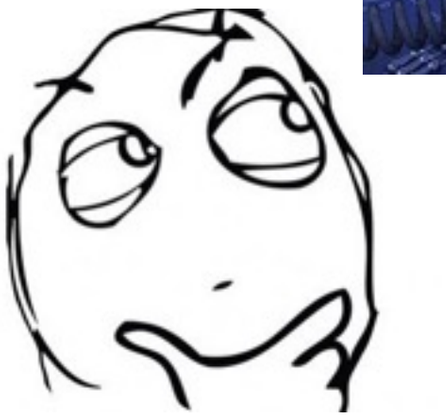
Chapter 3

Turing: What is Machine Intelligence?

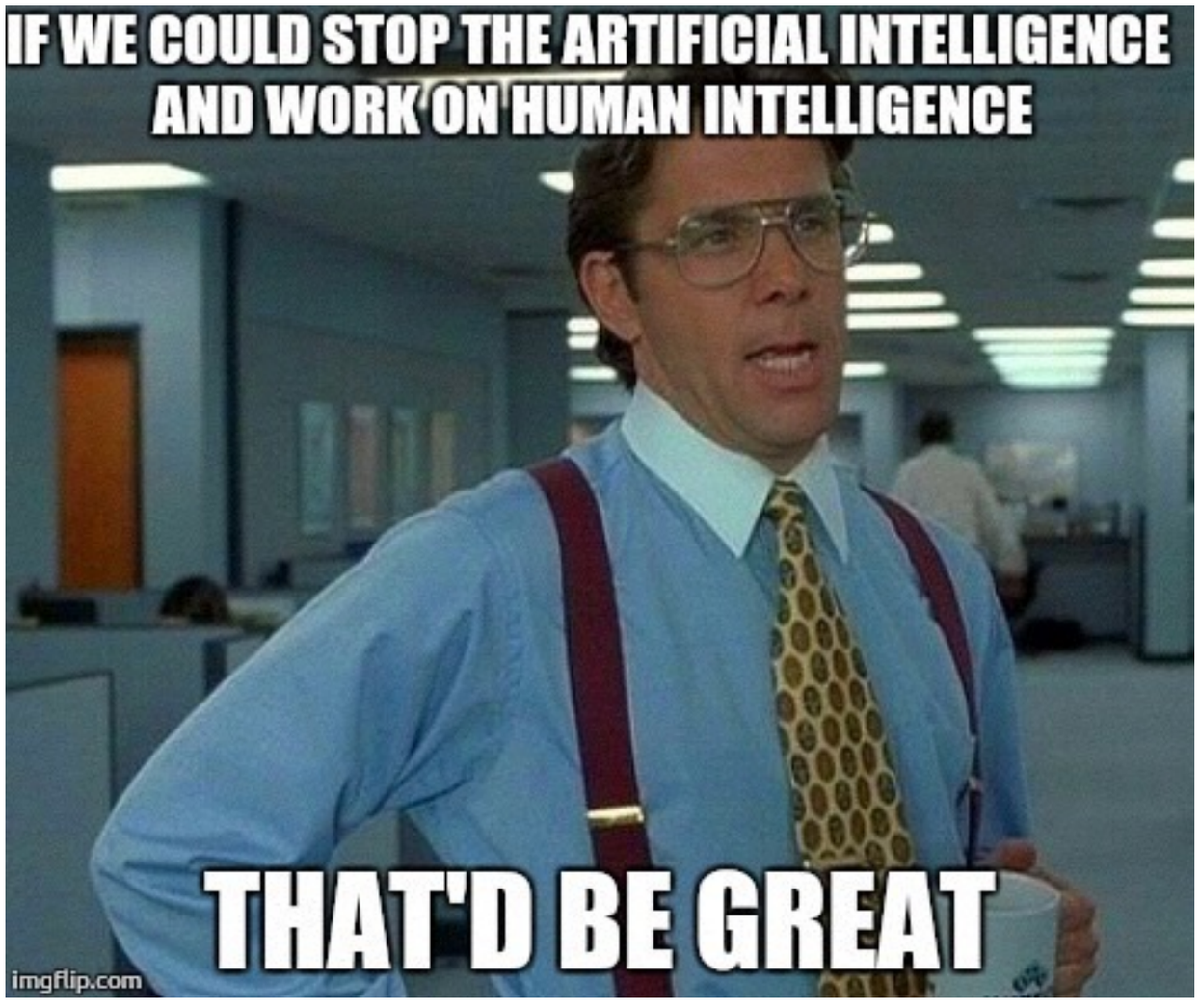


Overview

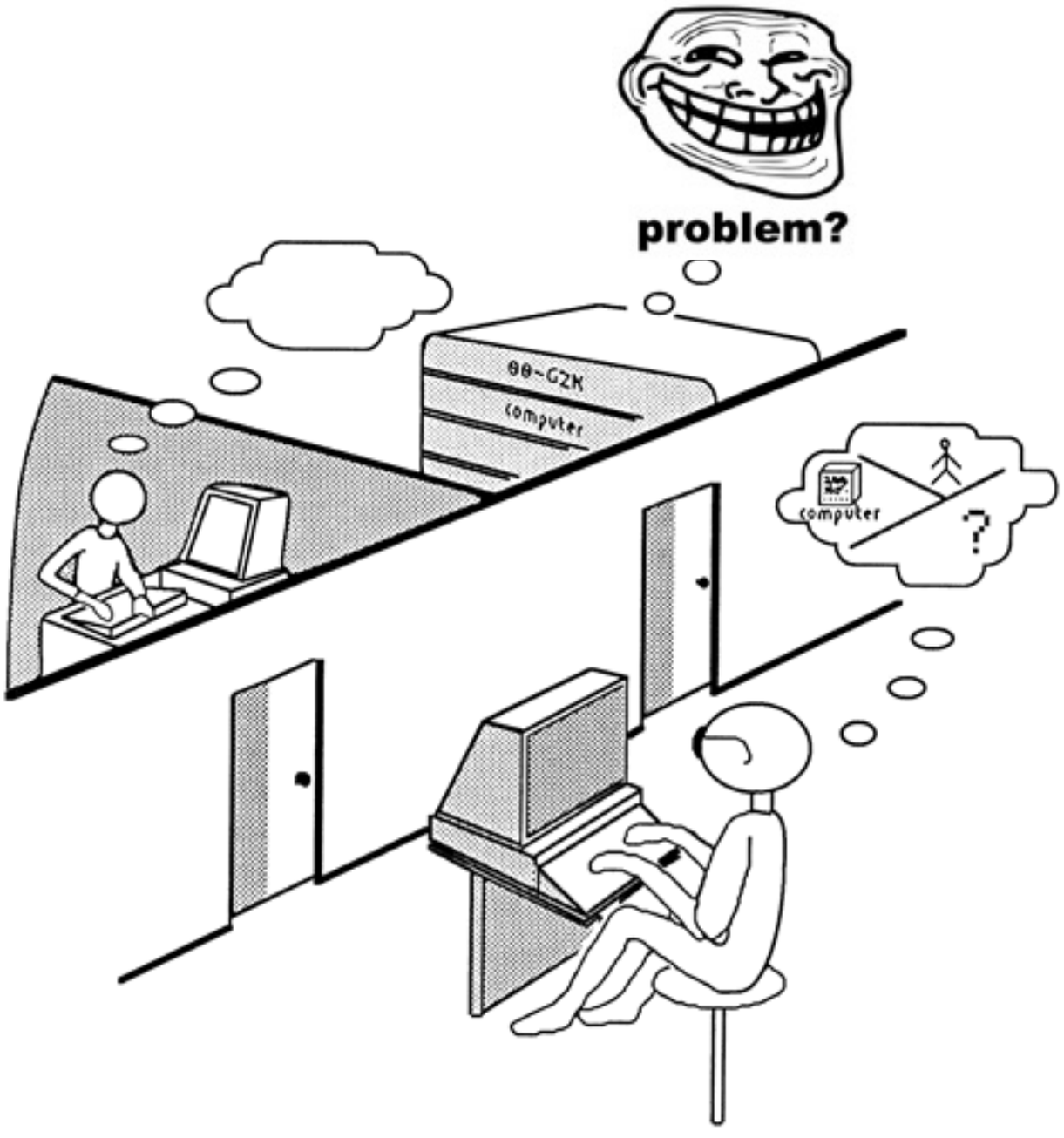
- What is machine intelligence?
- Turing Test
- Artificial intelligence and Machine intelligence
- Semantic Networks
- Computation complexity
- Decision problems
- Intractability
- Description Logic
- Ontology
- Inference Engines
- Software Agents

