Q: Why is the Turing Test significant in AI?

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A. It measures the speed of algorithms.

B. It assesses whether machines can behave intelligently like humans.

C. It evaluates the hardware capacity of AI systems.

D. It rates the efficiency of chatbots.

E. It assesses whether machines are smarter than humans.

CPSC 100

Computational Thinking

Artificial Intelligence

Instructor: Parsa Rajabi
Department of Computer Science
University of British Columbia

Agenda

- Course Admin
- Ethics
  - Impact of AI on Society
- Class Activity:
  - NLP

Learning Goals

Learning Goals

After this lecture, you should be able to:

- Explain the dilemma of the **Trolly Problem**
  - Describe the relevance of the problem to AI Ethics
- Identify and explain the traditional steps of **Natural Language Processing**
- Apply a traditional NLP algorithm to a given input

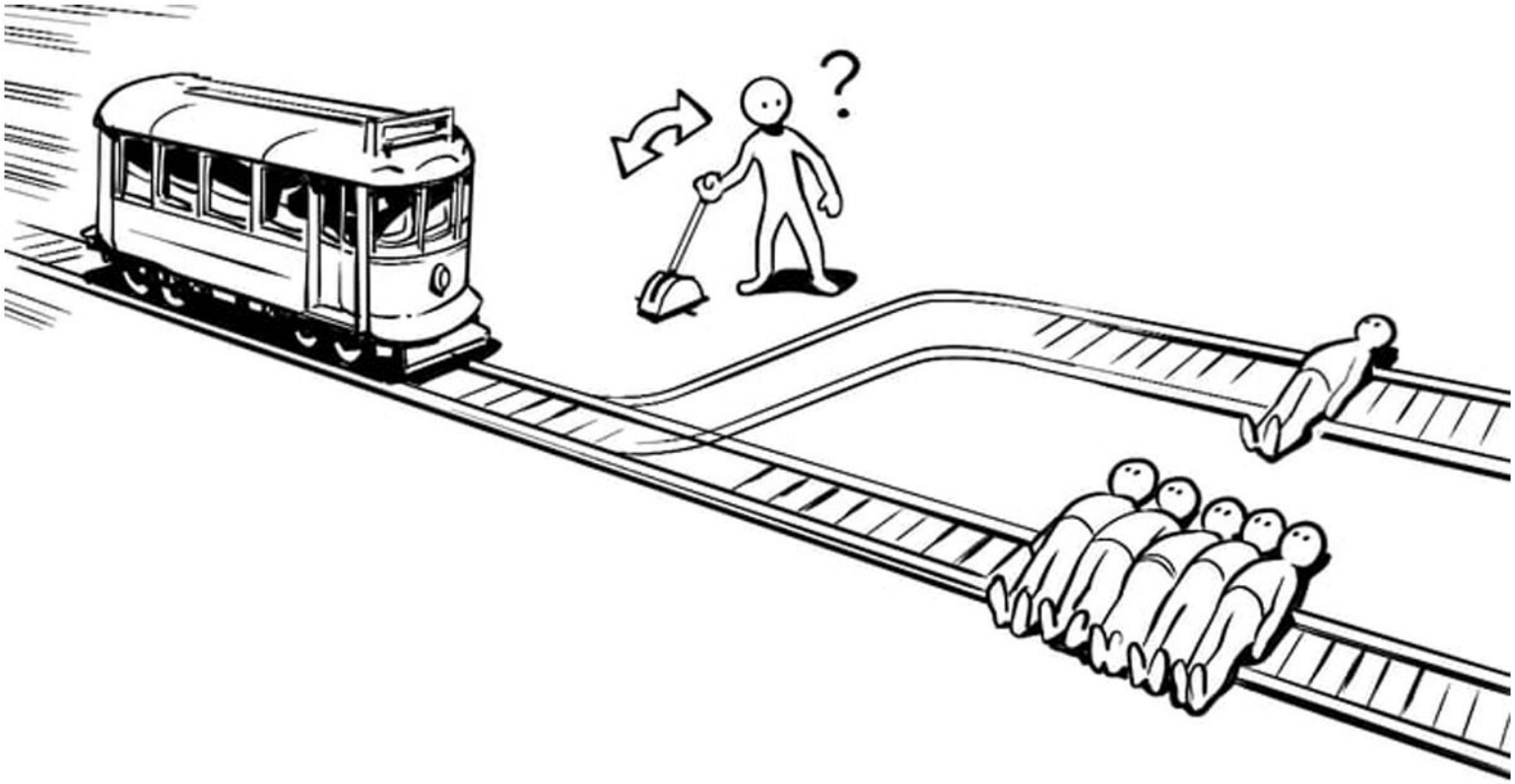
Course Admin

Post-Class Quiz

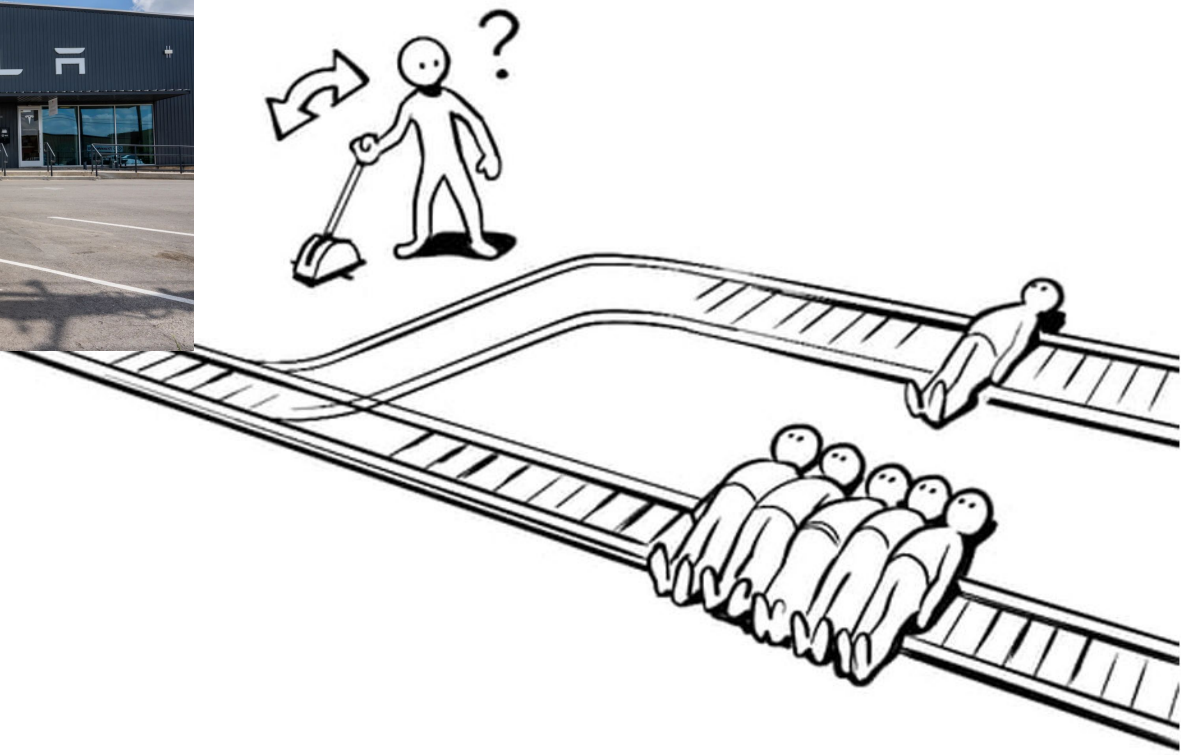
- First post-class quiz to be released next week (Monday)
  - To be completed individually via Canvas, 60 mins, 1 attempt
  - Due on Sunday, Jan 26
- Based on concepts discussed thus far
  - Algorithms
  - Artificial Intelligence

