An Effective Knowledge base system Architecture and issues in representation techniques

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Abstract

The research in AI is divided in to two categories Knowledge representation and general. For making the computer or Machine as intelligent as human being we require two things Knowledge representation and inference mechanism. Development of an AI system is a crucial task because some time we have incomplete information and it can be ambiguous and uncertain. So solution to these problems is to build a knowledge effective knowledge base and an effective inference mechanism. The objective of this paper is to present the knowledge base system architecture/model for intelligent system and to present the issues in various hybrid KR techniques.

Keywords: Knowledge Representation (KR), FRORL, RT-FRORL, MANTRA,

1. Introduction

Artificial intelligence (AI) is the intelligence of machine. Basically AI is the branch of science to make the machine as intelligent as human being for particular domain. In 1950,s Alan Turing the British Mathematician presented a paper on Computing Machinery and Intelligence. The result of this paper was if a machine could pass certain test (known as Turing test) then it could be intelligent. . In this paper Turing also considered a number of arguments for, and objections to, the idea that computers could exhibit intelligence [1].AI was first coined as a discipline at a conference called "The Dartmouth Summer research Project on Artificial Intelligence", organized by John McCarthy and Marvin Minsky. In his above mentioned paper, Turing points out the fact that before answering the question "Can machines think?" one should first define "machine" and "think". From the artificial intelligence point of view, "machine" refers almost always to a computer. The term "think" or better the term "artificial intelligence" received a working definition in a paper of McCarthy and Hayes (1969): "A machine is intelligent if it solves certain classes of problems requiring intelligence in humans". Other definitions for artificial intelligence were also proposed: "Artificial Intelligence is the part of computer science concerned with designing computer systems that exhibit the characteristics we associate with intelligence in human behavior" (Barr and Feigenbaum, or "Artificial Intelligence is the study of mental faculties through the use of computational models" (Charniak and McDennott, [2]. John Mylopoulos presented a brief overview of terminology and issues related to Knowledge Representation [6].

1.1 Knowledge Representation

Till now several definitions are proposed for knowledge representation like The represented world by Furbach and Zeigler)[1][3]. They discuss the three major components of a representation, the correspondence between these two worlds. Another important point is that the represented and representing world should be provided with specific operators, with the help of which we are able to manipulate the entities belonging to these worlds. Furbach et al. call the union of a world and its operators a Body of Knowledge [1]. R. Davis, H. Shrobe, and P. Szolovits in 1993 presented knowledge representation as a surrogate, a substitute for the thing itself, used to enable an entity to determine consequences by thinking rather than acting, i.e., by reasoning about the world rather than taking action in it. They presented the following rolls of knowledge representation [4].

- It is a set of ontological commitments, i.e., an answer to the question: In what terms should I think about the world?
- It is a fragmentary theory of intelligent reasoning, expressed in terms of three components:(i) the representation's fundamental conception of intelligent reasoning; (ii) the set of inferences the representation sanctions; and (iii) the set of inferences it recommends.
- It is a medium for pragmatically efficient computation, i.e., the computational environment in which thinking is accomplished. One contribution to this pragmatic efficiency is supplied by the guidance a representation provides for organizing information so as to facilitate making the recommended inferences.
- It is a medium of human expression, i.e., a language in which we say things about the world.

In AI system the knowledge representation affects the following things, implementation, efficiency, speed and maintenance of the system. KB structure must be capable of representing a broad spectrum of knowledge types categorized by Feigenbaum include [5].

- Objects - information on physical objects and concepts
- Events - time-dependent actions and events that may indicate cause and effect relationships.
- Performance – procedure or process of performing tasks
- Meta-knowledge – knowledge about knowledge including its reliability, importance, performance evaluation of cognitive processors.

Many of the problems in AI require extensive knowledge about the world. Objects, properties, categories and relations between objects, situations, events, states and time, causes and effects are the things that AI needs to represents. Knowledge representation provides the way to represent all the above defined things.

