



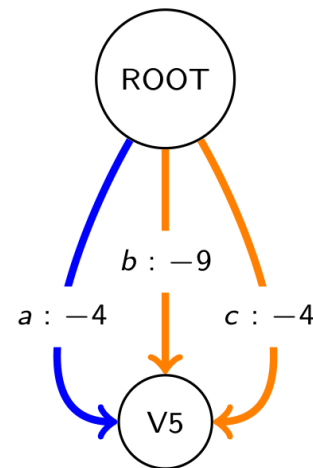
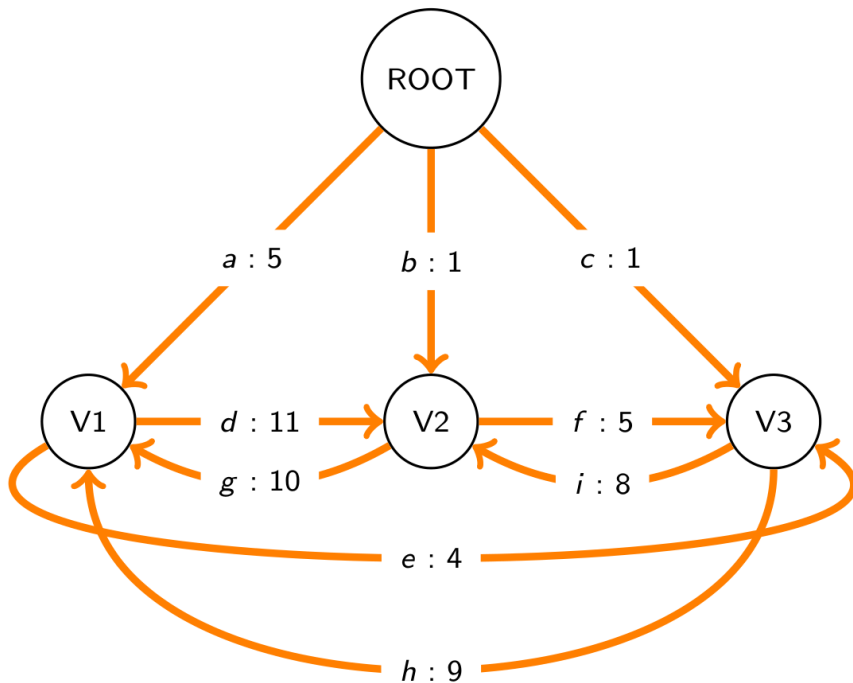
Understanding Language

CSC485/2501

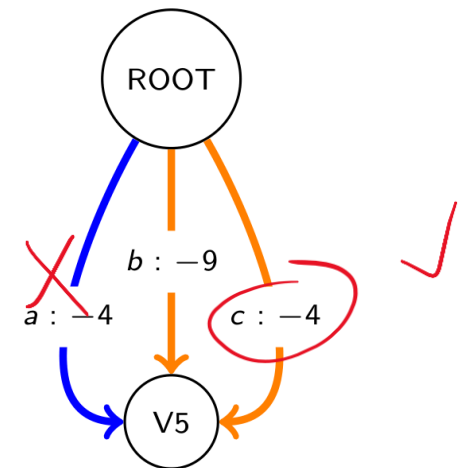
Lecture 6

Quiz

- In the example we saw in the last lecture, we encountered a tie at the end of the expanding phase, where both edges a and c have a weight of -4. Last time, we chose edge a. What would happen if we chose edge c instead? Which edges would be included in the final maximum spanning tree?

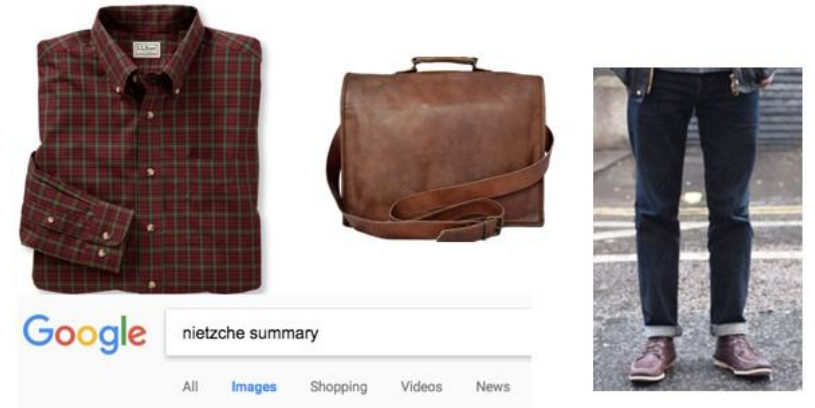


Last lecture: we chose a.



What if we didn't choose a and chose c instead?

Philosophy Major Starter Pack



What does it mean to
“**understand**” language?

The Turing Test

In the first line of your sonnet which reads
“Shall I compare thee to a summer’s day,”
would not “a spring day” do as well or
better?

It wouldn’t scan.

How about “a winter’s day”? That would
scan all right.

