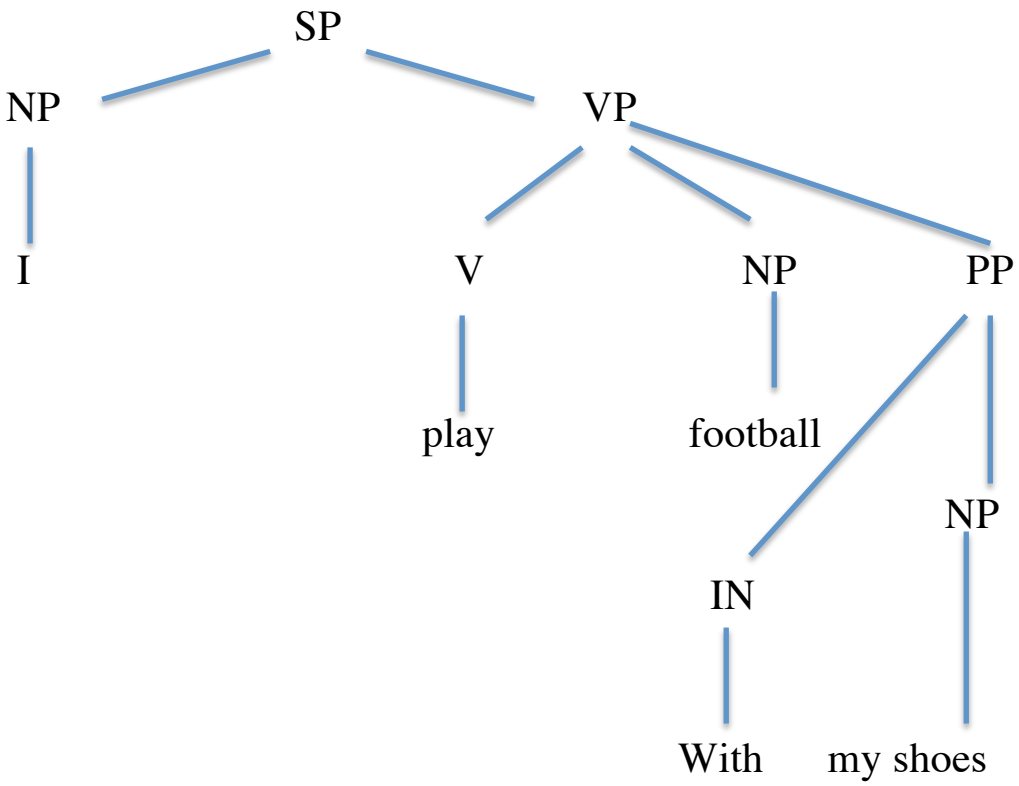
Part-1
PP attachment disambiguation

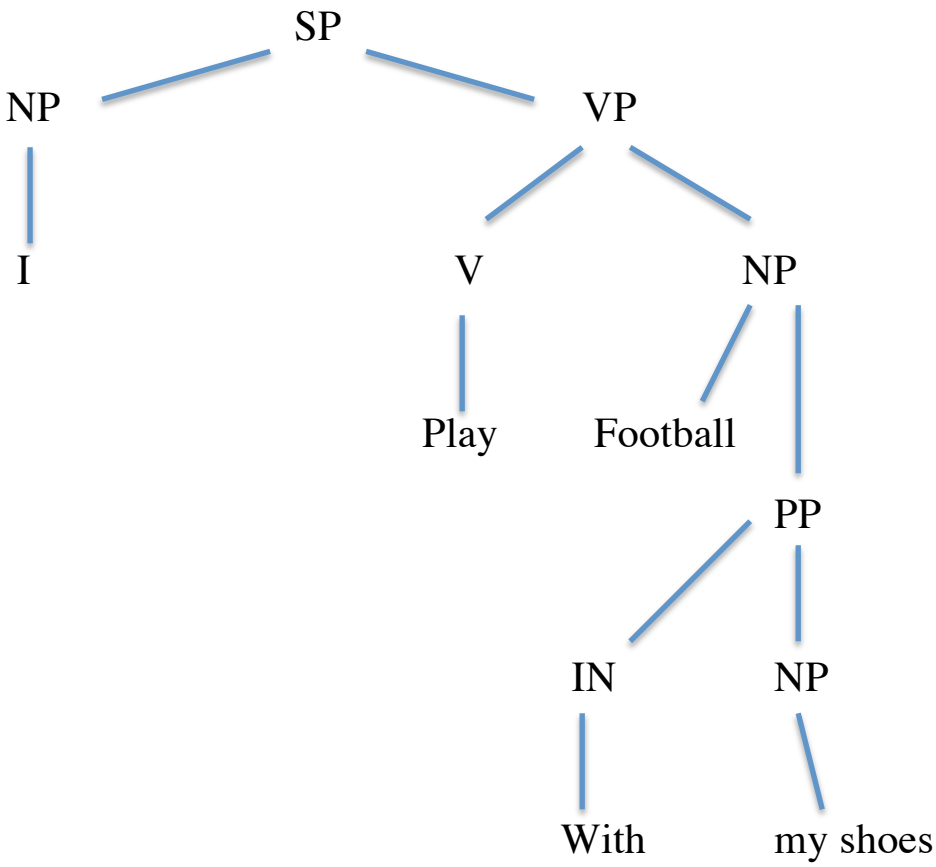
I. I play football with my shoes.
II. I play football with my brother.