2. Knowledge base system model /Architecture

The KR system must be able to represent any type of knowledge, “Syntactic, Semantic, logical, Presupposition, Understanding ill formed input, Ellipsis, Case Constraints, Vagueness”. For making it more effective the knowledge representation model is divided in

to five different parts the K Box, Knowledge Base, Query applier, reasoning and user interface as shown in fig 2.1.

K Box :- The first part of K Box takes The input from the outside world through user interface. The source of input can be a book, novel, News paper etc. The input is a concept can be divided in to the following categories: substance, quality, action, generality, particularity, inherence and negation and each substance can be earth, water, light, air, ether, time, space, soul and mind as in case of Indian logic [26].The Input from the user is divided into two categories either it can be a new information or it can be the query.

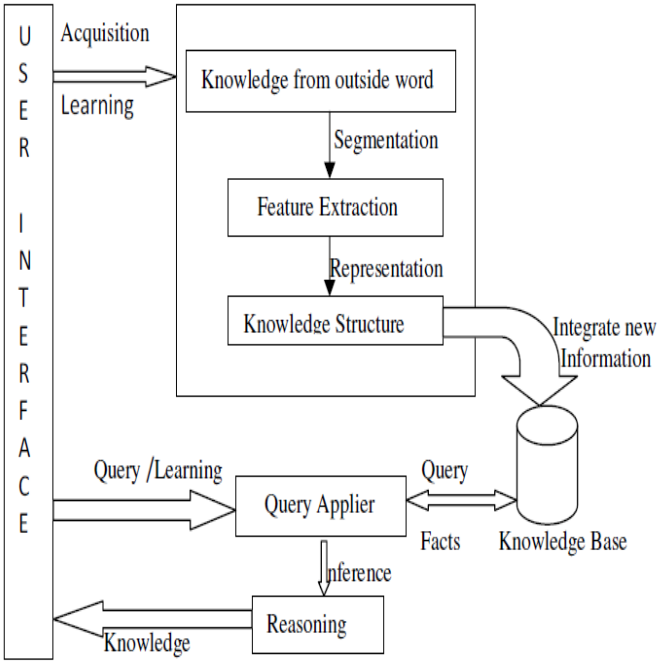

Fig. 2.1 Knowledge Base System Model/Architecture

If incoming input is the new information then it goes to the aquisition and learning process to check whether that knowledge is already in knowledge base if yes then system will discard that. Otherwise it checks whether that knowledge will be accommodate by the existing system if yes then segmentation process has been done on the input to check in which categories it lies and separates the action with the other.

Feature Extraction part of K Box is used to check whether there is an activity can be perform or some process is to be present in the incoming text for Ex. Mobile is ringing then the process is going on in this incoming knowledge means some sound is coming and the root of ringing is ring. If the sentence is like ram is a boy then no action will be performed. If the incoming knowledge is simple sentence then we can represent it by using semantic net, frames and predicate logic but when some activity could be performed by the entity then we need a structure that could be dynamic in nature and must be expressive.

Knowledge Structure part of K Box is used to represent the incoming knowledge by using best knowledge representation technique. The KR is combination of Semantic Net and Script techniques. Knowledge Base consist all the knowledge required to solve the problem. The knowledge base can be general or domain specific.

Query Applier is used for getting the facts from the system and then passes the data to the inference mechanism for reasoning. Whenever the new query comes system will learn whether that query is related to the previous query or it generates from the previous query and check how many time user ask the combination of these. We will use the association learning rule mining for learning the system at this stage for making the system intelligent.

Reasoning is used for getting new fact from the existing knowledge. The simplest reasoning technique is forward and backward reasoning.

3. Issues in Hybrid Knowledge Representation Techniques

Every knowledge representation technique have their own merits and demerits, that depends upon which type of knowledge we want to represent .for adequate representation we need different type of structures. To navigate the problem associated with single knowledge representation technique the hybrid knowledge representation came in picture. This section follows the various existing hybrid knowledge representation techniques and their issues.

