# Artificial Intelligence: Knowledge Representation

## CPSC 433: Artificial Intelligence
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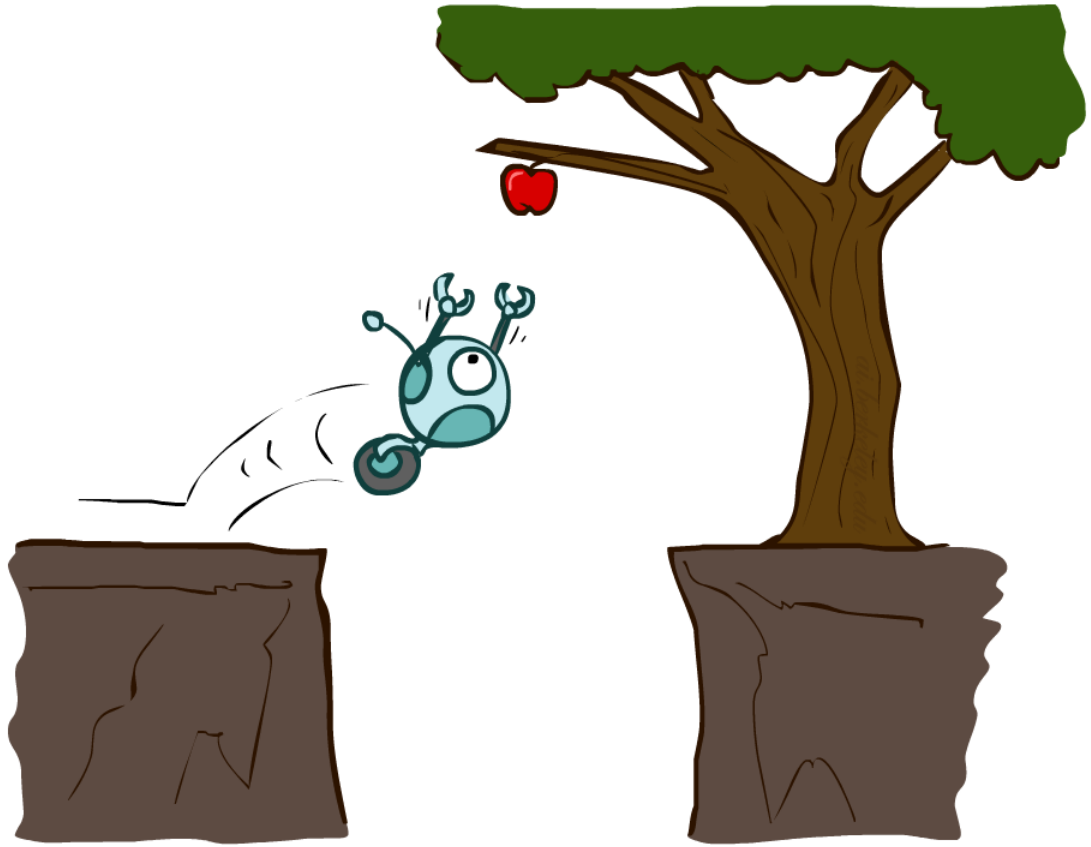
# Reflex Agents

