Reasoning Algorithm for Hybrid Knowledge Representation

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Abstract: Knowledge representation is most desirable area of research to make the system intelligent. Today is the ERA of knowledge that requires articulations, semantic, syntax etc. These requirements, forced to design a general system which is applicable to represent declarative as well as procedural knowledge. Without effective inference/Reasoning mechanism, the strength and utility of knowledge representation technique fulfill the partial requirement for an intelligent system. The objective of this research work is to present the Effective/Appropriate knowledge representation technique for representing the general knowledge and a reasoning algorithm so that appropriate knowledge can be infer from the system. The architecture of Knowledge Representation (KR) system is capable to integrate different type of knowledge.

Keywords: Knowledge Representation (KR), Semantic Net, Script, Reasoning, Forward Chaining, Backward Chaining.

I. INTRODUCTION AND LITERATURE SURVEY

Knowledge representation (KR) is an essential area for cognitive science and Artificial Intelligence. In former it is concerned with how knowledge is stored and processed and in later the main aim is to solve problems requiring intelligence which otherwise is possible only through knowledge. Basically knowledge representation is a study of methods of how knowledge is actually Visualized/realized and how efficiently/naturally it be similar to the depiction of knowledge in human brain. Constructing intelligent systems require large amount of knowledge and a method for representing large amounts of knowledge that permits interaction [1][3]. In fact knowledge representation is the fundamental issue in AI that attempt to understand intelligence [1][2]. The main problem of Artificial Intelligent system is to how to represent knowledge and how to incorporate both type of knowledge in single system i.e Declarative and Procedural[1]. Because of all these problems KR became a separate research area in AI. From few years a group of system came that incorporate all these fundamental issues known as hybrid knowledge representation system. The hybrid system includes two or more knowledge representation techniques.

A. KR Techniques

The KR techniques are divided in many categories. The representation techniques can be declarative,
Procedural, Hierarchical, Graphical etc. Objects, properties, [17] categories and relations between objects, situations, events, states and time [17], causes and effects are the things that an intelligent system desires to represents [4][8]. The semantic Net Conceptual Dependency and Script knowledge representation technique are describe here.

Semantic network: Semantic Nets commonly used knowledge representation technique. It represents the connection between objects or class of objects. It is a directed graph in which nodes / vertices represent the objects / class of objects and edges and links (unidirectional) represent the semantic relations between the objects. Semantic network are generally used to represent the inheritable knowledge. Inheritance is most useful form of inference. Inheritance is the property in which element of some class inherit the attribute and values from some other class [5][6][9].

Conceptual Dependency (CD): CD was developed by Roger Schank in 1973 to represent the knowledge acquired from natural language input. In CD Sentences are represented as a series of diagrams depicting actions using the abstract and real physical situations. CD representation provides the sets of primitive actions, different types of states, and different theories of inference. A variation in the theme of structured objects called scripts was devised by Roger Schank and his associates in 1973. It is an active type information which contain class of events in terms of contexts, participants and sub-events represented in the form of collection of slots or series of frames which uses inheritance and slots. Scripts predict unobserved events and can build coherent account from disjointed observations. A script describes the stereotypical knowledge [5][9][10].

B. Hybrid KR techniques

To combine the advantages and overcome the disadvantages of individual KR techniques many Hybrid knowledge representation techniques are available in market. KL-ONE KR tool was the first hybrid knowledge representation technique which is the hybrid of semantic net and first order predicate logic. The KL-ONE worked as a building block for many hybrid KR techniques [4][12][17].

RT-FRORL: RT-FRORL is the extension of FRORL proposed by (Tsai, Aoyama, Chang, 1988). RT-FRORL consists of two frame types: Objects and Activities. Each real world entity was modelled as an Object. Changes taken place in the world were represented in the requirement model as Activities. Each Object and Activity has certain properties, assumptions, or constraints associated with it that was integrated into a frame representation. The RT-FRORL was developed to express the real-time timing constraints [13][14].

SOL: SOL was used for knowledge representation and as an inference mechanism. In SOL the concept of smart object was developed for the development of a large, complex knowledge based system (KBS). Smart Objects are a tool for building systems in which inferential processes are an integral part of a broader design. The central methodological concept of the paradigm is the division of knowledge of a modelled environment into a domain component and an application component. The four elements of a smart object considered were Method, Interface, Attribute, and Monitor. The Smart Object paradigm was successful in meeting the design criteria they proposed for KR’s used in the design of complex KBS’. Encapsulation in SOL was used for data security [15].

