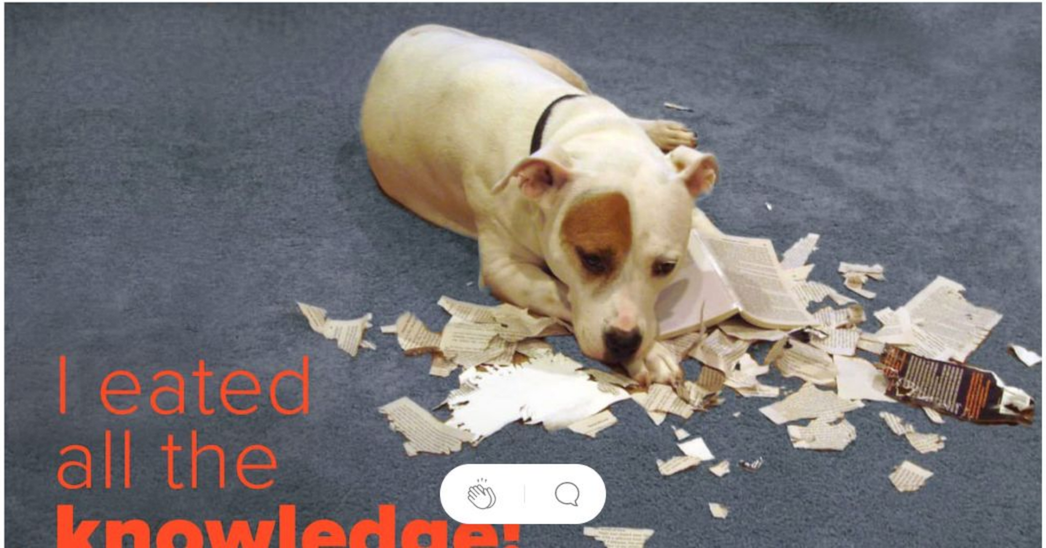
Kendall Clark

Aug 3, 2017 · 9 min read · Listen

What is a Knowledge Graph?

Unconnected Data is a Liability.

Stardog is the world's leading Knowledge Graph platform for the enterprise. But what is a Knowledge Graph, and why should you want one?



Data silos mean unconnected data — and unconnected data *sucks*.

Connectedness is the Solution

A knowledge graph is the only realistic way to manage enterprise data in full generality, at scale, in a world where connectedness is everything. This shouldn't really surprise us given that graphs are all about *connections* and *connectedness*.

The CIO of an enormous American ... ne recently that his organization annually spends 1/3rd of its IT budg... Enterprise Data Silo Problem.

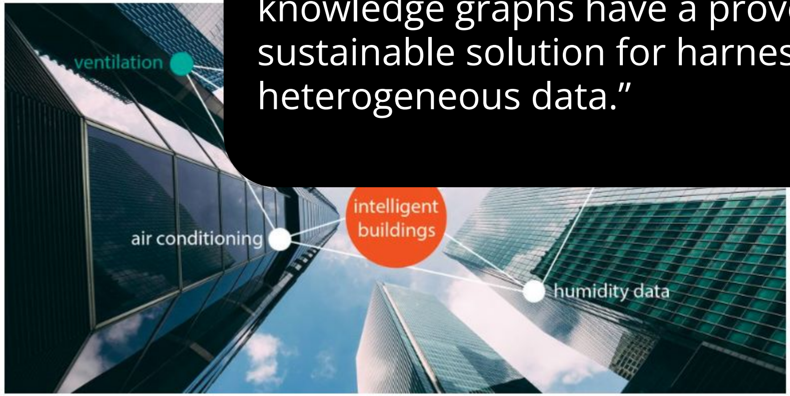
CEO & Cofounder of Stardog, the world's leading Knowledge Graph for the Enterprise.

Smart Buildings Are Built of Smart Data: Knowledge Graphs for Building Automation Systems

The building automation industry faces a growing need for smart data integration in order to manage and utilize the data coming in from controllers, sensors and devices. When it comes to turning data into actionable information, knowledge graphs have a proven record of offering a sustainable solution for harnessing and making sense of heterogeneous data. In this post, we show you the benefits knowledge graph technology brings to the building automation industry.

May 27, 2022 6 mins. read Teodora Petkova

"When it comes to turning data into actionable information, knowledge graphs have a proven record of offering a sustainable solution for harnessing and making sense of heterogeneous data."

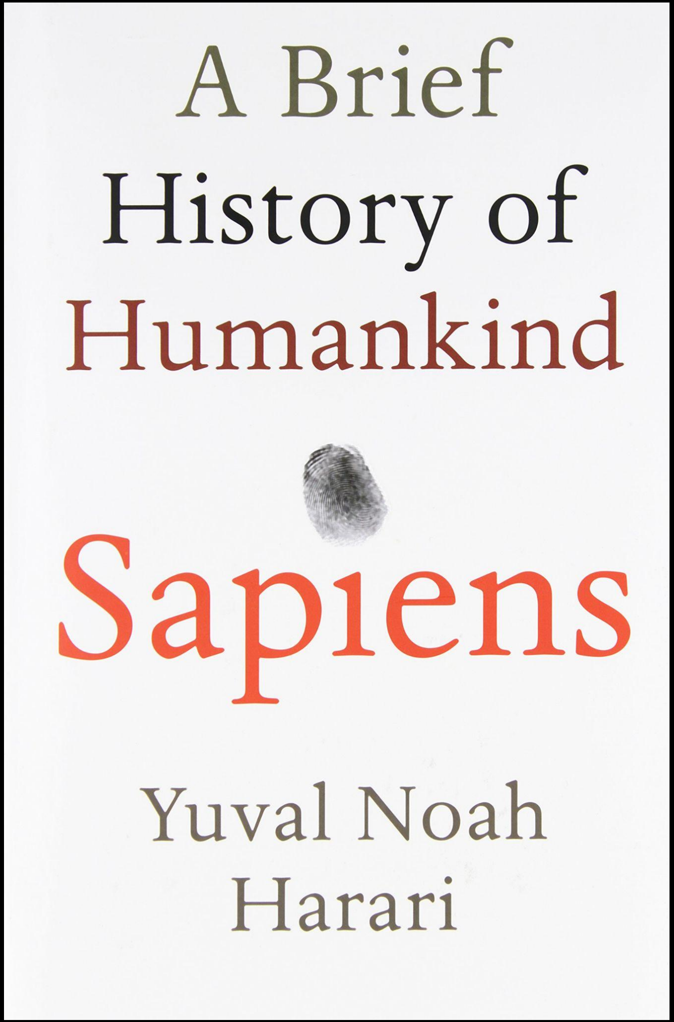


Johnson Controls selected GraphDB to provide semantic data creation and management for their Metasys system – a Top-5 Integrated Building Management System.

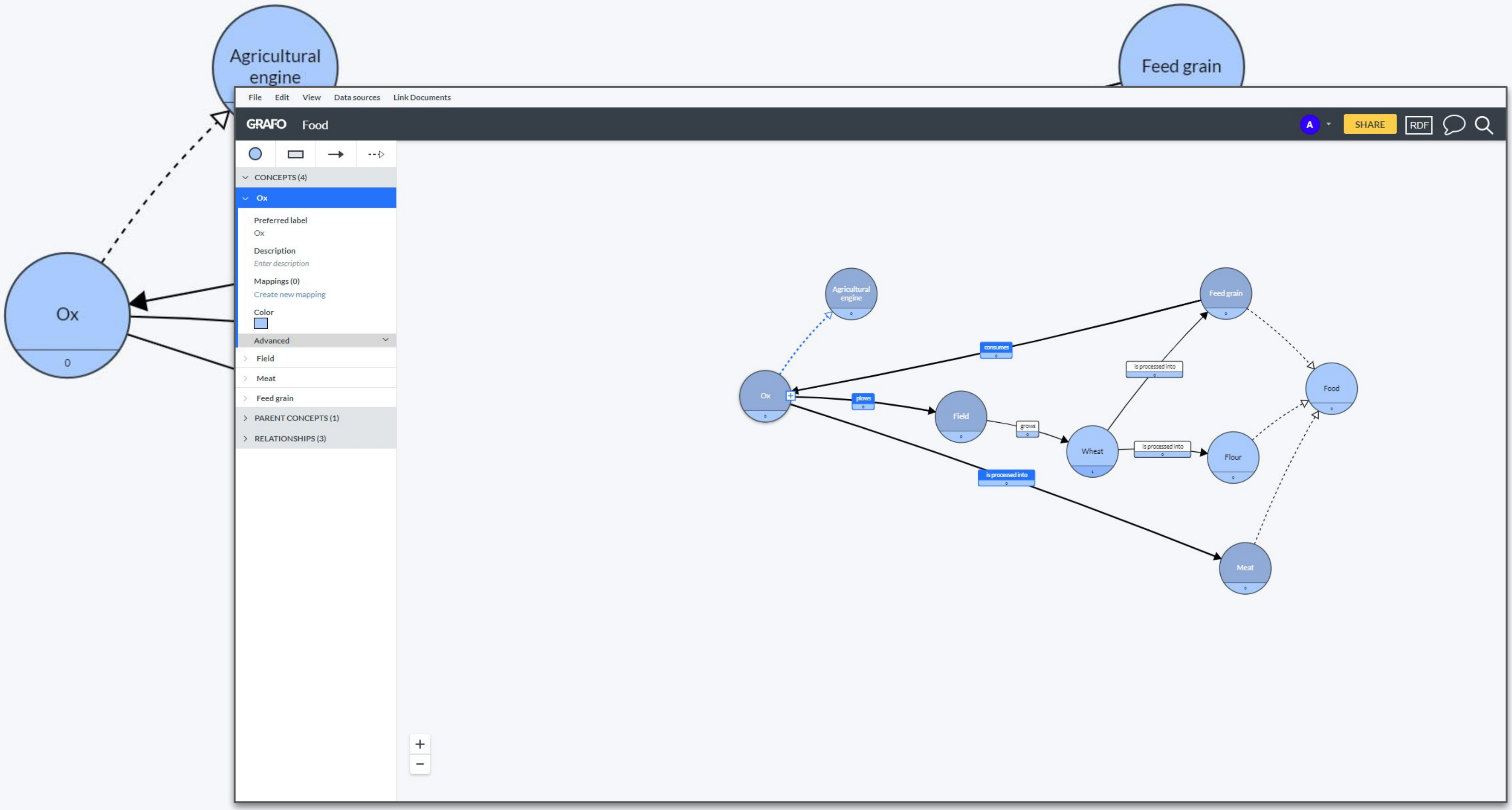
Graphs on the Ground Part III: Knowledge Graphs in Manufacturing