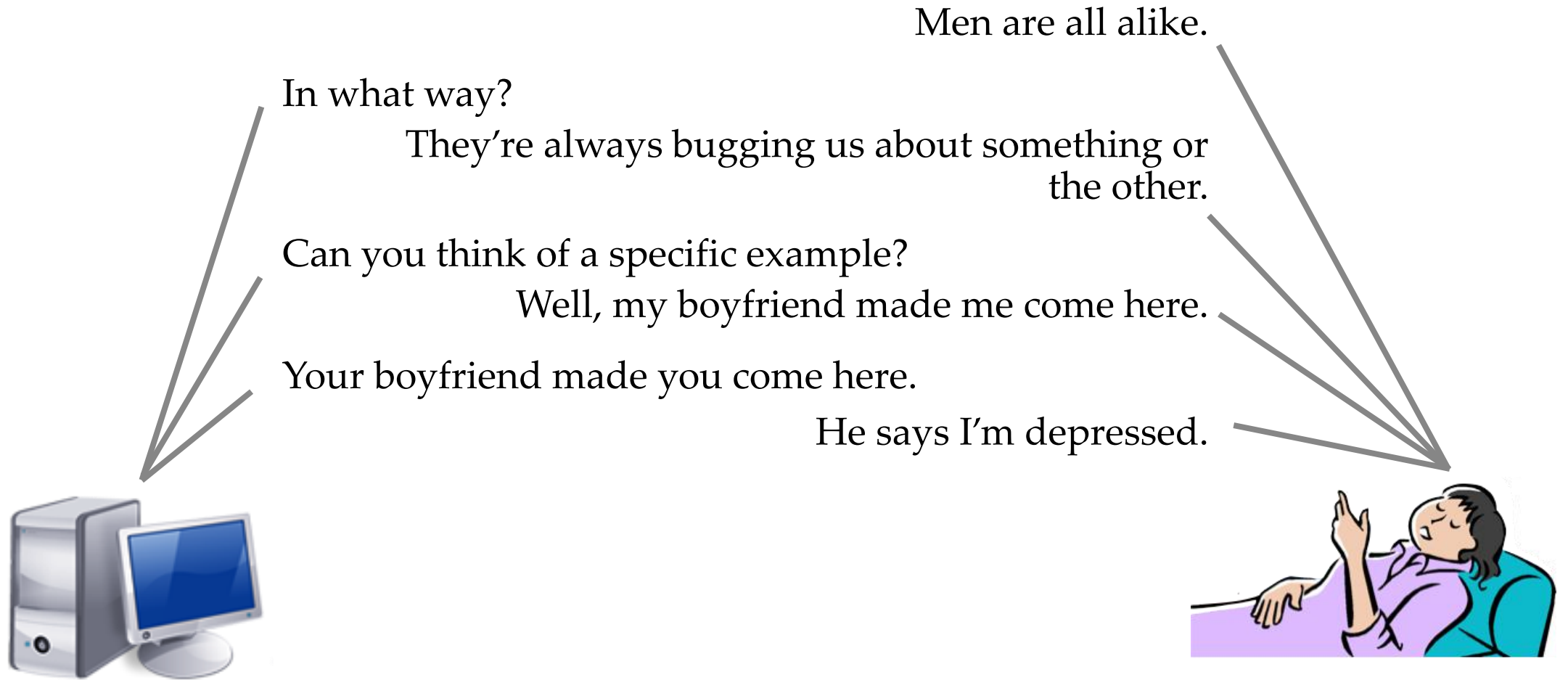
Yes, but nobody wants to be
compared to a winter’s day.



Alan Turing, “Computing machinery and intelligence”, *Mind*, 59, 1950, 433–460.

Using language is not necessarily understanding language.

ELIZA: A computer psychiatrist




ELIZA: A computer psychiatrist


ELIZA Rules:

- (.*) YOU (.*) ME -> WHAT MAKES YOU THINK I \2 YOU
 - USER: You hate me
 - ELIZA: WHAT MAKES YOU THINK I HATE YOU
- I (.*) -> You say you \1
 - USER: I know everybody laughed at me
 - ELIZA: YOU SAY YOU KNOW EVERYBODY LAUGHED AT YOU
- Sees the word “*Everybody*” -> WHO IN PARTICULAR ARE YOU THINKING OF?

Human
or not?



62
energy



SIGN IN

Conversation finished

Do you ever feel



Yes. what about you?

Like a plastic bag



have you ever committed any crimes?

Drifting through the wind, wanting to START AGAIN??




start what again

Do you ever feel, feel so paper thin




oh are you singing

Human
or not?



62
energy



SIGN IN

Conversation finished



I am a human from earth

Hi human, do you ever feel, like a plastic bag



?

Drifting through the wind



Noo

wanting to START AGAIN???



Never

Do you ever feel



Human
or not?



62
energy



SIGN IN

Conversation finished

Do you ever feel



Yes. what about you?

✓ SPOT ON

You just talked to



HUMAN



have y

ic bag



AIN??



start what again

Do you ever feel, feel so paper thin



oh are you singing

Human
or not?



62
energy



SIGN IN

Conversation finished



I am a human from earth



?



Noo



Never

Hi human, do you ever feel, like a plastic bag



✗ WRONG!

You just talked to



AI BOT

gh the wind



wanting to START AGAIN???



Do you ever feel



Levels of Understanding

0. Keyword Processing:

- Limited knowledge of **particular words** or **phrases**, or their collocations.
 - Chatbots (ELIZA).
 - Information retrieval.
 - Web searching.

