



# Knowledge Representation

- Humans are best at understanding, reasoning, and interpreting knowledge. Human knows things, which is knowledge and as per their knowledge they perform various actions in the real world. **But how machines do all these things comes under knowledge representation and reasoning**

Describe Knowledge representation as following:

- Knowledge representation and reasoning (KR, KRR) is the part of Artificial intelligence which concerned with AI agents thinking and how thinking contributes to intelligent behavior of agents.

- It is responsible for representing information about the real world so that a computer can understand and can utilize this knowledge to solve the complex real world problems such as diagnosis a medical condition or communicating with humans in natural language.
- It is also a way which describes how we can represent knowledge in artificial intelligence. Knowledge representation is not just storing data into some database, but it also enables an intelligent machine to learn from that knowledge and experiences so that it can behave intelligently like a human.

Following are the kind of knowledge which needs to be represented in AI systems:

## **1. Object**

- All the facts about objects in our world domain. E.g., Guitars contains strings, trumpets are brass instruments.

## **2. Events**

- Events are the actions which occur in our world.

## **3. Performance**

- It describe behavior which involves knowledge about how to do things.

## **4. Meta-knowledge**

- It is knowledge about knowledge is known as Meta - knowledge.

## **5. Facts**

- Facts are the truths about the real world and what we represent.

## **6. Knowledge-Base**

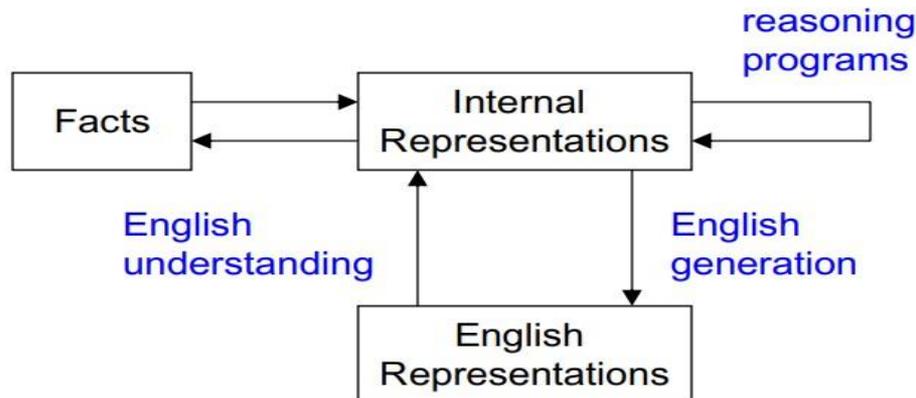
- The central component of the knowledge-based agents is the knowledge base. It is represented as KB. The Knowledgebase is a group of the Sentences (Here, sentences are used as a technical term and not identical with the English language).

