

# Modelling the World Logically

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- Why we need logic?

# How to model real world objects?

- Things, or data
- Database
- How data are modelled in database?
- Knowledge representation
- Now try this!

# Case Study



# How can machine understand?

Canid  $\sqsubseteq$  Mammal

Dog  $\sqsubseteq$  Canid

Fox  $\sqsubseteq$  Canid

Wolf  $\sqsubseteq$  Canid

Human  $\sqsubseteq$  Hominin

.....

Felid  $\sqsubseteq$  Mammal

Cat  $\sqsubseteq$  Felid

Lion  $\sqsubseteq$  Felid

Tiger  $\sqsubseteq$  Felid

Human  $\sqsubseteq$  Primate

.....

# How about now?



**Domesticated?**

# Can machine understand now?

Dog  $\sqsubseteq \exists \text{hasBodyPart}.\text{Leg}$

Cat  $\sqsubseteq \exists \text{hasBodyPart}.\text{Wisker}$

Cat  $\sqsubseteq \exists \text{hasBodyPart}.\text{Leg}$

Human  $\sqsubseteq \exists \text{hasBodyPart}.\text{Leg}$

Cat  $\sqsubseteq \exists \text{hasStatus}.\text{DomesticatedStatus}$

.....

# Other situations?

- What if you have a pet cat, called Bob?

$\text{Cat(Bob)}$

- How can a machine know your pet Bob is not a gorilla?

$\text{Cat} \sqcap \text{Gorilla} \sqsubseteq \perp$

- How about when Bob is a kitten?

$\text{Kitten} \equiv \text{Cat} \sqcap \text{Young}$

# Knowledge representation

- KR is hard
  - Experts
  - Consistence
  - Sharable
  - Semantics
  - Large
- KR is useful
  - Find hidden information
  - Theorem proving
  - SNOMED CT - NHS Digital
  - Artificial Intelligence

**NHS Digital SNOMED CT Browser**

Release: United Kingdom Edition 20181001 ▾ Perspective: Full ▾ About ▾

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Taxonomy Search Favorites Refset

**Taxonomy**

Inferred view ▾ Descendants Count: Off ▾

- SNOMED CT Concept
  - Body structure (body structure)
  - Clinical finding (finding)
  - Environment or geographical location (environment / location)
  - Event (event)
  - Observable entity (observable entity)
  - Organism (organism)
  - Pharmaceutical / biologic product (product)
  - Physical force (physical force)
  - Physical object (physical object)
  - Procedure (procedure)
  - Qualifier value (qualifier value)
  - Record artifact (record artifact)
  - Situation with explicit context (situation)
  - SNOMED CT Model Component (metadata)
  - Social context (social concept)
  - Special concept (special concept)
  - Specimen (specimen)
  - Staging and scales (staging scale)
  - Substance (substance)

**Concept Details**

**Concept Details**

Summary Details Diagram Expression Refsets Members References Classification Map

**Parents**

- SNOMED CT Concept (SNOMED RT+CTV3)

**Clinical finding (finding)** ★ ↗ No attributes

SCTID: 404684003  
404684003 | Clinical finding (finding) |  
Clinical finding (finding)  
Clinical finding

**Children (35)**  
35 Children

Stated Inferred