Levels of Understanding

1. Limited linguistic ability:

- Appropriate response to simple, highly constrained **sentences**.
 - Database queries in NL.
“Show all sales staff who exceeded their quota in May.”
 - Simple NL interfaces.
“I want to fly from Toronto to Vancouver next Sunday.”

Levels of Understanding

E.g., old Siri:



Levels of Understanding

2. *Full text comprehension:*

- Understanding multi-sentence text and its relation to the “real world”.
 - Conversational dialogue.
 - Automatic knowledge acquisition
 - Machine translation?

3. *Emotional understanding/generation:*

- Responding to literature, poetry, humour
- Story narration.

Levels of Understanding

??. *Full text comprehension:*

- Understanding multi-sentence text and its relation to the “real world”.
 - Conversational dialogue.
 - Automatic knowledge acquisition
 - Machine translation?

??. *Emotional understanding/generation:*

- Responding to literature, poetry, humour
- Story narration.

AI won an art contest, and artists are furious



By Rachel Metz, CNN Business

🕒 4 minute read · Published 10:54 AM EDT, Sat September 3, 2022



Art & Tech

A Photographer Wins a Top Prize in an A.I. Competition for His Non-A.I. Image

Miles Astray was disqualified after his image was revealed as the real thing.



Write me a poem about the course CSC485: introduction to computational linguistics.



CSC485: The Language of Machines

In halls where words and numbers blend,
Where syntax meets a cryptic trend,
We dive into the depths unseen,
To teach a machine what language means.

With tokens parsed and patterns traced,
From grammar rules to models laced,
We craft the code, we bend the phrase,
To navigate this complex maze.

From phonemes small to syntax grand,
We learn to make machines understand.
Semantics twist in subtle dance,
Where words and meanings take their stance.

A corpus filled with tales untold,
Data's treasure, mined from gold.
Markov chains and vectors wide,
Statistical rules our trusted guide.

Ambiguity lurks in every line,
But algorithms, with time, refine.
Through noise and context, sense is found,
The power of language, profound and unbound.

So here's to CSC485's quest,
To parse, to learn, to do our best.
For in this field where code and speech entwine,
We find the future, word by word, defined.

ChatGPT 4o ▾

There were four or five people inside, and they just started firing. Ms. Sanders was hit several times and was pronounced dead at the scene. The other customers fled, and the police said it did not appear that anyone else was injured.

What is the temporal relationship (before, after, equal, or not specified) between the event "started" and "fled". Please respond in the JSON format: {"answer": "ANSWER"}

< 3/3 >



json

Copy code

```
{"answer": "after"}
```



There were four or five people inside, and they just **started firing**

Ms. Sanders was **hit** several times and was **pronounced dead** at the scene.

The other customers **fled**, and the police **said** it did not **appear** that anyone else was **injured**.

Full text comprehension?

...

We are still not there yet.

ChatGPT o1-preview ▾

There were four or five people inside, and they just started firing. Ms. Sanders was hit several times and was pronounced dead at the scene. The other customers fled, and the police said it did not appear that anyone else was injured.

What is the temporal relationship (before, after, equal, or not specified) between the event "dead" and "hit". Please respond in the JSON format: {"answer": "ANSWER"}

< 14/14 >



Thought for a few seconds ^

Identifying temporal sequence

I'm mapping out the temporal relationship between two events: "dead" and "hit." Event A, Ms. Sanders was hit several times, and Event B, she was pronounced dead at the scene.

json

Copy code

```
{"answer": "before"}
```



Levels of linguistic structure and analysis

- Phonology
 - The **sound system** of a language.
- Morphology
 - The **minimal meaningful units** of language (root of a word; suffixes and prefixes), and how they combine.
- Lexicon
 - The semantic and syntactic **properties of words**.

Levels of linguistic structure and analysis

- Syntax
 - The means of expressing meaning: **how words can combine**, and in what order.
- Semantics
 - The **meaning** of a sentence (a logical statement?).
- Pragmatics
 - The **use** of a sentence: pronominal referents; intentions; multi-sentence structure.

“Building blocks” of CL systems

- Language interpretation + language generation = machine translation?
 - Part-of-speech (PoS) tagging.
 - Parsing and grammars.
 - Reference resolution.
 - Dialogue management.
- These are better thought of as functional units now rather than as modular components of modern NLP architectures.

Natural Language Interpretation

A.k.a. Natural Language Understanding (NLU)

Does Flight 207 serve lunch?



