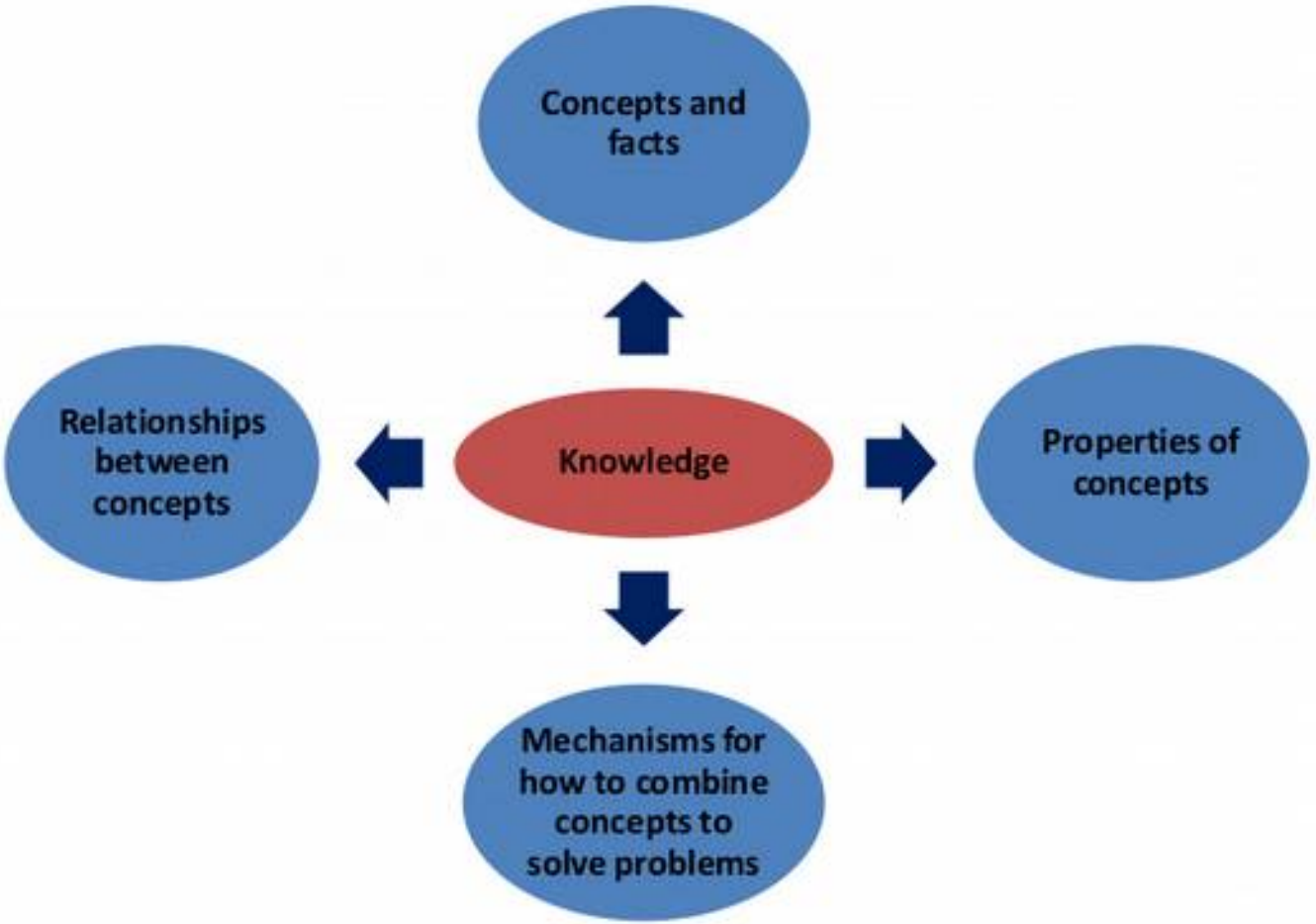
Introduction to Knowledge

What is Knowledge?

- Knowledge is understanding of a subject area.



Why do we need Knowledge Representation?

