

SEMANTICS

Luisa Coheur

Overview

- Learning objectives
- Topics
 - Computational Semantics
 - Language Representation: symbolic approach
 - Compositional Semantics
 - Compositional Semantic Parsing
 - Semantic Parsing as a sequence prediction problem
 - Semantic Stuff
 - Semantic Relations
 - Semantic Resources
- Key takeaways
- Suggested readings

LEARNING OBJECTIVES

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- After this class, students should be able to
 - Define main concepts from Computational Semantics
 - Identify several semantic resources
 - Given a grammar with semantic rules, apply them and obtain the logical form representing the semantics of a given sentence

TOPICS

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COMPUTATIONAL SEMANTICS

- The enterprise of designing meaning representations and associated semantic parsers is referred to as computational semantics!!!

COMPUTATIONAL SEMANTICS

- Mapping what the user says in something that captures that meaning and the computer understands
- Let us see, in practice, what this means

COMPUTATIONAL SEMANTICS

- Mapping what the user says in something that captures that meaning and the computer understands
- Scenario

COMPUTATIONAL SEMANTICS

- Mapping what the user says in something that captures that meaning and the computer understands
- Scenario
- Meaning Representation
 - can be First Order Logic, but also a vector...

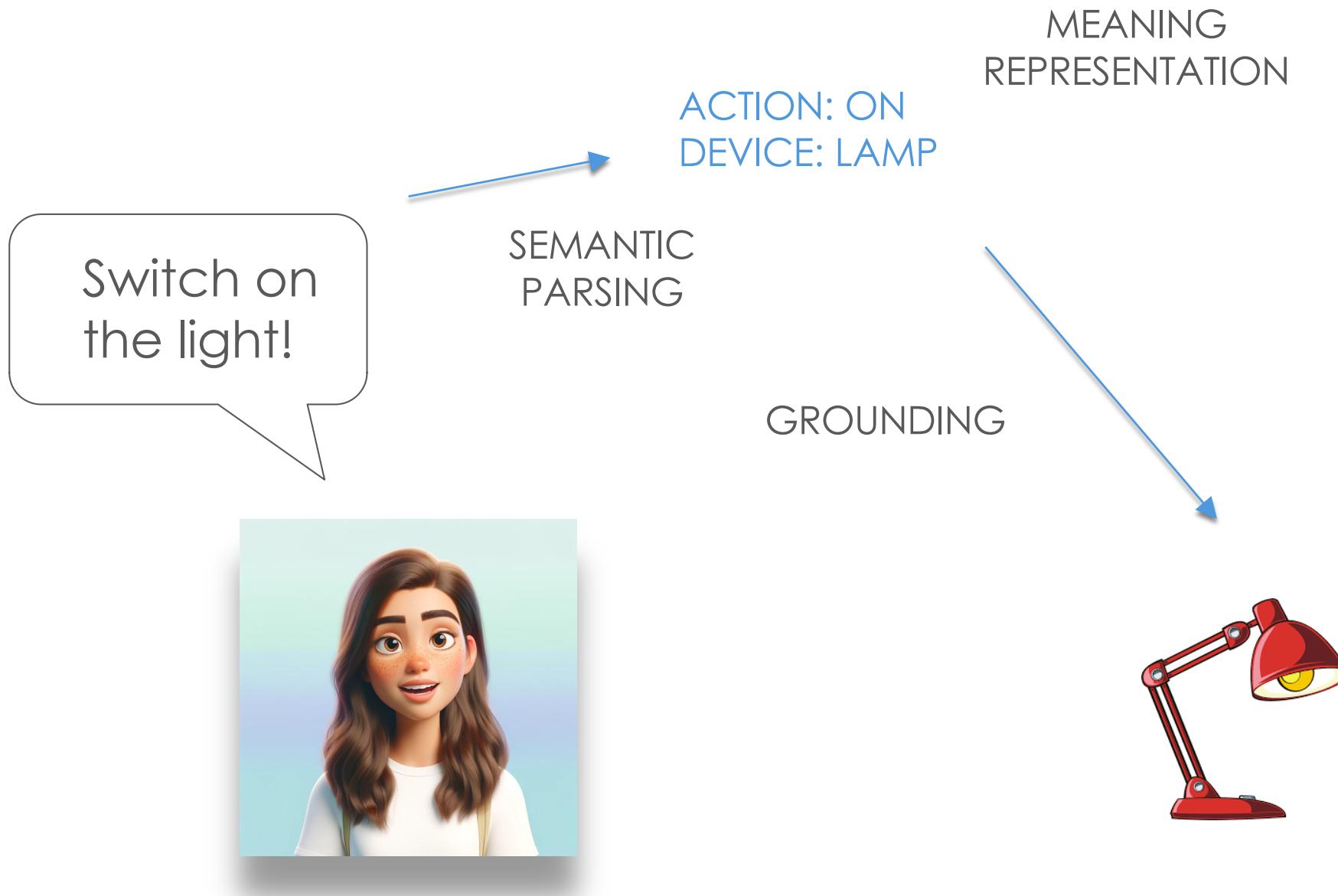
COMPUTATIONAL SEMANTICS

- Mapping what the user says in something that captures that meaning and the computer understands
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- Actionable Meaning Representation (ex: SQL)

COMPUTATIONAL SEMANTICS

- Mapping what the user says in something that captures that meaning and the computer understands
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- Meaning Representation
 - can be First Order Logic, but also a vector
- Actionable Meaning Representation (ex: SQL)
- Semantic parsing or semantic analysis

COMPUTATIONAL SEMANTICS



COMPUTATIONAL SEMANTICS

- Symbolic representation of language: a meaning representation consists of a set of symbols, human-interpretable, corresponding to:
 - Objects (ex: lamp),
 - Properties of objects (ex: red), or
 - relations among objects in some world (ex: love(X, Y))
- So... not vectors

Overview

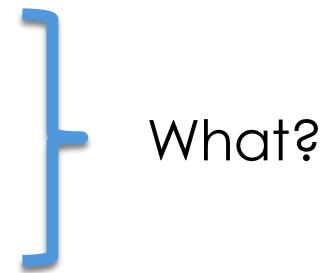
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SYMBOLIC REPRESENTATION

- Some symbolic formalisms
 - First Order Logic (or some subsets/simplified versions of it)
 - Discourse Representation Structures (DRS) (Kamp and Reyle, 1993)
 - ...
 - Abstract Meaning Representation (AMR) (Banarescu et al. 2013)
 - ...

SYMBOLIC REPRESENTATION

- Main used representations
 - Keywords
 - Sentences
 - Regular expressions/templates
 - Logical forms
 - Frames
 - Graphs



SYMBOLIC REPRESENTATION

Keywords

Robot understands:

“left”, “right”, “stop”
(that is, it knows how to
act, when those words
are given as input)

Sentences

Agent understands:

“Who built the
palace” (that
is, it knows how to
answer it)



This can be seen
as understanding
fixed sequences
of keywords.

Regular expressions

Agent understands:

“Who built .* palace” (that is,
it knows how to answer it)



Can be seen as
understanding
keywords within
some pre-defined
order.

