Intelligent use of data by computers for surveillance: the case for ontologies

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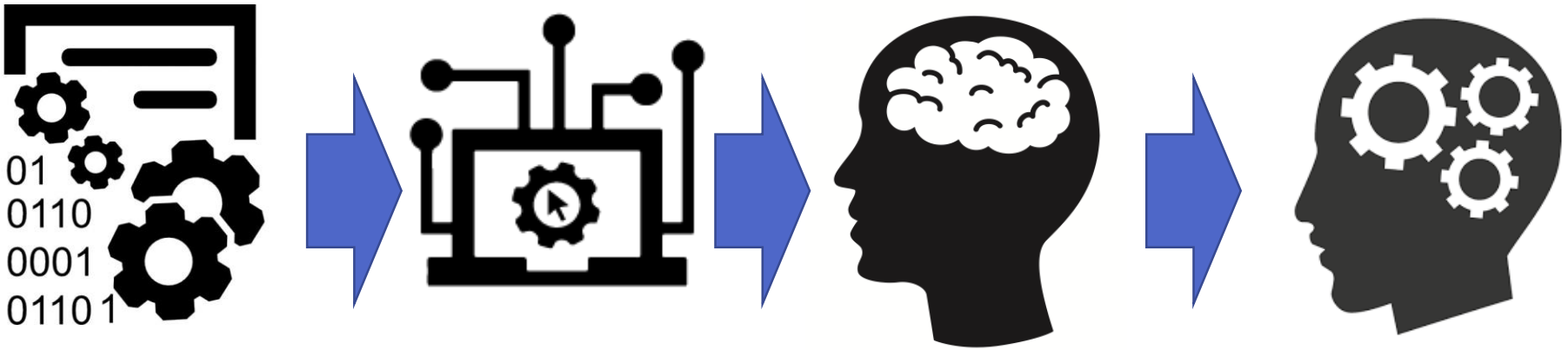


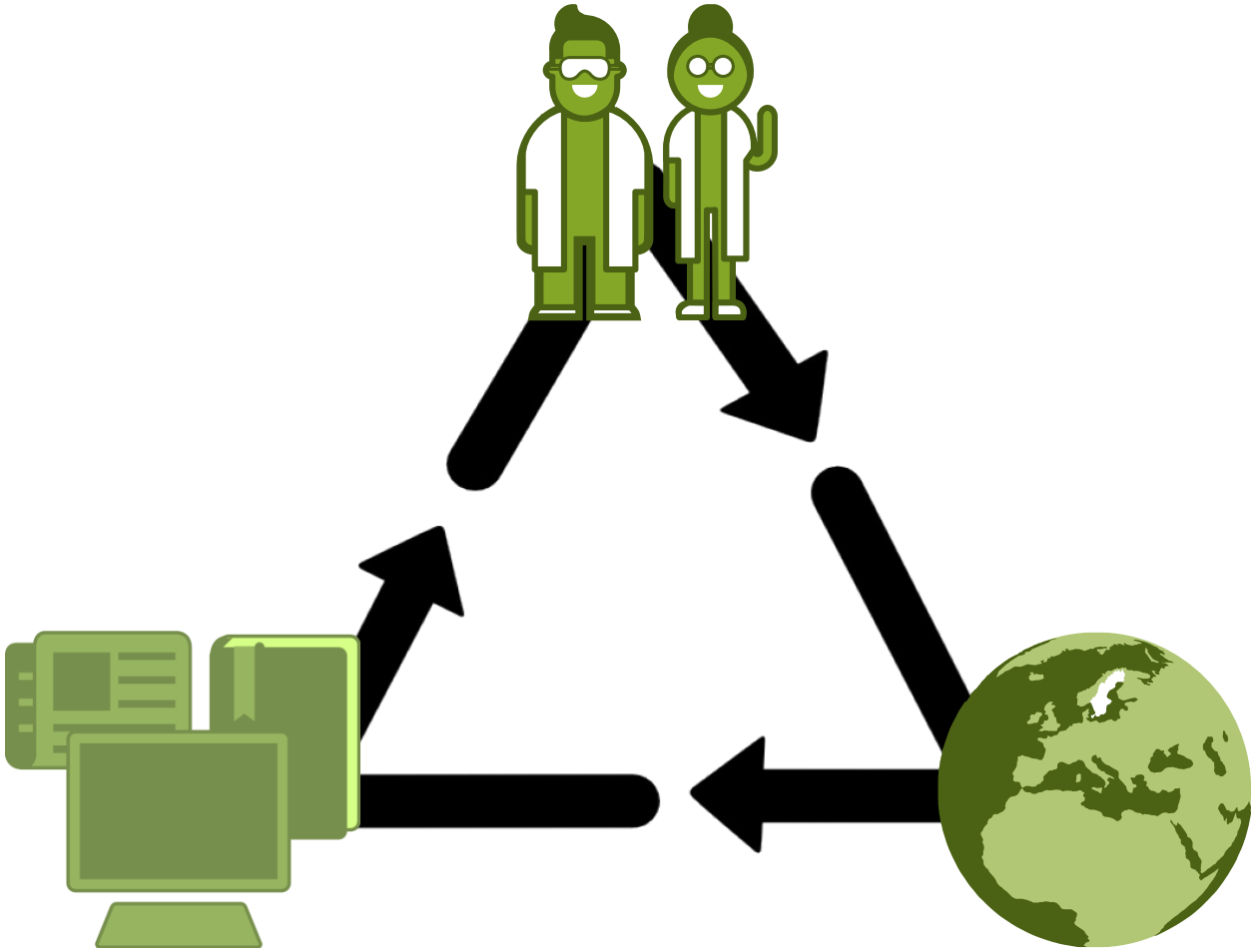
Data Information Knowledge Understanding