What is Machine Intelligence

- Intelligent machinery
- What is meant by “thinking” and “intelligence”?
- Human intelligence reflects: Ability to learn, organize, apply knowledge
- AI addresses the question of what it means for a machine to have intelligence
- After WW2, AI became more than just science



Turing Test



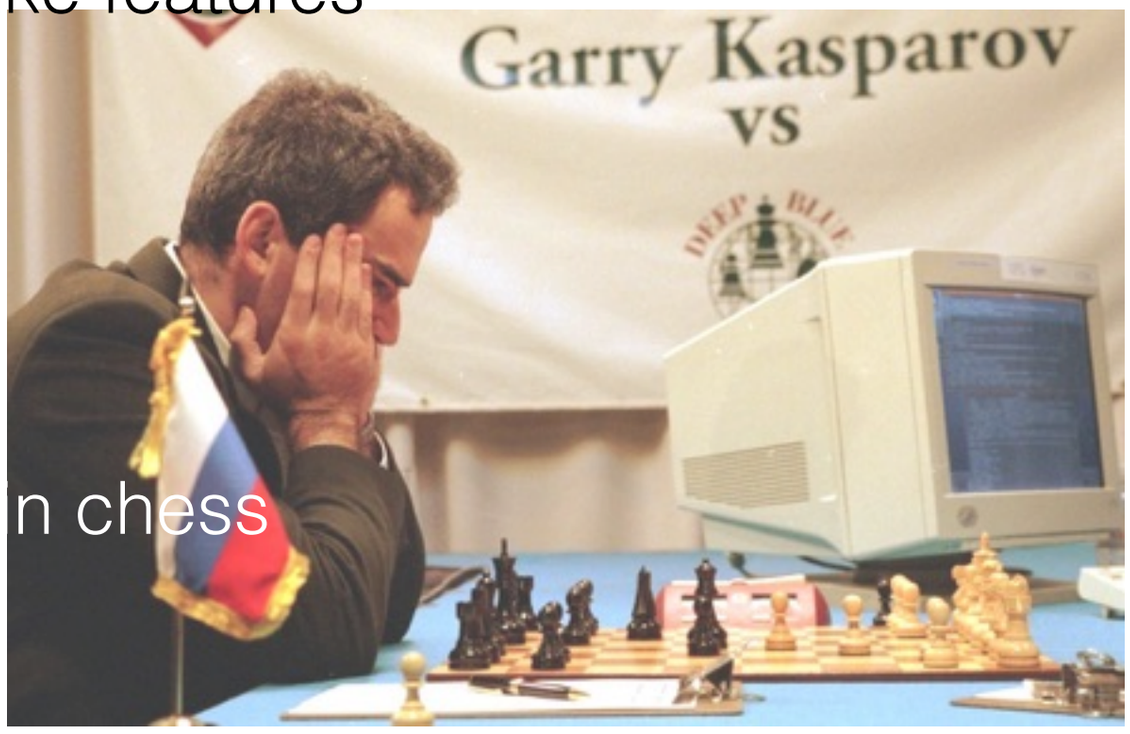
- Alan Turing suggested computers can be called intelligent
- The Turing Test
- The Loebner Prize: A scaled down test limited to a specific topic

John Searle's Chinese Room

- Doubt about intelligent machines
- The Chinese Room
- Where does insight reside?