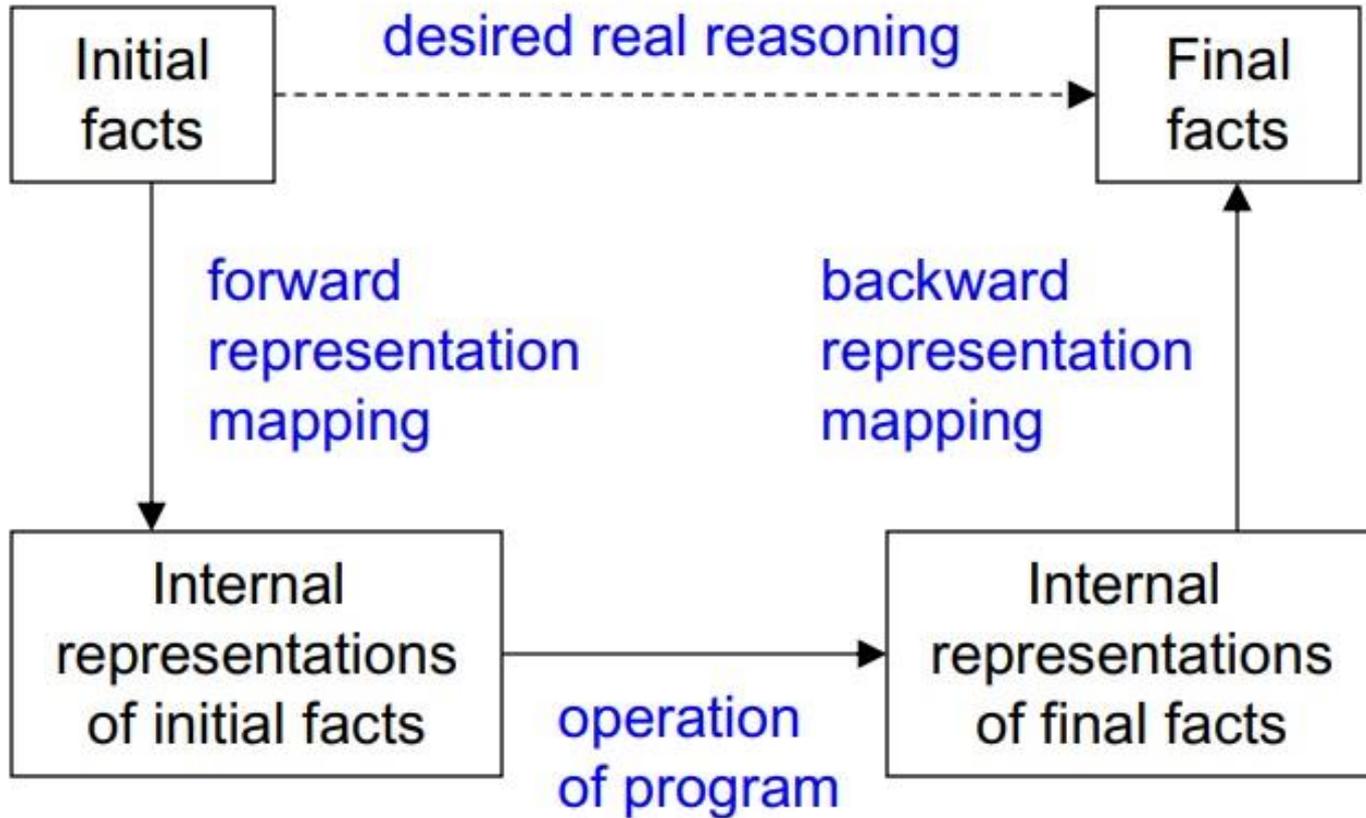
# Representation and Mapping

- **Knowledge:** Knowledge is awareness or familiarity gained by experiences of facts, data, and situations. Following are the types of knowledge in artificial intelligence:

## Representation and Mapping

- Facts: things we want to represent.
- Representations of facts: things we can manipulate.





