

# Semantic Parsing

Ian Perera

# Overview

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## ▶ 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



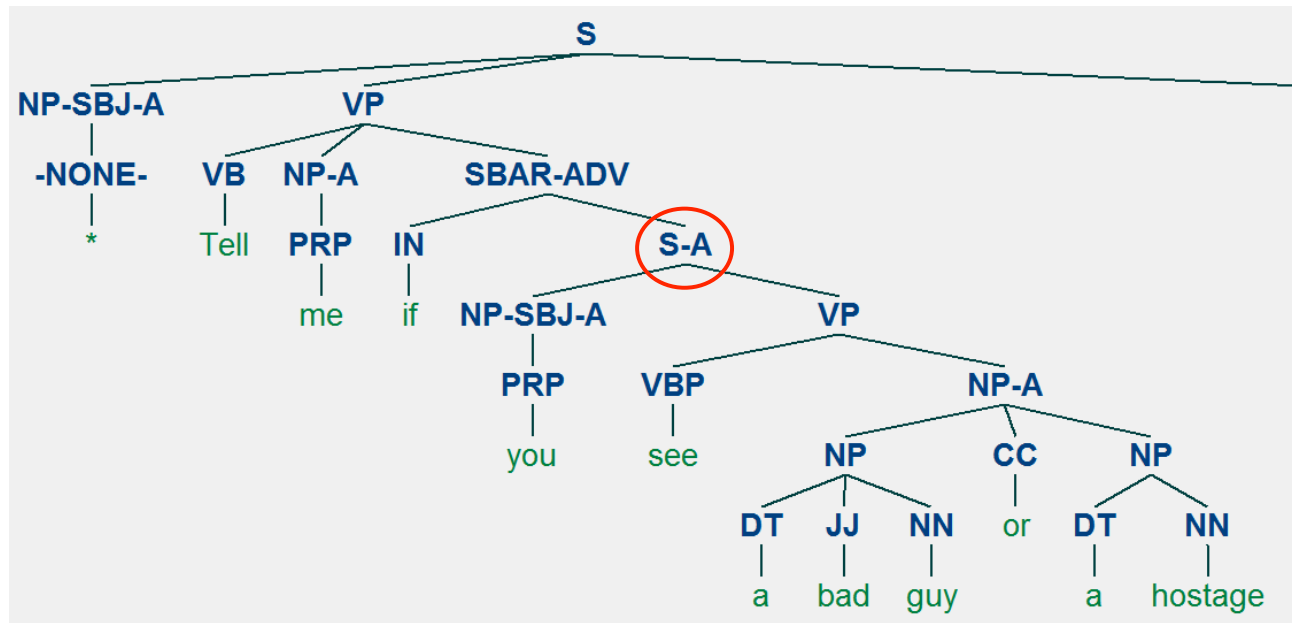
# Clause Splitting

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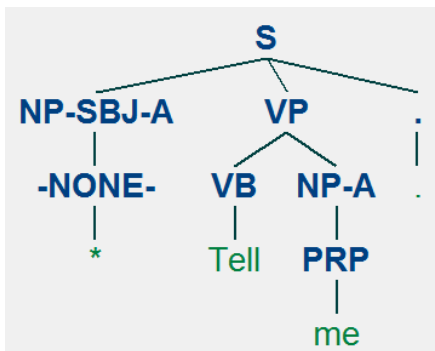
- ▶ Take parse tree and split into separate clauses
- ▶ Used for separating subordinating conjunctions (if, while, until...)
- ▶ Conditionals separate PAR inputs and outputs:
  - ▶ Inputs (see bomb, see hostage, get flipped)
  - ▶ Outputs (call Commander, defuse bomb)



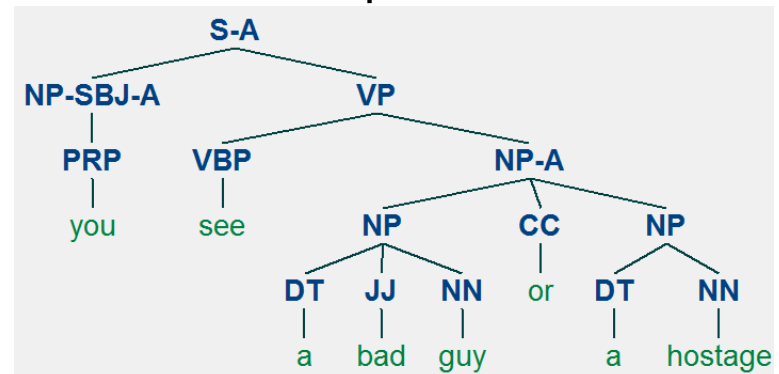
# Clause Splitting



“Output”