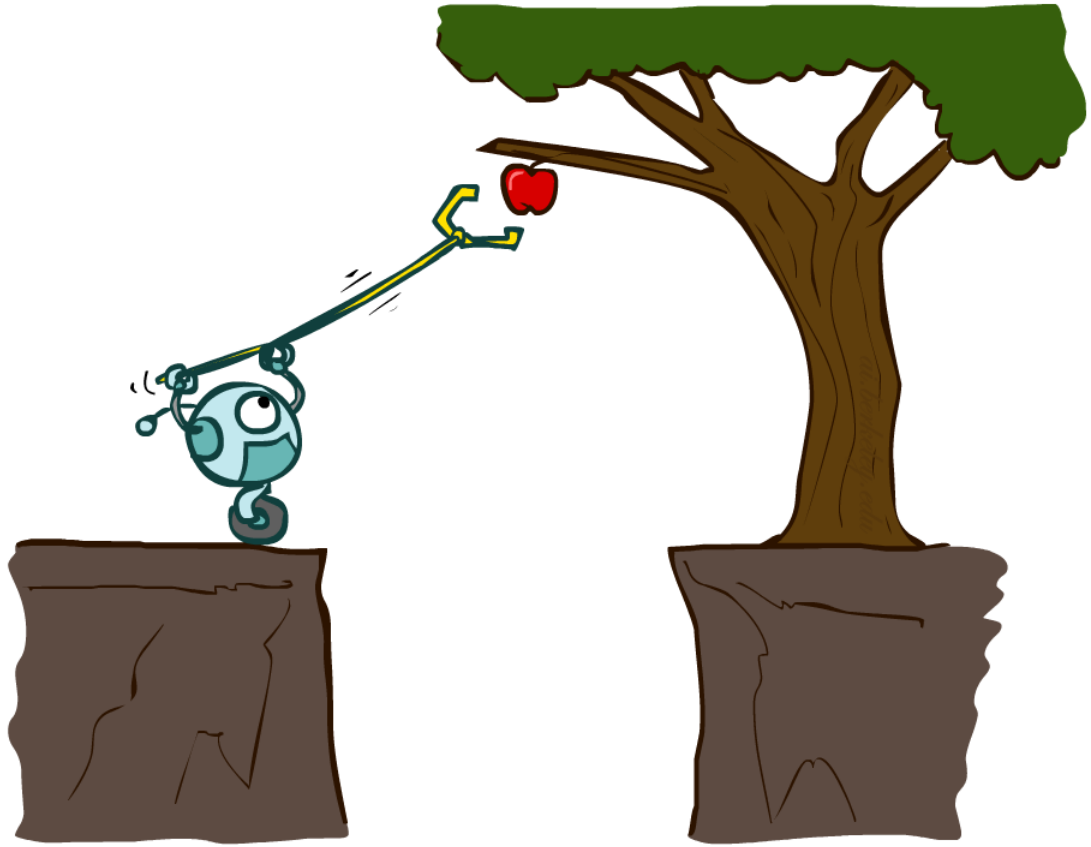
- Reflex agents:
  - Choose action based on current percept (and maybe memory)
  - May have memory or a model of the world's current state
  - Do not consider the future consequences of their actions
  - Consider how the world IS