SYMBOLIC REPRESENTATION

- First Order Logic:
 - You probably studied this before (v.g., in Logic for Programming)
 - Define constants and relations; use: $\exists \forall \neg \wedge \vee \Rightarrow$
 - Examples:
 - Pedro is a student: $\text{student}(\text{PEDRO})$
 - Note: never use $p1(p2)$, being $p1$ and $p2$ predicates
 - All students are great: $\forall x \text{ student}(x) \Rightarrow \text{great}(x)$
 - Note: \forall “asks” for \Rightarrow
 - Why $\forall x \text{ student}(x) \wedge \text{great}(x)$ Is not an option?
 - There is (at least) one great student: $\exists x \text{ student}(x) \wedge \text{great}(x)$
 - Note: \exists “asks” for \wedge .
 - Why $\exists x \text{ student}(x) \Rightarrow \text{great}(x)$ Is not an option?

ACTIVE LEARNING MOMENT



EXERCISE

- Consider:
 - The constant: John
 - The predicates:
 - $\text{sister}(X, Y)$ that is true if Y is X's sister
 - $\text{like}(X, Y)$ that is true if X likes Y
- Represent in First Order Logic:
 - John likes his sisters
 - John has (at least) one sister
 - All of John's sisters like him

EXERCISE

- Consider:
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 - $\text{sister}(X, Y)$ that is true if Y is X's sister
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- Represent in First Order Logic:
 - John likes his sisters: $\forall x [\text{sister}(\text{John}, x) \Rightarrow \text{likes}(\text{John}, x)]$
 - John has (at least) one sister: $\exists x \text{sister}(\text{John}, x)$
 - All of John's sisters like him: $\forall x [\text{sister}(\text{John}, x) \Rightarrow \text{likes}(x, \text{John})]$

SYMBOLIC REPRESENTATION

- Frames:
 - Concept coined by Minsky (much more complicated)

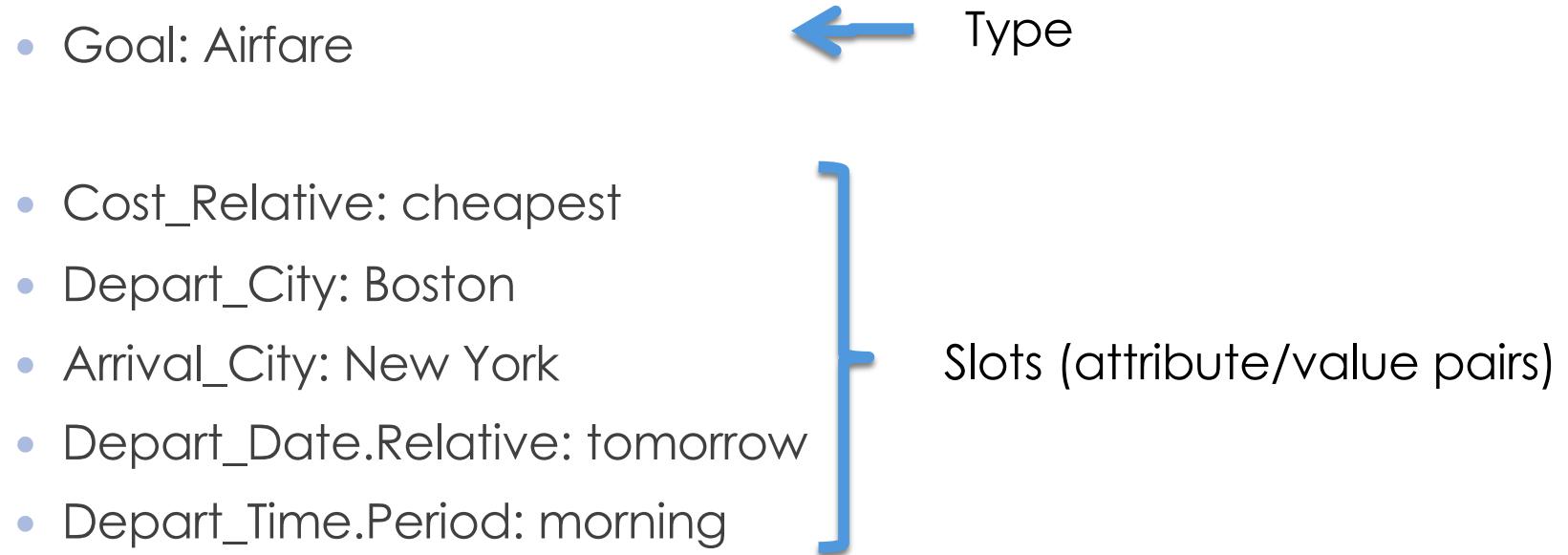


Marvin Lee Minsky

- Simplified definition of frame (Ward and Issar, 1994):
 - Type:
 - Types of actions that can be taken by the system (intent);
 - Slots:
 - Pieces of information relevant to the action
 - Typically pairs attribute/value

SYMBOLIC REPRESENTATION

- Example (Tur et al., 2010):
 - Input:
 - How much is the cheapest flight from Boston to New York tomorrow morning?
 - Meaning Representation as a frame:
 - Goal: Airfare



ACTIVE LEARNING MOMENT



EXERCISE

- Imagine that you are going to create a dialogue system where customers interact with a bot to book cinema tickets. Which types (intents) and slots should be used?
- Possible solution:

Types:

- Movies_Available
- Showtime
- Seat_Availability
- Ticket Booking
- Payment
- Booking Confirmation
- Booking Cancellation
- Booking Modification
- ...

Slots:

- movie_title
- number_of_tickets
- date
- cinema
- seat_preferences
- accessibility_options
- language
- subtitle_options
- ...

REAL EXAMPLE

Customer: I'd like to book tickets for **Strange Days** next **Friday**.

Bot: Sure! You want to book tickets for Strange Days on next Friday. We have showtimes at 3:00 PM, 6:00 PM, and 9:00 PM. Which time works best for you?

Customer: Let's go with the **6 PM show**.

Bot: Got it! You've selected the 6:00 PM show for Strange Days on Friday, October 11th. Which cinema would you prefer? We have Colombo and Amoreiras available.

Customer: **Colombo** sounds good.

Bot: "Perfect! [...] How many tickets would you like?"

- Customer: "Two tickets, please."

movie_title: StrangeDays
number_of_tickets: 2
date/time: Friday 6 PM.
cinema: Colombo

REAL EXAMPLE

- Bot: Great! You're booking two tickets for StrangeDays at Colombo, 6:00 PM, on Friday, October 11th. Would you like to proceed with payment?
- Customer: Actually, I changed my mind. Can I book Memento instead?
- ...

```
movie_title: StrangeDays Memento  
number_of_tickets: 2  
date/time: Friday 6 PM.  
cinema: Colombo
```

REAL EXAMPLE

- Entity Recognition (Named Entity Recognition):
 - Recognize key entities such as:
 - Movie titles (e.g., Memento)
 - Dates (e.g., "next Friday," "October 11")
 - Times (e.g., "6 PM show")
 - Cinema locations (e.g., "Colombo")
 - ...

By the way...