3.1 Krypton

In 1983 Ronald J. Brachman, Richard E. Fikes, Hector J. Levesque has developed krypton a hybrid knowledge representation technique.

Technical description: Two boxes are used terminological box(T box) and assertion box (A box). TBox used the structure of KL-ONE in which terms are organized taxonomically, using frames an ABox used the first-order logic sentences for those predicates come from the TBox, and a symbol table maintaining the names of the TBox terms so that a user can refer to them. It is basically a tell ask module. All interactions between a user and a KRYPTON knowledge base are mediated by TELL and ASK operations shown in fig 3.1[14][16].

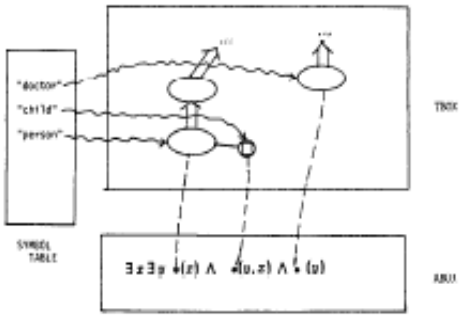

Fig.3.1 Overview of KRYPTON[14]

Advantages:- Combine the advantages of both frame based and pradicate logic. Can work for incomplete information.

Disadvantages /Limitations:- Less expressive and the limited interface between user and a knowledge base. The user is only limited to what is knowledge base rather than the functionality**.**

3.2 MANTRA

In 1991 MANTRA was developed by J. Calmet, I.A.Tjandra, G.Bittencourt**.**

Technical description: It is the combination of four different knowledge representation techniques. First order logic, terminological language, semantic networks and Production systems. all algorithm used for inference are decidable because this representation used the four value logic. Mantra is a three layers architecture model. It consist the epistemological level, the logical level, Heuristic level.

Example [1]:- Ex of operation in logic level

1 command ::= tell(know1edge base, Fact) .
2 ask(knowledge base, Query)
3 to-frame(frame-def)
4 to-met(snet-den)
5 Fact ::= to-logic(formu1a)
6 Query ::= from logic(formula)

Ex of operation on terminological box

frame - def ::= identifier : c = concept | identifier : r = relat ion

concept ::= (concept) | concept .

Advantages:- 1 An intelligent, graphical user interface would help in building knowledge bases. 2 Support procedural knowledge. 3 A graph editor can be used t o visualize, for instance, hierarchies or terminologiesthat would help the user for representing expert's knowledge.

Disadvantages:- Less Expressive. Only applicable for symbolic computation (Mathematical model**).**

3.3 FRORL

(frame-and-rule oriented requirement specification Language) was developed by Jeffrey J. P. Tsai, Thomas Weigert, Hung-Chin Jang in 1992.

Technical Description: FRORL is based on the concepts of frames and production rules Which is designed for software requirement and specification analysis. Six main steps are following [10][11].

1) Identify subject and themes
2) Define object frames.
3) Define object abstract inheritance relation

4) Define object attributes.
5) Identify activity frames.
6) Define actions and communication

There are two types of frames
Object frame and activity frames
Object Frames are used to represent the real world entity not limited to physical entity. These are act as a data structure. Each activity in FRORL are represented by activity frame to represent the changes in the world. Activity, Precondition and action are reserved word not to be used in specification. Language for FRORL consist of Horn clause of predicate logic.

Advantages:- 1 Modularity. 2 Incremental development. 3 Reusability. 4 Prototyping.

Disadvantages:- Only limited for building prototype model for software.

5. Conclusion

There are various knowledge representation schemes in AI. All have different semantics, structure and different level of power. Combination of two or more representation scheme may be used for making the system more efficient and improving the knowledge representation. We are trying to build the intelligent system that can learn itself by the query.

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