Artificial Intelligence

- How far is AI from reaching human-level intelligence?
- Two main lines of AI research: Biological and formalizing common sense
- Strong AI: Machines that can think on a level equal to humans
- Weak AI: Simply holds for thinking-like features
- What is Web Intelligence?
- Still on an early stage
- IBM machine beat world champion in chess



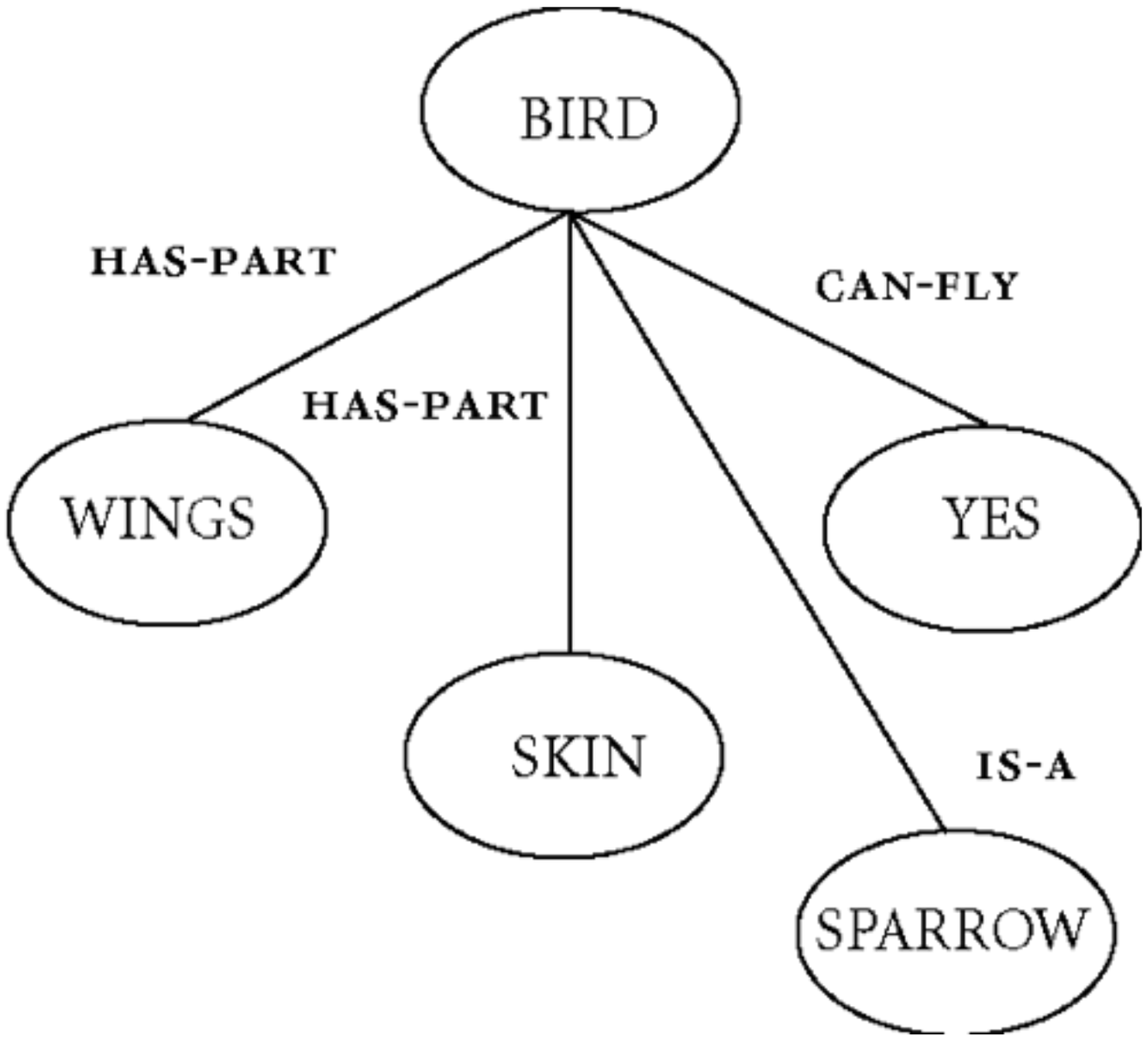

28 DAYS LATER
EX_MACHINA
THERE IS NOTHING MORE HUMAN
THAN THE WILL TO SURVIVE
COMING SOON

Ex Machina

Machine Intelligence

- Some subbranches of AI is of particularly relevance to the Semantic Web:
- Computation complexity
- Descriptive Logic (DL)
- Ontology
- Inference
- Software Agents