Epidemiological data collection is about technology, but effective disease surveillance is about people

People matter in animal disease surveillance: Challenges and opportunities for the aquaculture sector

Cecile Brugere
Dennis Mark Onuigbo
Kenton Ll. Morgan

Interoperability



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Leonardo da Vinci - Wikipedia
https://en.wikipedia.org/wiki/Leonardo_da_Vinci
Leonardo di ser Piero da Vinci more commonly **Leonardo da Vinci** or simply Leonardo, was an Italian Renaissance polymath whose areas of interest included ...
Vitruvian Man · The Last Supper · Mona Lisa · Lady with an Ermine

Leonardo da Vinci - Artist, Mathematician, Inventor, Writer - Biography ...
https://www.biography.com/people/leonardo-da-vinci-40396
27 Apr 2017 - Artist, Mathematician, Inventor, Writer(1452–1519) ... **Leonardo da Vinci** was a leading artist and intellectual of the Italian Renaissance who's known for his enduring works "The Last Supper" and "Mona Lisa." ... Born on April 15, 1452, in **Vinci**, Italy, **Leonardo da Vinci** was the epitome ...

BBC - History - Leonardo da Vinci
www.bbc.co.uk/history/historic_figures/da_vinci_leonardo.shtml
Leonardo da Vinci (1452 -1519) ... **Leonardo da Vinci** was born on 15 April 1452 near the Tuscan town of **Vinci**, the illegitimate son of a local lawyer. He was apprenticed to the sculptor and painter Andrea del Verrocchio in Florence and in 1478 became an independent master.

Leonardo Da Vinci: The Complete Works
www.leonardoda-vinci.org/
Leonardo Da Vinci - The complete works, large resolution images, ecard, rating, slideshow and more! One of the largest **Leonardo Da Vinci** resource on the ...

Leonardo da Vinci Paintings,Drawings,Quotes,Biography
www.leonardodavinci.net/
Leonardo da Vinci was a true genius who graced this world with his presence from April 15, 1452 to May 2, 1519. Like Athens in the age of Pericles, ...

https://en.wikipedia.org/wiki/The_Last_Supper_(Leonardo_da_Vinci)

n | The Guardian

Leonardo da Vinci

Mathematician

Leonardo di ser Piero da Vinci, more commonly Leonardo da Vinci or simply Leonardo, was an Italian Renaissance polymath whose areas of interest included invention, painting, sculpting, architecture, ... Wikipedia

Born: 15 April 1452, Anchiano

Died: 2 May 1519, Clos Lucé, Amboise, France

On view: The Louvre, Uffizi Gallery, National Gallery of Art, more

Periods: High Renaissance, Early renaissance, Renaissance, Italian Renaissance, Florentine painting

Siblings: Bartolomeo da Vinci, Giovanni Ser Piero, more

Structures: Milan Cathedral

Quotes View 7+ more

Simplicity is the ultimate sophistication.