SYMBOLIC MEANING REPRESENTATION (TO CONCLUDE)

- “I have a car” in: a) FOL (top), b) Abstract Meaning Representation (AMR) – graph and textual forms – and, c) framed-based or slot-filler

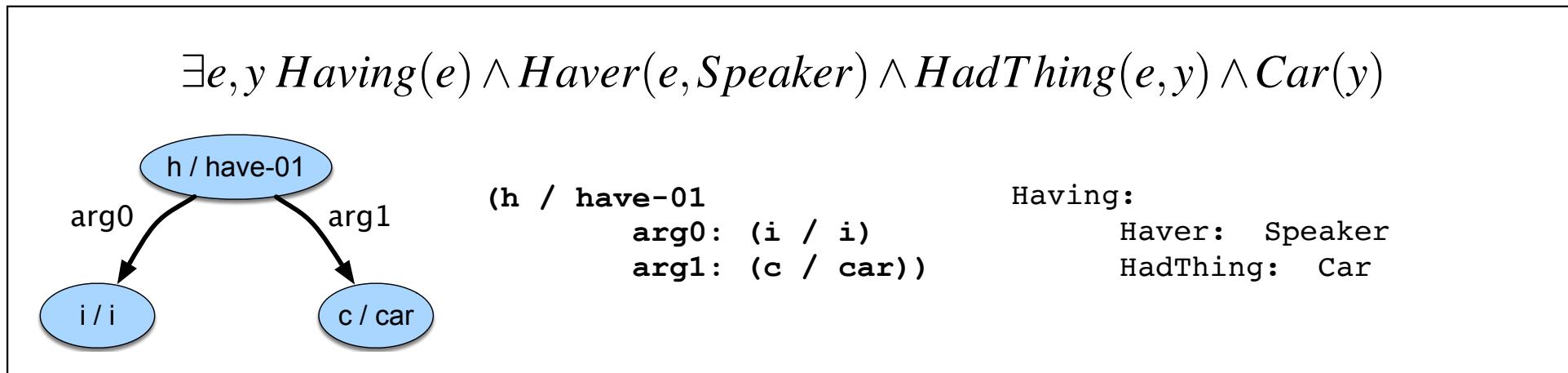


Figure 16.1 A list of symbols, two directed graphs, and a record structure: a sampler of meaning representations for *I have a car*.

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COMPOSITIONAL SEMANTIC PARSING

- Semantic parsing (**compositional process**) generates meaning representations by **recursively combining the meanings of smaller subcomponents** (such as words or phrases) according to syntactic structures
- **Richard Montague** was the first person to present a framework that systematically maps natural language to formal meaning representations (early 1970s)

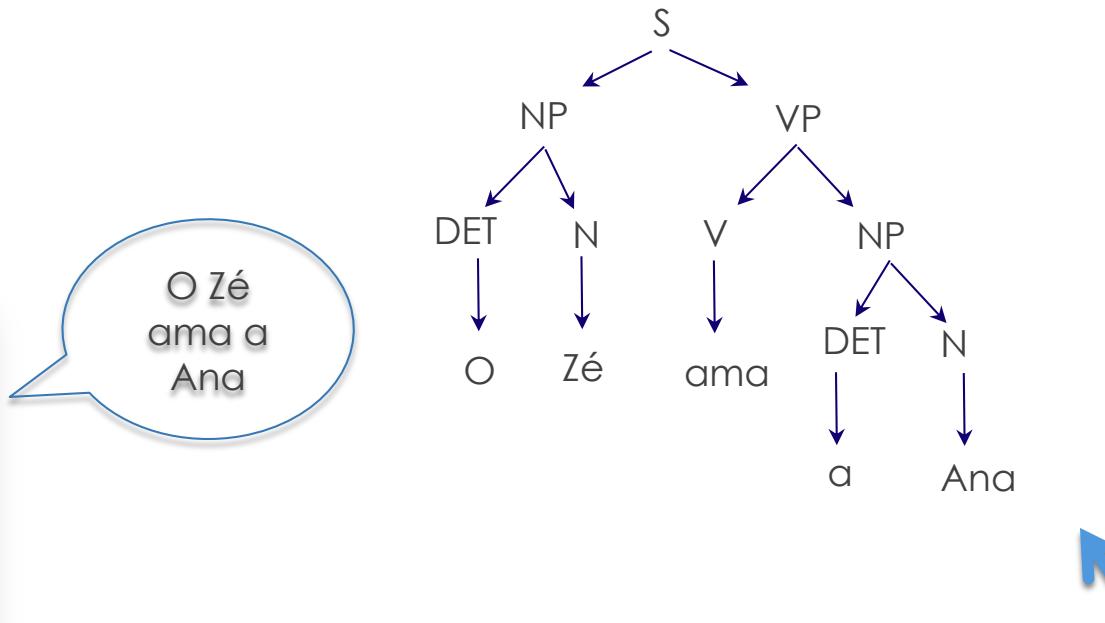


COMPOSITIONAL SEMANTIC PARSING

- Notation (from Sebenta):
 - $x.\text{sem}$: semantics of x
 - $\text{replace}(A.\text{sem} N B.\text{sem})$: replace the semantics of A in the N th argument of the semantics of B .

EXAMPLE

Grammar	Lexicon	POS
$S \rightarrow NP\ VP$	o, a	DET
$NP \rightarrow DET\ N$	Zé, Ana	N
$VP \rightarrow V\ NP$	ama	V

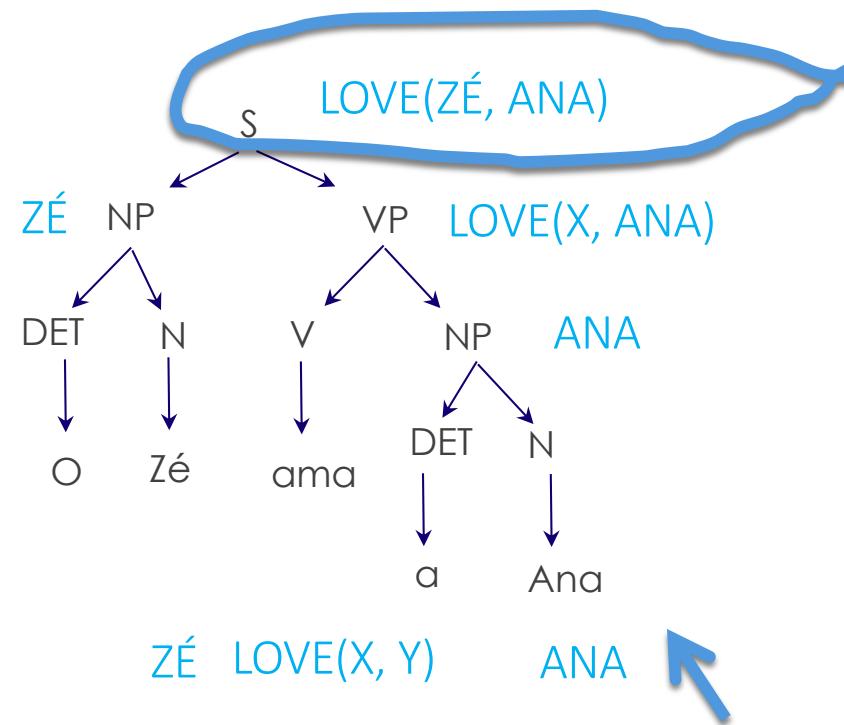
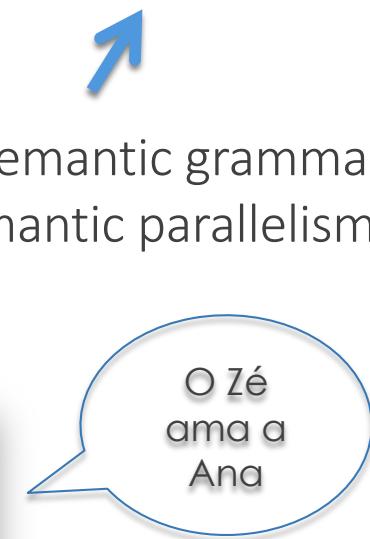