- Unlike human mind, computers cannot acquire and represent knowledge by themselves.
- It is complicated to machine process a knowledge represented in natural language.
- Human knowledge is of different types.
- Knowledge manipulation involves:
  - Knowledge acquisition: gathering, structuring and organizing knowledge.
  - Knowledge storing: putting the knowledge into computer.
  - Knowledge retrieval: getting the knowledge when needed.
  - Reasoning: gives conclusion, inference or explanation.

Basic Components of Knowledge

- Set of data
- A Form of belief or hypothesis
- Kind of information

As Set of Data

- Knowledge is different from data.
- Data is raw form of observations
- Knowledge is organised form of data and procedures which can be used for some useful purposes.
- Eg: Physician treating a patient

As form of belief or hypothesis

- Knowledge is different from belief and hypothesis.
- Belief is any meaningful coherent expression that can be expressed.
- Belief may be true or false.
- Hypothesis is a belief that is backed with some supporting evidence but it may still be false.
- **Knowledge is true justified belief.**

As kind of Information

- Information is data plus meaning of the same.
- When information is capable of creating more information and can become part of some action then it falls in the category of knowledge.

- **Knowledge is information about objects, concepts and relationships that are assumed to exist in a particular area of interest.**

What is Knowledge?

- Difference between data, information and knowledge:
  - Data: Primitive verifiable facts. Example: name of novels available in a library.
  - Information: Analyzed data. Example: The novel that is frequently asked by the members of library is "Harry Potter and the Chamber of Secrets".
  - Knowledge: Analyzed information that is often used for further information deduction. Example: Since the librarian knows the name of the novel that is frequently asked by members, s/he will ask for more copies of the novel the next time s/he places an order.

- Knowledge is richer, structured and more contextual form of information that is required to perform the task of problem solving.
- Salient points to be noted in context of knowledge are:
  - Understand knowledge
  - Use knowledge for decision making
  - Recognise objects through vision
  - Interpret situations
  - Plan strategies

Expert Systems

- They are AI based systems which make the task of diagnosis, analysis, querying and suggesting appropriate solutions to real world problems of the quality at par with the quality of human being.
- Expert systems are develped using knowledge and are a kind of knowledge-based systems.

Expert Systems

- Various techniques are used for knowledge acquisition and knowledge representation for acquiring and representing knowledge for using in the development of expert systems.
- Knowledge based systems are used by knowledge engineers and the process of development, building and maintaining knowledge-based systems is the domain of knowledge engineering.

Types of Knowledge in AI

- Declarative
- Procedural
- Inheritable
- Inferential
- Relational
- Heuristic
- Common sense
- Explicit
- Implicit
- Uncertain

Declarative knowledge

- The knowledge which is based on concepts, facts and objects.
- It provides all the necessary information about the problem in terms of simple statements, either true or false.
- Eg: facts about college
- Facts can be static or dynamic

Procedural knowledge

- Procedural knowledge derives the information on the basis of rules, strategies, agendas and procedure.
- It describes how a problem can be solved.
- Procedural knowledge directs the steps on how to perform something.
- For example: Computer program.

Heuristic knowledge

- Heuristic knowledge is based on thumb rule.
- It provides the information based on a thumb rule, which is useful in guiding the reasoning process.
- In this type, the knowledge representation is based on the strategies to solve the problems through the experience of past problems, compiled by an expert.

Inheritable Knowledge

- It is a knowledge representation scheme in which knowledge is represented using objects, their attributes and corresponding value of the attributes.
- The relation between different objects is defined using a “isa” property.
- For example if two entities “male” and “Person” are represented as objects then the relation between the two is that male “isa” person.

