An Overview of Semantic Networks and Its Components

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***Abstract*—Semantic network analysis, similar to network analysis, is both a research method and a theoretical framework. Semantic network analysis differs from traditional network methods because it focuses on the structure of a system based on shared meaning rather than on links among communication partners. In other words, two nodes are connected in a semantic network to the extent that their uses of concepts overlap. The purpose of this article is to present the components and a set of procedures for describing a semantic network analysis. The semantic network represents the structure of a system based on shared meaning. Second, the semantic network analysis of an organization is compared to a traditional network analysis of the same system.**

Keywords—Semantic Net, Lexical part, Procedural part, Multiple Inheritances

I. INTRODUCTION:

Semantic similarity measures are specific types of **Semantic measures**: mathematical tools used to estimate the strength of the semantic relationship between units of language, concepts or instances, through a numerical description obtained according to the comparison of information formally or implicitly supporting their meaning or describing their nature.[1]

Semantic similarity measures the likeness of terms, words, documents (or any objects which can be characterized through semantics). The likeness of compared objects is based on their meaning or semantic content, as opposed to similarity which can be estimated regarding their syntactical representation (e.g. their string format).Concretely, **Semantic similarity** can be estimated for instance by defining a topological similarity, by using ontologies to define a distance between terms/concepts. As an example, a naive metric for the comparison of concepts ordered in a partially ordered set and represented as nodes of a directed acyclic graph (e.g., taxonomy), would be the minimal distance in terms of edges composing the shortest-path linking the two concept nodes. Based on text analyses, semantic relatedness/distance between units of language (e.g., words, sentences) can also be estimated using statistical means such as a vector space model to correlate words and textual contexts from a suitable text corpus (co-occurrence).

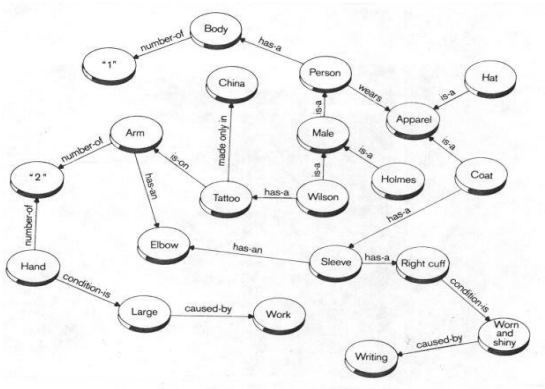
A semantic network is used when one has knowledge that is best understood as a set of concepts that are related to one another.Most semantic networks are cognitively based. They also consist of arcs and nodes which can be organized into a taxonomic hierarchy. Semantic networks contributed ideas of spreading activation, inheritance, and nodes as proto-objects.

II. SEMANTIC NETWORKS [1] [4]

• A semantic network is a simple representation scheme that uses a graph of labeled nodes and labeled, directed arcs to encode knowledge. Usually used to represent static, taxonomic, concept Dictionaries
• Semantic networks are typically used with a special set of accessing procedures that perform "reasoning" – e.g., inheritance of values and relationships
• Semantic networks were very popular in the '60s and '70s but less used in the '80s and '90s. Back in the '00s as RDF – Much less expressive than other KR formalisms: both a feature and a bug.
• The **graphical depiction** associated with a semantic network is a significant reason for their popularity.

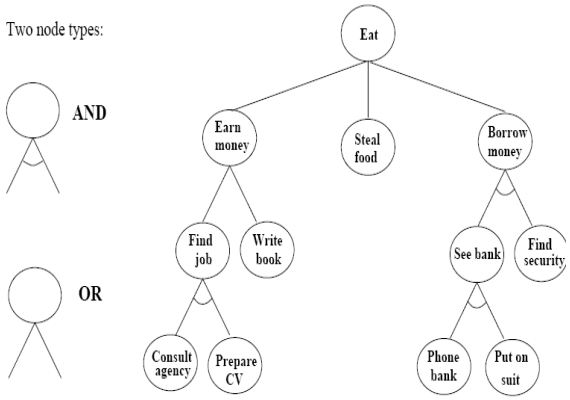
III. COMPONENTS OF A SEMANTIC NETWORK

We can define a ***Semantic Network*** by specifying its fundamental components: [4]
Lexical part nodes – denoting objects links – denoting relations between objects labels – denoting particular objects and relations.
Structural part the links and nodes form directed graphs the labels are placed on the links and nodes.
Semantic part meanings are associated with the link and node labels (the details will depend on the application domain)
Procedural part constructors allow creation of new links and nodes destructors allow the deletion of links and nodes writers allow the creation and alteration of labels readers can extract answers to questions Clearly we are left with plenty of flexibility in creating these representations.
Nodes and Arcs
Arcs define binary relationships that hold between objects denoted by the nodes.