- *Can a reflex agent be rational?*

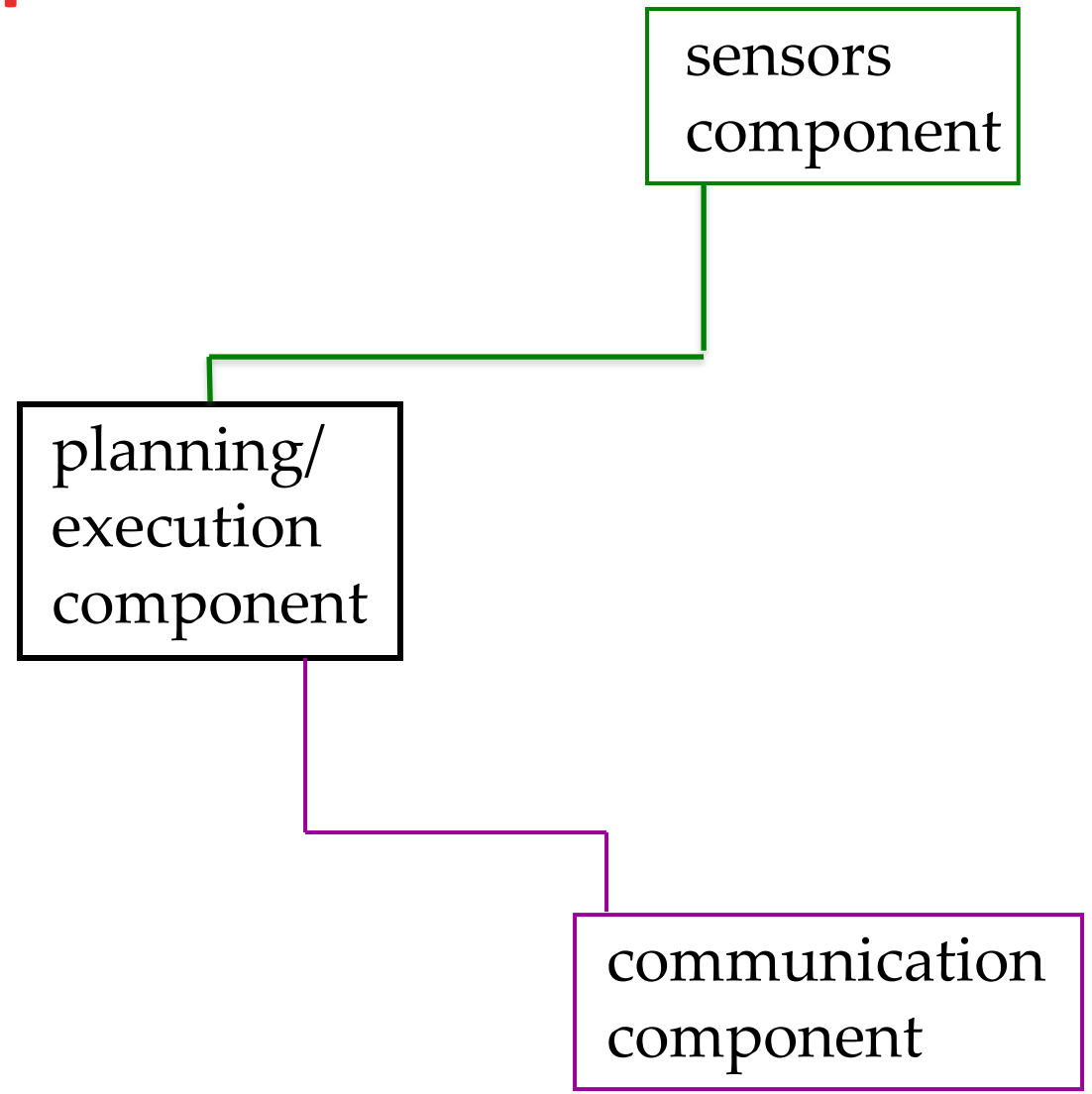


# Planning Agents

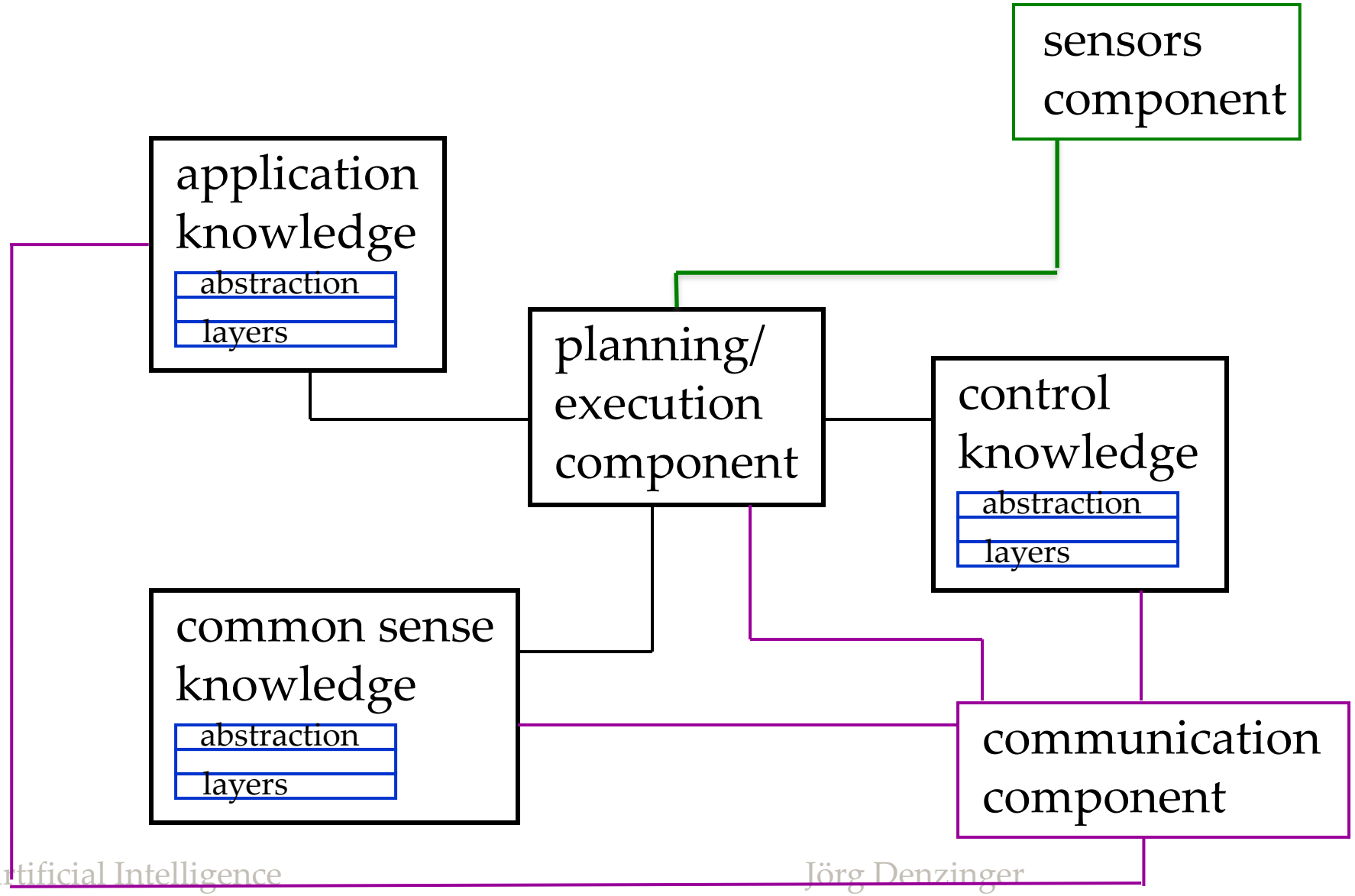
- Planning agents:
  - Ask “what if”
  - Decisions based on (hypothesized) consequences of actions
  - Must have a model of how the world evolves in response to actions
  - Must formulate a goal (test)
  - Consider how the world WOULD BE
- Optimal vs. complete planning
- Planning vs. replanning