YNQ ($\exists e$ SERVING(e) \wedge SERVER(e , flight-207)
 \wedge SERVED(e , lunch))

Natural Language Generation

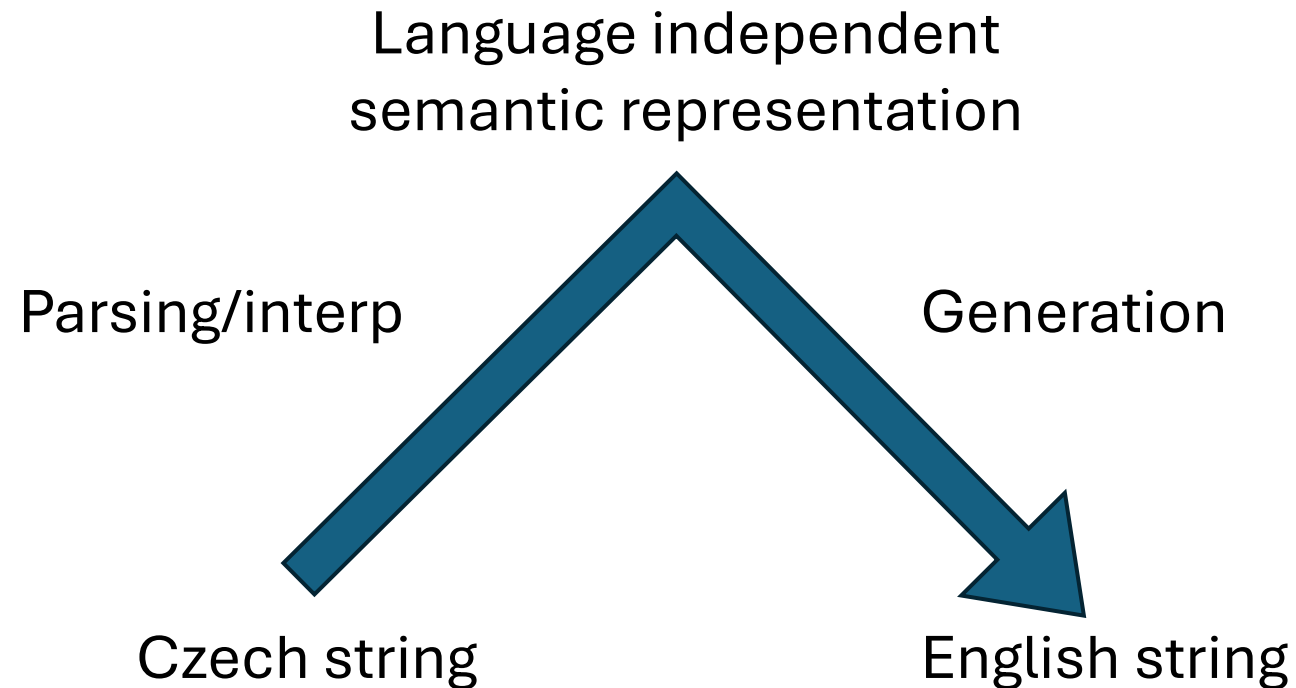
(spray-1 (OBJECT paint-1)
 (PATH (path-1
 (DESTINATION wall-1))))
 (CAUSER sally-1))



Sally sprayed paint onto the wall.

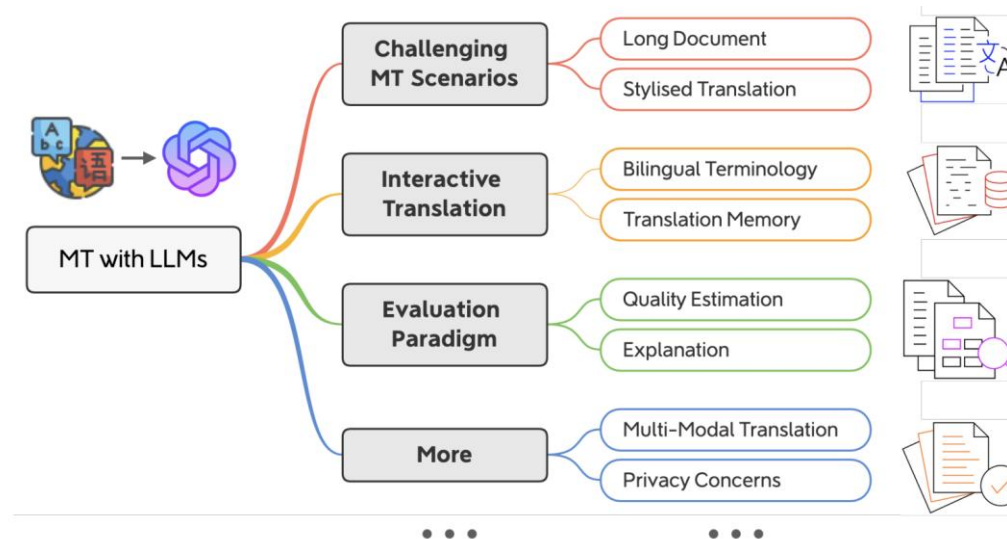
Machine translation

- History lesson: the *Vauquois triangle* (1968).
(Vauquois)



Machine Translation

- History lesson: the *Vauquois triangle* (1968).
- Current systems based purely on statistical associations and lexical semantic embeddings.
- Getting incrementally better as they learn from more data.
- Probably more emergent knowledge of linguistics in there than we give them credit for, but it's awfully difficult for us to extract it.
- Future: MT with LLMs?
Flexibility




Gymnázium Duchcov



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NADACE ČEZ

Historie Gymnázia Duchcov


Všeobecná touha českých obyvatel po zřízení střední školy s českým vyučovacím jazykem byla naplněna až po první světové válce. Dne 6. října 1919 začalo české gymnázium prozatímně působit v části německého reálného gymnázia. Obrovský zájem o studium (české gymnázium v Duchcově bylo jediným pro teplický, duchcovský a bílinský okres) přiměl ředitelství ústavu otevřít několik tříd i mimo německé gymnázium. Toto a všeobecné přání získat vlastní objekt stálo u zrodu záměru postavit pro duchcovské české gymnázium účelnou a důstojnou budovu. Od přání z roku 1919 k realizaci uplynulo ještě dlouhých osm let. Novostavba byla předána do užívání v neděli 22. května 1927. V průběhu desetiletí se škola stala nejen významným vzdělávacím ústavem, ale i centrem českého menšinového života, řada vynikajících absolventů svědčí o úrovni výuky. Bylo vybudováno zázemí, vytvořeny tradice, škola se dostala do širokého povědomí.