Inheritable Knowledge

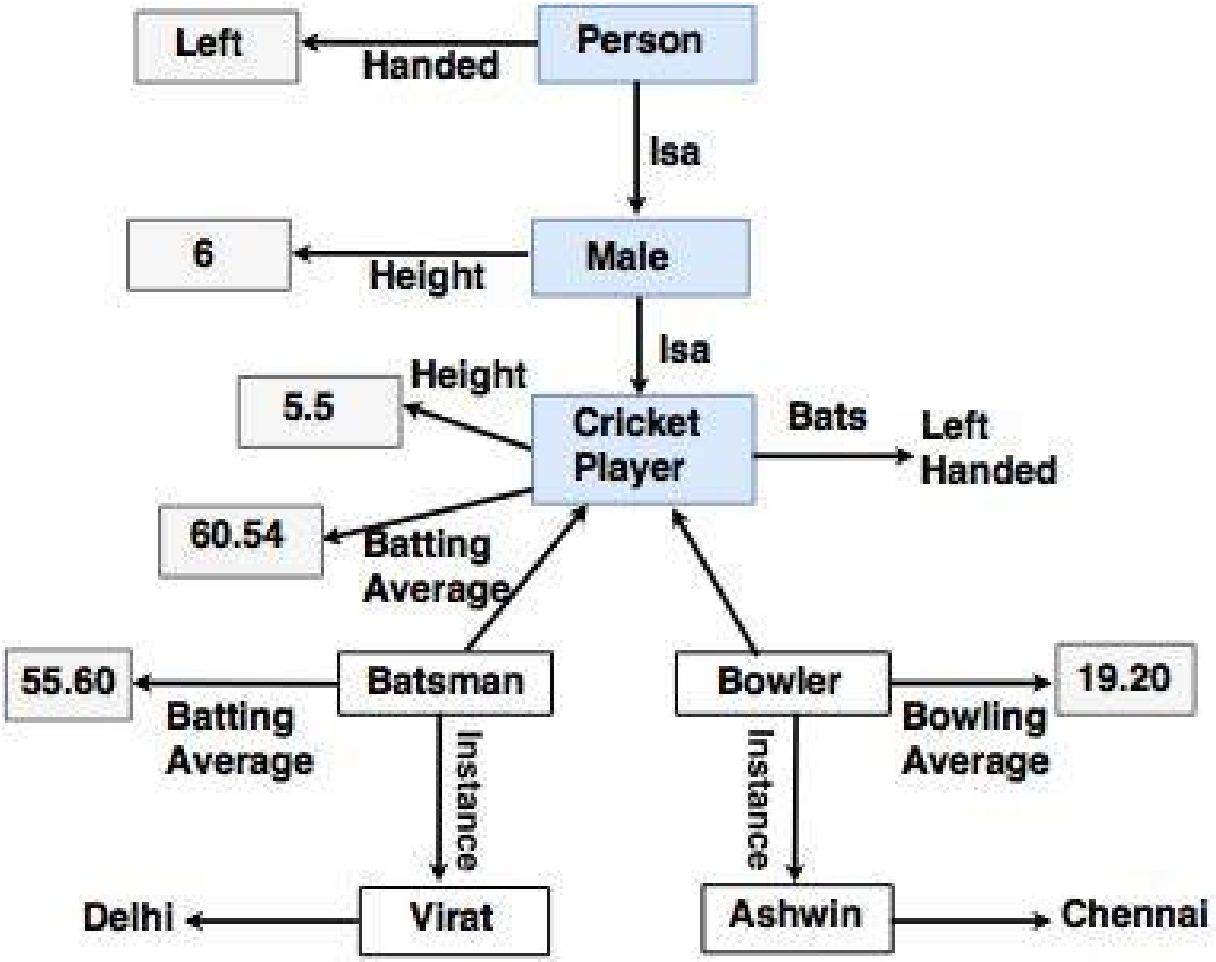


Fig: Inheratable Knowledge Representation

Relational knowledge

- The relational knowledge base determines a set of attributes and associated values that together describe the objects of knowledge base.

Player	Height	Weight	Bats_throws
John	6.1	180	Right_throws
Sam	5.10	170	right_right
Jack	6.2	215	Bats_throws

E.g. Player_info("john","6.1",180,right_throws)

- The knowledge about the objects, their attributes and their values need not be as simple as shown.

Inferential Knowledge

- Represent knowledge as formal logic
- Property inheritance is a powerful form of inferential knowledge.

Tacit knowledge

- Knowledge gained from personal experience that is more difficult to express.
- knowledge embedded in the human mind through experience and jobs.
- Personal wisdom and experience, context-specific, more difficult to extract and codify. Tacit knowledge Includes insights, intuitions.

Explicit knowledge

- Knowledge that is easy to articulate, write down, and share.
- knowledge codified and digitized in books, documents, reports, memos, etc.
- Documented information that can facilitate action.
- Knowledge what is easily identified, articulated, shared and employed.

