

Semantic Parsing

Ian Perera

Overview

▶ Goals

- ▶ Assign semantic roles to words in a given parse tree
- ▶ Construct MetaPAR structure with given roles
- ▶ Extract queries for Question Answering system

▶ Semantics pipeline

- ▶ Parse Tree Splitting
 - ▶ Clause splitting
 - ▶ Conjunction splitting
- ▶ Semantic Interpretation
 - ▶ Keyword searching
 - or-
 - ▶ Verbnet

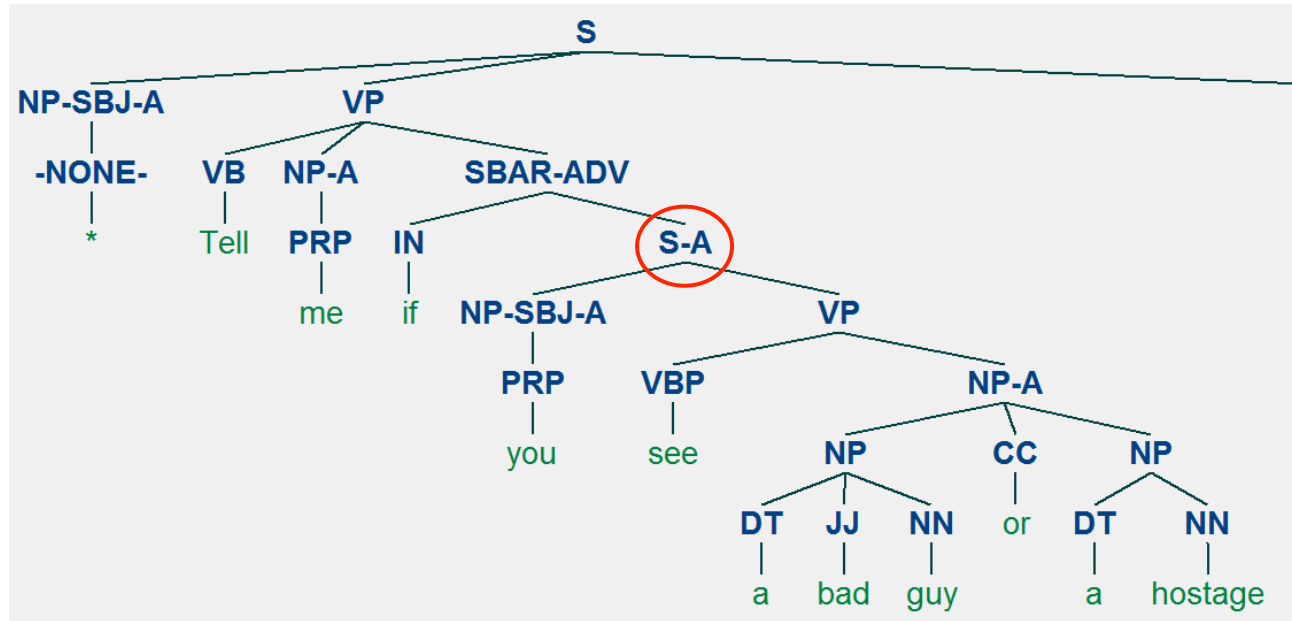


Clause Splitting

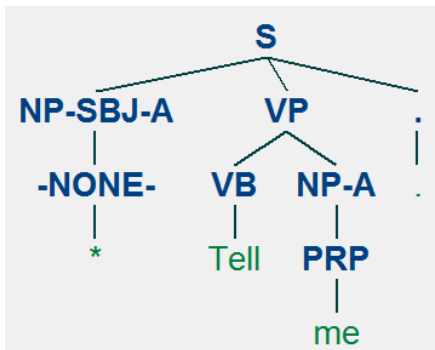
- ▶ Take parse tree and split into separate clauses
- ▶ Used for separating subordinating conjunctions (if, while, until...)
- ▶ Conditionals separate PAR inputs and outputs:
 - ▶ Inputs (see bomb, see hostage, get flipped)
 - ▶ Outputs (call Commander, defuse bomb)