Stejně jako celá naše země prožívala své slavné i méně slavné dny. Ty nejhorší snad za války, kdy byla výuka zcela přerušena. Z hlediska stavebního budova velmi utrpěla i v letech 1948 - 1953, v době, kdy bylo zrušeno reálné gymnázium a v objektu se střídaly různé druhy škol, které zde pro své provozní potřeby prováděly stavební úpravy.



Gymnázium Duchcov




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NADACE ČEZ



INFOPHARM®

History Gymnasium Duchcov

General desire Czech population after the establishment of secondary schools and English language teaching has been filled up after the First World War. On 6 October 1919 became the Czech grammar school provisionally operate in the German real grammar school. Huge interest in the study (Czech grammar school in Duchcov was only for Teplice, duchcovský and bílinský District) led the Directorate of the Institute to open a few classes and outside the German grammar school. Such a universal desire to acquire its own building stood for the birth of intent to build a school for duchcovské Czech efficient and dignified building. From the desire of the year 1919 to be implemented yet expired long eight years. New was transferred to use on Sunday 22nd May 1927. Over the decades, the school became not only an important educational institution, but also the centre of minority life, a number of outstanding graduates shows the level of instruction. It was built facilities, established tradition, the school into a broad awareness.

Like our country prožívala its famous and less famous days. The worst, perhaps during the war, when it was completely interrupted instruction. From the perspective of building a building suffered in the years 1948 - 1953, when it was cancelled real school building to pieces and various types of schools, which are for their operational needs to carry out structural adjustments.

History Grammar Duchcov



General desire of the Czech population after the establishment of secondary schools in the Czech language of instruction was filled to the First World War. 6 October 1919 Czech Grammar School began to operate provisionally in the German grammar school. The enormous interest in the study (in Czech high school was only for Duchcov Teplice, Duchcovská and Bilina district) headquarters forced the institute to open a few classes outside of the German school. This and a

general desire to get their own building was the genesis of the project to build a gymnasium for Duchcovská Czech efficient and dignified building. From the desire of the year 1919 to implement more long passed for eight years. New building was handed over for use on Sunday 22 May 1927. Over the decades, the school became not only an important educational institution, but also the center of the minority lives, many outstanding graduates shows the level of teaching. It was built facilities, created a tradition, the school turned into a broad awareness.

Like our country has endured its famous and less famous days. Perhaps the worst of the war, when teaching was completely interrupted. In terms of construction the building was seriously damaged in the years 1948 - 1953, when school was canceled and the real object is rotated different kinds of schools here for their operational needs to carry out construction work.

History Grammar School Duchcov



The general desire Czech population after the establishment of secondary school teaching in Czech language was filled to the First World War. On October 6, 1919 began Czech gymnasium provisionally act in the German grammar school. The huge interest in the study (Czech secondary school in Duchcově was only for Teplice, Bílina Duchcov and district) caused the Directorate of the Institute opened a few classes outside the German Gymnasium. This and a general desire to get your own object was the genesis of the project to build a high school

for Duchcov Czech efficient and dignified building. From the desire of 1919 for implementation has passed even eight long years. The new building was handed over for use on Sunday 22 May 1927. During the decade, the school has not only become an important educational institution, but also the center of the minority, many outstanding graduates indicative of the level of education. It was built facilities, established tradition, the school came into widespread awareness.

Like our whole country had its famous and less famous days. The worst perhaps during the war when teaching was completely interrupted. In terms of construction and the building was seriously damaged in the years 1948 - 1953, when the grammar school was canceled in the building and alternated different types of schools, which are for its operational needs in construction work.

History of the school

Added: 14.11.2014 | Author: Holikova | Viewed: 45142x |

The school was formed by the merger of two institutions - a grammar school and a secondary technical school. The tradition of both schools dates back to the 1920s. At present, both schools are located in the building of the grammar school, which was built in 1927. After extensive reconstruction, which took place in 1990 1996, it dominates the town of Duchcov. As one of the most beautiful buildings in the north of Bohemia is listed in the regional list of architectural monuments

HISTORY OF INDEPENDENT INDUSTRIAL SCHOOL

1919 - 1938

Soon after the proclamation of the Czechoslovak Republic on October 28, 1918, it seemed paramount to establish a Czech vocational school. Until then, only a German vocational school (Bergschule) existed in Duchcov. On **1 December 1919**, the Ministry of Education established the **State Vocational Secondary School** based in Duchcov. 46 Czech miners signed up for the first year.