Syntactic tree

EXAMPLE

Grammar/Semantic Rules	Lexicon/SEM	POS
$S \rightarrow NP\ VP$ replace(NP.sem 1 VP.sem)	o, a/---	DET
$NP \rightarrow DET\ N$ N.sem	Zé, Ana/ZÉ, ANA	N
$VP \rightarrow V\ NP$ replace(NP.sem 2 V.sem)	Ama/LOVE(X, Y)	V

Syntactic/semantic grammar
(syntax/semantic parallelism)



Compositional (bottom-up) process

COMPOSITIONAL SEMANTIC PARSING

- Notation (From Eisenstein's NLP book):
 - From Lambda Calculus:
 - $(\lambda y.\lambda x.A(x, y))@a = \lambda x.A(x, a)$ (β -reduction)
 - @ indicates function application
 - Example:
 - $\lambda x.\text{LOVES}(x, \text{MARIA})$
 - is the meaning of "loves Maria"
 - $(\lambda x.\text{LOVES}(x, \text{MARIA}))@\text{ZÉ} = \text{LOVES}(\text{ZÉ}, \text{MARIA})$

ACTIVE LEARNING MOMENT



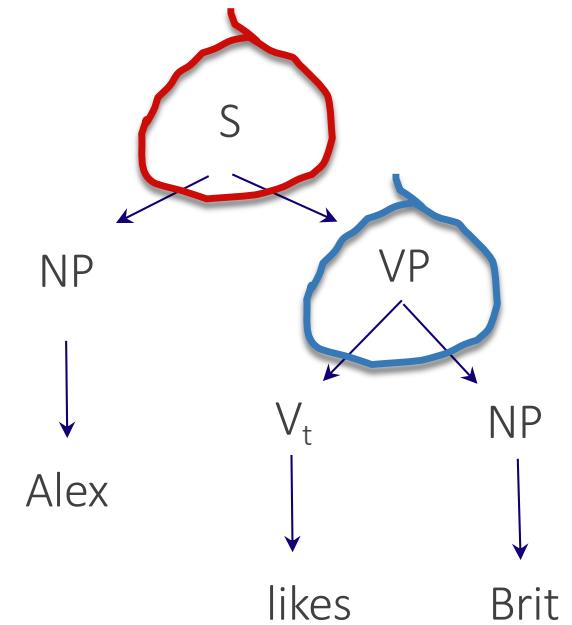
COMPOSITIONAL SEMANTIC PARSING

- Considering the given grammar (from Eisenstein book), find the meaning representation of:
 - *Alex likes Brit*

S	\rightarrow NP VP	VP.sem@NP.sem
VP	\rightarrow V_t NP	$V_t.sem@NP.sem$
VP	\rightarrow V_i	$V_i.sem$
V_t	\rightarrow <i>likes</i>	$\lambda y.\lambda x.\text{LIKES}(x, y)$
V_i	\rightarrow <i>sleeps</i>	$\lambda x.\text{SLEEPS}(x)$
NP	\rightarrow <i>Alex</i>	ALEX
NP	\rightarrow <i>Brit</i>	BRIT

S	$\rightarrow NP\ VP$	$VP.sem @ NP.sem$
VP	$\rightarrow V_t\ NP$	$V_t.sem @ NP.sem$
VP	$\rightarrow V_i$	$V_i.sem$
V_t	$\rightarrow likes$	$\lambda y.\lambda x.LIKES(x, y)$
V_i	$\rightarrow sleeps$	$\lambda x.SLEEPS(x)$
NP	$\rightarrow Alex$	ALEX
NP	$\rightarrow Brit$	BRIT

- Alex likes Brit



$$\begin{aligned}
 V_t.sem @ NP.sem &= \\
 (\lambda y.\lambda x.LIKES(x, y)) @ BRIT &= \\
 \lambda x.LIKES(x, BRIT)
 \end{aligned}$$

$$\begin{aligned}
 VP.sem @ NP.sem &= \\
 (\lambda x.LIKES(x, BRIT)) @ ALEX &= \\
 \textcolor{blue}{LIKES(ALEX, BRIT)}
 \end{aligned}$$

Too easy. I am sure there is something you are not telling us...



Generated by DALL-E



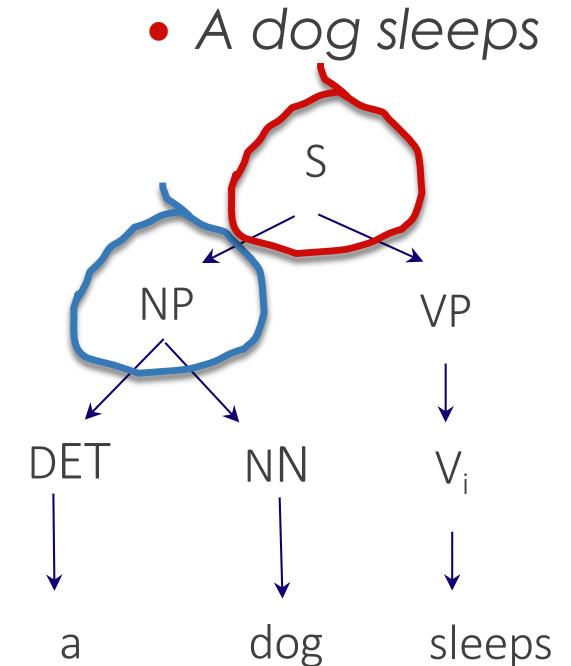
COMPOSITIONAL SEMANTIC PARSING

- Considering this other grammar (also from Eisenstein book), find the meaning representation of:

- A dog *sleeps*
- A dog *likes* Alex

S	\rightarrow NP VP	NP.sem@VP.sem
VP	\rightarrow V_t NP	$V_t.sem@NP.sem$
VP	\rightarrow V_i	$V_i.sem$
NP	\rightarrow DET NN	DET.sem@NN.sem
NP	\rightarrow NNP	$\lambda P.P(NNP.sem)$
DET	\rightarrow <i>a</i>	$\lambda P.\lambda Q.\exists xP(x) \wedge Q(x)$
DET	\rightarrow <i>every</i>	$\lambda P.\lambda Q.\forall x(P(x) \Rightarrow Q(x))$
V_t	\rightarrow <i>likes</i>	$\lambda P.\lambda x.P(\lambda y.LIKES(x, y))$
V_i	\rightarrow <i>sleeps</i>	$\lambda x.SLEEPS(x)$
NN	\rightarrow <i>dog</i>	DOG
NNP	\rightarrow <i>Alex</i>	ALEX
NNP	\rightarrow <i>Brit</i>	BRIT

S	$\rightarrow NP\ VP$	$NP.sem @ VP.sem$
VP	$\rightarrow V_t\ NP$	$V_t.sem @ NP.sem$
VP	$\rightarrow V_i$	$V_i.sem$
NP	$\rightarrow DET\ NN$	$DET.sem @ NN.sem$
NP	$\rightarrow NNP$	$\lambda P.P(NNP.sem)$
DET	$\rightarrow a$	$\lambda P.\lambda Q.\exists xP(x) \wedge Q(x)$
DET	$\rightarrow every$	$\lambda P.\lambda Q.\forall x(P(x) \Rightarrow Q(x))$
V_t	$\rightarrow likes$	$\lambda P.\lambda x.P(\lambda y.LIKES(x, y))$
V_i	$\rightarrow sleeps$	$\lambda x.SLEEPS(x)$
NN	$\rightarrow dog$	DOG
NNP	$\rightarrow Alex$	ALEX
NNP	$\rightarrow Brit$	BRIT



