The Essence of Artificial Intelligence

Chapter 2: Knowledge Representation and Inference

Top Ten Salient Sentences

1. One of the assumption underlying most work in artificial intelligence is that intelligent behavior can be achieved through the manipulation of symbol structures representing bits of knowledge.

2. A knowledge representation language should allow you to represent adequately complex facts in a clear and precise yet natural way, and in a way that easily allows you to deduce new facts from your existing knowledge.

3. It is not enough to have a precise syntax and semantics if this means that your representation scheme is non-intuitive and difficult to use and understand. So we also require that our representation scheme is reasonably natural, capturing the structure of knowledge in an obvious way.

4. The final requirement, being able to deduce new facts from existing knowledge, is referred to as inferential adequacy. A knowledge representation language must support inference. We can't represent explicitly everything that the system might ever need to know – some things should be left implicit, to be deduced by the system as and when needed in problem solving.

5. Representing and reasoning with anything that involves time, beliefs or uncertainty is hard in predicate logic. There are special logics, such as temporal and modal logics, which allow such things to be represented, byt reasoning in such logics may not be efficient.

6. One simple way to describe precisely the meaning of nodes and links in a semantic network is in terms of set theory. We interpret a class node as denoting a set of objects . . . So the instance relationship can be defined in terms of set membership . . .

7. Allowing slots themselves to be frames means that we can specify various attributes of a slot. . . . Many systems allow slots to include procedures. The term procedural attachment is used for this. An arbitrary piece of program code may be placed in a slot, which is run whenever the value for that slot is needed. We may also allow pieces of code that are run whenever a value is added, perhaps to do consistency checks or to propagate results to other slots.

8. There are many things that cannot be easily represented using frames. For example it is hard to express negation, disjunction or certain types of quantification. If these things are needed then using a logic may be more appropriate.

9. Predicate logic provides a powerful way to represent and reason with knowledge. Some things that cannot be easily represented using fames, such as negation, disjunction and quantification, are easily represented using predicate logic. The available inference rules and proof procedures mean that a much wider range of inferences are possible than the simple inheritance-based inference allowed in a frame system.

10. Instead of representing knowledge in a relatively declarative, static way, rule based systems represent knowledge in terms of a set of rules that tell you what you should do or what you can conclude in different situations. A rule-based systems consists of a set of IF-THEN rules, a set of facts normally representing things that are currently held to be true, and some interpreter controlling the application of the rules, given the facts.