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DOREA/FERNANDAMRS 22MAY2017 ARN LIS

TAP Portugal Flight 782
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Lisbon LIS
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TAP Portugal 781	TAP Portugal 35	TAP Portugal 36	TAP Portugal 782
ARN to LIS May 22, 6:35 PM	LIS to FOR May 23, 5:00 PM	FOR to LIS Jun 7, 11:05 PM	LIS to ARN Jun 8, 12:35 PM

TAP PORTUGAL GSA STOCKHOLM CTOSTO@tap.pt via amadeus.com
May 16
to me

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TAP PORTUGAL GSA STOCKHOLM              BOOKING REF: 56EV75
ARLANDA TERMINAL 5                      DATE:        16 MAY 2017
195 05  ARLANDASTAD
STOCKHOLM                               DOREA/FERNANDAMRS Plus INF
SWEDEN                                  MEYER/JONAS
TELEPHONE: +46 8 669 3495
FAX:       +46 8 658 2950
EMAIL:     CTOSTO@TAP.PT


FLIGHT     TP 781 - TAP PORTUGAL                                MON 22 MAY 2017
-------------------------------------------------------------------------------
DEPARTURE: STOCKHOLM, SE (ARLANDA), TERMINAL 5                    22 MAY 18:35
ARRIVAL:   LISBON, PT (AIRPORT), TERMINAL 1                       22 MAY 22:00
           FLIGHT BOOKING REF: TP/56EV75          LAST CHECK IN TIME: 17:35
           RESERVATION CONFIRMED, ECONOMY (U)                 DURATION: 04:25
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
           BAGGAGE ALLOWANCE:       2PC
           SEAT:                    16F CONFIRMED FOR DOREA/FERNANDAMRS
           MEAL:                    MEAL
NON STOP   STOCKHOLM TO LISBON
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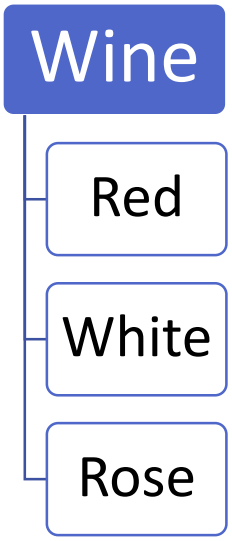
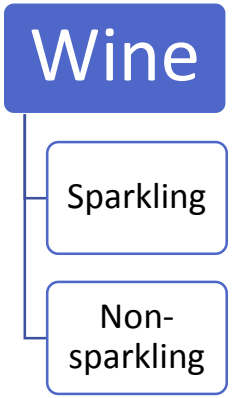
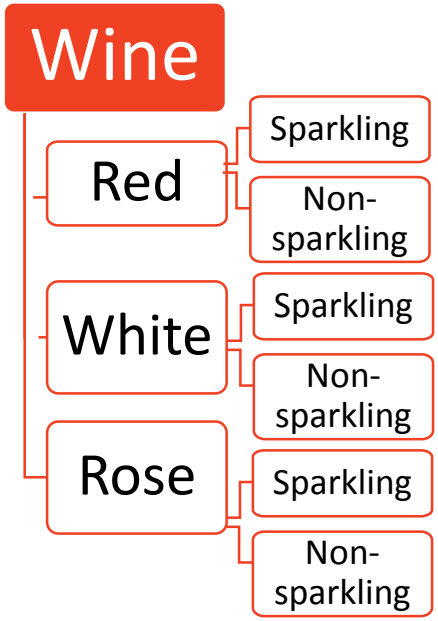
VeNom (Veterinary Nomeclature)