Read about several of the use cases for


Patsy's
Italian Restaurant
of New York since 1944
RESTAURANT
ESTAURANT
BASSO56
BASSO56



"The basics of the forager economy can be reconstructed with some confidence based on quantifiable and objective factors. For example, we can calculate how many calories per day a person needed in order to survive, how many calories were obtained from a kilogram of walnuts, and how many walnuts could be gathered from a square kilometre of forest. With this data, we can make an educated guess about the relative importance of walnuts in their diet."



Agricultural engine
Feed grain
Ox
0
File
Edit
View
Data sources
Link Documents
GRAFO
Food
A
SHARE
RDF
CONCEPTS (4)
Ox
Preferred label
Ox
Description
Enter description
Mappings (0)
Create new mapping
Color
Advanced
Field
Meat
Feed grain
PARENT CONCEPTS (1)
RELATIONSHIPS (3)
Agricultural engine
Feed grain
consumes
is processed into
Food
Ox
plows
Field
grows
Wheat
is processed into
Flour
is processed into
Meat

Welcome to Schema.org

Schema.org is a collaborative, community activity with a mission to create, maintain, and promote schemas for structured data on the Internet, on web pages, in email messages, and beyond.

Schema.org vocabulary can be used with many different encodings, including RDFa, Microdata and JSON-LD. These vocabularies cover entities, relationships between entities and actions, and can easily be extended through a well-documented extension model. Over 10 million sites use Schema.org to markup their web pages and email messages. Many applications from Google, Microsoft, Pinterest, Yandex and others already use these vocabularies to power rich, extensible experiences.

Founded by Google, Microsoft, Yahoo and Yandex, Schema.org vocabularies are developed by an open community process, using the public-schemaorg@w3.org mailing list and through GitHub.

A shared vocabulary makes it easier for webmasters and developers to decide on a schema and get the maximum benefit for their efforts. It is in this spirit that the founders, together with the larger community have come together - to provide a shared collection of schemas.

We invite you to get started!

View our blog at blog.schema.org or see release history for version 14.0.

Recipe

A Schema.org Type

[more...]

A recipe. For dietary restrictions covered by the recipe, a few common restrictions are enumerated via suitableForDiet. The keywords property can also be used to add more detail.

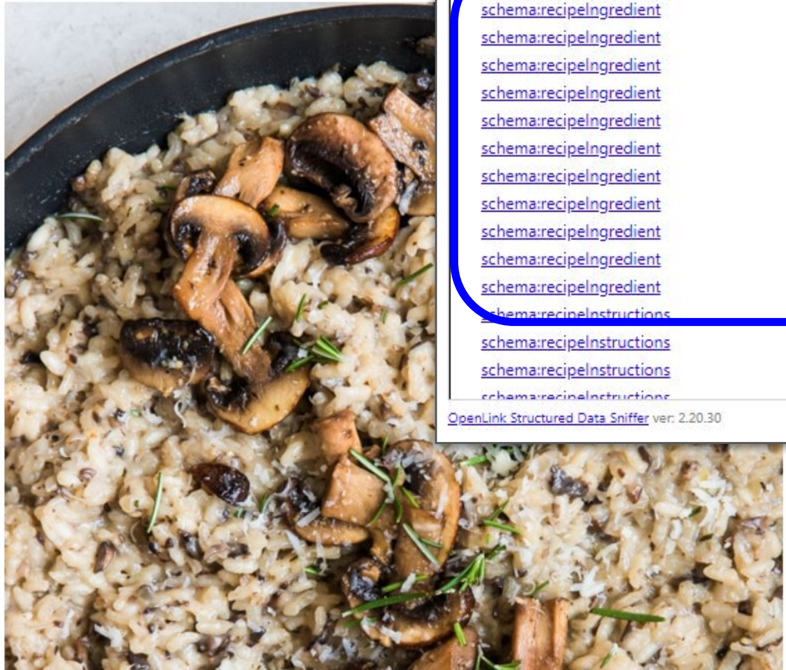
Property	Expected Type	Description
Properties from Recipe		
`cookTime`	Duration	The time it takes to actually cook the dish, in ISO 8601 duration format.
`cookingMethod`	Text	The method of cooking, such as Frying, Steaming, ...
`nutrition`	NutritionInformation	Nutrition information about the recipe or menu item.
`recipeCategory`	Text	The category of the recipe—for example, appetizer, entree, etc.
`recipeCuisine`	Text	The cuisine of the recipe (for example, French or Ethiopian).
`recipeIngredient`	Text	A single ingredient used in the recipe, e.g. sugar, flour or garlic. Supersedes ingredients.
`recipeInstructions`	CreativeWork or ItemList or Text	A step in making the recipe, in the form of a single item (document, video, etc.) or an ordered list with HowToStep and/or HowToSection items.
`recipeYield`	QuantitativeValue or Text	The quantity produced by the recipe (for example, number of people served, number of servings, etc).
`suitableForDiet`	RestrictedDiet	Indicates a dietary restriction or guideline for which this recipe or menu item is suitable, e.g. diabetic, halal etc.
Properties from HowTo		
`estimatedCost`	MonetaryAmount or Text	The estimated cost of the supply or supplies consumed when performing instructions.
`performTime`	Duration	The length of time it takes to perform instructions or a direction (not including time to prepare the supplies), in ISO 8601 duration format.
`prepTime`	Duration	The length of time it takes to prepare the items to be used in instructions or a direction, in ISO 8601 duration format.
`step`	CreativeWork or HowToSection or HowToStep or Text	A single step item (as HowToStep, text, document, video, etc.) or a HowToSection. Supersedes steps.
`supply`	HowToSupply or Text	A sub-property of instrument. A supply consumed when performing instructions or a direction.
`tool`	HowToTool or Text	A sub property of instrument. An object used (but not consumed) when performing instructions or a direction.
`totalTime`	Duration	The total time required to perform instructions or a direction (including time to prepare the supplies), in ISO 8601 duration format.
`yield`	QuantitativeValue or	The quantity that results by performing instructions. For example, a paper airplane, 10

Easy Mushroom Risot
& Parme

SIDES | PUBLISHED OCT 26, 2020 | UPDA

JUMP TO RECIPE PRINT REC

Creamy Mushroom Risotto is easier to make than you
home all in one pan. Be sure to wa



Microdata | JSON-LD | RDFa | POSH | RSS

schema:isPartOf	#article
schema:mainEntityOfPage	#webpage
schema:name	Easy Mushroom Risotto
schema:nutrition	#NutritionInformation
schema:prepTime	PT15M
schema:recipeCategory	Side Dish
schema:recipeCuisine	Italian
schema:recipeIngredient	1 shallot, finely chopped (~ 2 1/2 Tbsp.)
schema:recipeIngredient	1 Tbsp. olive oil
schema:recipeIngredient	1 cup freshly shredded Parmesan cheese
schema:recipeIngredient	1 tsp. garlic, minced
schema:recipeIngredient	1/2 medium white onion, finely chopped (~3/4 cup)
schema:recipeIngredient	2 Tbsp. minced fresh rosemary leaves
schema:recipeIngredient	2 cups arborio rice
schema:recipeIngredient	4 Tbsp. butter, divided
schema:recipeIngredient	6-7 cups chicken broth
schema:recipeIngredient	8 oz. baby bella mushrooms, small dice
schema:recipeIngredient	salt and pepper, to taste
schema:recipeInstructions	#HowToStep
schema:recipeInstructions	#HowToStep_1
schema:recipeInstructions	#HowToStep_2
schema:recipeInstructions	#HowToStep_3

OpenLink Structured Data Sniffer ver: 2.20.30

Welcome to my tiny "korner" on the Internet! I am a Registered Dietitian Nutritionist who loves cookies as much as kale. (OK, maybe I like cookies a little bit more but shh, don't tell anyone). Follow along for hassle free, realistic and

Google

grain

All | Images | Videos | News | Maps | More | Tools

About 1,560,000,000 results (0.54 seconds)

https://en.wikipedia.org › wiki › Grain

Grain - Wikipedia

A **grain** is a small, hard, dry seed – with or without an attached hull or fruit layer – harvested for human or animal consumption. ... A **grain** crop is a **grain**- ...

