Natural Language Processing

R18 B.Tech. CSE (AIML) III & IV Year JNTU Hyderabad

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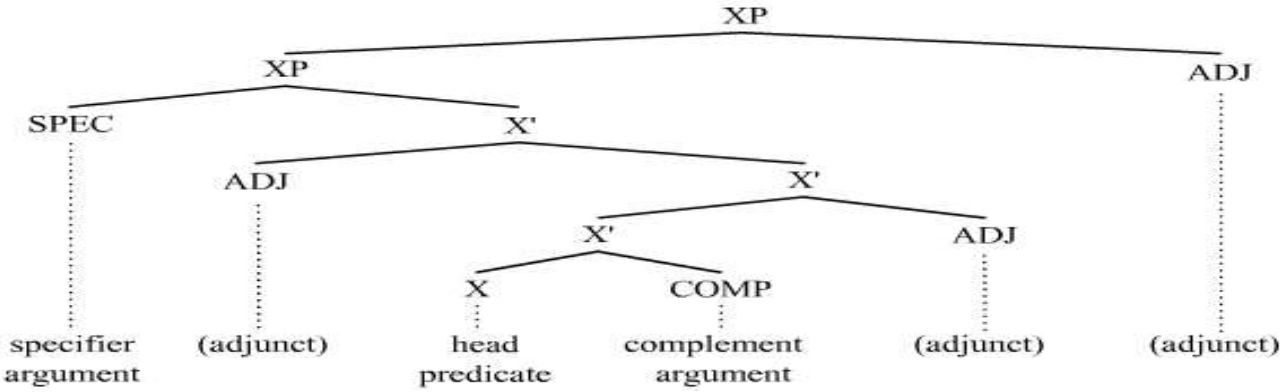
UNIT IV

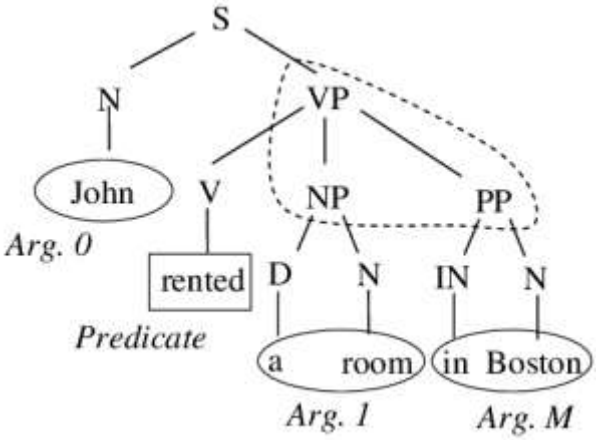
Predicate-Argument Structure, Meaning Representation Systems, Software.

Predicate-Argument Structure

Verbal predicates that demand just a subject argument (e.g. sleep, work, relax) are intransitive, verbal predicates that demand an object argument as well (e.g. like, fry, help) are transitive, and verbal predicates that demand two object arguments are ditransitive (e.g. give, lend).



A thing that refers to the type of event or state we are dealing with is termed a predicate, while the things that refer to the participants in the event/state are called the arguments of the predicate.



Expressiveness -- Ability to express wide range of subject matter. The ideal situation: a single meaning representation language that could adequately represent the meaning of any sensible natural language utterance. Although this ideal situation may not be possible, but the first order predicate calculus (FOPC) is expressive enough to handle a lot of things. In fact, it is claimed that anything can be representable with other three representation language, it can be also representable with FOPC. We will concentrate on FOPC, but other representation languages are also used. For example, Text Meaning Representation (TMR) used in the machine translation system of NMSU is a frame based representation

Predicate-Argument Structure

All natural languages have a form of predicate-argument arrangement at the core of their semantic structure. Specific relations hold among the constituent words and phrases of the sentence. (predicate and its arguments)Our meaning representation should support the predicate-argument structure induced by the language. In fact, there is a relation between syntactic frames and semantic frames. We will try to find these relations between syntactic frames and semantic frames
.Example:Want(somebody,something) -- Want is predicate with two arguments

Syntactic Structures:I want Turkish food. NP want NPI want to spend less than five dollars. NP want InfVPI want it to be close by here. NP want NP Inf VP Verb sub-categorization rules allow the linking of the arguments of syntactic structures with the semantic roles of these arguments in the semantic representation of that sentence. The study of semantic roles associated with verbs is known as thematic role.
In syntactic structures, there are restrictions on the categories of their arguments. Similarly, there are also semantic restrictions on the arguments of the predicates. The selectional restrictions specify semantic restrictions on the arguments of verbs.
Other objects (other than verbs) in natural languages may have predicate-argument structure. A Turkish restaurant under fifteen dollars. Under(TurkishRestaurant,$15)meaning representation is associated with the preposition under. The preposition under can be characterized by a two-argument predicate. Make a reservation for this evening for a table for two persons at 8.Reservation(Hearer,Today,8PM,2)meaning representation is associated with the noun reservation (not with make).Our meaning representation should support :variable arity predicate-argument structuresthe semantic labeling of arguments to predicatessemantic constraints on the fillers of argument roles.

First Order Predicate Calculus (FOPC)

First Order Predicate Calculus (FOPC) is a flexible, well-understood, and computationally tractable approach. So, FOPC satisfies the most of the things that we expect from a meaning representation language. FOPC provides a sound computational basis for verifiability, inference, and expressiveness requirements. The most attractive feature of FOPC is that it makes very few specific commitments for how things should be represented.

