Artificial intelligence: An Abstract Representation of knowledge

Ms. Juhi Singh, Assistant Professor,

Department of computer science and engineering

Amity university Haryana

Abstract

In today's era of research and innovation, it is very important to represent the acquire knowledge in a systematic way. This paper explains some very useful technique of knowledge representation techniques of artificial intelligence and these techniques can be easily applicable to any domain. However knowledge representation is useless until it is in the form of human comprehension. So for better human comprehension the idea of abstract modeling/ representation can be integrated with the representation techniques of artificial intelligence, which can improve the qualitative and quantity of knowledge representation. In the domain of artificial intelligence basically it is used for expert system and with the help of abstract modeling techniques, it would give the better and cumulative human comprehension by using abstract graph instead using the conventional knowledge representation techniques of Artificial intelligence

Keywords: artificial intelligence, knowledge representation, and abstract modeling

1. Introduction

The term *abstract model* is used to represent the rough idea about anything when it comes under the roof of artificial intelligence it made a distinction models *are* and *what models are made of*. [1]These models are used to solve the real world problem that is directly proportional to how well it corresponds to a past, present, future, actual or potential state of affairs. A model of a concept is quite different because in order to be a good model it need not have this real world correspondence. In artificial intelligence abstract models and abstract graphs are used to represent knowledge for building expert systems and knowledge-based systems. This paper is concern about the abstract representation of artificial intelligence techniques. to represent expert opinion on what is true not their own ideas on what is true.[2]

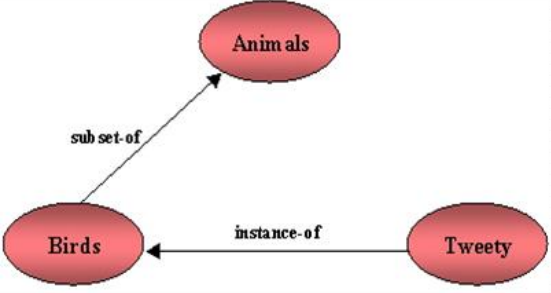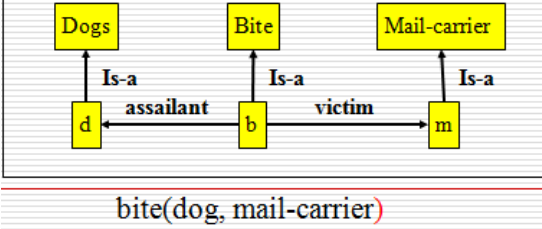## 2. Knowledge Representation Techniques: A abstract graph

There are various knowledge representation technique of artificial intelligence which are tradition used but this paper focus on the major knowledge representation techniques that can be further folded towered the abstract representation. Here are the some more important. [3]

2.1 Semantic networks: A semantic network is often used as a form of knowledge representation. It is a directed graph consisting of vertices which represent concepts and edges which represent semantic relations between the concepts. [4]

A semantic net is a structure which is used to represent associations between objects.

- A semantic network consists of
  - a set of nodes that represent **concepts** : comes from its relationship to other concepts.
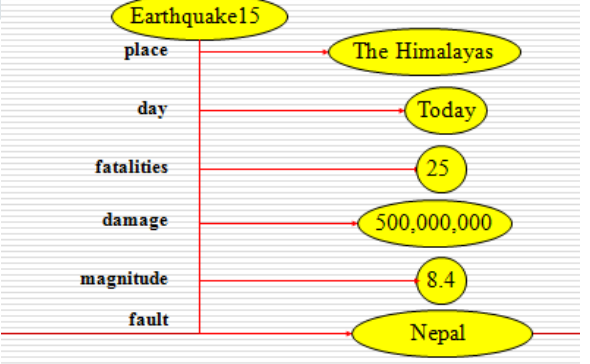 - Labeled arcs that connect nodes representing **relations** between concepts.

Table 1: semantic representation example

Example Semantic Representation	Example Semantic Representation Under abstract model
Fig 1(a): Graph representation under semantic network	Fig 1(b): abstract representation under semantic network
Fig 1, Graphical representation of knowledge "Tweety is a Bird" in the form of semantic network. Same knowledge can be represented as a concept for example if the knowledge "The dog bit the mail carrier" can be represented in form the abstract model under the semantic network.	