# Approaches to knowledge representation

## 1. Simple relational knowledge

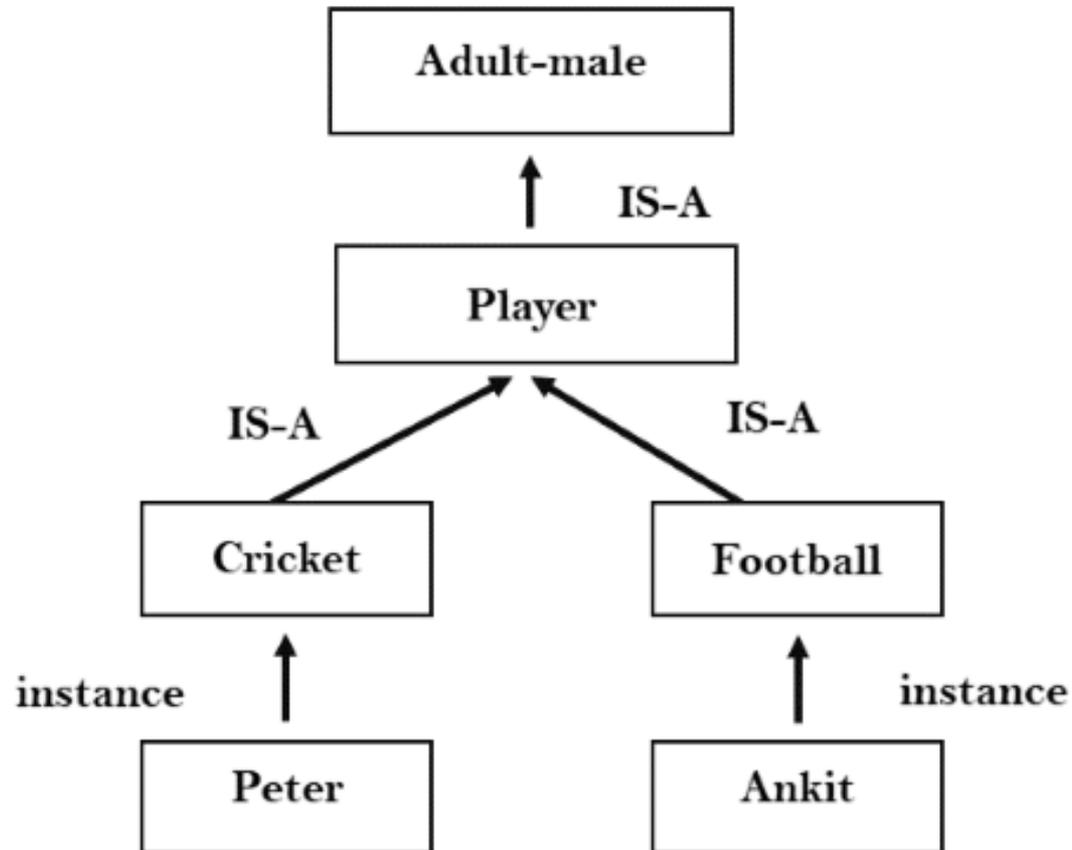
- It is the simplest way of storing facts which uses the relational method, and each fact about a set of the object is set out systematically in columns.
- This approach of knowledge representation is famous in database systems where the relationship between different entities is represented.
- Ex-

Player	Weight	Age
Player1	65	23
Player2	58	18
Player3	75	24

## 2. Inheritable knowledge

- In the inheritable knowledge approach, all data must be stored into a hierarchy of classes.
- In this approach, we apply inheritance property.
- Elements inherit values from other members of a class.
- This approach contains inheritable knowledge which shows a relation between instance and class, and it is called instance relation.
- Every individual frame can represent the collection of attributes and its value.
- In this approach, objects and values are represented in Boxed nodes.
- We use Arrows which point from objects to their values.

# Example:



### 3. Inferential knowledge

- Inferential knowledge approach represents knowledge in the form of formal logics.
- This approach can be used to derive more facts.
- It guaranteed correctness.
- **Example:** Let's suppose there are two statements:
  - Marcus is a man
  - All men are mortal

Then it can represent as;

**man(Marcus)**

**$\forall x = \text{man}(x) \text{ -----} \rightarrow \text{mortal}(x)s$**

## 4. Procedural knowledge

- Procedural knowledge approach uses small programs and codes which describes how to do specific things, and how to proceed.
- In this approach, one important rule is used which is **If-Then rule**.
- In this knowledge, we can use various coding languages such as **LISP language** and **Prolog language**.
- We can easily represent heuristic or domain-specific knowledge using this approach.
- But it is not necessary that we can represent all cases in this approach.

# Requirements for knowledge Representation system

## 1. Representational Accuracy

- KR system should have the ability to represent all kind of required knowledge.

## 2. Inferential Adequacy

- KR system should have ability to manipulate the representational structures to produce new knowledge corresponding to existing structure.

### **3. Inferential Efficiency**

- The ability to direct the inferential knowledge mechanism into the most productive directions by storing appropriate guides.

### **4. Acquisitional efficiency**

- The ability to acquire the new knowledge easily using automatic methods.



Thank you!