AAANTS: AAANTS a hybrid knowledge representation system called AAANTS((Adaptive, Autonomous, Agent colony interactions with Network Transparent Services). The proposed model was a multi-agent system that conceptualises and implements a colony of agents that actively interact with a collection of distributed services in order to provide adaptive behaviour. AAANTS knowledge representation methodology was the hybrid of frame-based Uniframers and Accumulators to complement the learning achieved through Reinforcement Learning (LR) techniques [16]. There are many other hybrid KR tools are available like Extended Semantic Net, Loom, Mantra etc. They all have separate problem definition and area. So generally we require a new hybrid KR technique for new problem domain.

II. KNOWLEDGE BASE SYSTEM 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 sub parts the K Box, Knowledge Base, Query applier, reasoning and user interface as shown in figure 1.[3][8]. The knowledge base architecture defined in Figure 1 is used as a story reader. The knowledge base of the system is capable to store the hybrid of semantic net and Script. Semantic net is used to represent the
inheritable and relational knowledge where as semantic net is used to represent the events in the story. The methodology used to implement the system is shown in figure 2. be a book, news paper, magazine etc. the system check is made when ever a new input is entered by the user to see whether the same is already stored in knowledge base or not. If the same is already stored in knowledge base than system gives the alert message other it accept the new input and pass it to further processing. As shown in figure 2 the system is able to take the input from out side word. The source of input can

A. Knowledge Base (KB)

![Knowledge Base System Model / Architecture](image)

Figure 1 Knowledge Base System Model / Architecture [3][8]

![Methodology Diagram](image)

Figure 2 Represents the methodology
The knowledge base used in fig 1 and fig 3 is used to store the knowledge required to solve the problem domain. The KB in fig 1 is used to store the incoming knowledge i.e story and the hybrid representation corresponding to that story where as the KB used in figure 3 is used to store the rules required to infer the knowledge from the input.

B. Query applier

Query Applier is used for getting the facts from the system and then passes the data to the inference mechanism for reasoning [7]. Whenever the new query comes from the system will learn whether that query is related to the previous query or it generates from the previous query and check how many time users ask the combination of these [7]. We have use the association learning rule mining for learning the system at this stage for making the system intelligent.

C. Reasoning Algorithm

Reasoning system is used for getting new fact from the existing knowledge or to draw inference for the situation. The inference can be inductive / deductive. There are so many algorithm for searching are available like uninformed search techniques (depth first and depth first) and heuristic/informed search techniques (best first search, A*, AO*) in Artificial Intelligence. Resolution and chaining (forward and backward) are the known reasoning techniques. Forward chaining refers to deduction where as the backward chaining refer to induction. Let us consider an example of Deductive and inductive reasoning. The example of former is “Poonam must be either cooking or washing clothes”. If she is not cooking she must be washing clothes. i.e in case of deductive reasoning the truth of premises must lead to truth of conclusion. Now let us consider the example of inductive i.e is “the initial failure of machine was caused by some spare part failure”. i.e the truth of premise supports the conclusion without giving exact assurance. The system is able to reasoning the answer for any query related to the input using forward reasoning. Each problem domain in AI requires extensive knowledge. To solve / to reason we require a collection of rules and a control mechanism.

![Figure 3 Represents the Architecture of an artificial story reader System](image)

Algorithm used by the system for query applier is given below.

Algorithm Forward (KB, K) - return a substitute that didn’t found in K.
1. Repeat until KB is empty or NEW is not found.
2. Initialize NEW
3. NEW ← { φ }
4. For each statement S in KB do.
5. (S1 ^ S2 ^ S3^--- ⇒ Q) ← ( A )
6. Term ← λ
7. For each λ in Q : such that ( S1 ^ S2 ^ S3^--- ⇒ Q ) ← ( A )
8. Q'← ( λ , Q )
   If Q' not in query then
9. Q'← NEW
10. Add Q' to KB otherwise
11. No answer.
III. RESULT AND CONCLUSION

The implementation of the system is under processing. As the communication style of each one is different or varies from person to person, the proposed system can act as an intelligent system like a reader. In today hectic life no one has that much time to read a book of thousand pages. The system is able to reasoning the answer from the 1000 lines input. It can be used in daily life activities because the system is capable to represent the knowledge in day to day applications using semantic net and script. The Hybrid of declarative and procedural technique makes the system interactive and user friendly.

REFERENCES

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