Trolly Problem

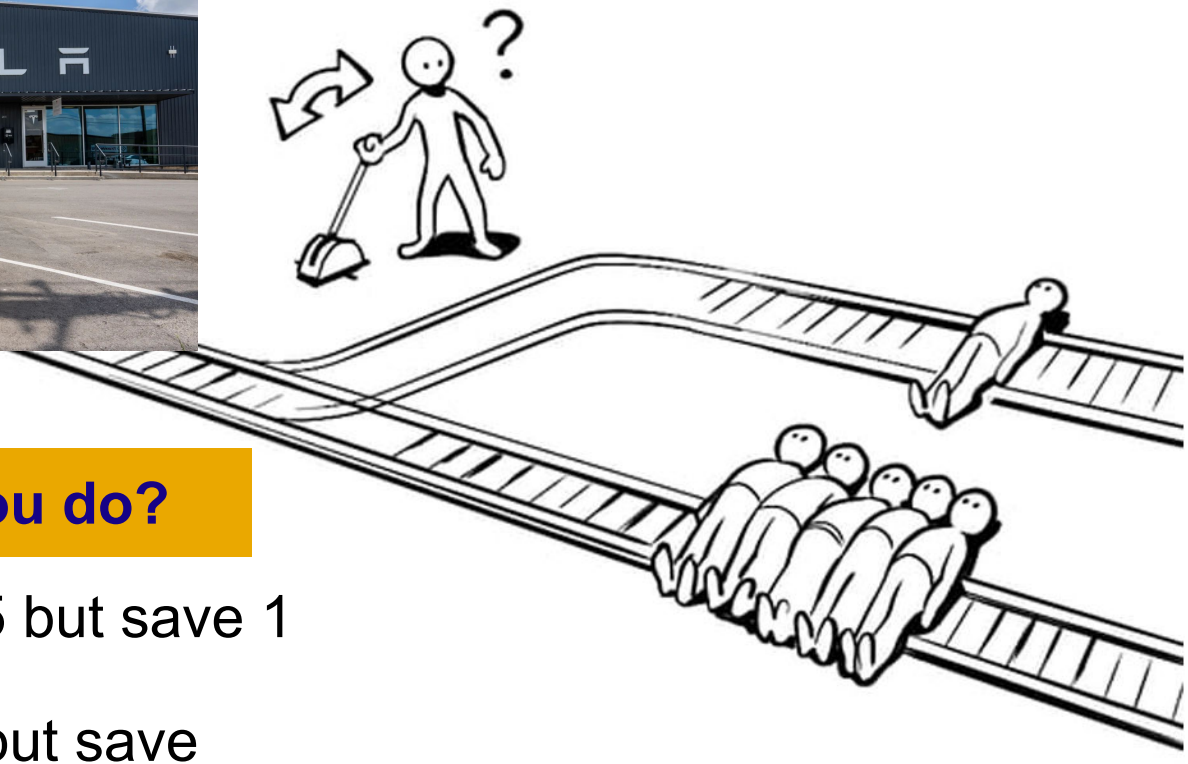
Trolley Problem



Trolley Problem



Trolley Problem



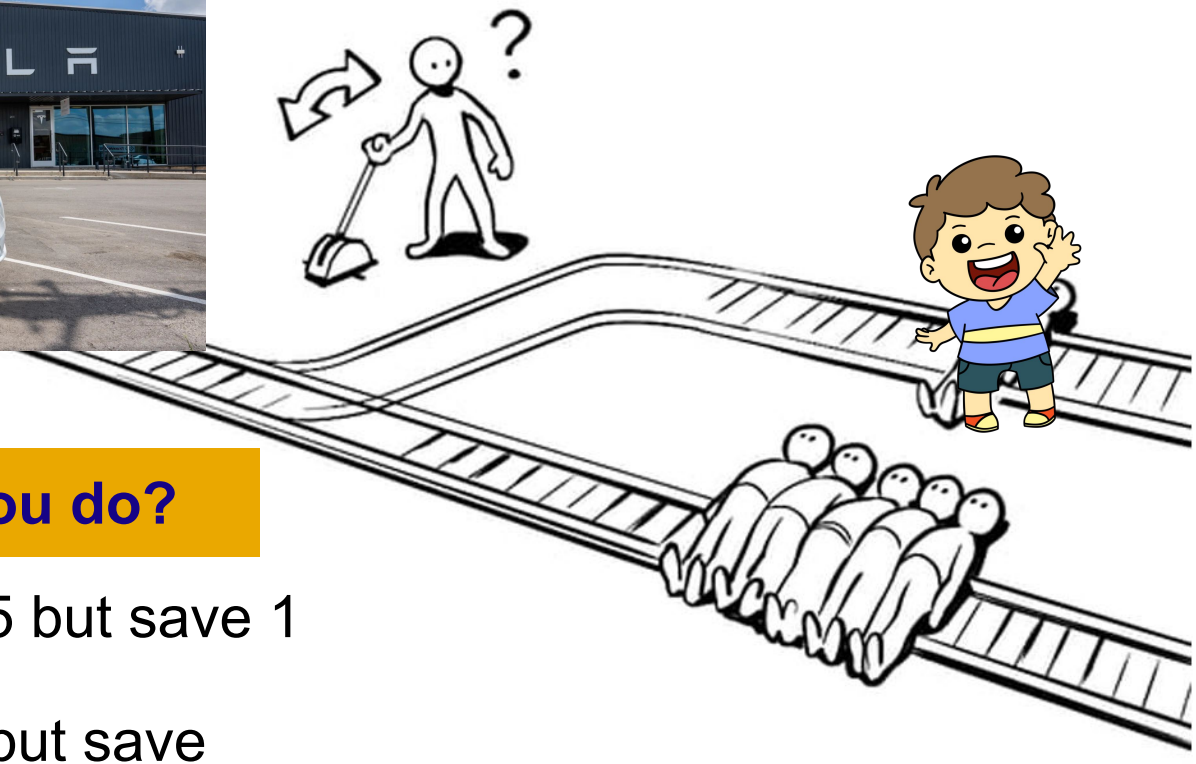
iClicker

Q: What would you do?

A. Do nothing, kill 5 but save 1

B. Pull lever, kill 1 but save

Trolley Problem



iClicker

Q: What would you do?

A. Do nothing, kill 5 but save 1

B. Pull lever, kill 1 but save

NLP Recap

How does NLP work?

Traditional NLP Steps

1. **Recognize speech** (typically chatbots receive ASCII versions of the questions)
