B.Sc. (H) Computer Science Semester VI
Core Paper XIII – Artificial Intelligence

Topic:

- **Semantic Network**
- **Frames**

Semantic Network Representation

Semantic networks are alternative of predicate logic for knowledge representation. In Semantic networks, we can represent our knowledge in the form of graphical networks. This network consists of nodes representing objects and arcs which describe the relationship between those objects. Semantic networks can categorize the object in different forms and can also link those objects. Semantic networks are easy to understand and can be easily extended.

This representation consists of mainly two types of relations:

IS-A relation (Inheritance)

Kind-of-relation

Example: Following are some statements which we need to represent in the form of nodes and arcs.

Statements:

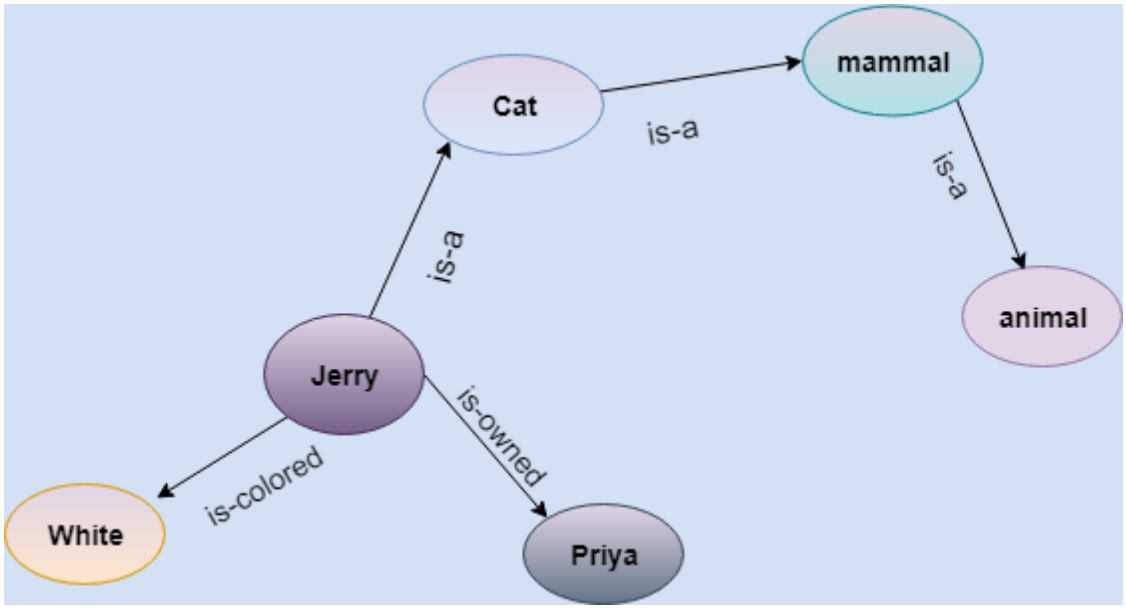
Jerry is a cat.

Jerry is a mammal

Jerry is owned by Priya.

Jerry is brown colored.

All Mammals are animal.



Source: https://www.javatpoint.com/ai-techniques-of-knowledge-representation

In the above diagram, we have represented the different type of knowledge in the form of nodes and arcs. Each object is connected with another object by some relation.

Drawbacks in Semantic representation

Semantic networks take more computational time at runtime as we need to traverse the complete network tree to answer some questions. It might be possible in the worst case scenario that after traversing the entire tree, we find that the solution does not exist in this network.

Semantic networks try to model human-like memory (Which has 1015 neurons and links) to store the information, but in practice, it is not possible to build such a vast semantic network.

These types of representations are inadequate as they do not have any equivalent quantifier, e.g., for all, for some, none, etc.

Semantic networks do not have any standard definition for the link names.

These networks are not intelligent and depend on the creator of the system.

Advantages of Semantic network

Semantic networks are a natural representation of knowledge.

Semantic networks convey meaning in a transparent manner.

These networks are simple and easily understandable.

Please draw figures yourself given on page 128-129 [1] based on semantic networks.

Frame Representation

A frame is a record like structure which consists of a collection of attributes and its values to describe an entity in the world. Frames are the AI data structure which divides knowledge into substructures by representing stereotypes situations. It consists of a collection of slots and slot values. These slots may be of any type and sizes. Slots have names and values which are called facets.

Facets: The various aspects of a slot is known as Facets. Facets are features of frames which enable us to put constraints on the frames. Example: IF-NEEDED facts are called when data of any particular slot is needed. A frame may consist of any number of slots, and a slot may include any number of facets and facets may have any number of values. A frame is also known as slot-filter knowledge representation in artificial intelligence.

Frames are derived from semantic networks and later evolved into our modern-day classes and objects. A single frame is not much useful. Frames system consist of a collection of frames which are connected. In the frame, knowledge about an object or event can be stored together in the knowledge base. The frame is a type of technology which is widely used in various applications including Natural language processing and machine visions.

Example: 1

Let's take an example of a frame for a book

Slots	Filters
Title	Artificial Intelligence
Genre	Computer Science
Author	Peter Norvig
Edition	Third Edition
Year	1996
Page	1152

NOTE: The following resources are used to prepare the content written above. Please go through the reference book also for the above topic and feel free to mail your doubts or discuss anything.

References/Resources

1. Dan. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall, 2004
2. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009
3. https://www.javatpoint.com
4. http://www.vssut.ac.in
5. https://career.guru99.com

Assignment

Q1. Explain the knowledge representation using semantic net with the help of an example.

Q2. Draw an associative network for the following sentences:

Tweety is a yellow bird that has wings and tail.
Tweety ate a fat worm.
John is going to Boston by bus.

Q3. How are frames used for knowledge representation? Explain using an example.

Q4. A 3-feet tall monkey is in a room, where some bananas are suspended from 8-feet high ceiling. The room contains two stackable, movable and climbable 3-feet high crates. Give the initial state, goal state, successor function and cost function for getting the bananas.

Q5. Write a short note on different knowledge representation techniques?