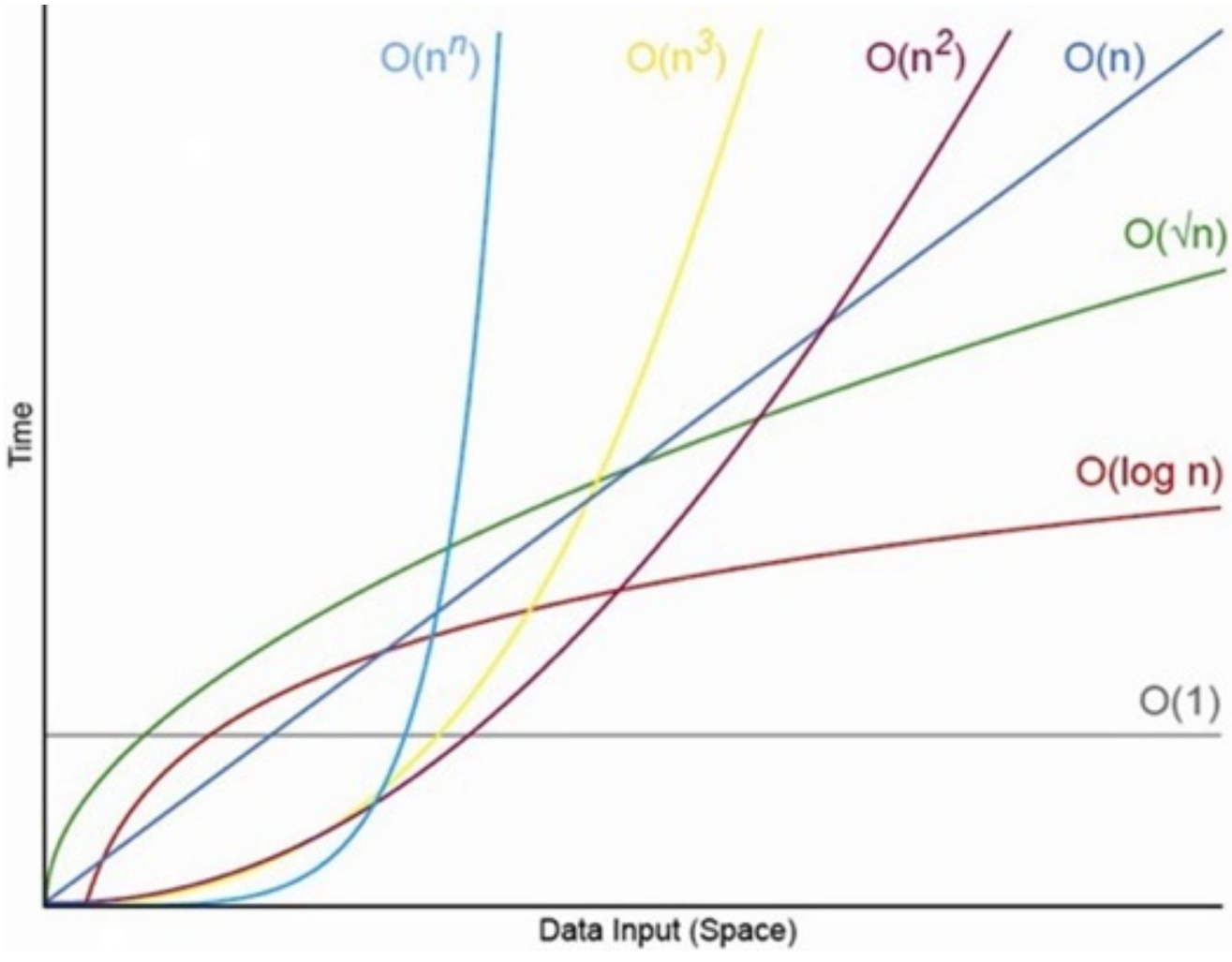
Semantic Network



- A semantic network is a graphic approach
- A more complex semantic network is called frames
- Declarative graphic representation is common to all semantic networks