'Squamous cell carcinoma - clitoral'
'Squamous cell carcinoma - conjunctival'
'Squamous cell carcinoma - corneal'
'Squamous cell carcinoma - gastric (stomach)'
'Squamous cell carcinoma - penis/prepuce'
'Squamous cell carcinoma - oesophageal'
'Squamous cell carcinoma - nasal sinus'
'Squamous cell carcinoma - perineal'
'Squamous cell carcinoma - third eyelid/nictitating membrane'
'Squamous cell carcinoma - urethral'
'Squamous cell carcinoma - urinary bladder'

Different dimensions of knowledge contained in the data



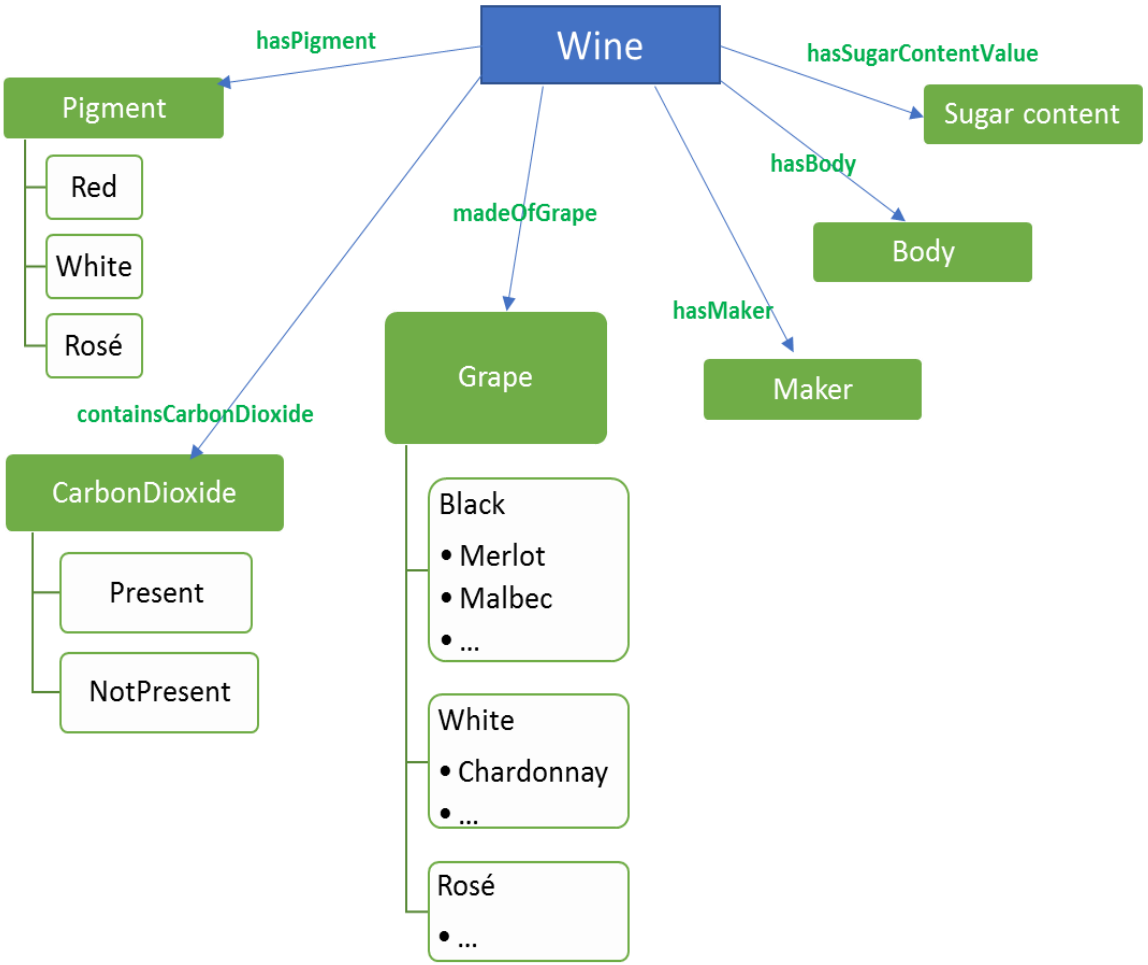




Ontologies

- Data model

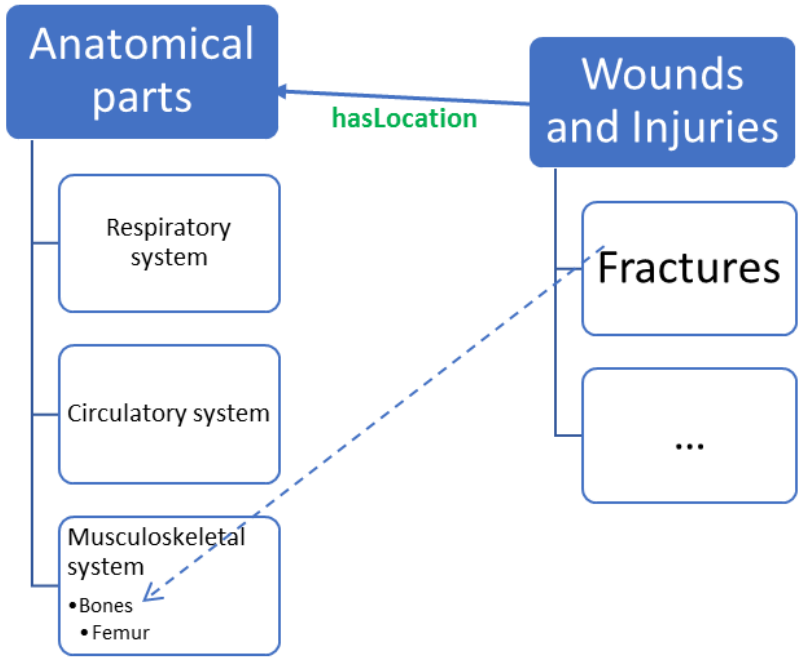
- Classes
- Properties
- Instances