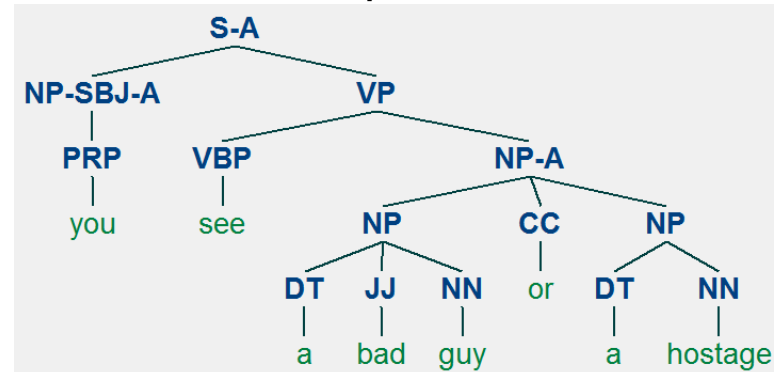
Clause Splitting



“Output”



“Input”

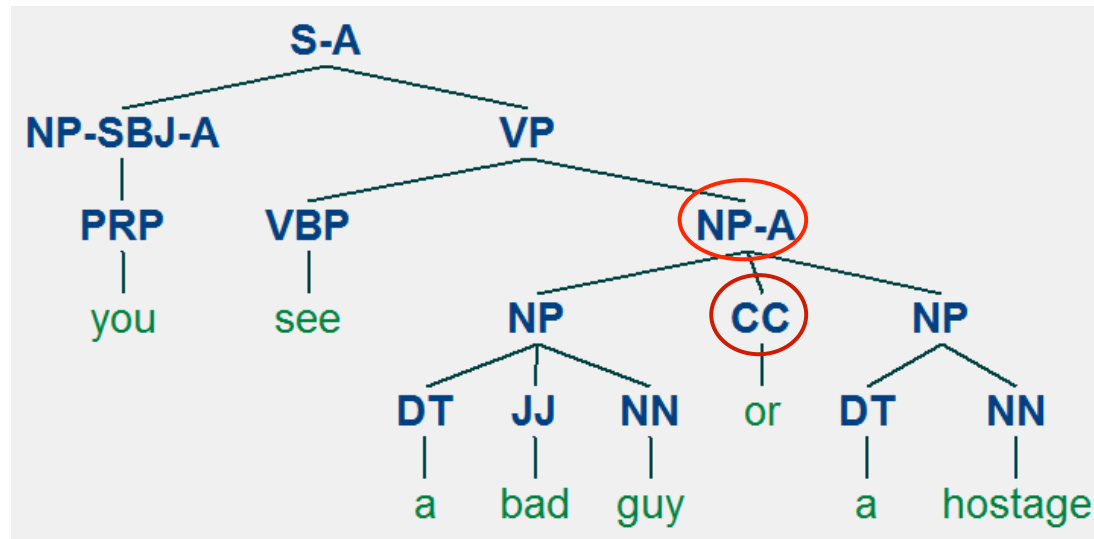


Conjunction Splitting

- ▶ Separate clauses that contain coordinating conjunctions (and, or...)
- ▶ Duplicate the rest of the clause for each phrase
- ▶ Used to create multiple PARs (one for each input)