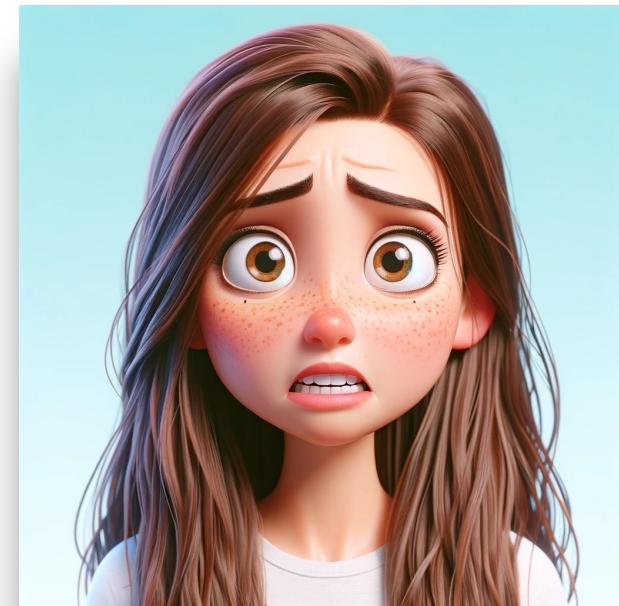
$$DET.sem @ NN.sem = (\lambda P.\lambda Q.\exists xP(x) \wedge Q(x)) @ DOG = \\ \lambda Q.\exists x DOG(x) \wedge Q(x)$$

$$NP.sem @ VP.sem = (\lambda Q.\exists x DOG(x) \wedge Q(x)) @ (\lambda z.SLEEPS(z)) = \\ \exists x DOG(x) \wedge (\lambda z.SLEEPS(z) @ x) = \\ \exists x DOG(x) \wedge SLEEPS(x)$$

Change variables to avoid ambiguity

$(\lambda A.A(x)) @ B$ and B contains a λ , do $B @ x$

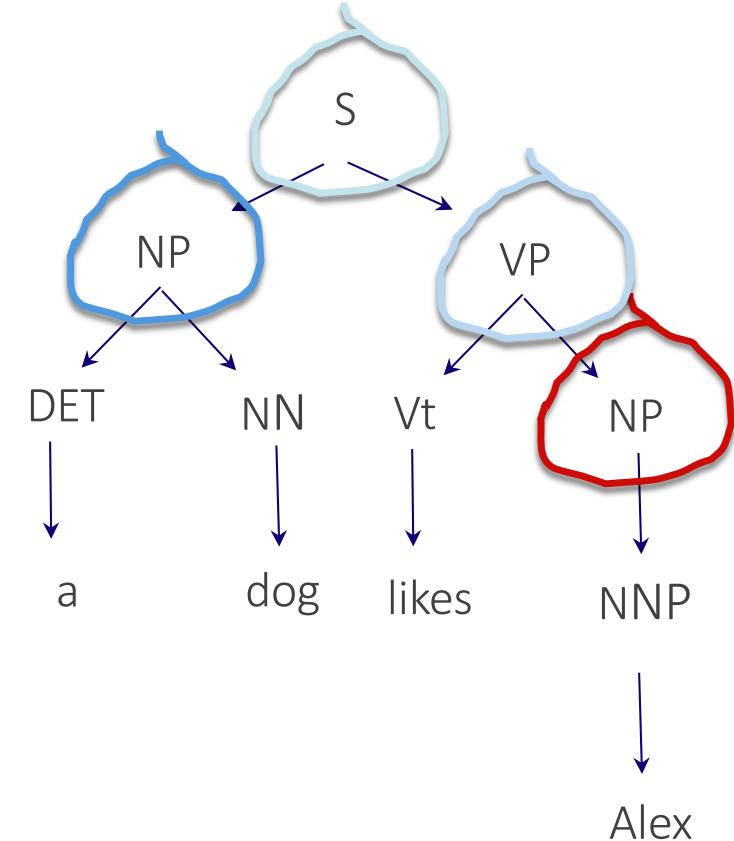
Hmm... Could you
please show another
example?



S	$\rightarrow NP \ VP$	NP.sem@VP.sem
VP	$\rightarrow V_t \ NP$	V _t .sem@NP.sem
VP	$\rightarrow V_i$	V _i .sem
NP	$\rightarrow DET \ NN$	DET.sem@NN.sem
NP	$\rightarrow NNP$	$\lambda P.P(NNP.sem)$

DET	$\rightarrow a$	$\lambda P.\lambda Q.\exists xP(x) \wedge Q(x)$
DET	$\rightarrow every$	$\lambda P.\lambda Q.\forall x(P(x) \Rightarrow Q(x))$
V _t	$\rightarrow likes$	$\lambda P.\lambda x.P(\lambda y.LIKES(x,y))$
V _i	$\rightarrow sleeps$	$\lambda x.SLEEPS(x)$
NN	$\rightarrow dog$	DOG
NNP	$\rightarrow Alex$	ALEX
NNP	$\rightarrow Brit$	BRIT

- A dog likes Alex



(from previous exercise) DET.sem@NN.sem = $\lambda Q.\exists x \text{ DOG}(x) \wedge Q(x)$

$\lambda P.P(NNP.sem) = \lambda P.P(ALEX) \leftarrow \text{Stop! No @}$

$V_t.sem@NP.sem = (\lambda P.\lambda x.P(\lambda y.LIKES(x,y))) @ \lambda Q.Q(ALEX) = \lambda x. (\underline{\lambda Q.Q(ALEX)} @ \lambda y.LIKES(x,y)) =$

$\lambda x. (\underline{\lambda y.LIKES(x,y)} @ ALEX) = \lambda x.LIKES(x, ALEX)$

$NP.sem@VP.sem = (\lambda Q.\exists x \text{ DOG}(x) \wedge Q(x)) @ \lambda y.LIKES(y, ALEX) =$

$\exists x \text{ DOG}(x) \wedge (\underline{\lambda y.LIKES(y, ALEX)} @ x) = \exists x \text{ DOG}(x) \wedge \text{LIKES}(x, ALEX)$