Grains and cereal · Classification · Cereal grains · Oilseeds

https://en.wikipedia.org › wiki › Grain_(unit)

Grain (unit) - Wikipedia

A **grain** is an obsolescent unit of measurement of mass, and in the troy weight, avoirdupois, and Apothecaries' system, equal to exactly 64.798 91 milligrams.

Unit system: Troy weight, avoirdupois weight… 1 gr in: is equal to
Unit of: Mass SI units: 64.79891 mg

Top stories

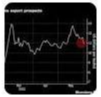
Al Jazeera

UN had 'constructive' talks in Moscow on Russian grain exports

1 day ago

yahoo!finance

Grain Futures Plummet With Ukraine Export Prospects in Focus



1 day ago

EURACTIV.com

Belarus route for Ukrainian grain gives EU leaders hope and headache

2 days ago

Successful Farming

Soybeans close higher but corn, wheat futures end the day under pressure |...

12 hours ago

More news

https://grain.org

GRAIN | Home

GRAIN is a small international non-profit organisation that works to support small farmers and social movements in their struggles for community-controlled ...

https://www.nationalgeographic.org › encyclopedia › g...

More images

Grain

Food

A grain is a small, hard, dry seed – with or without an attached hull or fruit layer – harvested for human or animal consumption. A grain crop is a grain-producing plant. The two main types of commercial grain crops are cereals and legumes. Wikipedia

Serving size

Alternative

Bushel

Colors

Bulk Grains

View 10+ more

Bulk Grains Rye Org...

Bulk Grains Bulgur O...

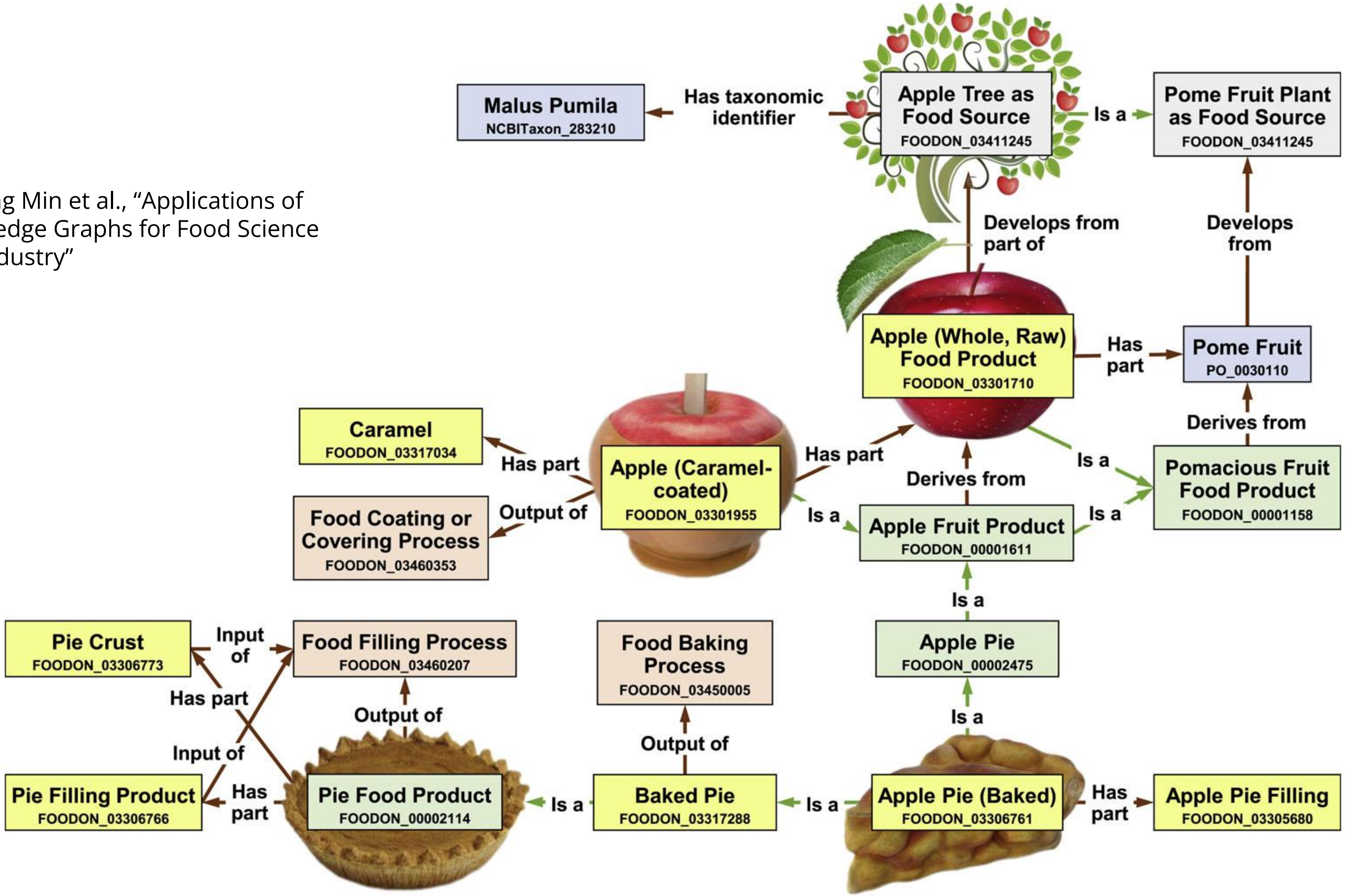
Riceland White Long Gr...

Bulk Grains Organic...

FoodOn: A farm to fork ontology

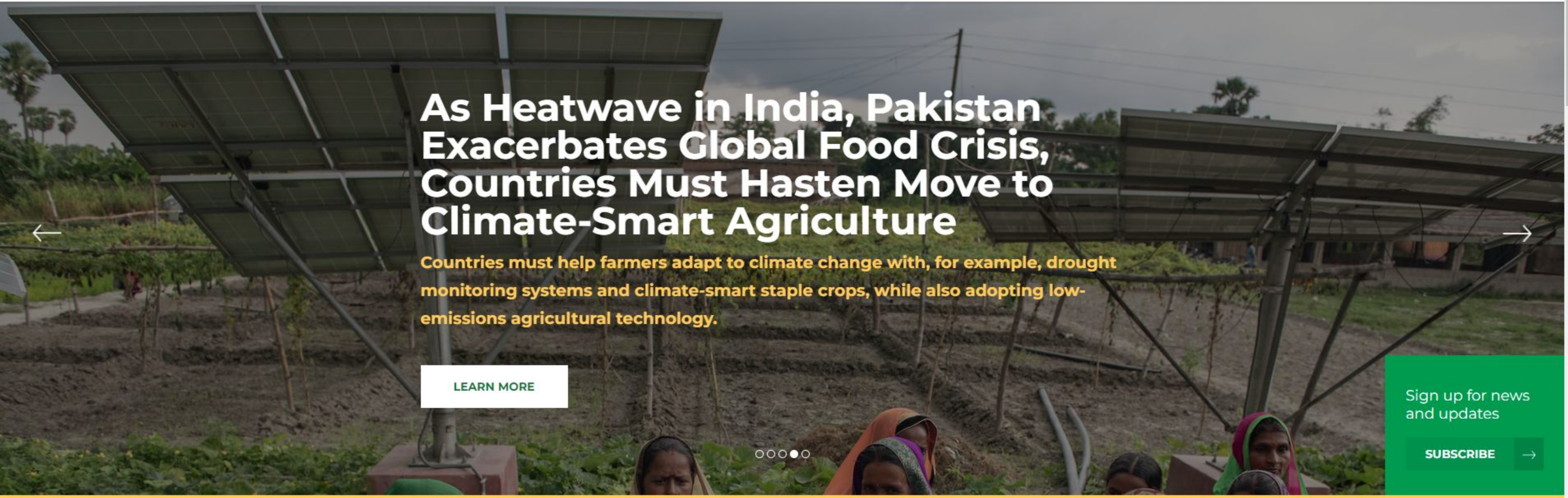
The need to represent knowledge about food is central to many human activities including agriculture, medicine, food safety inspection, shopping patterns, and sustainable development. FoodOn is an ontology – a controlled vocabulary which can be used by both people and computers – to name all parts of animals, plants, and fungai which can bear a food role for humans and domesticated animals, as well as derived food products and the processes used to make them. The ontology can be used like a grammar to construct

Weiqing Min et al., “Applications of Knowledge Graphs for Food Science and Industry”



AGROVOC Multilingual Thesaurus

PREFERRED TERM	**livestock**	
DEFINITION	Domesticated animals such as cattle, pigs, poultry, sheep, horses, goats. Any creature kept for the production of food, wool, skin or fur or for the purpose of its use in the farming of the land or for amenity purposes. (en)	
BROADER CONCEPT	domestic animals (en)	
NARROWER CONCEPTS	asses (en) camels (en) cattle (en) domestic buffaloes (en) gaurs (en) goats (en) sheep (en) swine (en) yaks (en) zebu (en)	
RELATED CONCEPTS	livestock feeding (en)	
ENTRY TERMS	*animal stock (en)* *farm animals (en)*	
INCLUDES	herds (en) horses (en) livestock breeds (en) meat animals (en) milk yielding animals (en) working animals (en)	
IS OBJECT OF ACTIVITY	livestock censuses (en) livestock production (en) livestock-raising (en)	
IN OTHER LANGUAGES	دواب	Arabic
	牲畜 *家畜原种* *农畜*	Chinese
	hospodářská zvířata *dobytek*	Czech



As Heatwave in India, Pakistan Exacerbates Global Food Crisis, Countries Must Hasten Move to Climate-Smart Agriculture

Countries must help farmers adapt to climate change with, for example, drought monitoring systems and climate-smart staple crops, while also adopting low-emissions agricultural technology.