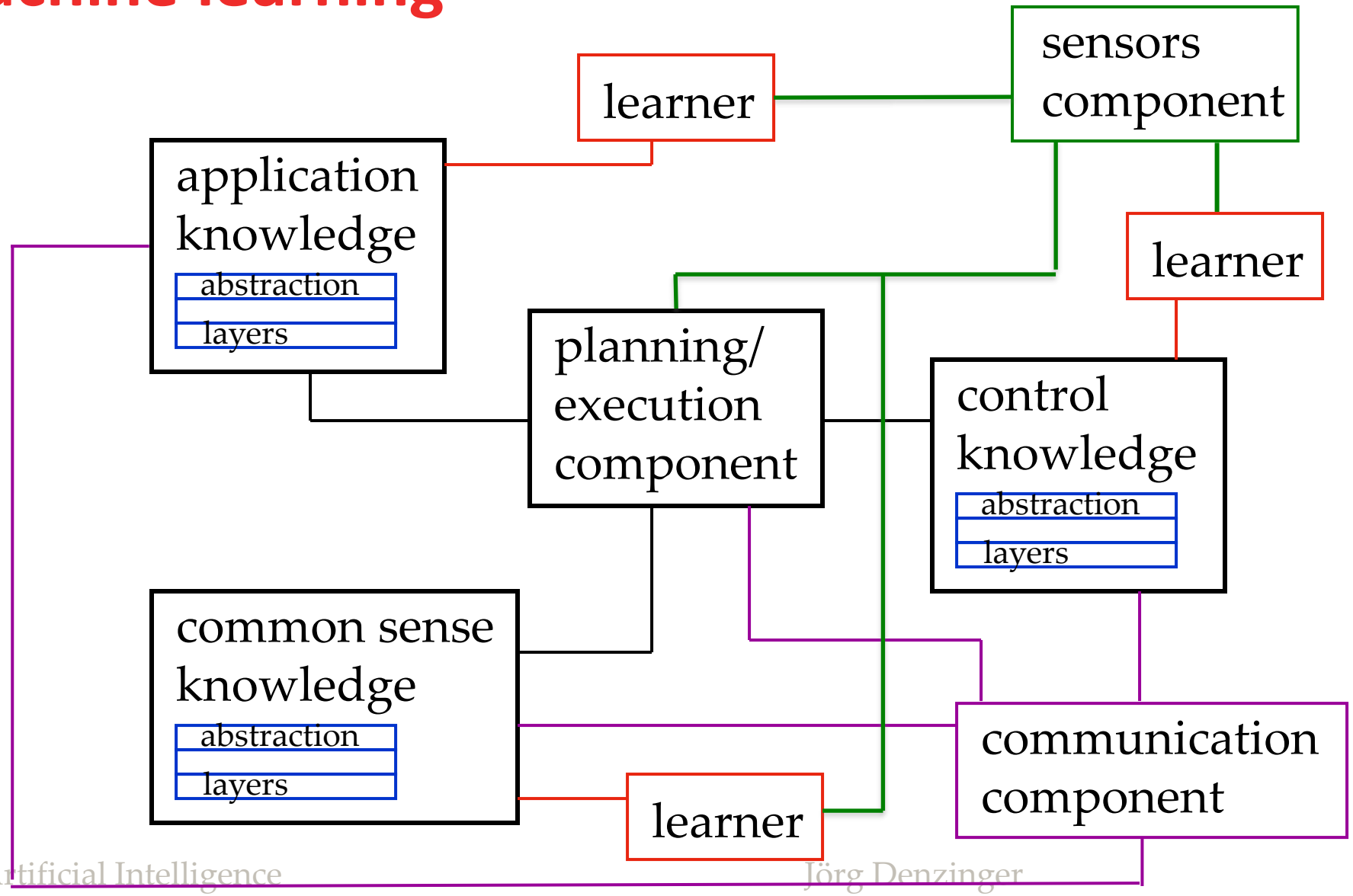
# A very general AI system



# with Knowledge Processing



# and machine learning



# Knowledge Processing

# Knowledge Processing in general

- Task: use knowledge represented in system plus new knowledge and produce a result:
  - Add knowledge to knowledge base
  - Find inconsistencies in knowledge base
  - Answer user question

  ☞ make implicit knowledge explicit
- Approaches:
  - Search (produce a certain result or new consistent knowledge base)
  - Apply procedural knowledge (computation)

# General Problems

- What parts of the knowledge base are needed?
- What parts of the knowledge base must be changed (frame problem)?
- What pieces of knowledge are applicable?
- What concrete piece of knowledge to choose next?

# Search versus Computation

# Search versus Computation

- Deep down in our computers everything is a computation
- On higher levels, there are different computation processes:
  - Processes where each step is always necessary to achieve their goals
    ☞ computation
  - Processes where after they finished you can identify steps that did not contribute to achieving the goals
    ☞ search

# Why is difference of importance?

- In AI we deal with knowledge
- More or better knowledge can be used to improve almost all search processes (even without totally new algorithm)
- Better knowledge only very seldomly can be used to improve computation (except if developing new algorithm)
- Also: due to unnecessary steps searches often take much longer
  ☞ improvements very often needed
- But: there are different definitions of "necessary"
  ☞ some searches can be made into computations
  (examples: PROLOG, local search; see later)

# Computation: Applying procedural knowledge

Computation used in

- Many rule-based systems
- Neural networks (when applying them)
- Truth Maintenance Systems, when updating the labels
- Lower levels of search systems:
  - Procedures in frame based systems
  - Weights/measures in search controls
  - Determining mgu or matches

☞ See later sections!

# What does computation offer?

- Usually run time is predictable
- No dealing with choices
- No unnecessary steps
- Implicit knowledge representation
  ☞ difficult to know what is going on
- Not always possible to achieve

☞Nice to have, but in AI systems often not possible

# Onward to …
# Search Definitions

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