FOPC Example: I only have five dollars and I don't have a lot of time.

Have(Speaker,LotOfTime)¬ ∧Have(Speaker,FiveDollars)

A restaurant that serves Turkish food near Bilkent.
∧Serves(x,TurkishFood) ∧x Restaurant(x) ∃Near(LocationOf(x),LocationOf(Bilkent))

All vegetarian restaurants serve vegetarian food.
Serves(x,VegetarianFood)⇒x VegetarianRestuarant(x) ∀

Semantics of FOPC The truth value of each FOPC formula can be computed using meanings of the elements of FOPC.

⇒ ∨ ∧ ¬Truth tables for ∃ ∀Meanings of Assigned meanings to Predicates, Constant, Functions in an interpretation.

The truth values of our examples:
Have(Speaker,LotOfTime)¬ ∧Have(Speaker,FiveDollars) ∧ Serves(x,TurkishFood) ∧x Restaurant(x) ∃Near(LocationOf(x),LocationOf(Bilkent)) Serves(x,VegetarianFood)⇒x VegetarianRestuarant(x) ∀
An argument expressed with sentences in predicate logic is valid if and only if the conclusion is true in every interpretation in which all the premises are true.

Meaning Representation Systems

In NLP training, the senses through which we experience the world, are referred to as representational systems.

The words used to describe these systems are called predicates.

Hence, you have several different systems working for you:

Visual predicates (for things you see),

auditory predicates (for things you hear),

kinaesthetic predicates (things you feel or tactile sensations), **AD or self talk predicates** (also called labelling system),

olfactory predicates (things you smell), and gustatory predicates (things you taste).

The Neuro Linguistic Programming community says that we all have a system that we prefer to another and hence, process most information through it. This is, of course, a generalisation, yet it will give you a clue as to what might be going on right inside someone else's' internal map of the world. This preferred system can be determined through physiology and predicates used in a conversation. Let's look at an example:
-The way I look at this, is that it is still rather unclear. (Almost totally visual predicates).
-I really don't feel comfortable with this. (Tactile/Kinaesthetic predicates).
-This doesn't sound right to me. (Auditory predicates).
Knowing the preferred representational system (and therefore the predicates they prefer) of someone is useful in virtually any context. Imagine you go to Spain and communicate in English. Chances are, the general gist of what you want to say will get across (hopefully!), yet the finer distinctions of what you are saying are lost. It is the same with representational systems. If you present information in somebody else's preferred system, this information will be virtually irresistible to them!
Below is a chart which outlines the types of words/predicates people will use more often than not in a preferred system. Remember the preferred system can change depending on the context they are in.

Predicates Chart

Visual
Memorize by seeing pictures and are less distracted by noise. Often have trouble remembering and are bored by long verbal 'instructions because their mind may wander. They are interested by how the program looks.

Auditory
Typically are easily distracted by noise. They can repeat things back to you easily & learn by listening. They like music and like to talk on the phone. Tone of voice and the words used can be important.

Kinaesthetic
Often they talk slowly and breathy. They respond to physical rewards & touching. They memorize by doing or walking through something. They will be interested in a program that feels right or gives them a gut feeling.

AD/Labelling

They spend a fair amount of time talking to themselves. They memorize by steps, procedures, sequences. They will want to know the program makes sense. They can also sometimes exhibit characteristics of other rep systems.

• See • Look • View • Appear • Show • Dawn • Reveal • Envision • Illuminate • Imagine • Clear • Foggy • Focused • Hazy • Crystal picture	• Hear • Listen • Sound(s) • Make music • Harmonize • Tune in/out • Be all ears • Rings a bell • Silence • Be heard • Resonate • Deaf • Mellifluous • Dissonance • Question • Unhearing	• Feel • Touch • Grasp • Get hold of • Slip through • Catch on • Tap into • Make contact • Throw out • Turn around • Hard • Unfeeling • Concrete	• Sense • Experience • Understand • Think • Learn • Process • Decide • Motivate • Consider • Change • Perceive • Insensitive • Distinct • Conceive • Know

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V Visual

People who are visual often stand or sit with their heads and/or bodies erect, with their eyes up. They will be breathing from the top of their lungs. They often sit forward in their chair and tend to be organized, neat, well-groomed and orderly. They memorize by seeing pictures, and are less distracted by noise. They often have trouble remembering verbal instructions because their minds tend to wander. A visual person will be interested in how your program LOOKS. Appearances are important to them. They are often thin and wiry.

A Auditory

People who are auditory will move their eyes sideways (remember Richard Nixon?). They breathe from the middle of their chest. They typically talk to themselves, and are easily distracted by noise. (some even move their lips when they talk to themselves.) They can repeat things back to you easily, they learn by listening, and usually like music and talking on the phone. They memorize by steps, procedures, and sequences (sequentially). The auditory person likes to be TOLD how they're doing, and responds to a certain tone of voice or set of words. They will be interested in what you have to say about your program.

K Kinaesthetic

People who are kinaesthetic will typically be breathing from the bottom of their lungs, so you'll see their stomach go in and out when they breathe. They often move and talk verrry slooowly. They respond to physical rewards, and touching.

They also stand closer to people than a visual person. They memorize by doing or walking through something. They will be interested in your program if it "feels right".

Ad Auditory Digital (self talk, or labelling system)

This person will spend a fair amount of time talking to themselves. They will want to know if your program "makes sense". The auditory digital person can exhibit characteristics of the other major representational systems.