

Knowledge Representation

Hrishikesh Bhaumik

Associate Professor, RCCIIT

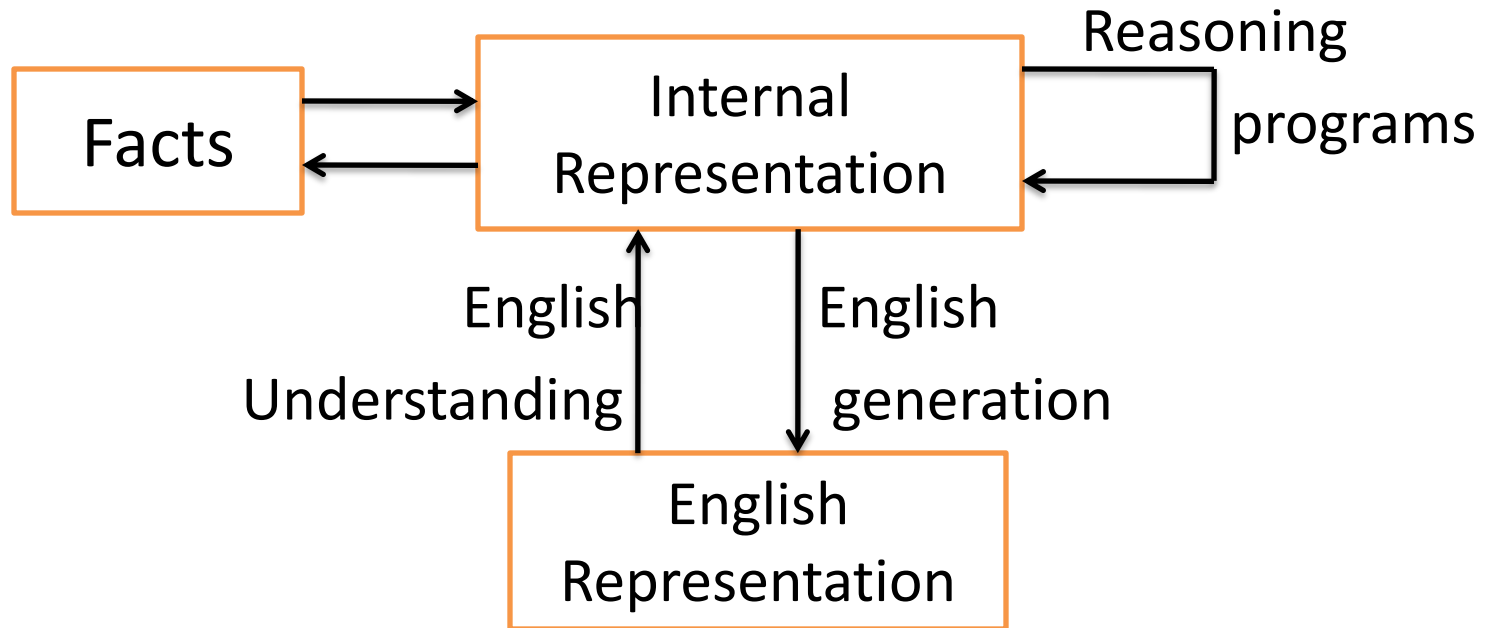
Knowledge Representation

Knowledge: Solution to new problems can be had if both a large amount of knowledge and some mechanism for manipulating knowledge is available.

Facts: These are truths in some real world. Facts are things we want to represent.

Representation: It is some chosen **finalism** so that facts acquire a form where we are able to manipulate them.

Mapping between facts and representation



fig(1):

Knowledge Level:

At this level facts, which include agent's behaviors and current goals are described.

Symbol level:

It the level at which representations of objects at the knowledge level are defined in terms of symbols that can be manipulated by programs.