Uncertain Knowledge

- Knowledge provided is uncertain and incomplete.
- What we know is provided
- The real world phenomenon are highly uncertain.
- Using probabilistic techniques or fuzzy logic to handle them
- Systems that use such methods are called fuzzy systems

Knowledge Representation

- Nature of problems related to AI are different, hence different types of knowledge representation techniques are required for finding solutions
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Knowledge Representation

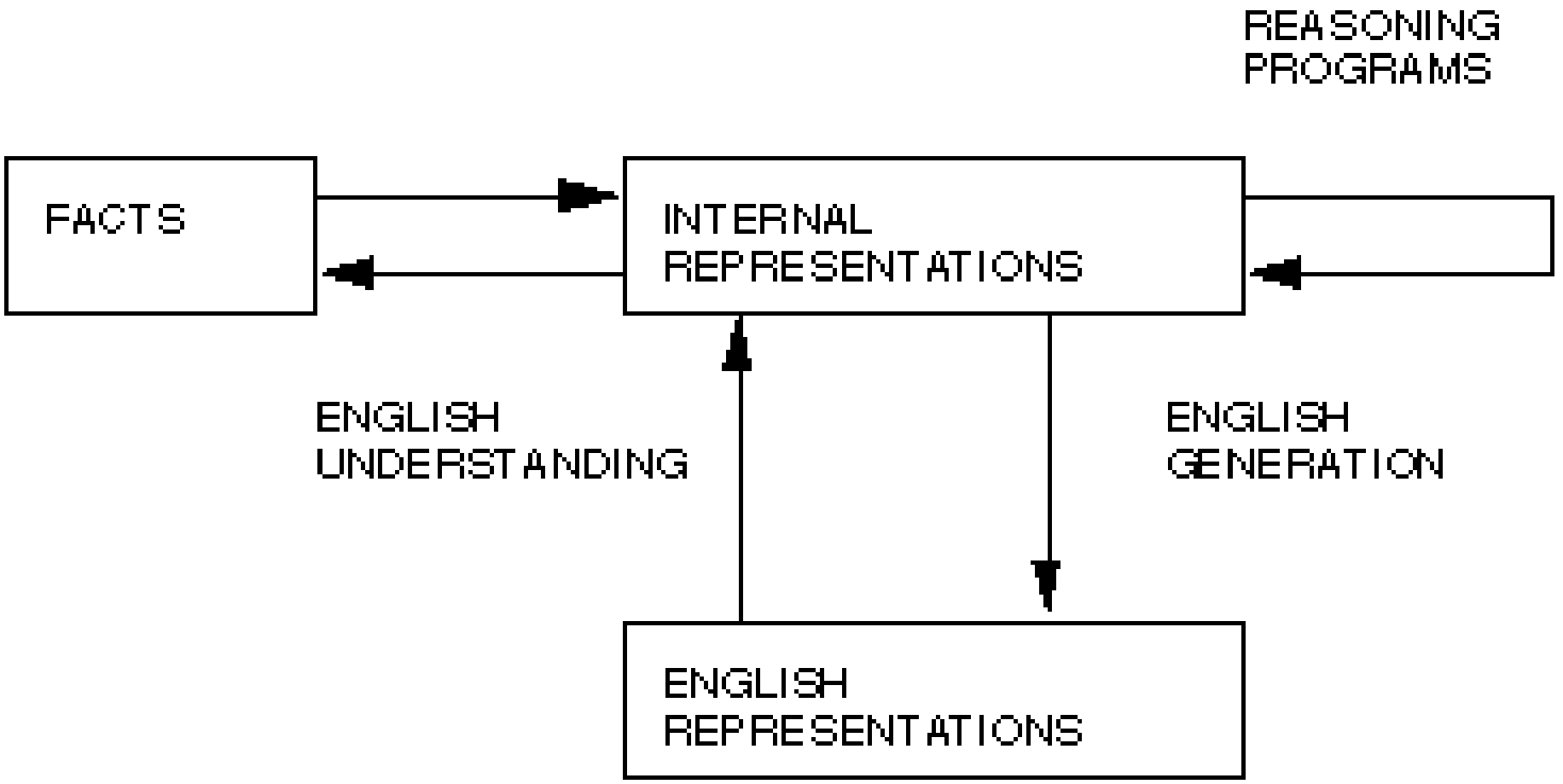

Fig: Basic knowledge representation of facts