LEARN MORE

Introducing the CGIAR Research Portfolio

Today, research and innovation in food, land and water systems are crucial for a sustainable, climate-resilient world free from hunger and malnutrition. New approaches — and a doubling of investment — are needed to ensure we can achieve the Sustainable Development Goals by 2030. A more integrated and impactful CGIAR is rising to the challenge, with a fresh portfolio of Initiatives to deliver a new 10-year strategy.

Photo: Anindya Phani

ABOUT AgrO

An ontology is a formal representation of a disciplinary domain, representing a semantic standard that can be employed to annotate data where key concepts are defined, as well as the relationships that exist between those concepts (Gruber, 2009). Ontologies provide a common language for different kinds of data to be easily interpretable and interoperable allowing easier aggregation and analysis.

The Agronomy Ontology (AgrO) provides terms from the agronomy domain that are semantically organized and can facilitate the collection, storage and use of agronomic

Contact us

Céline Aubert
Consultant – IFPRI
Email: aubertceline@ymail.com

Marie-Angélique Laporte
Associate Scientist
Alliance Bioversity International-

Table: Ontologies used in AgrO

Ontology acronym	Ontology full name	Ontology content used in AgrO	Example of terms
BFO	Basic Formal Ontology	Foundation of the ontology	entity, continuant, occurrent
ChEBI	Chemical Entities of Biological Interest	Chemical entities along with their biochemical role	role fertilizer, chemical entity
ENVO	Environment Ontology	Environments and entities	animal manure, soil, field
IAO	Information Artifact Ontology	Information entities. Entends OBI	assay, has measurement datum has time stamp
OBI	Ontology for Biomedical Investigations	Study design, protocols and instrumentation	achieves_planned_objective objective_achieved_by
PATO	Phenotype And Trait Ontology	Qualities of entities	adjacent to, contributes to, concentration of,
PECO	Plant Experimental Condition Ontology	Abiotic treatments, growing conditions and study types	silt content exposure, clay content exposure
PO	Plant Ontology	Plant anatomy, morphology and growth	leaf, bud, seed
TO	Plant Trait Ontology	Phenotypic traits in plants	yield trait
UO	Unit Ontology	Units	m, kg, L

Sequences

AGTC

Sequence Ontology
Features and attributes of biological sequence.

Genes

Gene Ontology
Molecular entities focused on 'small' chemical compounds.

Biochemical entities

ChEBI Ontology
Molecular functions, biological processes, cellular components.

Proteins

Protein Ontology
Protein-related entities.

Cell

Cell Ontology
Cell types in animals.

Cell Behavior Ontology
Multi-cell computational models.

Tissues and enzymes

BRENDA tissues and enzyme
Tissues, cell types and enzyme sources.

Anatomy

Anatomical Entity Ontology
Ontology of anatomical structures.

Plant Ontology
Plant anatomy, morphology, growth and development.

Species

NCBI Taxonomy
Organisms' classification and nomenclature.

MycoBank
Mycological nomenclatural novelties.

EPPO
Pest-specific information.

Environment

Environment Ontology
Environmental features and habitats.

Plant Experimental Conditions Ontology
Growth conditions used in plant experiments.

Agronomy

Agronomy Ontology
Agronomic practices, techniques and inputs.

Fisheries and aquaculture

Small-scale fisheries & aquaculture ontology
Fisheries and aquaculture (under development).

Plant phenotype

Crop Ontology
Species-specific phenotypic plant traits.

Phenotype And Trait Ontology
Phenotypic qualities.

Trait Ontology
Phenotypic traits in plants.

Livestock phenotype

Animal Trait Ontology for Livestock
Phenotypes of livestock in their environment.

Phenotype And Trait Ontology
Phenotypic qualities.

Food and nutrition

Food Ontology
Food, fodder and food processes.

Compositional Dietary Nutrition Ontology
Nutritional attributes contributing to human diet.

Socio economics

SEONT
Ontology for agricultural household surveys.

Ontology Development 101: A Guide to Creating Your First Ontology

Natalya F. Noy and Deborah L. McGuinness
Stanford University, Stanford, CA, 94305
noy@smi.stanford.edu and dlm@ksl.stanford.edu

1 Why develop an ontology?

In recent years the development of ontologies—explicit formal specifications of the terms in the domain and relations among them (Gruber 1993)—has been moving from the realm of Artificial-Intelligence laboratories to the desktops of domain experts. Ontologies have become common on the World-Wide Web. The ontologies on the Web range from large taxonomies categorizing Web sites (such as on Yahoo!) to categorizations of products for sale and their features (such as on Amazon.com). The WWW Consortium (W3C) is developing the Resource Description Framework (Brickley and Guha 1999), a language for encoding knowledge on Web pages to make it understandable to electronic agents searching for information. The Defense Advanced Research Projects Agency (DARPA), in conjunction with the W3C, is developing DARPA Agent Markup Language (DAML) by extending RDF with more expressive constructs aimed at facilitating agent interaction on the Web (Hendler and McGuinness 2000). Many disciplines now develop standardized ontologies that domain experts can use to share and annotate information in their fields. Medicine, for example, has produced large, standardized, structured vocabularies such as SNOMED (Price and Spackman 2000) and the semantic network of the Unified Medical Language System (Humphreys and Lindberg 1993). Broad general-purpose ontologies are emerging as well. For example, the United Nations Development Program and Dun & Bradstreet combined their efforts to develop the UNSPSC ontology which provides terminology for products and services (www.unspsc.org).

An ontology defines a common vocabulary for researchers who need to share information in a domain. It includes machine-interpretable definitions of basic concepts in the domain and relations among them.

Why would someone want to develop an ontology? Some of the reasons are:

- To share common understanding of the structure of information among people or software agents
- To enable reuse of domain knowledge
- To make domain assumptions explicit
- To separate domain knowledge from the operational knowledge
- To analyze domain knowledge

Sharing common understanding of the structure of information among people or software agents is one of the more common goals in developing ontologies (Musen 1992; Gruber 1993). For example, suppose several different Web sites contain medical information or provide medical e-commerce services. If these Web sites share and publish the same underlying ontology of the terms they all use, then computer agents can extract and aggregate information from these different sites. The agents can use this aggregated information to answer user queries or as input data to other applications.

Enabling reuse of domain knowledge was one of the driving forces behind recent surge in ontology research. For example, models for many different domains need to represent the notion of time. This representation includes the notions of time intervals, points in time, relative measures of time, and so on. If one group of researchers develops such an ontology in detail, others can simply reuse it for their domains. Additionally, if we need to build a large

Wine Agent: Semantic Web Testbed Application

Eric I. Hsu and Deborah L. McGuinness
Knowledge Systems Laboratory
Stanford University
{ehsu, dlm}@ksl.stanford.edu

Abstract

The Wine Agent is a demonstration system that uses an underlying domain ontology to provide suitable wines for a given meal. In doing so it serves as a testbed, not only for the logical domain description, but additionally for emerging Semantic Web technologies that process, infer, justify, and execute the pairings. Specifically, it combines the the DAML+OIL and OWL Web-based description logics with the JTP theorem prover. The resulting knowledge base can be queried remotely via the DQL query language. Suitable pairings are explained within the Inference Web apparatus, and then transacted via a preliminary implementation of Web Services. Besides serving as a prototype for these methodologies, the wine agent has provided useful empirical lessons regarding reasoning via Semantic Web axioms, language requirements, and requirements for explanation, as well as pragmatic issues concerning implementation and integration.

1 Overview

The Wine Agent is accessed over the Web, at http://onto.stanford.edu:8080

The main interface, shown in Figure 1, allows the user to select a type of course that will be served from a mock-up menu. Alternatively, they can select a specific individual food, in which case the Wine Agent will make an additional set of inferences in order to determine the type of course for that food, and then proceed as if the user had chosen that type.