An ontology defines a common vocabulary for users who need to share information within a domain.

It includes machine-interpretable definitions of basic concepts in the domain and relations among them.

To make domain assumptions explicit

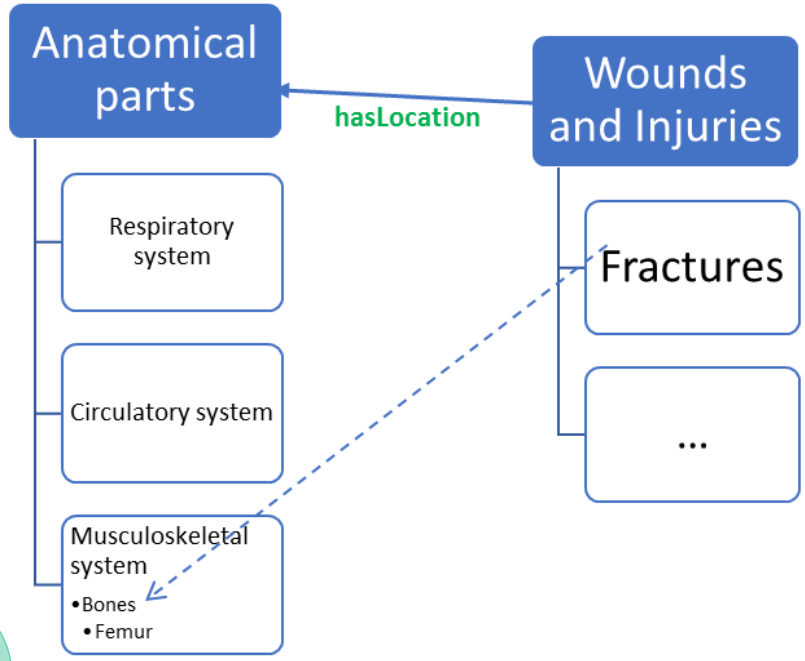


To enable reuse of domain knowledge

Uberon multi-species anatomy ontology

Anatomical Entity Ontology

Foundational Model of Anatomy



Ontology for General Medical Science

Symptom Ontology

Clinical Measurement Ontology

To support research and knowledge discovery from data

Fracture of the femur

Osteochondroma of femur

All injuries of the femur?

All injuries of the LEG?