2.2. Frames: used to represent commonsense or stereotyped knowledge. Consist of a cluster of nodes and links manipulated as a whole. Frame can represent a specific entity, or a general concept are hierarchically organized.

- A frame describes some real-world entity and is a collection of attributes and its value
- Frames are implicitly associated with one another because the value of a slot can be another frame.
  - **Slots: each** slot contains one or more facets.
  - **values:** facets may take the following forms

Table 2: Frame Representation example

Example of Frame Representation	Example of Frame Representation under abstract model
Fig 2(a): Frame representation of knowledge "kapil Dev and Sachin Tendulkar are cricket players"	Fig 2(b): abstract representation under frame

As per the above description, represented knowledge can be further extending up to depth

based on the previous or perceived knowledge as shown in fig 2(a). Now consider another example to represent knowledge under frame as abstract representation, as shown in fig 2(b)

2.3.Rule-based representations: used to represent the condition based outcome knowledge in the form of if then rule[7]. This kind of representation usually comes under the problem solving techniques of artificial intelligence in which the initial and goal state are known with the state space to solve a given problem as mention in table 3, water jug problem [6]

Table 3

Given	Goal	Actions
- a tap of running water, - two jugs one with the capacity of 3 Gallon and another with the 4 Gallon jug - No measuring marks on either water jug	Fill the 2liter water in the 4gallon jug.	- Filling jugs with the water from tap wither into 4 gallon jug or into 3 gallon jug. - dumping 4 gallon into 3 gallon jug until 3 gallon jug is full - Dumping 3 gallon jug into 4 gallon jug until empty or until 4 gallon is full

Based on the action plan here are following rule to solve the given problem [6]

1. if the 4 gallon jug is empty

2. if the 3 gallon jug is empty

3. Extract some water from 4 gallon jug that is currently filled

4. Extract some water from 3 gallon jug that is currently filled

5. Extract water from 4 gallon jug

6. Extract water from 4 gallon jug

7. Now fill the 4 gallon jug by pouring some water from 3 gallon jug until it is full

8. Now fill the 3 gallon jug by pouring some water from 4 gallon jug until it is full

9. Pour all the water from the 3-gallon jug into the 4-gallon jug

10. Pour all the water from the 4-gallon jug into the 3-gallon jug

11. Pour the 2 gallons from 3-gallon jug into the 4-gallon jug

12. Empty the 2 gallons in the 4-gallon jug on the ground

Solution of the given water jug problem by applying rules mention in table 3:

Gallons in the 4-gallon jug	Gallons in the 3-gallon jug	Rule applied
0	0	2
0	3	9
3	0	2
3	3	7
4	2	5 or 12
0	2	9 0r 11
2	0	Solved

2.4. Logic-based representations: this is totally dependent upon the reason based logic that can be either   deductive or inductive reasoning, which may contains the following :

- Facts and premises for propositional logic and predicate logic with certainty factor with the value true or false or unknown.
- Fuzzy logic that is used to handle the vagueness of data and deals with uncertainty, where the available information are associated with some certainty with the degree of membership with the closed interval of 0 and 1 .
- Probability theory provide the chance of occurrence with the value between 0 and 1

    Following table 4 shows a brief description of the logic-based representation:

Table 4: tabular representation of logic based representation [5]

Theories of Logic	Existence of logic	Value based on belief
Propositional logic: Boolean - dealing with complete statements	Facts	T/F/Unknown
First Order Predicate Logic /Predicate Logic: use addition information and to show them it usage concepts of function as well as variables	Facts, objects, relations	T/F/Unknown
Probability theory	Facts	Degree of belief [0…..1]
Fuzzy Logic	Degree of truth	Degree of belief [0…..1]

Conclusion:

This paper is concern about the abstract representation of artificial intelligence techniques to solve the real world problem faced by many. Because if the gathered knowledge is not able showcase by proper manner, then it is very difficult for the human comprehension to understand and provide the expert opinion on that. As discuss here the above mention techniques are very useful to represent any kind of knowledge of any domain whether its demand graphical or tabular representation or any rule based restricted domain or any logic either with certainty or uncertainty , each kind of abstract knowledge can be represented and handled properly through artificial intelligence

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