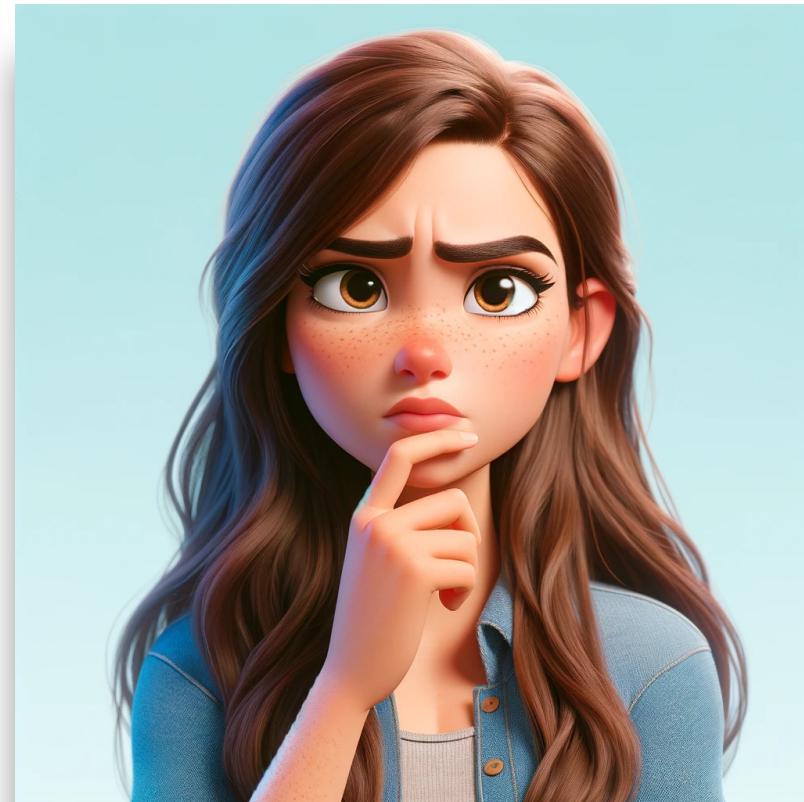
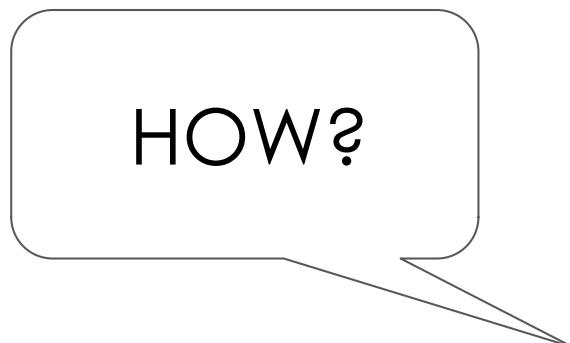
Change variables!

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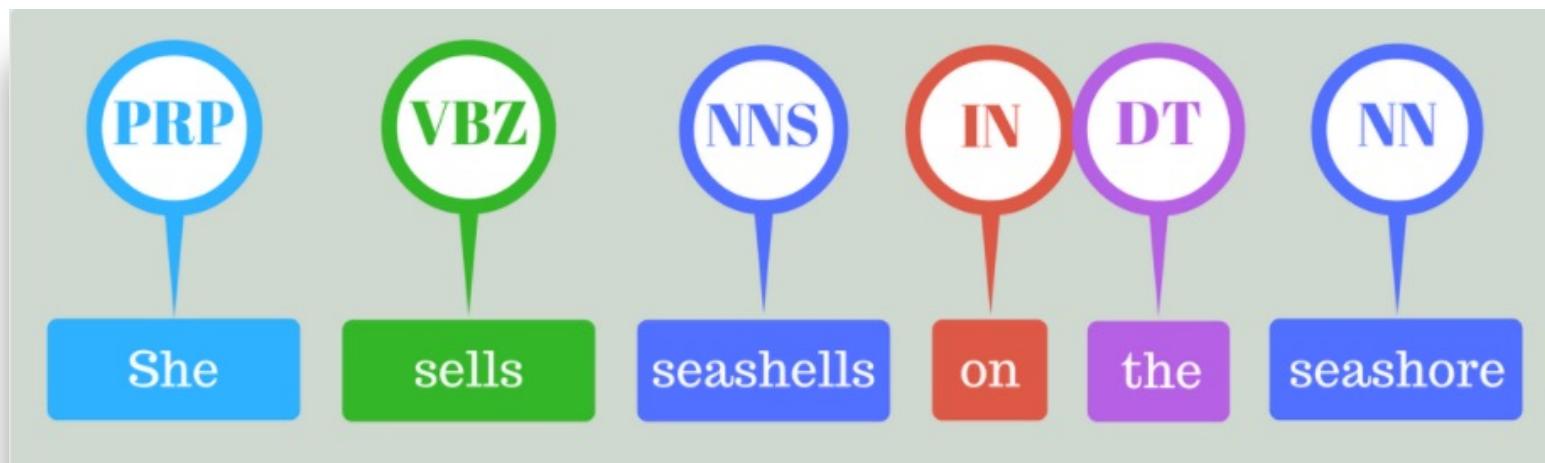
SEMANTIC PARSING AS SEQUENCE PREDICTION

- Semantic parsing can also be model as a sequence prediction task



SEQUENTIAL TASKS IN NLP

- Well...
 - POS-TAGGING was a sequence prediction task
 - Remember?



<https://nlpforhackers.io/wp-content/uploads/2016/08/Intro-POS-Tagging.png>

SEQUENTIAL TASKS IN NLP

- A new notation can work a miracle
 - BIO Tagging:
 - If we want to recognize a set of chunks (example: locations), we can use:
 - B for the word in the Beginning of the chunk (sometimes ignored)
 - I for words Inside the chunk
 - O for words Outside the chunk
 - Notice that there are many different flavours for this

SEQUENTIAL TASKS IN NLP

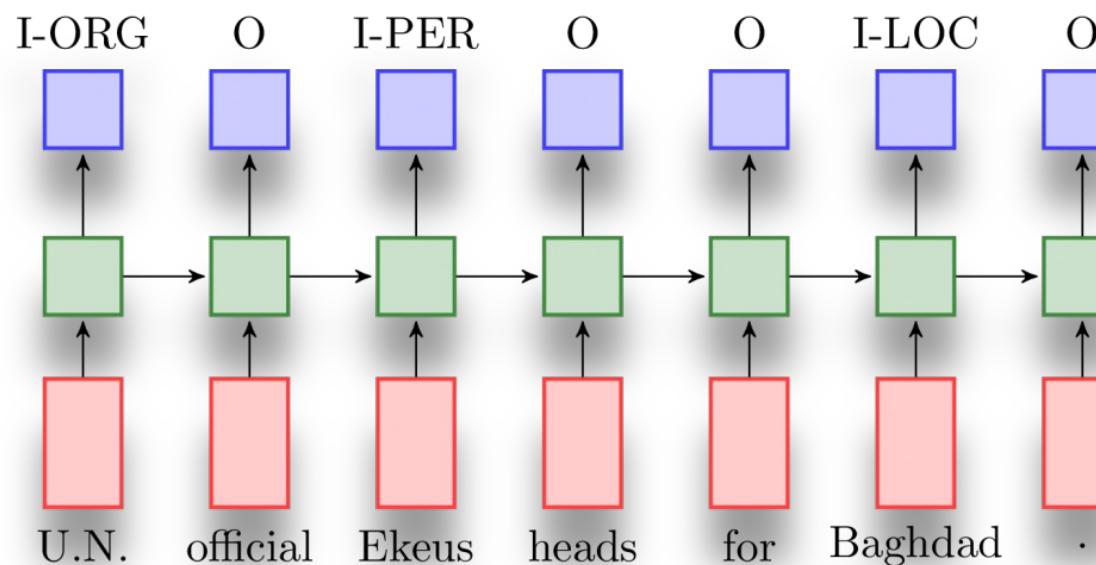
- Even **Syntactic Analysis** (remember?) can be done as a sequential task with the BIO notation

W e	s a w	t h e	y e l l o w	dog
PRP	VBD	DT	JJ	NN
B-NP	O	B-NP	I-NP	I-NP

<https://www.nltk.org/book/ch07.html>

SEQUENTIAL TASKS IN NLP

- The same for Named Entity Recognition



<https://www.depends-on-the-definition.com/guide-sequence-tagging-neural-networks-python/>