Recap of AlgDat Computation Complexity

- A problem is in reality a class of related questions
- Example: Determine the prime factors of a number
- Time complexity
- If a problem can be solved in n squared steps, the problem has time complexity of O(n^2)



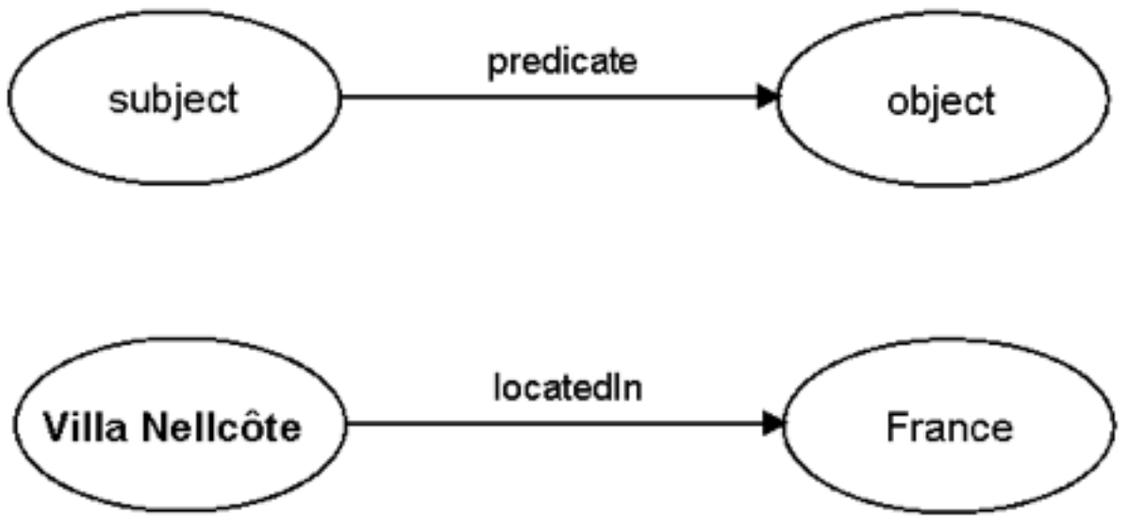
Decision problems

- Complexity theory
- Answer always comes down to Yes or No
- Example: Decide whether or not a number is a prime
- Complexity classes: P, NP
- Intractability

Description Logic

- Description Logic (DL) as a class of logic-based knowledge-representation languages
- Components of DL is representation an reasoning
- Semantic Web requires a language that expresses data and rules for reasoning the data
- XML and RDF are important for the Semantic Web
- RDF is expressed in triples
- Subject, predicate and object
- Written in XML
- Computers must have access to structured collections of information as RDF

$$
\begin{array}{lll}
C, D \longrightarrow A \mid & & \text{(atomic concept)} \\
\top \mid & & \text{(universal concept)} \\
\bot \mid & & \text{(bottom concept)} \\
C \sqcap D \mid & & \text{(intersection)} \\
C \sqcup D \mid & & \text{(disjunction)} \\
\neg C \mid & & \text{(negation)} \\
\forall R.C \mid & & \text{(value restriction)} \\
\exists R.C \mid & & \text{(existential quantification)}
\end{array}
$$



Ontology

- Discover common meanings
- A solution provided by the Semantic Web is called ontologies
- Document that defines the relation among terms
- Typical ontology uses a taxonomy and a set of inference rules
- Inference rules: Rule for manipulating information
- Example: UCSD —> San Diego —> California —> US
- The real power of Semantic Web is not realized yet

Inference engines
and
Software Agents

- Inference engines process knowledge available in the Semantic Web
- Inference engine controls overall execution
- Software agents are reactive
- Software agents are essential for the Semantic Web

Summary

- What is machine intelligence?
- The Turing Test
- Artificial intelligence
- Semantic network
- Computation complexity
- Description Logic
- Ontology
- Inference engines and software agents

Next chapter…