The first year of teaching took place under difficult conditions. The school had only one room at the Duchcov German grammar school. The teaching staff consisted practically of two professors, the director of Dr. Ing. Alois Parma and his assistant Ing. Václav Přibáně. Later the school moved to the more spacious rooms of the Waldstein chateau in Duchcov.

1938 - 1941

The time of occupation was very difficult for the school as well as for the whole republic. In 1938 the borderland was seized by the Germans. On September 23, the class was stopped and on October 10 the Ministry of Education and National Enlightenment ordered the school to be transferred to Kladno, saying that pupils enrolled in Duchcov would leave the school and new ones would not be admitted. At the end of the school year on 30 June 1941 the school was liquidated.

1945 - 1959

After the end of World War II in May 1945 the building of the former German upper school (in Bezručova Street) was secured by representatives of the MNV in Duchcov. The former headmaster of the school, Ing. Hugo Malý to take over the school building and inventory. 37 pupils were admitted to the first year. The period of study was set at 2 years. It was taught only in the morning. In the afternoon the pupils went down the mines.

The school year 1952 - 53 began in the new building of the former national school Hynek Holub in Kubicových Street. In the school year 1954 - 55, the study of the previous field of Coal Mining was extended to include the field of Mining Measurement. In the school year 1955 - 56, a friendship was established with the mining school of E. Thälmann in Senftenberg in the GDR, which lasted until the 1980s.

1959 - 1969

The beginning of the 1960s was a milestone in the development of the school. The boom in mining in the 1960s led to an increase in the requirements for the number of graduates of the **Secondary Technical Mining School** in Duchcov, as the school was called since 1961. In order to speed up the training of graduates, a three-year field of study **Coal Mining** was introduced for trained miners. The study field **Mining Mechanization and Electrification** and the specialization **Coal Treatment** was also established.

Between 1960 and 1970, the study forms were extended by distance study, **Geology and Drilling**. At the end of the 1960s, the fields of **Power Electrical** and **Geodesy Equipment** were introduced.

1969 - 1979

On September 1, 1979, the school changed its name to the **Secondary Technical School**. In the second half of the 1980s, the mining branch changed its name to **Mining and Mining Geology**.

<https://www.gspsd.cz/index.php?type=Post&id=256&ids=249>
Translated by Google Translate, 5th September 2019.

History of the school

Added: 14.11.2014 | Author: Holikova | Viewed: 45142x |

The school was formed by the merger of two institutions - a grammar school and a secondary technical school. The tradition of both schools dates back to the 1920s. At present, both schools are located in the building of the grammar school, which was built in 1927. After extensive reconstruction, which took place in 1990-1996, it dominates the town of Duchcov. As one of the most beautiful buildings in the north of Bohemia is listed in the regional list of architectural monuments

HISTORY OF INDEPENDENT INDUSTRIAL SCHOOL

1919 - 1938

Soon after the proclamation of the Czechoslovak Republic on October 28, 1918, it seemed paramount to establish a Czech vocational school. Until then, only a German vocational school (Bergschule) existed in Duchcov. On **1 December 1919**, the Ministry of Education established the **State Vocational Secondary School** based in Duchcov. 46 Czech miners signed up for the first year.

The first year of teaching took place under difficult conditions. The school had only one room at the Duchcov German grammar school. The teaching staff consisted practically of two professors, the director of Dr. Ing. Alois Parma and his assistant Ing. Václav Přibáně. Later the school moved to the more spacious rooms of the Waldstein chateau in Duchcov.

1938 - 1941

The time of occupation was very difficult for the school as well as for the whole republic. In 1938 the borderland was seized by the Germans. On September 23, the class was stopped and on October 10 the Ministry of Education and National Enlightenment ordered the school to be transferred to Kladno, saying that pupils enrolled in Duchcov would leave the school and new ones would not be admitted. At the end of the school year on 30 June 1941 the school was liquidated.

<https://www.gpspd.cz/index.php?type=Post&id=256&ids=249>
Translated by Google Translate, 5th September 2019.

<https://www.gpspd.cz/index.php?type=Post&id=256&ids=249>
Translated by Google Translate, 16th September 2024.

History of the school

Posted: 11/14/2014 | Author: Holikova | Viewed: 85348x

The school was created by the merger of two institutions - a gymnasium and a secondary industrial school. The tradition of both schools dates back to the 1920s. Currently, both schools are located in the gymnasium building, which was built in 1927. After an extensive reconstruction that took place in 1990-1996, Duchcova is a dominant feature of the city. As one of the most beautiful buildings in the north of Bohemia, it is listed in the regional list of architectural monuments

HISTORY OF THE INDEPENDENT INDUSTRIAL SCHOOL

1919 - 1938

Soon after the proclamation of the Czechoslovak Republic on October 28, 1918, it appeared to be of primary importance to establish a Czech vocational school. Until then, there was only a German vocational school (Bergschule) in Duchcov. On December 1, 1919, the Ministry of Education established the **State Vocational Mining School** with headquarters in Duchcov. 46 Czech miners signed up for the first year.

The first year of teaching took place under difficult conditions. The school had only one room available in the German gymnasium in Duchcov. The faculty practically consisted of two professors, the director Dr. Ing. Alois Parma and his assistant Ing. Václav Přibán. Later, the school moved to more spacious rooms of the Valdštejn castle in Duchcov.