The result of one such interaction, where the user has chosen a pasta with spicy red sauce, is shown in Figure 1. The Wine Agent lists the requisite properties of a suitable wine, in terms of the wine's color, sugar, body, and flavor. This statement is appended with a link to an inference web explanation, and then followed by a listing of individual wines meeting the desired characteristics. A link labeled "Web Inventory Search" instructs the agent to search various external sites for these wines, offering them for direct purchase. In case this provides an inadequate number of options, the Wine Agent also identifies general varietals featuring the targeted characteristics. Each is displayed as a link to a specific merchant, wine.com, whose inventory of that specific varietal can be browsed or searched by the user.

The Wine Agent employs a suite of emerging Semantic Web formalisms in order to derive this functionality from a core ontology that describes the general properties of meals, foods, and wines. The ontology is expressed using the description logics

source: https://www.freeimages.com/search/food-question-mark

FoodKG: A Semantics-Driven Knowledge Graph for Food Recommendation

Fork me on GitHub

The proliferation of recipes and other food information on the Web presents an opportunity for discovering and organizing diet-related knowledge into a knowledge graph. Currently, there are several ontologies related to food, but they are specialized in specific domains, e.g., from an agricultural, production, or specific health condition point-of-view. There is a lack of a unified knowledge graph that is oriented towards consumers who want to eat healthily, and who need an integrated food suggestion service that encompasses food and recipes that they encounter on a day-to-day basis, along with the provenance of the information they receive. Our resource contribution is a software toolkit that can be used to create a unified food knowledge graph that links the various silos related to food while preserving the provenance information.

Resources

- Demo Videos: Demonstration videos shared here.
- FoodKG construction: we describe the construction process of our knowledge graph and make available all the scripts that were used.
- What To Make Ontology and Application: An Ontology modeled to to let a user determine what recipe to make based on ingredients at hand while taking constraints such as allergies into account.
- Answering Natural Language Questions over FoodKG: A cognitive agent that can perform natural language question answering on the knowledge graph.

Knowledge Graph Store

To load the integrated knowledge graph that will be generated using the software we have provided, we recommend using Blazegraph. Please follow the instructions in the User Guide to download, install, and load the RDF data in to the Blazegraph endpoint on your system.

Optionally, you may use whyis as your knowledge graph store.

Team

FoodKG is a research and development effort of the Health Empowerment by Analytics Learning and Semantics (HEALS) project.

The team members include:

- Ching-Hua Chen, IBM Research, USA
- Deborah L. McGuinness, Rensselaer Polytechnic Institute
- Nidhi Rastogi, Rensselaer Polytechnic Institute
- Oshani Seneviratne, Rensselaer Polytechnic Institute
- Sola Shirai, Rensselaer Polytechnic Institute
- Ananya Subburathinam, Rensselaer Polytechnic Institute
- Mohammed J. Zaki, Rensselaer Polytechnic Institute

source: https://www.freeimages.com/search/food-question-mark.

Answering Natural Language Questions over FoodKG

We demonstrate a potential use of our FoodKG for answering natural language questions over knowledge graphs, aka, knowledge base question answering (KBQA). Given questions in natural language such as "what Indian dishes can I make with chicken and garlic?", our goal here is to automatically find answers from the FoodKG. We believe this is a natural way to access a large-scale knowledge graph, especially for non-experts users. Moreover, in this way, our FoodKG is able to benefit users by providing nutrition facts of ingredients and diverse recipe options in a user-friendly way. To this end, we build this application which is **Answering Natural Language Questions over FoodKG**. We first create a synthetic Q&A dataset based on our FoodKG using a set of manually designed question templates. Then we train a state-of-the-art neural network-based KBQA model called BAMnet on the Q&A dataset. After training the KBQA model, it is supposed to answer similar natural language questions based on the FoodKG.

Prerequisites

In order to run the following experiments, you will need to first download the code. All relevant code is in the **app_kbqa** folder. This code is written in python 3. You will need to install a few python packages in order to run the code. We recommend you to use `virtualenv` to manage your python packages and environments. Please take the following steps to create a python virtual environment.

1. If you have not installed virtualenv, install it with `pip install virtualenv`.
2. Create a virtual environment with `virtualenv venv`.
3. Activate the virtual environment with `source venv/bin/activate`.
4. Install the package requirements with `pip install -r requirements.txt`.

Create a synthetic Q&A dataset

Fetch KG subgraphs from a remote KG stored in Blazegraph

We assume you have already loaded the FoodKG into Blazegraph. If not, please follow the instructions in the User Guide to download, install, and load the FoodKG RDF data in to the Blazegraph endpoint on your system. Please also confirm that the variable `USE_ENDPOINT_URL` hard-coded in **data_builder/src/config/data_config.py** matches the URL and namespace of your Blazegraph instance.

1. Go to the data_builder/src folder, run the following cmd:

```
python usda.py -o [qas_dir]
python recipe.py -o [qas_dir]
```

   In the [qas_dir] folder, you will see two JSON files: **usda_subgraphs.json** which is for the USDA data and **recipe_kg.json** which is for the Recipe1M data.

2. Note that in the recipe data, a few tags contain more than 5000 recipes which might cause Out of Memory issue when running the KBQA system. So you may want to create a smaller recipe dataset by randomly keeping at most 2000 recipes under each recipe tag. In order to do that, run the following cmd:

```
python filterout_recipe.py -recipe [qas_dir/recipe_kg.json] -o [qas_dir/sampled_recipe_kg.json] -max_dish_count_per_tag 2000
```

3. Now, you can merge the above two files into a single file using the following cmd:

```
cat [qas_dir/usda_subgraphs.json] [qas_dir/sampled_recipe_kg.json] > [qas_dir/foodkg.json]
```

   This is the local KG file which will be accessed by a KBQA system.

Google Play Games Apps Movies & TV Books Children

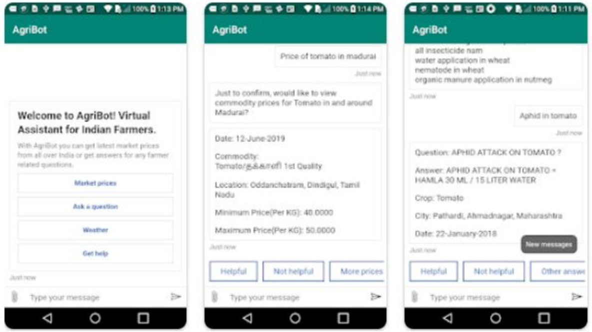
AgriBot - Virtual Assistant for Farmers

Adhish Technologies

100+ Downloads | E Everyone ⓘ

Install | Add to wishlist

This app is available for all of your devices



About this app →

A Modern Way of Staying a Step Ahead in Agriculture

Developer contact

Similar apps →

Hombli
Hombli

Gluten Dude
Scott Hayes
4.4 ★

HomeHabit - Smart Home Dashboard
Habit Automated LLC
3.8 ★

Q - caterpiler on grem damage?
A - spray quinolphos 30ml/15 l water

Second, some of the queries are registered in the regional language which poses a problem in pre-processing the data because the translation resources for specific languages are

For now, we consider English as a primary language and remove the queries registered in other languages. We then cleaned our data, which includes lower casing words, removing stop-words and stem to the roots. Then apart from using the current spell correct[11] for English dictionary, we develop our spell correct for local language words which may have appeared in the query mainly the crop names (Fig. 3). We then removed weather-related queries from our

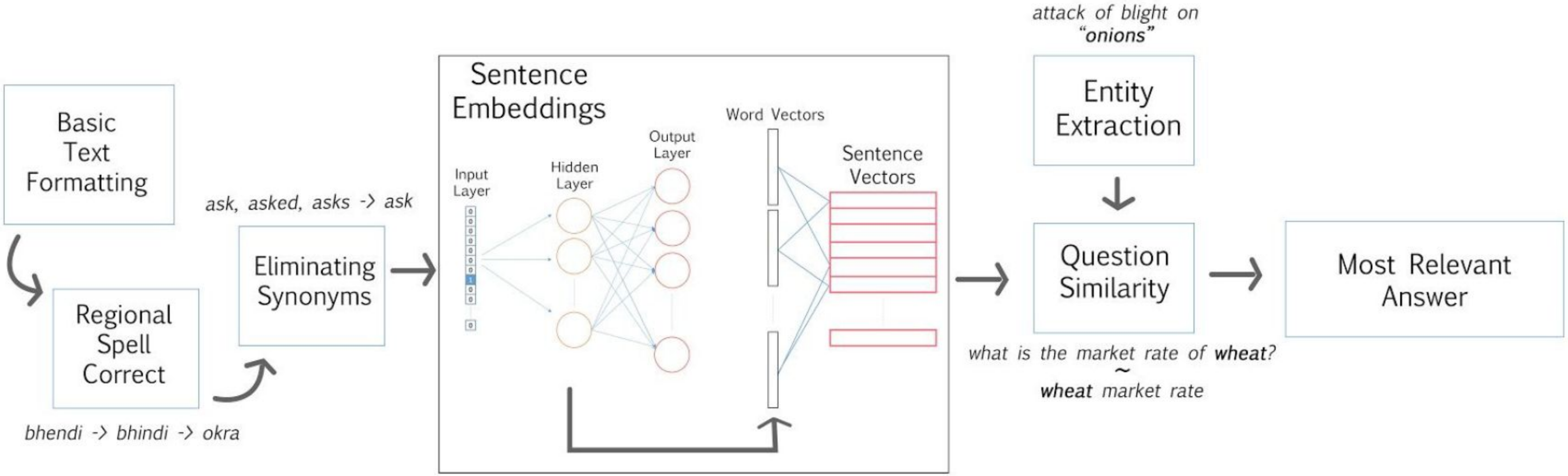


Fig. 3. Overview of the Sen2Vec model

Naman Jain et al., "AgriBot: Agriculture-Specific Question Answer System"