2. **Syntax analysis, or parsing**: inferring parts of speech and sentence structure, using a lexicon and grammar
3. **Semantic analysis**: inferring meaning using syntax and semantic rules
4. **Pragmatics**: inferring meaning from contextual information

(1) Input: Sentence: “The rat ate cheese”

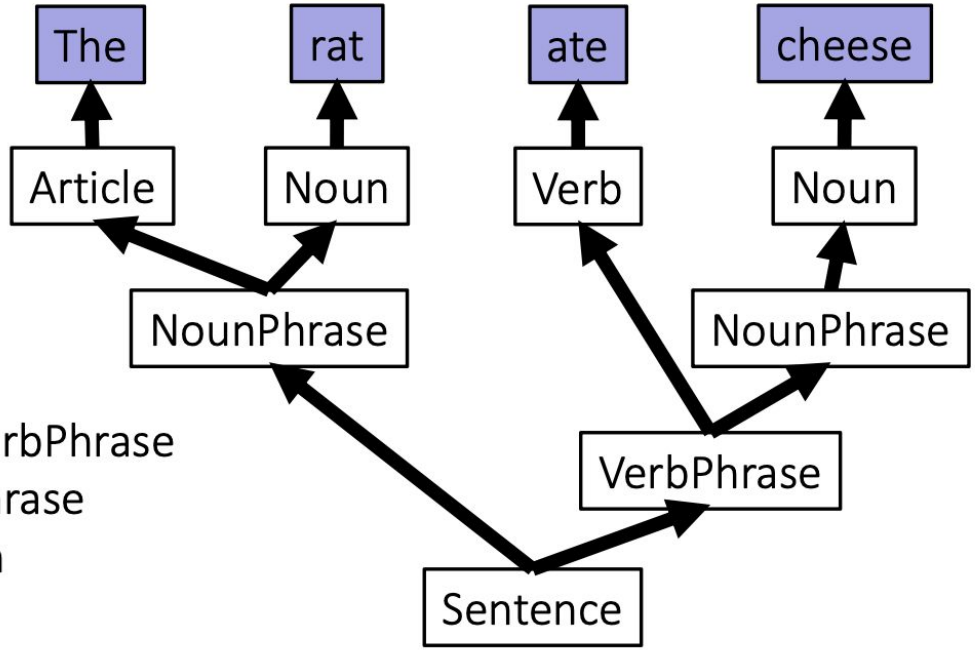
(2) Lexicon:

rat	Noun
cheese	Noun
ate	Verb
The	Article

(3) Grammar:

Sentence → NounPhrase, VerbPhrase
VerbPhrase → Verb, NounPhrase
NounPhrase → Article, Noun
NounPhrase → Noun

(4) Output: A parse tree:



(1) Input: Sentence: “The rat ate cheese”