1938 - 1941

The period of occupation was very difficult for the school, as well as for the entire republic. In 1938, the border area was taken over by the Germans. On September 23, classes were stopped, and on October 10, the Ministry of Education and National Education ordered the school to be transferred to Kladno, stating that students enrolled in Duchcov would leave the school and new ones would not be accepted. At the end of the school year on June 30, 1941, the school was liquidated.

Vloženo: 14.11.2014 | Autor: Holikova | Zobrazeno: 85348x

Škola vznikla sloučením dvou institucí - gymnázia a střední průmyslové školy. Tradice obou škol sahá až do dvacátých let minulého století. V současnosti sídlí obě školy v budově gymnázia, která byla postavena v roce 1927. Po rozsáhlé rekonstrukci, která proběhla v letech 1990-1996, je dominantou města Duchcova. Jako jedna z nejkrásnějších staveb na severu Čech je zapsána v regionálním seznamu architektonických památek.

HISTORIE SAMOSTATNÉ PRŮMYSLOVÉ ŠKOLY

1919 - 1938

Brzy po vyhlášení Československé republiky 28. října 1918 se jevílo jako prvořadé zřídit českou odbornou školu. V Duchcově existovala do té doby jen německá odborná škola (Bergschule). Ministerstvo školství zřídilo dne **1. prosince 1919 Státní odbornou horní školu** se sídlem v Duchcově. Do prvního ročníku se přihlásilo 46 českých horníků.

První rok vyučování probíhal za ztížených podmínek. Škola měla k dispozici jen jednu místnost v duchcovském německém gymnáziu. Profesorský sbor se prakticky skládal ze dvou profesorů, ředitele Dr. Ing. Aloise Parmy a jeho asistenta Ing. Václava Příbání. Později se škola přestěhovala do prostornějších místností valdštejnského zámku v Duchcově.

1938 - 1941

Doba okupace byla pro školu, stejně tak jako pro celou republiku, velmi těžká. V roce 1938 bylo pohraničí zabráno Němci. Dne 23. září bylo vyučování zastaveno a 10. října nařídilo ministerstvo školství a národní osvěty přeložení školy do Kladna s tím, že žáci zapsaní v

School History

Posted: 14.11.2014 | Author: Holikova | Viewed: 85348x

The school was established by merging two institutions - a grammar school and a secondary technical school. The tradition of both schools dates back to the 1920s. Currently, both schools are housed in the grammar school building, which was constructed in 1927. After extensive reconstruction between 1990 and 1996, it has become a landmark of the town of Duchcov. As one of the most beautiful buildings in northern Bohemia, it is listed in the regional register of architectural monuments.

HISTORY OF THE INDEPENDENT TECHNICAL SCHOOL

1919 - 1938

Shortly after the proclamation of the Czechoslovak Republic on October 28, 1918, the establishment of a Czech vocational school was considered as a priority. Until then, a German vocational school (Bergschule) operated in Duchcov. The Ministry of Education established the State Vocational Mining School on December 1, 1919, in Duchcov. In the first year, 46 Czech miners enrolled.

The first year of teaching was conducted under challenging conditions. The school had only one classroom available in the German grammar school in Duchcov. The teaching staff consisted of only two teachers, the principal Dr. Ing. Alois Parma and his assistant Ing. Václav Příbání. Later, the school moved to the more spacious premises of the Valdštejn Castle in Duchcov.

1938 - 1941

The occupation period was very difficult for the school, as it was for the entire country. In 1938, the border area was seized by the Germans. On September 23, 1938, teaching was suspended, and on October 10, the Ministry of Education ordered the relocation of schools from Duchcov to Kladno, stating that students enrolled in Duchcov schools would not be admitted to new schools. By the end of the school year, on June 30, 1941, the school was closed.

Translate this page for me

Interactive Translation

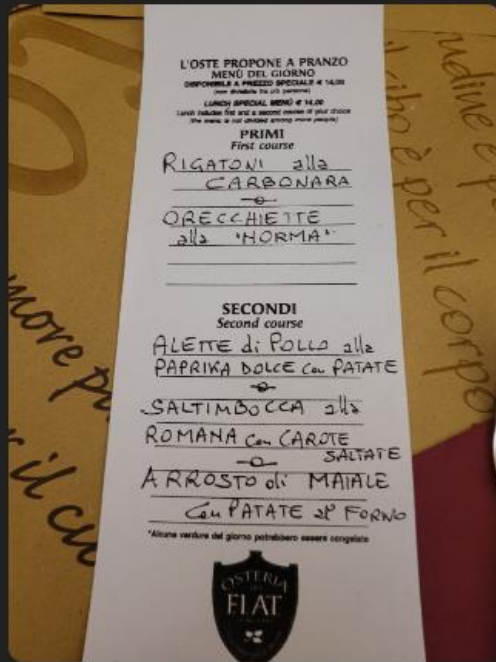
For people's names, Anglicize them and remove all the diacritical marks. However, also add the original text in brackets ().

The first year of teaching was conducted under challenging conditions. The school had only one classroom available in the German grammar school in Duchcov. The teaching staff consisted of only two teachers, the principal Dr. Ing. Alois Parma and his assistant Ing. Václav Přibáň. Later, the school moved to the more spacious premises of the Valdštejn Castle in Duchcov.



