Knowledge Representation & Issues

Introduction

- The objective of research into intelligent machines is to produce systems which can reason with available knowledge and so behave intelligently.
- One of the major issue - how to incorporate knowledge into these systems.

The Problem of Knowledge Representation

- How is the whole abstract concept of knowledge reduced into forms which can be written into a computers memory.
- This is called the problem of Knowledge Representation.

KR – contd...

- The intelligent systems are used to solve complex AI problems of specific domain.
- Therefore, it is important to represent the knowledge (facts and principles) in some internal form (computer understandable form). The two important entities are:
  - Facts: truths in some relevant world.
  - Representations of facts in some chosen formalism.

Properties required for KR

- Representational Adequacy – the ability to represent all kinds of knowledge required in that domain.
- Inferential Adequacy – the ability to manipulate the representational structures using deduction techniques to derive new structures corresponding to new knowledge inferred from old.
- Inferential Efficiency – the ability to incorporate into the knowledge structure additional information to improve the inference procedure
- Acquisitional Efficiency – the ability to acquire new information easily either using direct insertion of new knowledge into the database by a person or reasoning program.

Approaches to KR

- Declarative knowledge - Concepts, Facts, Objects
- Procedural knowledge - Rules, Strategies, Agendas, Procedures
- Heuristic knowledge - Rules of Thumb
- Meta knowledge - Knowledge about the other types of knowledge and how to use them
- Inheritable knowledge
- Relational knowledge
- Structural knowledge
- Rule sets, Concept relationships, Concept to object relationships
- Inferential Knowledge

Representation Schemes

- Logical schemes
  - Predicate calculus
  - Propositional calculus
- Procedural schemes
  - IF..THEN..rules
- Structured schemes
  - Scripts
  - Frames
- Networked schemes
  - Semantic nets
  - Conceptual graphs

Issues - KR

- Basic attributes that are common to many problems are instance and isa.
- Relationship among attributes – deals with attribute types and its representation, assigning values, techniques for reasoning about values and single valued attributes.
- **Examples**
- attribute types and its representation
  - height – number measured in length
  - team(a-b-c, India) or team=India and members=a-b-c
- techniques for reasoning about values
  - constraints – Age of a person cannot be greater than parent
  - if-needed-rules (backward rules)-rules for computing the value when it is needed to prove fact
  - if-added-rules (forward rules)-rules that describe actions to be taken for computing the value when it is needed – to derive inference.
- single valued attributes age, empcode

Issues – KR-contd..,

- Level of representation – primitive or higher level
- Representing set of objects using extensional or intensional definition
- Storing large amount of knowledge and retrieving required knowledge by assessing relevant part
- Finding the right structure from different chemes for knowledge representation.
- Representing the fact that change or do not change through search process-frame problem.