“Input”



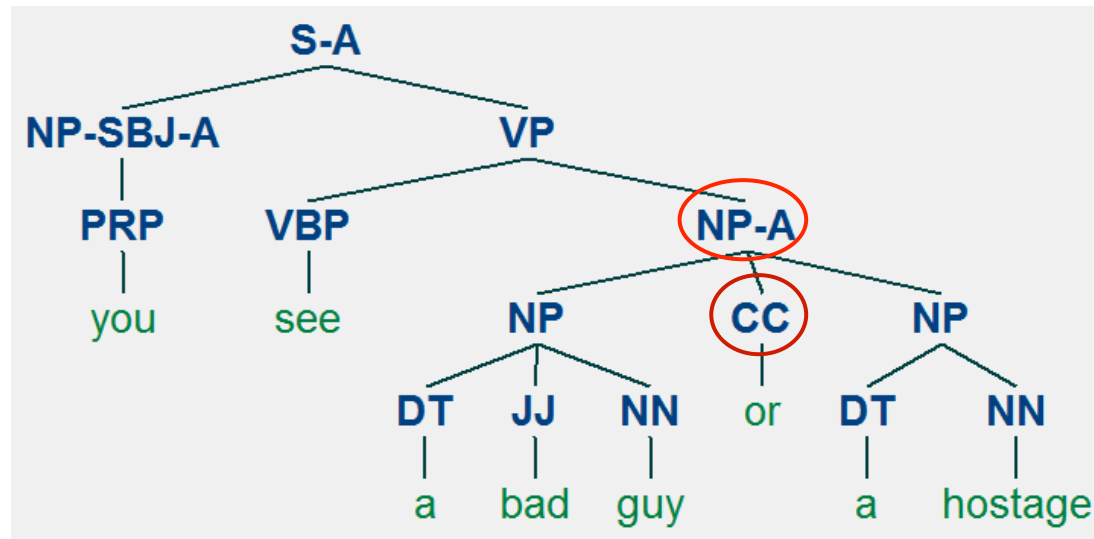
# Conjunction Splitting

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- ▶ 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)

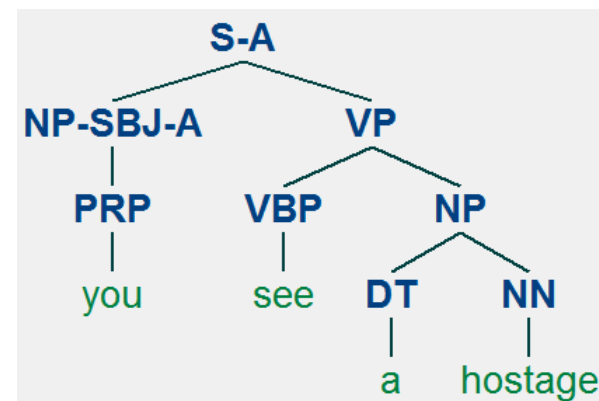
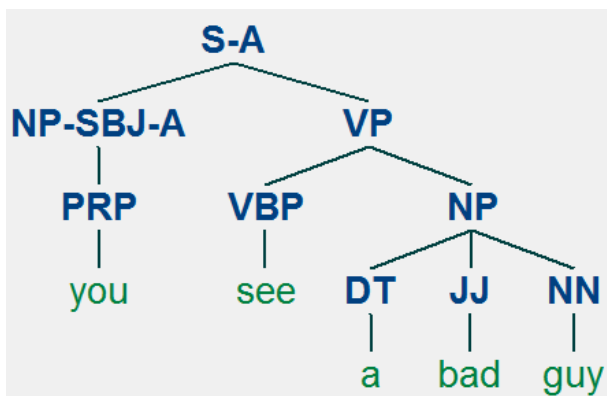


# Conjunction Splitting



(BadGuy, CallCommander)

(Hostage, CallCommander)



# Keyword Searching

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- ▶ **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

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- ▶ 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

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- ▶ “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

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## ▶ 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

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- ▶ **Semantics pipeline**
  - ▶ Parse Tree Splitting
    - ▶ Clause splitting
    - ▶ Conjunction splitting
  - ▶ Semantic Interpretation
    - ▶ Keyword searching
- or-
- ▶ Verbnet<sup>1</sup>

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

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