Semantic Parsing

1. Introduction

- In language understanding is the identification of a meaning representation that is detailed enough to allow reasoning system to make deduction (the process of reaching a decision or answer by thinking about the known facts).
- But at the same time, is general enough that it can be used across many domains with little to no adaptation (not capable of adjusting to new conditions or situations).
- It is not clear whether a final, low-level, detailed semantics representation covering various applications that use some form of language interface can be achieved or
- An ontology (a branch of metaphysics concerned with the nature and relations of being) can be created that can be created that can capture the various granularities and aspects of meaning that are embodied in such that a variety of applications.
- None of these approaches are not created, so two compromise approaches have emerged in the NLP for language understanding.
- In the first approach, a specific, rich meaning representation is created for a limited domain for use by application that are restricted to that domain, such as travel reservations, football game simulations, or querying a geographic database.
- In the second approach, a related set of intermediate-specific meaning representation is created, going from low-level analysis to a middle analysis, and the bigger understanding task is divided into multiple, smaller pieces that are more manageable, such as word sense disambiguation followed by predicate-argument structure recognition.
- Here two types of meaning representations: a domain-dependent, deeper representation and a set of relatively shallow but general-purpose, low-level, and intermediate representation.

- The task of producing the output of the first type is often called deep semantic parsing, and the task of producing the output of the second type is often called shallow semantic parsing.
- The first approach is so specific that porting to every new domain can require anywhere from a few modifications to almost reworking the solution from scratch.
- In other words, the reusability of the representation across domains is very limited.
- The problem with second approach is that it is extremely difficult to construct a general purpose ontology and create symbols that are shallow enough to be learnable but detailed enough to be useful for all possible applications.

Semantic Interpretation

- Semantic parsing can be considered as part of Semantic interpretation, which involves various components that together define a representation of text that can be fed into a computer to allow further computations manipulations and search, which are prerequisite for any language understanding system or application.

A semantic theory should be able to:

- **Explain sentences having ambiguous meaning**: For example, it should account for the fact that the word bill in the sentence ***the bill is large*** is ambiguous in the sense that it could represent money or the beak of the bird.

- **Resolve the ambiguous of words in context**: For example, if the same sentence is extended to form "***The bill is large but need to be paid***" then the theory should be able to disambiguate the monetary meaning of the bill.

- **Identify meaningless but syntactically well-formed sentences**, such as "***Colourless green ideas sleep furiously***"

- Identify syntactically or transformationally unrelated paraphrases of a concept having the same semantic content.

Requirements for achieving a semantic representation:

- Structural ambiguity
- Word sense
- Entity and Event resolution
- Predicate-Argument Structure
- Meaning Representation

Structural Ambiguity:

- Structural ambiguity arises when a sentence has more than one meaning due to the way of words are arranges in that senetence.
- The sentence " Sara caught the butterfly by the tree" is structurally ambiguous because it has 2 meanings:
    - Sara caught the butterfly while she was standing by the tree
    - Sara caught the butterfly which was fluttering near the tree

Word Sense:

- In any given language, the same word type is used in different contexts and with different morphological variants to represent different entities or concepts in the world.
- For example, we use the word nail to represent a part of the human anatomy and also to represent the generally metallic object used to secure other objects.
- The same word type or word lemma is used in different morphological variants to represent different entities or concepts in the world.
- Take a word nail(human anatomy or metallic object)

- He nailed the loose arm of the chair. (metallic object)
    - He got a box of metallic nails. (metallic object)
    - This nails are growing too fast. (Human anatomy)
    - He went to manicure to remove his nails. (Human anatomy)
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