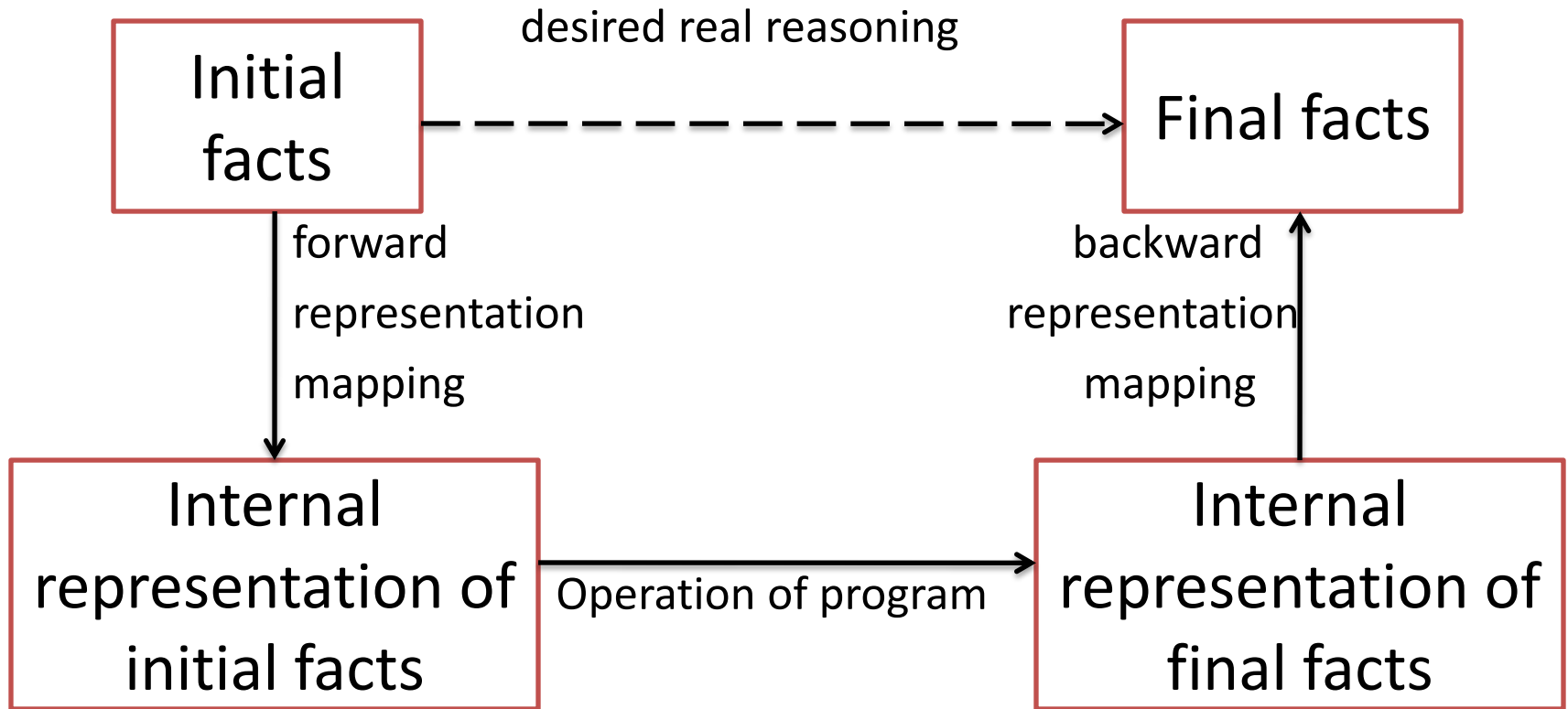
Ram is an old man: $\text{old man}(\text{Ram})$

All old men have white hair: $\forall x: \text{old men}(x) \rightarrow \text{has white hair}(x)$

New representation object: $\text{has white hair}(\text{Ram})$

Backward mapping: Ram has white hair

Representation of facts



fig(2):

Properties of a good knowledge representation system

1. Representational Adequacy: The ability to represent all of the kinds of knowledge that are needed in that domain.
2. Inferential Adequacy: The ability to manipulate the representational structure in such a way as to device new structures corresponding to new knowledge inferred from old.
3. Inferential Efficiency: It is the ability to incorporate into the knowledge structure additional information that can be used to focus the attention of the inference mechanisms in the most promising directions.
4. Acquistional Efficiency: It is the ability to aquire new information easily. The simplest case involves direct insertion, by a person, of new knowledge into the database. Ideally, the program itself would be able to control knowledge acquisition.

Simple relational knowledge:

In this technique of knowledge representation, the declarative facts are representation, the declarative facts are represented as a set of relations of the same sort as used in database systems.