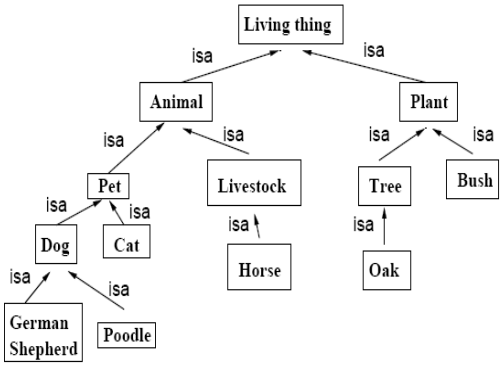
AND / OR Trees

One particularly simple form of semantic network is an ***AND/OR Tree***. For example:



An IS-A Hierarchy

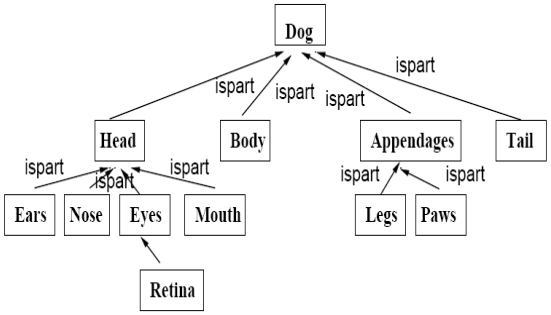
Another simple form of semantic network is an ***is-a hierarchy***. For example:



In set-theory terms, ***is-a*** corresponds to the sub-set relation □, and ***instance*** corresponds to the membership relation □.

An IS-PART Hierarchy

If necessary, we can take the hierarchy all the way down to the molecular or atomic level with an ***is-part hierarchy*** [3][4] . For example:

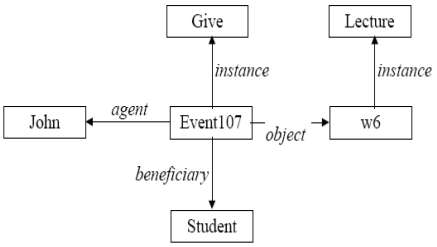


Naturally, where we choose to stop the hierarchy depends on what we want to represent.

Representing Events and Language

Semantic networks are also very good at representing events, and simple declarative

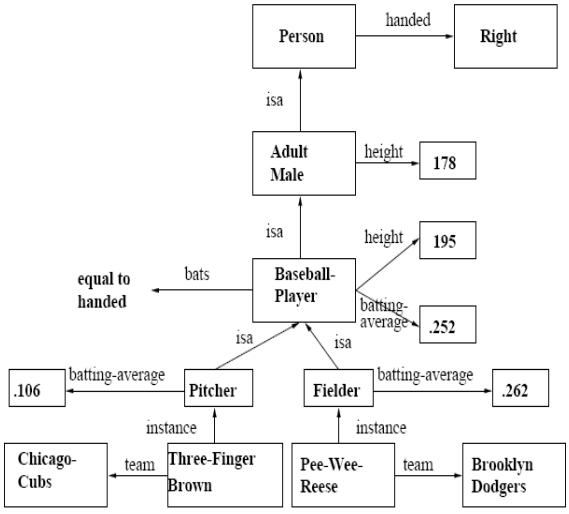
Sentences, by basing them round an "event node". For example: "John gave lecture w6 to his students".



In fact, several of the earliest semantic networks were English-understanding programs.

A Typical Mixed-Type Semantic Network

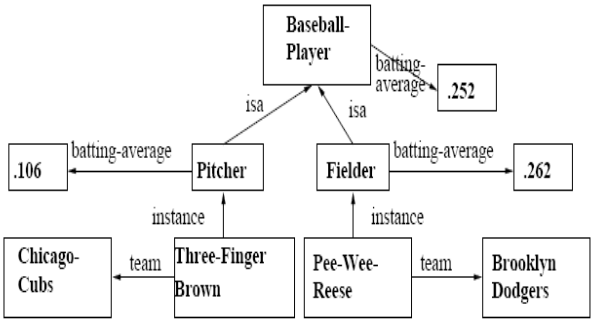
Here's the example of a *Semantic Network:*



Intersection Search

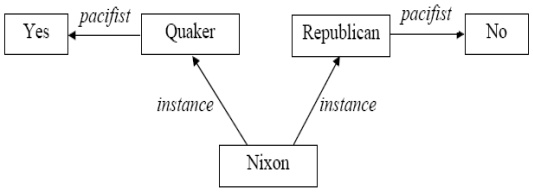
One of the earliest ways that semantic networks were used was to find relationships

between objects by spreading ***activation*** from each of two nodes and seeing where the activations met. This process is called ***intersection search*** [2][4].



Question: "What is the relation between Chicago cubs and Brooklyn Dodgers?"
Answer: "They are both teams of baseball players."

Multiple Inheritances
With simple trees, inheritance is straight-forward. However, when multiple inheritance
is allowed, problems can occur. For example, consider this famous example:
Question: "Is Nixon a pacifist?"



Conflicts like this are common is the real world. It is important that the inheritance
algorithm reports the conflict, rather than just traversing the tree and reporting the first
answer it finds. In practice, we aim to build semantic networks in which all such conflicts are either over-ridden or resolved appropriately.

IV. ADVANTAGES OF SEMANTIC NETS

Semantic nets have the ability to represent default values for categories. In the above figure Jack has one leg while he is a person and all persons have two legs. So persons have two legs has only default status which can be overridden by a specific value.

Semantic nets convey some meaning in a transparent manner.

Semantic nets are simple and easy to understand.

V. LIMITATIONS:

Semantic networks are intractable for large domains, and they do not represent performance or meta-knowledge very well.Some properties are not easily expressed using a semantic network, e.g., negation, disjunction, and general non-taxonomic knowledge. Expressing these relationships requires workarounds, such as having complementary predicates and using specialized procedures to check for them, but this can be regarded as less elegant.

VI. REFERENCES:

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