Ontologies applied to *data-driven surveillance*

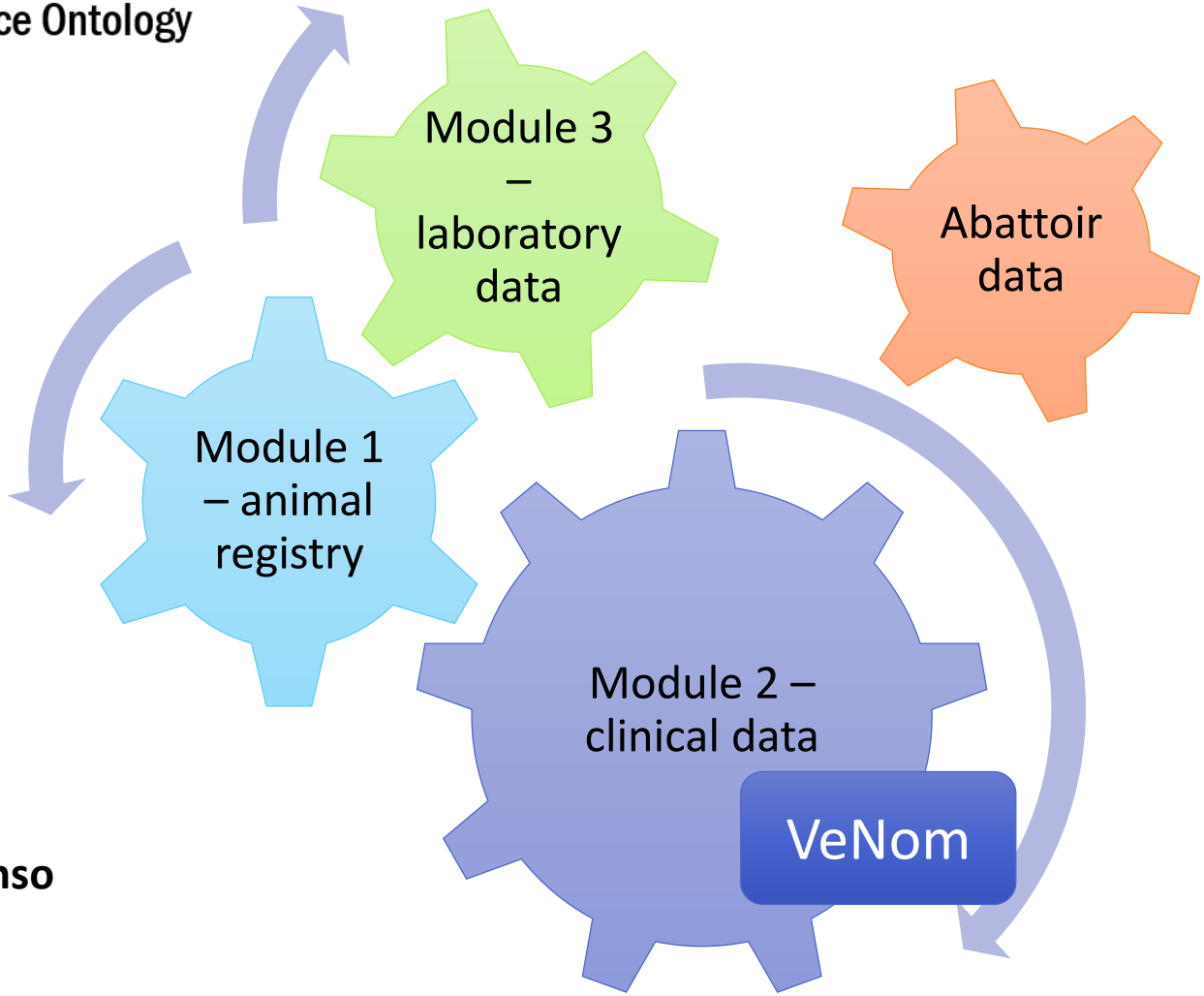
Desired functions

- Convert health data into information in *real-time*
- Use medical knowledge to infer surveillance relevant information from *data collected for other purposes*
- Provide a *permanent source of term mappings* that are open and can be shared/expanded by community (***IRI***)