ASCII TABLE

Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	`
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
21	15	[NEGATIVE ACKNOWLEDGE]	53	35	5	85	55	U	117	75	u
22	16	[SYNCHRONOUS IDLE]	54	36	6	86	56	V	118	76	v
23	17	[END OF TRANS. BLOCK]	55	37	7	87	57	W	119	77	w
24	18	[CANCEL]	56	38	8	88	58	X	120	78	x
25	19	[END OF MEDIUM]	57	39	9	89	59	Y	121	79	y
26	1A	[SUBSTITUTE]	58	3A	:	90	5A	Z	122	7A	z
27	1B	[ESCAPE]	59	3B	;	91	5B	[	123	7B	{
28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
30	1E	[RECORD SEPARATOR]	62	3E	>	94	5E	^	126	7E	~
31	1F	[UNIT SEPARATOR]	63	3F	?	95	5F	_	127	7F	[DEL]

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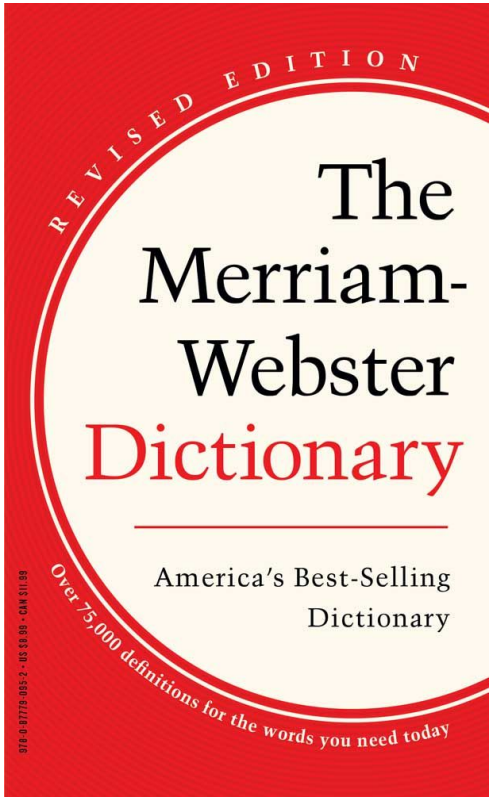
The	Article



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The	Article

(3) Grammar:

Sentence → NounPhrase, VerbPhrase

“The dog barked.”
- Noun Phrase (NP): “The dog”
- Verb Phrase (VP): “barked”

“A cat is sleeping.”
- Noun Phrase (NP): “A cat”
- Verb Phrase (VP): “is sleeping”

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ate	Verb
The	Article

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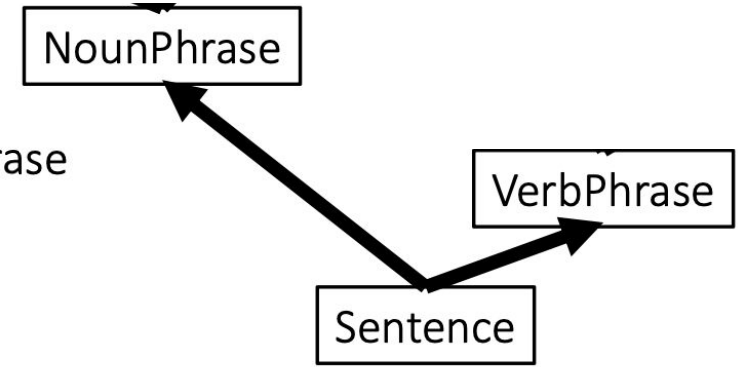

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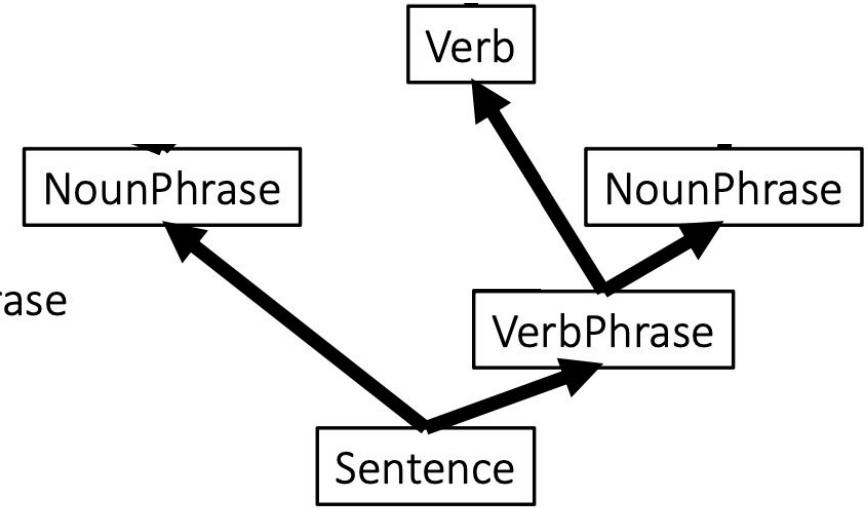