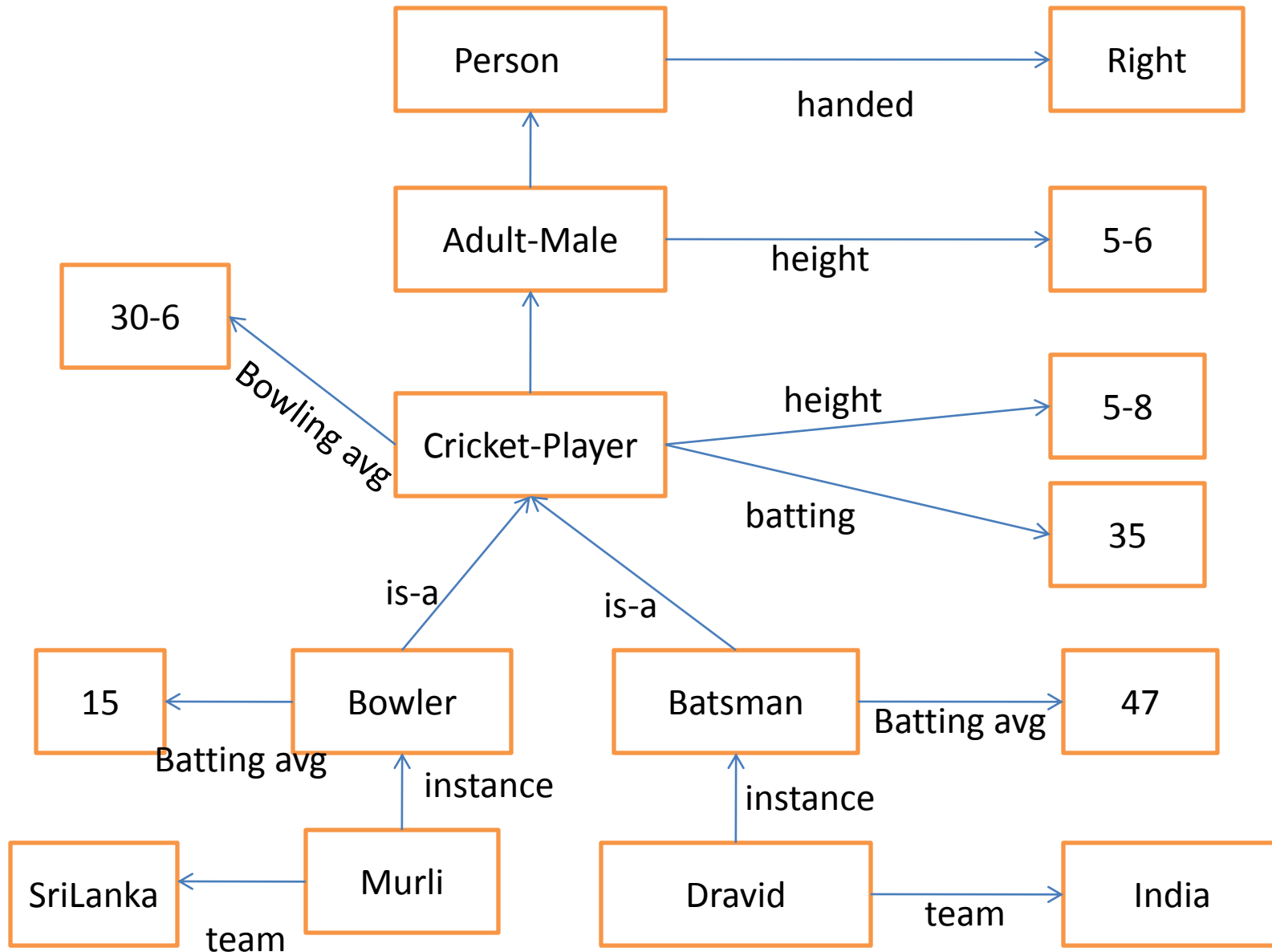
Example: Name Age Sex Address

This representation technique is simple because standing alone it provides very weak inferential capabilities. Knowledge represented in this form may **sene** as the input to more powerful inference engines.

Inheritable knowledge:

In this knowledge representation technique, the basic representation is augmented with inference mechanisms that operate on the structure of the representation. For this to be effective, the structure must be designed to correspond to the inference mechanism that are desired. A useful form of inference is property inheritance in which elements of specification classes inherit attributes and values from more general classes in which they are included.

Inheritable knowledge.. Contd..



Lines represent attributes Boxed nodes represent objects and values of attributes of objects. Structure is called a slot and filler structure or a semantic network or a collection and values associated with a particular node.

Node as a frame:

Cricket Player

is a:

height:

batting avg:

bowling avg:

Inferential Knowledge:

This consists of an inference procedure that can exploit knowledge which is present in some form. The inference procedure implements the standard logical rules of inference. The procedure may reason forward from given facts to conclusions. It may also reason backward from desired conclusions to given facts.

Procedural knowledge:

This type of knowledge is also called operational Knowledge and specifies what to do. This knowledge can be represented as a code in some programming languages. The machine uses the knowledge when it executes the code to perform a task. But this way representing procedural knowledge is less efficient with respect to properties like inferential adequacy(because it is very difficult to write a program that can reason difficult to write a program that can reason about another program's behaviors)and acquisitional efficiency (because the process of updating and debugging large pieces of code because unwidely). The most common technique for representing procedural knowledge in AI is by the use of production rules. Production rules that are augmented with information on how they are to be used are more procedural than other representation methods.

Declarative Knowledge :

It is one in which knowledge is specified, but the use to which that knowledge is to be put is not given. Declarative knowledge must be augmented with a program that specifies what is to be done to the knowledge and how.