Inherent challenges to overcome

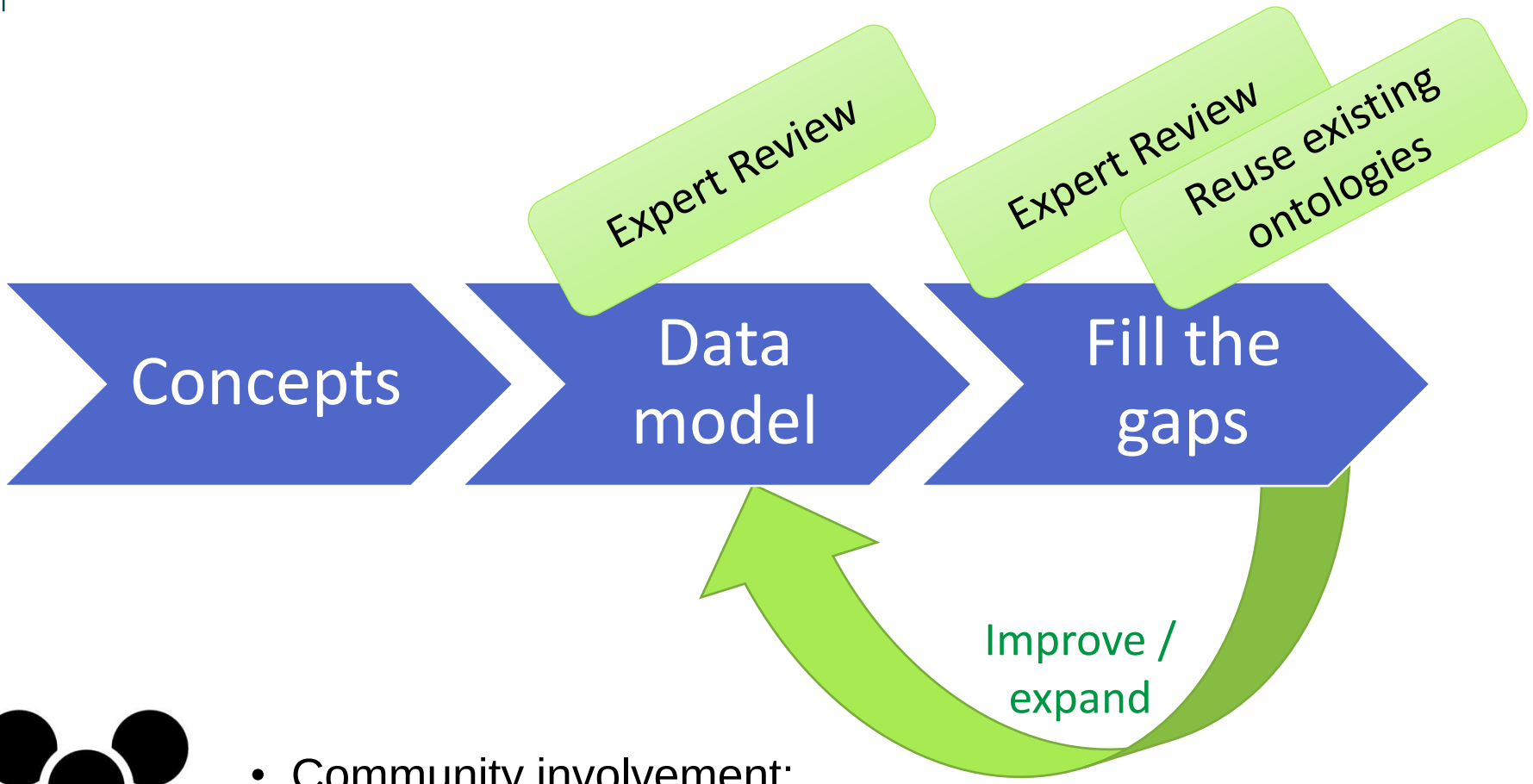
- Distributed data (not likely to be shared)
- Data non-coded or coded using different standards
- Solutions must work prospectively and retrospectively

Animal Health Surveillance Ontology



https://w3id.org/ahso

Workflow for each data source



- Community involvement:

Workgroups for each module

datadrivensurveillance.org/ahso

Google forum
Github
Home page
Open edit book

Ontology file (machine-interpretable)

datadrivensurveillance.org