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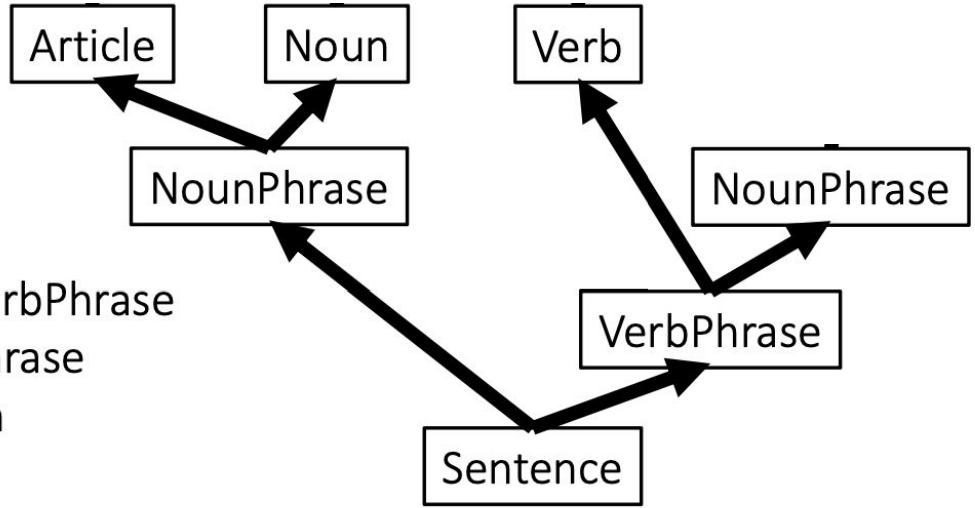

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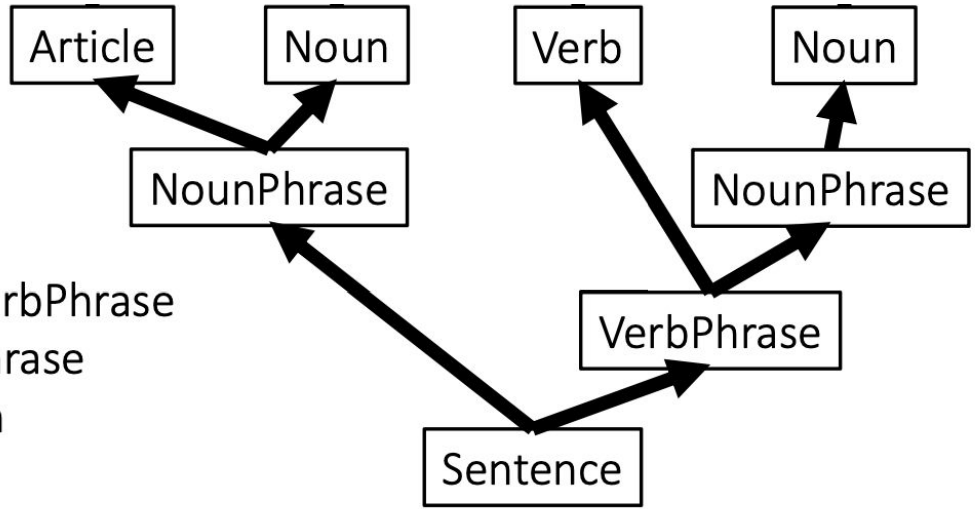