SEMANTIC PARSING AS SEQUENCE PREDICTION

- Now let us see how Semantic Parsing can also be model as a **sequence prediction task**

W	find	recent	comedies	by	james	cameron
S	↓	↓	↓	↓	↓	↓
O	O	B-date	B-genre	O	B-dir	I-dir
D	movies					
I	find_movie					

Figure 1: *An example utterance with annotations of semantic slots in IOB format (S), domain (D), and intent (I), B-dir and I-dir denote the director name.*

Multi-Domain Joint Semantic Frame Parsing using Bi-directional RNN-LSTM
Dilek Hakkani-Tu ̈r, Gokhan Tur, Asli Celikyilmaz, Yun-Nung Chen†, Jianfeng Gao, Li
Deng, and Ye-Yi Wang

SEMANTIC PARSING AS SEQUENCE PREDICTION

- Example:
 - Given
 - How much is the cheapest flight from Boston to New York?
 - How to create the frame (meaning representation):
 - Goal: Airfare <----- Intent (classification task, as in your project)
 - Cost Relative: cheapest
 - Depart_City: Boston
 - Arrival_City: New York

How much is the cheapest flight from Boston to New York?
O O O O B-Cost_Relative O O B-Depart_City O B-Arrival_City I-Arrival_City

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SEMANTIC RELATIONS

- **Synonyms:** two words are synonyms if they have the same meaning (sense), regardless of context.
 - Example (EN):
 - Large and big (are these words really synonyms?)
 - Ok: How big/large is that plane?
 - Not ok: Joana is my big/large sister.
 - Example (PT):
 - Balofa vs. anafada
 - Bafio vs. mofo
 - ...

SEMANTIC RELATIONS

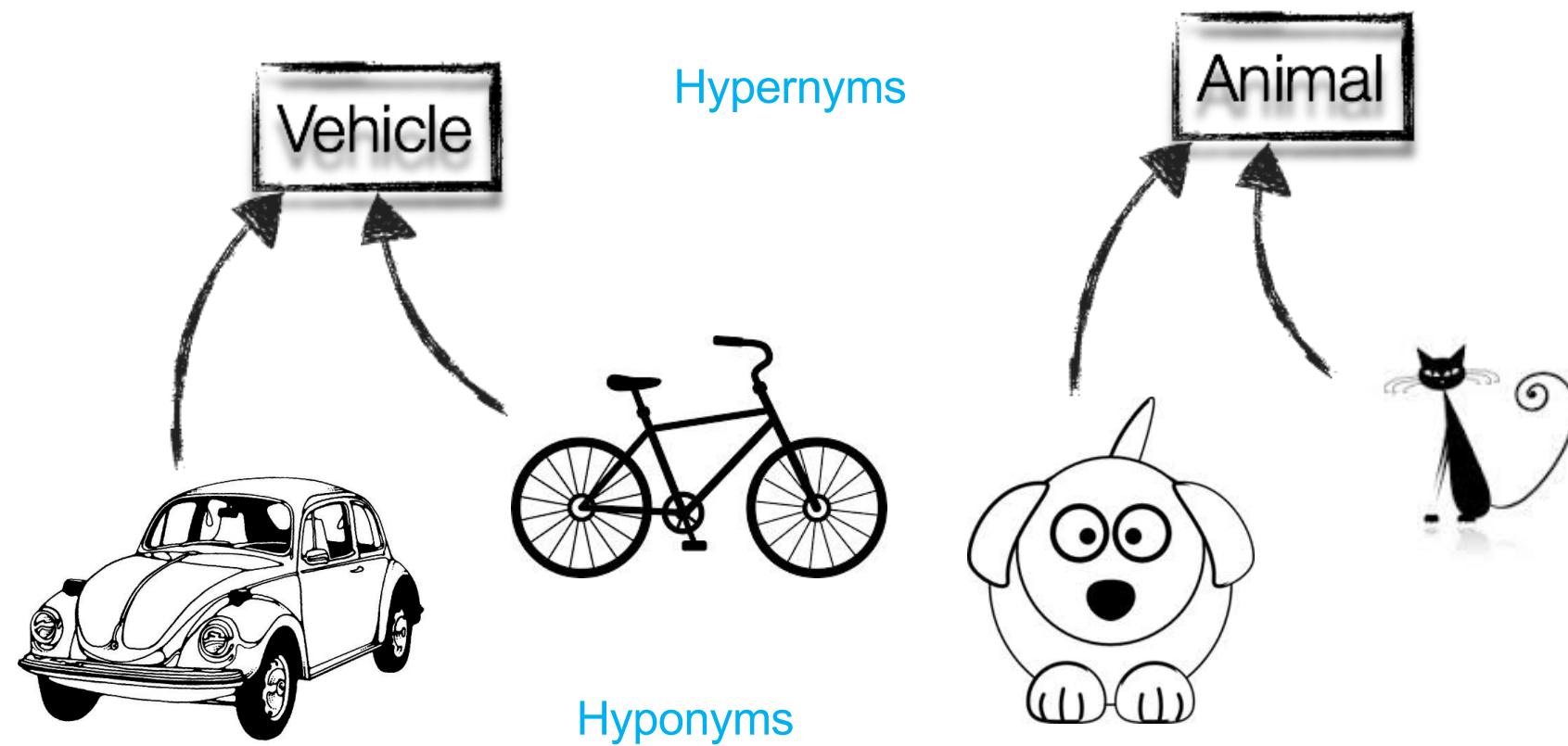
- **Antonyms:** two words are antonyms if they are opposites regarding one aspect of their meaning (being the rest fairly similar).
 - Example:
 - short vs. tall
 - rise vs. fall
 - cold vs. hot
 - ...

SEMANTIC RELATIONS

- **Hyponym:** a word is a hyponym (or subordinate)/hypernym (or superordinate) of another word if its meaning is more specific/general, respectively, than the meaning of the other word.
 - Example:
 - dog vs. animal (dog is a hyponym of animal)

SEMANTIC RELATIONS

- More examples:

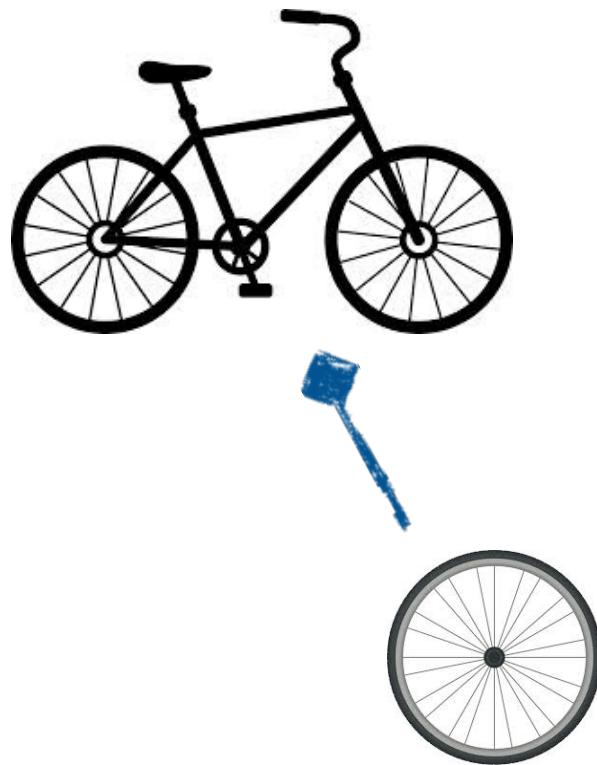


SEMANTIC RELATIONS

- **Meronym:** a word is a meronym (part-whole relation) of another word if its meaning corresponds to a part of the meaning of the other word.
 - Example:
 - wheel vs. car (wheel is a meronym of car; car is a holonym of wheel)