International Conference on Database Systems for Advanced Applications
↳ DASFAA 2019: **Database Systems for Advanced Applications** pp 533–537 | Cite as

AgriKG: An Agricultural Knowledge Graph and Its Applications

Yuanzhe Chen, Jun Kuang, Dawei Cheng, Jianbin Zheng, Ming Gao & Aoying Zhou

Conference paper | First Online: 24 April 2019

Part of the Lecture Notes in Computer Science book series (LNISA,volume 11448)

Sections | Figures | References

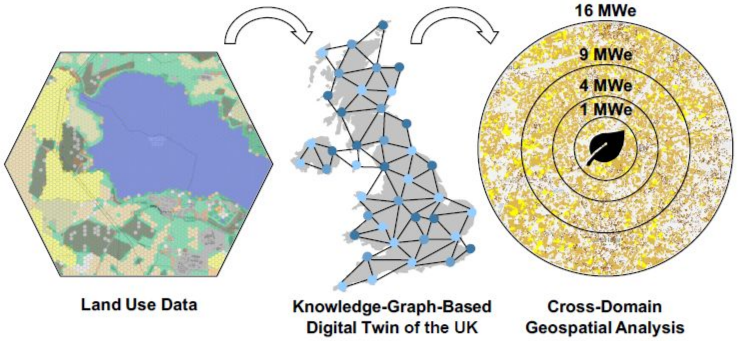
Abstract
Notes
References
Acknowledgments
Author information

Abstract

Recently, with the development of information and intelligent technology, agricultural production and management have been significantly boosted. But it still faces considerable challenges on how to effectively integrate large amounts of fragmented information for downstream applications. To this end, in this paper, we propose an agricultural knowledge graph, namely AgriKG, to automatically integrate the massive agricultural data from internet. By applying the NLP and deep learning techniques, AgriKG can automatically recognize agricultural entities from unstructured text, and link them to form a knowledge graph. Moreover, we illustrate typical scenarios of our AgriKG and validate it by real-world applications, such as **agricultural entity retrieval**, and **agricultural question answering**, etc.

Abstract

This paper develops an ontological description of land use and applies it to incorporate geospatial information describing land coverage into a knowledge-graph-based Universal Digital Twin. Sources of data relating to land use in the UK have been surveyed. The Crop Map of England (CROME) is produced annually by the UK Government and was identified as a valuable source of open data. Formal ontologies to represent land use and the geospatial data arising from such surveys have been developed. The ontologies have been deployed using a high-performance graph database. A customised vocabulary was developed to extend the geospatial capabilities of the graph database to support the CROME data. The integration of the CROME data into the Universal Digital Twin is demonstrated in a cross-domain use case that combines data about land use with a geospatial analysis of scenarios for energy provision. Opportunities for the extension and enrichment of the ontologies, and further development of the Universal Digital Twin are discussed.



Jethro Akroyd et al., “Universal Digital Twin – Land Use”

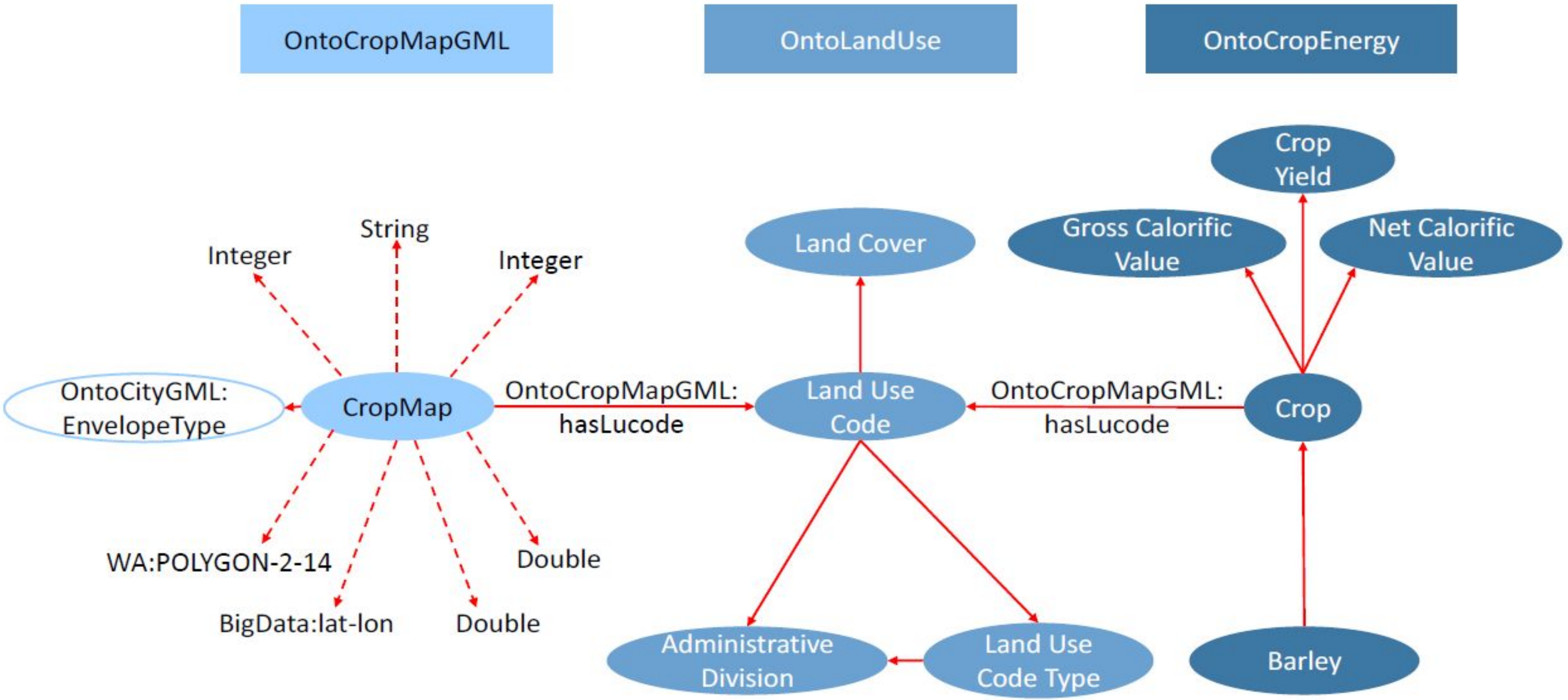
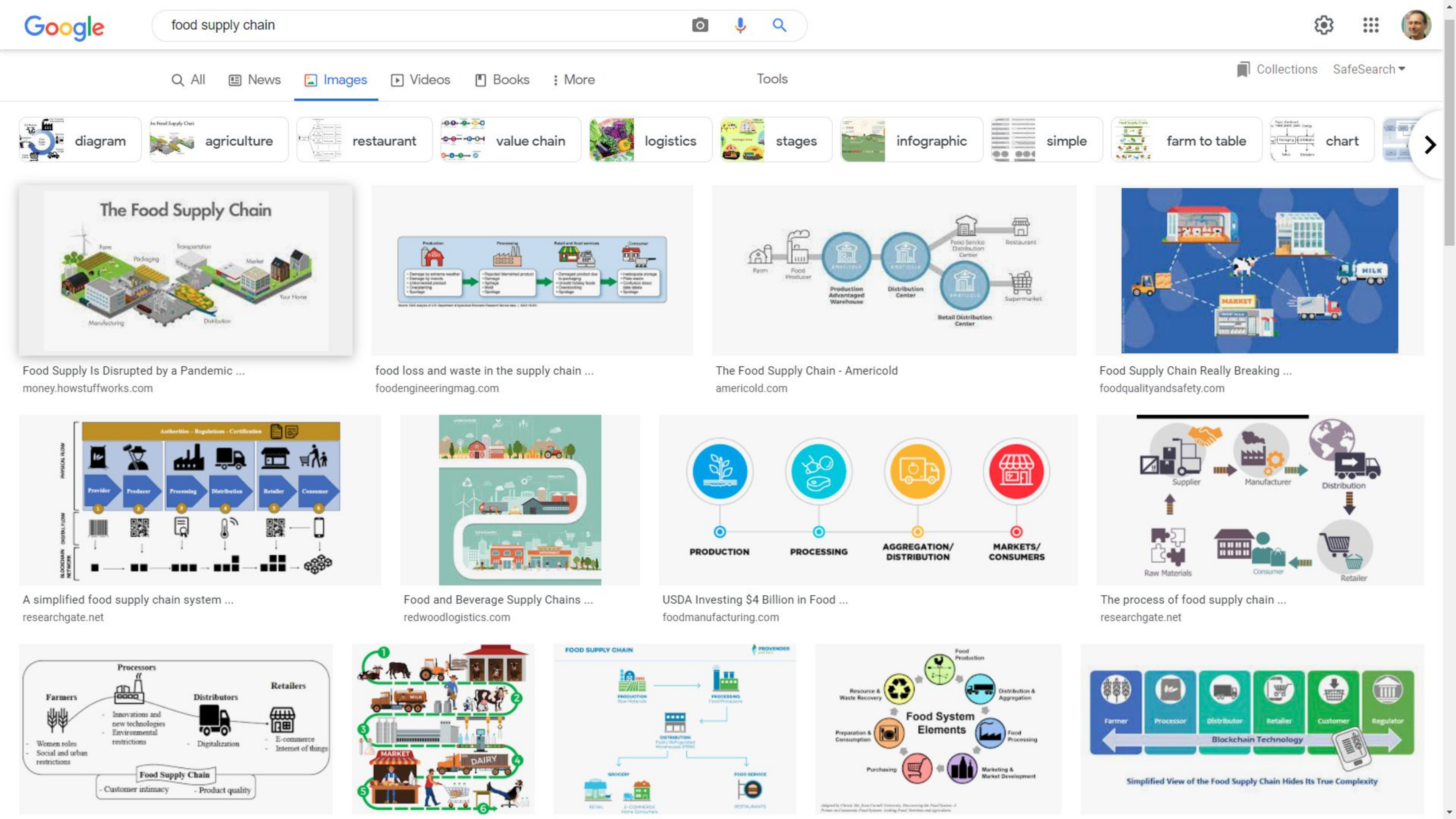
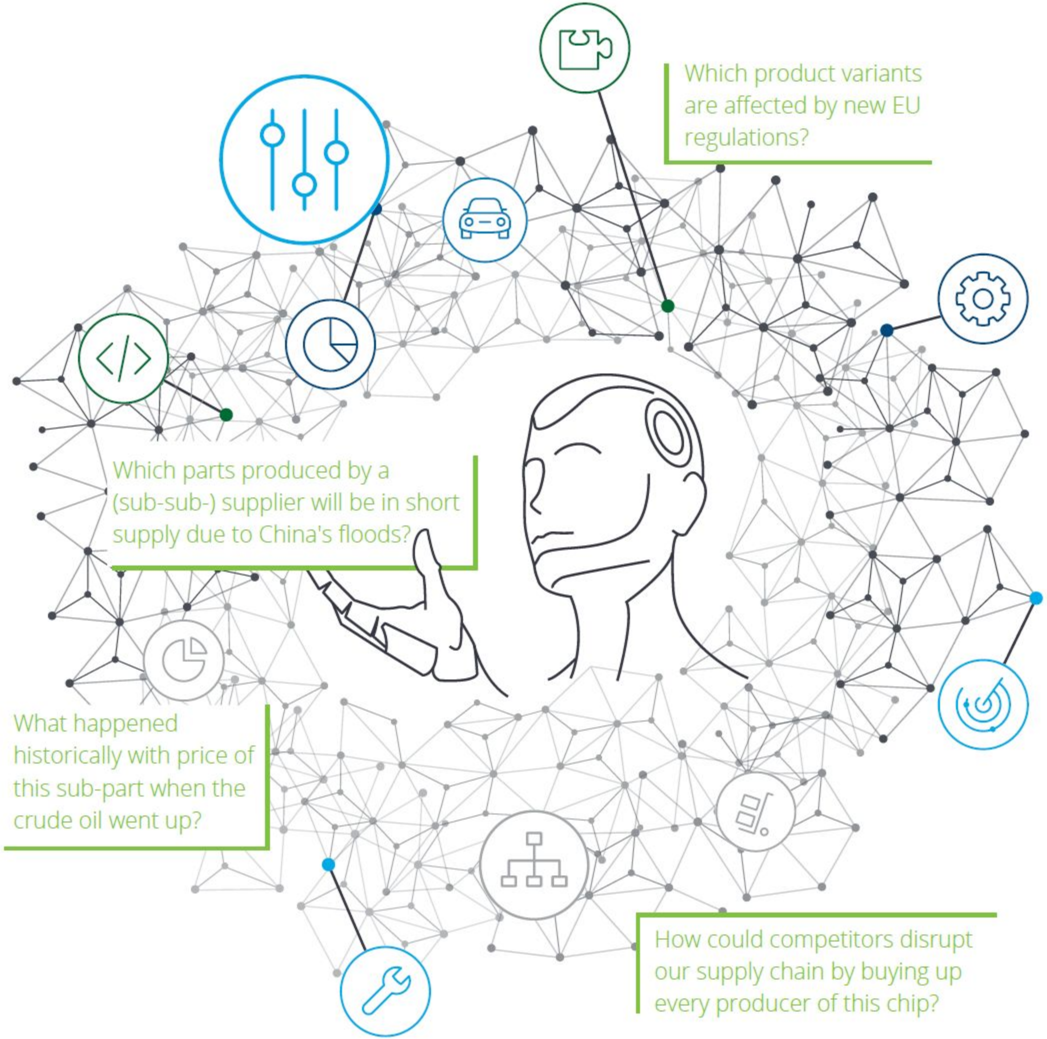