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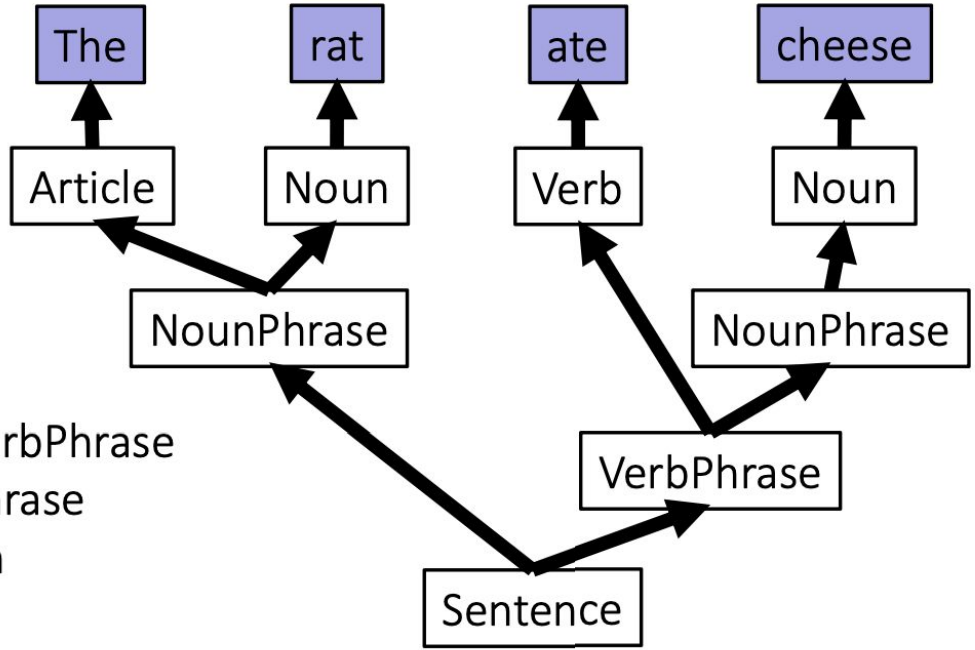

Class Activity

Class Activity: Parsing!

Parse “time flies like an arrow”. Make a tree structure and write down your algorithm in steps.

http://tiny.cc/100-W2C

Grammar

```
Sentence     → NounPhrase, VerbPhrase
NounPhrase → Article, Adjective, Noun
NounPhrase → Article, Noun
NounPhrase → Noun, Noun
NounPhrase → Noun
VerbPhrase  → Verb, Article, NounPhrase
VerbPhrase  → Verb, NounPhrase
VerbPhrase  → Verb, PrepPhrase
PrepPhrase → Preposition, NounPhrase
```

Lexicon

Word	Category
a / an	article
arrow	noun
banana	noun
flies	noun
flies	verb
fruit	noun
fruit	adjective
like	preposition
like	verb
time	noun
time	verb

Q: What parts of speech did you come up with?

iClicker

A. Noun Noun Verb Article Noun

B. Verb Noun Verb Article Noun

C. Noun Verb Preposition Article Noun

D. Noun Verb Verb Article Noun

E. None of the above

Wrap up

Wrap Up

- Complete group contract by Jan 24
  - Find group members in your lab

Take Home Slides

NLP: Semantic Analysis Processes

- **Word Sense Disambiguation**: Identifying the correct meaning of words with multiple interpretations in a given context.
- **Semantic Role Labeling**: Assigning roles (e.g., agent, patient) to elements in a sentence to understand their relationships.
- **Named Entity Recognition**: Identifying and categorizing named entities like names, locations, and organizations in text.
- **Semantic Parsing**: Converting natural language into a formal representation of meaning, aiding in understanding user queries or commands.
- **Sentiment Analysis**: Determining the sentiment expressed in text (positive, negative, or neutral).
- **Semantic Similarity**: Measuring the likeness or relatedness of text based on its meaning.

Limitations of traditional NLP

- Natural language is structurally **ambiguous**, so parsing alone cannot lead to understanding.
- Synonyms for words can’t be used interchangeably in every context, e.g., “*minister of agriculture*” isn't “*priest of farming*.”
- Natural languages have many exceptions to grammatical rules; there’s no agreed-upon grammar for all uses of a language.

Tradition vs. Modern

- **Parsing**: While traditional parsing involves breaking down and analyzing the structure of language (like sentence structure and grammar), ChatGPT's transformer architecture processes text through a series of layers that capture different aspects of language, including some structural elements.
- **Semantic Analysis**: ChatGPT performs semantic analysis through its deep learning model, which understands the meanings and relationships of words and phrases in context. This is essential for generating coherent and contextually relevant responses.