SEMANTIC RELATIONS

- Part of (meronymy of)



From Ricardo Ribeiro and Fernando Batista slides

SEMANTIC RELATIONS

- **Homonyms:** two words are homonyms if they share the same pronunciation (homophones) AND the same spelling (homographs) but have unrelated meanings.
 - Examples:
 - homonyms – bank (to seat) vs. bank (financial institution); spell (a magical formula and to name or write the order of the letters in a word);
 - just homophones – concelho vs. conselho, riu vs. rio, write and right;
 - just homographs – almoço (nc) vs. almoço (v)

SEMANTIC RELATIONS

- **Polysemic:** a words is polysemic if it has various RELATED meanings.
 - Example:
 - banco (banco de dados vs. banco-cofre ou instituição financeira vs. edifício-banco)(bank – data; bank – finances)
 - dar (dar um livro, dar uma festa)(give – book; give – party)
 - ...

ACTIVE LEARNING MOMENT



EXERCISE

- What is the semantic relation between the following words?
 - couch/sofa
 - awake/asleep
 - stop/go
 - strong/weak
 - mammal/pig
 - get as obtain/ get as buy

EXERCISE

- What is the semantic relation between the following words?
 - couch/sofa: synonymy
 - awake/asleep: antonymy
 - stop/go: antonymy
 - strong/weak: antonymy
 - mammal/pig: hyponymy (pig is a hyponym of mammal)
 - get as obtain/ get as buy: polysemy

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WORDNET (Fellbaum, 1998)

- Large lexical database for English
 - Set of lemmas annotated with a set of senses called synsets:
 - Instead of representing concepts in logical terms (or as vectors), concepts are represented by lists of words that can be used to express that concept
 - Each synset:
 - contains a brief definition (“gloss”) and, in most cases, one or more short sentences illustrating the use of the synset members,
 - is linked to other synsets by a semantic relation
- Check: <https://wordnet.princeton.edu>
 - Available (and also included in nltk)

WORDNET

WordNet Search - 3.1

- [WordNet home page](#) - [Glossary](#) - [Help](#)

Word to search for:

murder

Display Options:

(Select option to change)



Key: "S:" = Show Synset (semantic) relations, "W:" = Show Word (lexical) relations

Display options for sense: <lexical filename > (gloss) "an example sentence"

Noun

- <noun.act>S: (n) **murder**, [slaying](#), [execution](#) (unlawful premeditated killing of a human being by a human being)

Verb

- <verb.social>S: (v) **murder**, [slay](#), [hit](#), [dispatch](#), [bump off](#), [off](#), [polish off](#), [remove](#) (kill intentionally and with premeditation) "*The mafia boss ordered his enemies murdered*"
- <verb.change>S: (v) [mangle](#), [mutilate](#), **murder** (alter so as to make unrecognizable) "*The tourists murdered the French language*"

Noun

- S: (n) animal, animate being, beast, brute, creature, fauna (a living organism characterized by voluntary movement)
 - direct hyponym / full hyponym
 - part meronym
 - S: (n) head, caput (the upper part of the human body or the front part of the body in animals; contains the face and brains) "he stuck his head out the window"
 - S: (n) face (the part of an animal corresponding to the human face)
 - member holonym
 - domain term category
 - substance meronym
 - direct hypernym / inherited hypernym / sister term
 - derivationally related form

Adjective

- S: (adj) animal, carnal, fleshly, sensual (marked by the appetites and passions of the body) "animal instincts"; "carnal knowledge"; "fleshly desire"; "a sensual delight in eating"; "music is the only sensual pleasure without vice"
 - similar to
 - S: (adj) physical (involving the body as distinguished from the mind or spirit) "physical exercise"; "physical suffering"; "was sloppy about everything but her physical appearance"
 - derivationally related form
 - antonym
 - W: (adj) mental [Indirect via physical] (involving the mind or an intellectual process) "mental images of happy times"; "mental calculations"; "in a terrible mental state"; "mental suffering"; "free from mental defects"

Proceedings of the Workshop on Multimodal Wordnets (MMWN-2020), pages 14–19
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English WordNet 2020: Improving and Extending a WordNet for English using an Open-Source Methodology

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PROPBANK

- Corpus of text where predicate-argument relations were added to syntactic trees.
- Check:
<https://verbs.colorado.edu/~mpalmer/projects/ace.html>

PROPBANK

- [John]ARG0 broke [the window]ARG1
- [The window]ARG1 broke

ARG0	agent	ARG3	starting point, benefactive, attribute
ARG1	patient	ARG4	ending point
ARG2	instrument, benefactive, attribute	ARGM	modifier

Table 1.1: List of arguments in PropBank

FRAMENET

- Lexical database of English
- Idea: the meanings of words are defined by a semantic frame (the type of the event, relation, or entity and the participants in it).
- Check: <https://framenet.icsi.berkeley.edu/>
- Available (and also in nltk)

FRAMENET

- Example: Cooking involves:
 - a person doing the cooking (Cook),
 - the food that is to be cooked (Food),
 - something to hold the food while cooking (Container)
 - a source of heat (Heating_instrument).

Cooking_creation

[Lexical Unit Index](#)

Definition:

This frame describes food and meal preparation. A Cook creates a Produced_food from (raw) Ingredients. The Heating_Instrument and/or the Container may also be specified.

Caitlin BAKED some cookies from the pre-packaged dough.

FEs:

Core:

Cook [Cook]

Semantic Type: Sentient

The Cook prepares the Produced_food.

Drew COOKED dinner for his friends.

Drew BAKED an apple pie.

Produced_food [Food]

The Produced_food is the result of a Cook's efforts.

Drew PREPARED dinner for his friends.

Drew BAKED an apple pie for dessert.

Non-Core:

Container [Container]

Semantic Type: Container

This FE identifies the Container that holds the food being produced.

BAKE the quiche in a pie tin.

Things that apply the heat directly are Heating_Instruments, e.g. crock-pot, electric griddle.

FRAMENET

- With FrameNet we can conclude that:
 - "John sold a car to Mary" essentially describes the same basic situation (semantic frame) as "Mary bought a car from John"

OTHER RESOURCES

- VerbNet
- BabelNet
- ...

KEY TAKEAWAYS

KEY TAKEAWAYS

- There are two main ways to represent language: via a symbolic framework and via vectors
- Computational Semantics is a key area in NLP and compositional semantics is part of it
- There are several semantic relations between words and between constituents of a sentence
- Along the years there were several efforts towards building semantic resources

SUGGESTED READINGS

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- Readings:
 - “Sebenta” 7.3 and 7.4
 - Jurafsky, on-line version, 3rd ed. draft, October 16, 2019:
chapter 19 (19.1-19.5), Word Senses and WordNet
 - Jurafsky, on-line version, 3rd ed. draft, October 16, 2019:
chapter 20 (20.1-20.5), Semantic Role Labelling