In the above two sentences we can immediately make out that *with* in the first sentence attaches to *play* and basically adds as an apparel needed to run with while in the second sentence we understand that *my brother* is not another apparel needed to play with but a person who accompanies when he plays *football*, and hence, the *with* attaches to the *football*.

We know this through our world knowledge and experience, which says that one, cannot use one's brother as an apparel to play with, and at the same time shoes cannot play football with shoes as a partner.

So, to resolve the meaning of both the sentences, we take syntactic parsed trees:






As shown above, there are two different structures that can be created. The *NP* refers to the phrases *my shoes* and *brother*. To find out which meaning is implied by sentences of the forms given, we can now refer to WordNet and FrameNet databases.

For the second sentence, looking up *brother* on the WordNet we get five matches, of which all are nouns. Among these five, none has anything to do with *playing*. This raises its probability of following with the second structure and attaching to the *NP* under the *PP*.

On searching FrameNet for *brother*, we find that it fits the container frame, and has *co-association* as its use. This too improves the probability that the second structure should be adopted.

Hence, with the given evidence we can conclude that the second

sentence fits the second tree and hence, the *PP* attaches to the *NP*.

Notice how we don't talk in absolutes, but in probabilities. This is so because getting an absolute resolution would require that we give the computer human-like world, semantic and syntactic knowledge. This is impossible to do so due to the technological limitations not to mention the inefficiencies that doing so will bring along with it. The best we can do is to assign probability distributions to the different interpretations and then choose the most probable one.

Now analyzing the first sentence, we look up *shoes* on Word Net. This gives us five matches, of which all are nouns. Its most relatable hypernym is *footwear shaped to fit the foot*. This increases the probability that the sentence adheres to the first dependency tree structure as an apparel to play comfortably.

Searching FrameNet for *shoes* shows us that the word belongs to the frame *clothing*. Further checking its lexical entry we find that *kick off* is directly listed as one of its g*overnors* which relates to playing something and not football. This tells us that the *shoes* is part of the action of playing, immensely raising the probability that the sentence follows the first structure.

Hence, with the given evidence we can conclude that the first sentence fits the first tree better, with the *PP* attaching to the *VP*.

II

Sentence

The nineteen inch monitor, which my parents got from Bangalore, emitted a noise and stopped working yesterday.

Questions

1. What stopped working?
2. When did the monitor stop working?

3. Who got the monitor?
4. Where did his parents get the monitor from?
5. What happened to the monitor that his parents got for him?
6. Whose monitor stopped working?
7. What happened when the monitor, that his parents got from Bangalore, stopped working?
8. What happened to the monitor?
9. How big was the monitor that his parents got from Bangalore?
10. What emitted a noise?

We see that in questions 1, 2, 3, 4, 6, 8 and 10, we observe that the question can be answered by looking at their respective verb frames. The rest of the questions cannot be answered just only by seeing the verb frame of only one verb. We have to see the verb frames of at least two verbs for questions 5 and 9. We also obsere that for the question 7, we need to look at all 3 verb frames to answer the question.

## III Noun Compounds

Noun compounds can express fourteen major types of semantic relations

- Cause (Malaria Mosquito)
- Theme (bike manager)
- Purpose (horse doctor)
- Location (field mouse)
- Instrumental (steam iron)
- Source (sunflower oil)
- Composite (silkworm)
- Possessive( aluminium can)
- Topic (price war)
- Time (winter morning)
- Result(cold virus)
- Product(light bulb)
- Destination (game bus)
- Agent(band concert)

ALGORITHM TO FIGURE OUT THE RELATION BETWEEN NOUN COMPOUNDS

Given a noun compound as an input, we carry out it's analysis with the following steps:

1. Search the given compound noun on **wordNet** or **ConceptNet**.
2. If the given word has a synset relation in **wordNet**, we obtain the relation specified.
3. Otherwise, we carry out the following steps for each of the nouns in the noun compound:-

    - We take the word and run a search on **conceptnet**.
    - We look at it's various related terms, synonyms, derived words, types etc to look for the noun compound or a noun that is a part of the given noun compound and keep a store of these relations.
    - We repeat the similar procedure for each of the remaining nouns.
    - We then find the intersection of the various relations and return the common relations.

NOTE: Given a large database of noun compounds, to figure out the relation for a new noun compound, we can have an engine that can be trained by having equal weight for head and modifier, and then trying to create a bi-partite map with another noun compound such that it gives us a noun compound already exisiting in the database.

Eg:-