Figure 6: *Interconnection between the OntoLandUse, OntoCropMapGML and OntoCropEnergy ontologies.*



Google
food supply chain
All
News
Images
Videos
Books
More
Tools
Collections
SafeSearch
diagram
agriculture
restaurant
value chain
logistics
stages
infographic
simple
farm to table
chart
The Food Supply Chain
Food Supply Is Disrupted by a Pandemic ...
money.howstuffworks.com
food loss and waste in the supply chain ...
foodengineeringmag.com
The Food Supply Chain - Americold
americold.com
Food Supply Chain Really Breaking ...
foodqualityandsafety.com
A simplified food supply chain system ...
researchgate.net
Food and Beverage Supply Chains ...
redwoodlogistics.com
PRODUCTION
PROCESSING
AGGREGATION/ DISTRIBUTION
MARKETS/ CONSUMERS
USDA Investing $4 Billion in Food ...
foodmanufacturing.com
Supplier
Manufacturer
Distribution
Raw Materials
Consumer
Retailer
The process of food supply chain ...
researchgate.net
Processors
Farmers
Distributors
Retailers
Food Supply Chain
FOOD SUPPLY CHAIN
Food System Elements
Farmer
Processor
Distributor
Retailer
Customer
Regulator
Blockchain Technology
Simplified View of the Food Supply Chain Hides Its True Complexity



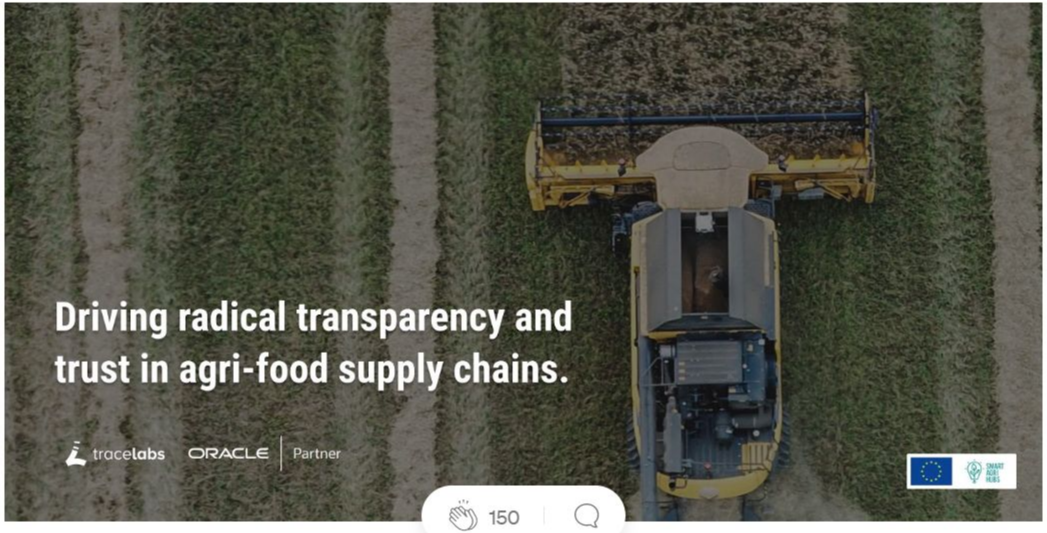
Deloitte, “Wisdom of Enterprise Knowledge Graphs”

neo4j, “Graphs in Supply Chain Management”

Trace Labs

Mar 29, 2021 · 9 min read · Listen

EU-funded SmartAgriHubs flagship innovation experiments deployed: Trace Labs driving radical transparency and trust in agri-food supply chains with OriginTrail and Oracle Blockchain Platform