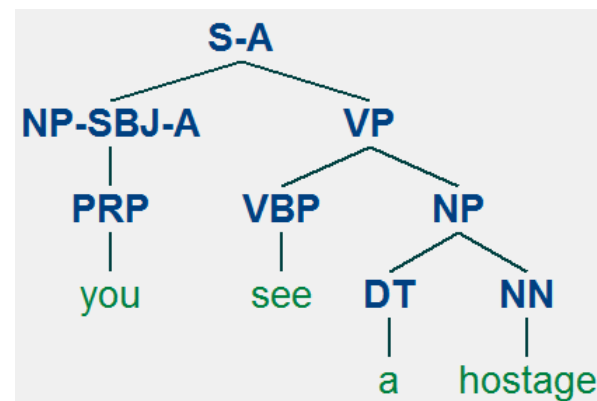
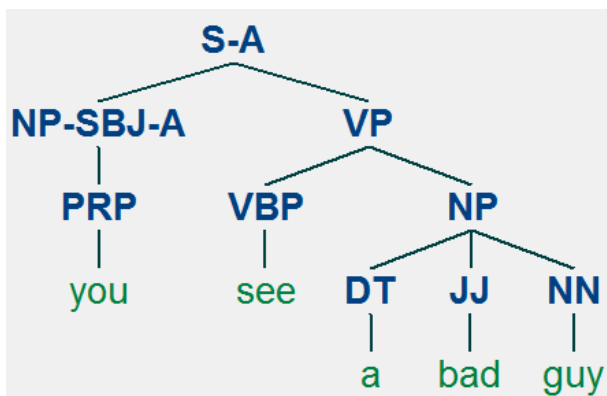


Conjunction Splitting



(BadGuy, CallCommander)

(Hostage, CallCommander)



Keyword Searching

- ▶ **Extract verbs from the sentence**
 - ▶ For each verb, find parameters in its tree
 - ▶ See → bomb, hostage, bad guy
 - ▶ Go → room 1, room 2...
 - ▶ Call/Tell → bomb, hostage, bad guy, commander
- ▶ **Advantages**
 - ▶ Easy to program
 - ▶ Can handle relatively complex structure
 - ▶ Captures the 'gist' of the sentence
- ▶ **Disadvantages**
 - ▶ Only handles programmed words
 - ▶ Only provides simple, specified relationships



VerbNet

- ▶ Expert maintained database that maps verb frames to semantic roles
- ▶ Search, Scout, Scavenge, Check
 - ▶ **NP V NP PP.THEME**
 - ▶ **"I SEARCHED THE CAVE FOR TREASURE."**
 - ▶ **AGENT V LOCATION {FOR} THEME**
- ▶ Process:
 - ▶ Find the verbs in the tree
 - ▶ Fit the parsed and split sentence to the frame for each verb
 - ▶ Choose the match that expresses the most semantic roles



VerbNet Results

- ▶ “While I kill the bad guys in the hallway, you search the rooms for bombs.”
 - ▶ search
 - ▶ {'Theme': 'bombs', 'VERB': 'search', 'Location': 'rooms', 'Agent': 'you', 'for': 'for'}
 - ▶ kill
 - ▶ {'VERB': 'kill', 'Patient': 'the bad guys in the hallway', 'Agent': 'I'}



VerbNet Advantages / Disadvantages

▶ Advantages

- ▶ Richer semantics captured
- ▶ Can extract semantics from a large database of verbs (over 5000 verb senses)

▶ Disadvantages

- ▶ Gaps in the database
 - ▶ Verbs – ‘defuse’ is not in the database
 - ▶ Frames – certain verb usages are not covered by frames
 - ▶ We are looking into ways of adding verbs and frames to the database
- ▶ No implementation standard
 - ▶ Syntactic restrictions are not well-defined, and difficult to program



Overview

- ▶ **Semantics pipeline**
 - ▶ Parse Tree Splitting
 - ▶ Clause splitting
 - ▶ Conjunction splitting
 - ▶ Semantic Interpretation
 - ▶ Keyword searching
- or-
- ▶ Verbnet¹

¹Karin Kipper-Schuler. 2005. VerbNet: A broad-coverage, comprehensive verb lexicon. Ph.D. thesis, Computer and Information Science Dept., University of Pennsylvania, Philadelphia, PA, June.

