## SYMBOLIC AI HISTORY

The pre-history of humanity is a history of knowledge representation

Always needed to transmit what we know.

Myths, constructions, symbols, stories, ideas, discoveries, risks

With time some meaning gets lost and wse end up unable to update as things evolve.

Language is ambiguous. Sometimes we are not sure how we are supposed to interpret it. We want to manage knowledge with some guarantees. We want to propagate it but we also we don't want misinterpretation.

Aristotle’s syllogism can handle knowledge about classes.

Four types sentence

A: (all). Every X is a Y - every human is mortal

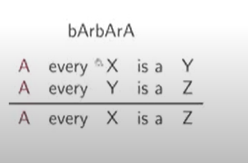
E: (exits). Some X are Y - some humans are vegetarian

I: No X is a Y - No human is a god. Same as no Y is an X

O: Some X are not Y - some humans are not athletes

Syllogisms are derivations rules

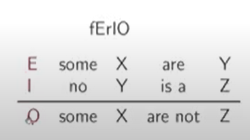
BARBARA



CELARENT

DARII

FERIO



Some humans are vegetarian

No vegetarian is a meat eater

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Some human are not meat eater

Derivation rules are sound (true premises derive true conclusion). If two premises are true the conclusion is always true. Don’t create an error

Those rules are complete. Whatever follows can be derived (partially true, it is only true if we restrict to types AEIO). Everything that is true. Whatever follows from the knowledge that we have can be derived using those rules

It is very limited. Can use only two classes. All the connections are made by two classes. There are no disjunctions (like all X and Y are Z)

Can’t make complex properties

No relations between objects.

2000 years later we got propositional logic

Simple logic, only speaks about prepositions (properties). Can predicate logic. First-order, higher-order. Can quantified properties

Propositional logic is too inexpressive

And than predicate logic

Predicate logic is too complex. No sound and complete derivation system

# The Era of AI

Computer are better, start to understand algorithms

With advices in computing and automated calculations, the AI dream started

One of the first approaches -> intelligent agents/intelligent systems.

To be intelligent, it needs to “understand” what is going on around them. Understand the situation and the environment and be able to react

## First machine - tailored KR formalism

Septic networks

Graphs with connecting properties

Green <—(hasColor)— frog —(isA)—> amphibian

From: object or a class

Amphibian: subclass

Green: abstract class

Has no formal semantics (don’t have one agreed interpretation, can be ambiguous). Every implementation interprets in its own way

## Frames

Blocks with open “windows” to fill in properties

All animals have a colour, a digestive system…

Specific animals have different instantiating of these prosperities

For programming it is useful but still no formal semantics

## Logic-based KR (knowledge representation)

Develop of languages for representing knowledge and reasoning automatically

This language need a clear syntax and formal semantics

We will have this artificial language but we put our symbols in a specific way. These expressions should be clear. Take some time to understand, the meaning is clear syntax and formal semantics (we know what we are saying) if we speak about objects everybody that speaks the same language will understand. Our symbols have one meaning.

Insight: different properties for different applications.

There was an application in mind.

Lots of different logical-based languages.

DLs (description logic)

Description logics are a family of KR language

* fragments of first-order logic
* Studies by trade-off between expressivity and computational properties

There are many DLs. Mainly well-structured

DLs are recent

## Semantic Web

What if machines could navigate and understand the web as we do? We will have an intelligent agent that can google like

Problem: represent what the page is about. This is the basic idea. Need to add tags that a machine can understand. Can extract informations

Semantic Web it failed. It needed a language to represent (need a meaning). When it was standardised it took inspiration from Description Logic

Share the same idea

KRR (knowledge representation and reasoning) is a fruitful and successful field

The reality is not as logical as we want it to be. Can study logic as much as we want, but at some point there is a reality that is not as logical. Some properties we can’t really understand.

To deal with real knowledge we must handle:

* Measures
* Time
* Uncertainly
* Vagueness
* Regulations
* Contradictions
* …