PROGRAMME

* What is KR (Knowledge Representation) and where does it come from?
* Boolean algebra/Basic of Logic
* KR (Knowledge Representation) as rules; basic logic programming
* Existential rules - Kripke semantics of FOL (First Order Logic)
* EL as a brief example of DLs (Description Logic)
* The DL ALC
* Other constructions for representing knowledge; trade-offs
* Linear temporal logic; Satisfiability of LTL formulas
* Uncertainty ProbLog

## LOGIC AND SYMBOLIC AI

**What is intelligence?**

AI deals with machines showcasing intelligent traits.

Not necessarily equivalent to (but often intersects with) simulation human cognitive attributes

Two separate thought process:

System 1 & 2 are not the same for everybody

System 1: (instinctive reactions, remove hands when touching the fire, it is our intuitive way to answer)

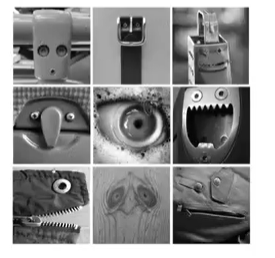
* fast
* Automatic
* Unconscious
* “Intuitive”

It is a hard-wired mechanism that immediately reacts to stimuli. We get an input and immediately receive an output. Very useful for simple tasks and patterning. Can be easily fooled (pareidolia).

Creating it and modifying it an be very expensive (because it is a hard wired

mechanism). Rigid structure. An athlete running marathons will take time to start running the 100m (even if he is in good shape, eats healthy…)

**Pareidolia**: we look at faces, it is a human thing to look for something familiar or at animals to be safe (to predict danger) as primitive. At first we see the face than we realise that we were fooled



AI system for

* winning games (chess…)
* Detecting disease (covid tracing, thumors…)
* Optimising results (minimise the amount of wires…)
* Classifying images (distinguish if someone is male or female, or movements…)
* …

Machine Learning and sub-symbolic AI are based on System 1

System 2: (conscious, it needs an effort, is the logical system, like trying to solve a sudoku) *(min 15:45)*

* Slow
* Effortful
* Conscious
* “Logical”

Deep learning is very useful for many things, but we should be aware of its limitations

* Lack of interpretability
* “Hallucinations” (always has an answer, never tell “I don’t know”, give an answer but tell the wrong answer)
* Static (if you train you can use it later, need to improve it)
* Disregard existing knowledge (don’t know anything, need to be train to identify everything, don’t have existing knowledge)

Symbolic AI is the analogues of System 2

It manipulates symbols to extract consequences and make decision

It performs reasoning

Advantages

* Interpretability
* Correctness guarantees
* Flexibility (if you find that something is wrong you can take it away)
* “Humbleness” (don’t have problems telling “i don’t know”)
* Memory
* No ambiguity (only one meaning)

**Logic**: A language without the nuances (sfumature), it is an artificial language. There are multiple logics. There are lots of them. We use it to express and manipulate knowledge