150

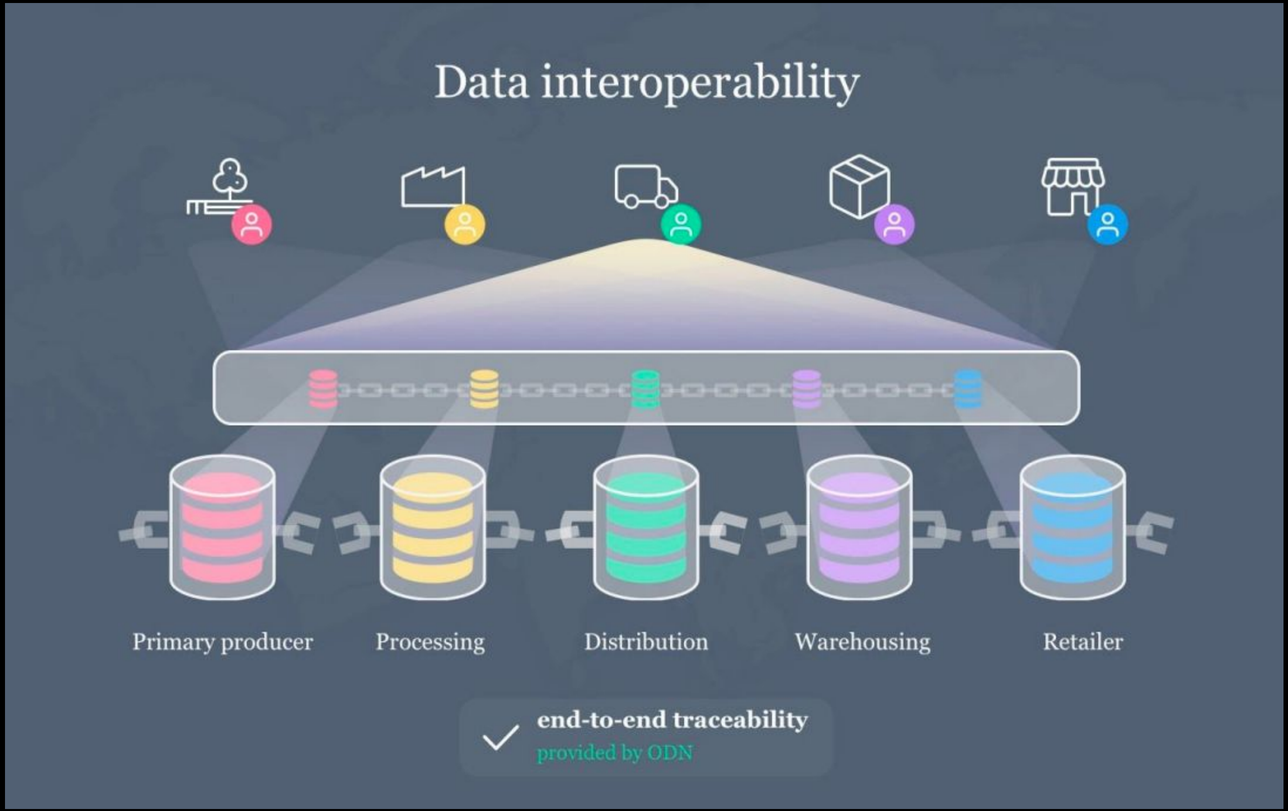
Search

Trace Labs

76 Followers

Trusted network applications for business communities of the future. Core development company of the @origin_trail protocol. #connectthedots

Follow



OriginTrail Whitepaper, 2017

Tim Berners-Lee
Date: 2006-07-27, last change: $Date: 2009/06/18 18:24:33 $
Status: personal view only. Editing status: imperfect but published.
Up to Design Issues

Linked Data

The Semantic Web isn't just about putting data on the web. It is about making links, so that a person or machine can explore the web of data. With linked data, when you have some of it, you can find other, related, data.

Like the web of hypertext, the web of data is constructed with documents on the web. However, unlike the web of hypertext, where links are relationships anchors in hypertext documents written in HTML, for data they links between arbitrary things described by RDF,. The URIs identify any kind of object or concept. But for HTML or RDF, the same expectations apply to make the web grow:

1. Use URIs as names for things

2. Use HTTP URIs so that people can look up those names.

3. When someone looks up a URI, provide useful information, using the standards (RDF*, SPARQL)

4. Include links to other URIs. so that they can discover more things.

Simple. In fact, though, a surprising amount of data isn't linked in 2006, because of problems with one or more of the steps. This article discusses solutions to these problems, details of implementation, and factors affecting choices about how you publish your data.

Recognizing Fake FAIR

Published on April 8, 2022

The real or the fake Venice?

Andreas Thalhammer
Senior Data Scientist at Roche Information Solutions

FAIR is a recurring buzzword in modern enterprise-level data management. This has led to the fact that, in various enterprises, almost any new data initiative sets out by stating

future internet

Review

Charting Past, Present, and Future Research in the Semantic Web and Interoperability

Abderahman Rejeb [1], John G. Keogh [2,*], Wayne Martindale [3], Damion Dooley [4], Edward Smart [5], Steven Simske [6], Samuel Fosso Wamba [7], John G. Breslin [8], Kosala Yapa Bandara [8], Subhasis Thakur [8], Kelly Liu [9], Bridgette Crowley [9], Sowmya Desaraju [9], Angela Ospina [10] and Horia Bradau [2]

1 Department of Management and Law, Faculty of Economics, University of Rome Tor Vergata, Via Columbia, 2, 00133 Rome, Italy; abderahman.rejeb@students.uniroma2.eu
2 McGill Centre for the Convergence of Health and Economics (MCCHE), Montreal, QC H3C 3J7, Canada; horia.bradau@nutriscope.ca
3 National Centre for Food Manufacturing, Centre of Excellence Technology Park, University of Lincoln, Holbeach, Spalding PE12 7LD, UK; wmartindale@lincoln.ac.uk
4 Centre for Infectious Disease Genomics and One Health, Simon Fraser University, Burnaby, BC V5A 1S6, Canada; damion_dooley@sfu.ca
5 Institute of Industrial Research, University of Portsmouth, Portsmouth PO1 2DY, UK; edward.smart@port.ac.uk
6 Systems Engineering Department, Colorado State University, Fort Collins, CO 80523, USA; steve.simske@colostate.edu
7 Department of Information, Operations and Management Sciences, Toulouse Business School, 31068 Toulouse, France; s.fosso-wamba@tbs-education.fr
8 Data Science Institute, National University of Ireland Galway, H91 TK33 Galway, Ireland; john.breslin@nuigalway.ie (J.G.B.); kosalayb@gmail.com (K.Y.B.); subhasis.thakur@insight-centre.org (S.T.)
9 McGill MCCHE Summer Research Intern Program, Montreal, QC H2Y 2E7, Canada; crkellyliu@gmail.com (K.L.); bridgette.crowley@icloud.com (B.C.); sowmyad96@gmail.com (S.D.)
10 Institut D'études Européennes (IEE), Université Libre de Bruxelles, 1050 Brussels, Belgium; ajospinae@gmail.com
* Correspondence: john@shantalla.org

Citation: Rejeb, A.; Keogh, J.G.; Martindale, W.; Dooley, D.; Smart, E.; Simske, S.; Wamba, S.F.; Breslin, J.G.; Bandara, K.Y.; Thakur, S.; et al. Charting Past, Present, and Future Research in the Semantic Web and Interoperability. *Future Internet* **2022**, *14*, 161. https://doi.org/10.3390/fi14060161

Academic Editors: Diego Reforgiato Recupero and Alessandro Sebastian Podda

Received: 18 April 2022
Accepted: 18 May 2022
Published: 25 May 2022

Abstract: Huge advances in peer-to-peer systems and attempts to develop the semantic web have revealed a critical issue in information systems across multiple domains: the absence of semantic interoperability. Today, businesses operating in a digital environment require increased supply-chain automation, interoperability, and data governance. While research on the semantic web and interoperability has recently received much attention, a dearth of studies investigates the relationship between these two concepts in depth. To address this knowledge gap, the objective of this study is to conduct a review and bibliometric analysis of 3511 Scopus-registered papers on the semantic web and interoperability published over the past two decades. In addition, the publications were analyzed using a variety of bibliometric indicators, such as publication year, journal, authors, countries, and institutions. Keyword co-occurrence and co-citation networks were utilized to identify the primary research hotspots and group the relevant literature. The findings of the review and bibliometric analysis indicate the dominance of conference papers as a means of disseminating knowledge and the substantial contribution of developed nations to the semantic web field. In addition, the keyword co-occurrence network analysis reveals a significant emphasis on semantic web languages, sensors and computing, graphs and models, and linking and integration techniques. Based on the co-citation clustering, the Internet of Things, semantic web services, ontology mapping, building information modeling, bioinformatics, education and e-learning, and semantic web languages were identified as the primary themes contributing to the flow of knowledge and the growth of the semantic web and interoperability field. Overall, this review substantially contributes to the literature and increases scholars' and practitioners' awareness of the current knowledge composition and future research directions of the semantic web field.

Keywords: semantic web; interoperability; ontology; internet of things; semantic web services; bioinformatics; building information modeling; bibliometric

THANK YOU!

Stay connected

twitter.com/aaranged
linkedin.com/in/aaranged