The first year of teaching was conducted under challenging conditions. The school had only one classroom available in the German grammar school in Duchcov. The teaching staff consisted of only two teachers, the principal Dr. Ing. Alois Parma (Alois Parmy) and his assistant Ing. Vaclav Priban (Václav Přibáň). Later, the school moved to the more spacious premises of the Waldstein Castle (valdštejnského zámku) in Duchcov.

Multi-Modal Translation



Please give me an explanation of this Italian menu. What are the first and second dishes are?



The menu in the image is from an Italian restaurant, offering a lunch special at €14.00. It is structured with "primi" (first courses) and "secondi" (second courses), typical of Italian dining.

Primi (First Courses)

1. **Rigatoni alla Carbonara** - Rigatoni pasta served with Carbonara sauce, which is traditionally made with eggs, cheese (Pecorino Romano), pancetta (or guanciale), and black pepper.
2. **Orecchiette alla 'Norma'** - Orecchiette pasta with a sauce that likely refers to "alla Norma," typically made with tomatoes, fried eggplant, grated ricotta salata cheese, and basil.

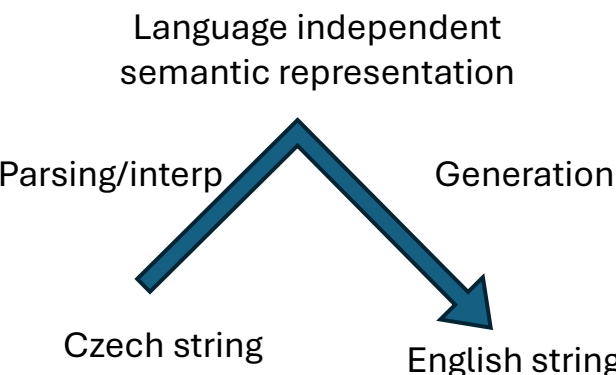
Secondi (Second Courses)

1. **Alette di Pollo alle Paprika Dolce con Patate** - Chicken wings seasoned with sweet paprika, served with potatoes.
2. **Saltimbocca alla Romana con Carote Saltate** - Saltimbocca, a dish made of veal topped with prosciutto and sage, cooked in wine or oil, served with sautéed carrots. The "Romana" style means it is a recipe from Rome.
3. **Arrosto di Maiale con Patate al Forno** - Roasted pork served with oven-baked potatoes.

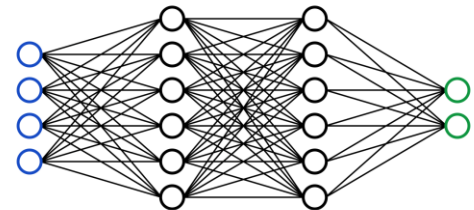
The menu mentions that some vegetables of the day might be frozen, suggesting that not all ingredients are fresh daily. This kind of menu offers a balanced selection of both pasta and meat dishes, allowing diners to enjoy a variety of classic Italian flavors.



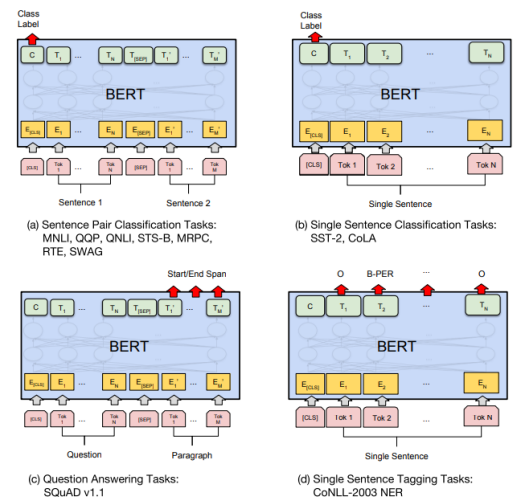
Approaches to NLU



Rule-based,
symbolic



Statistical models,
Typically: neural



BERT:
Pretrain-finetune
paradigm



LLM:
The future?

Information Extraction

“Bridgestone Sports Co. said Friday it has set up a joint venture in Taiwan with a local concern and a Japanese trading house to produce golf clubs to be shipped to Japan. The joint venture, Bridgestone Sports Taiwan Co., capitalized at 20 million new Taiwan dollars, will start production in January 1990.”




Tie-up-1: *Relation:* Tie-up
Entities: Bridgestone Sports Co.
a local concern
a Japanese trading house
Joint venture: Bridgestone Sports Taiwan Co.
Activity: Activity-1
Amount: NT \$ 20,000,000

Activity-1: *Company:* Bridgestone Sports Taiwan Co.
Product: golf clubs
Start date: January 1990

LLM has Killed NLP, Right?

Event Coreference

RoBERTa_{base}
125 million params



- Fully supervised
- Pretrain-finetune

Task	Event Coreference	Temporal	Causal	Subevent
Baseline	81.7	55.8	31.6	27.2

LLM has Killed NLP, Right?

Event Coreference

RoBERTa_{base}
125 million params

- Fully supervised
- Pretrain-finetune

GPT-3.5:
175 **billion** params
1000x larger!

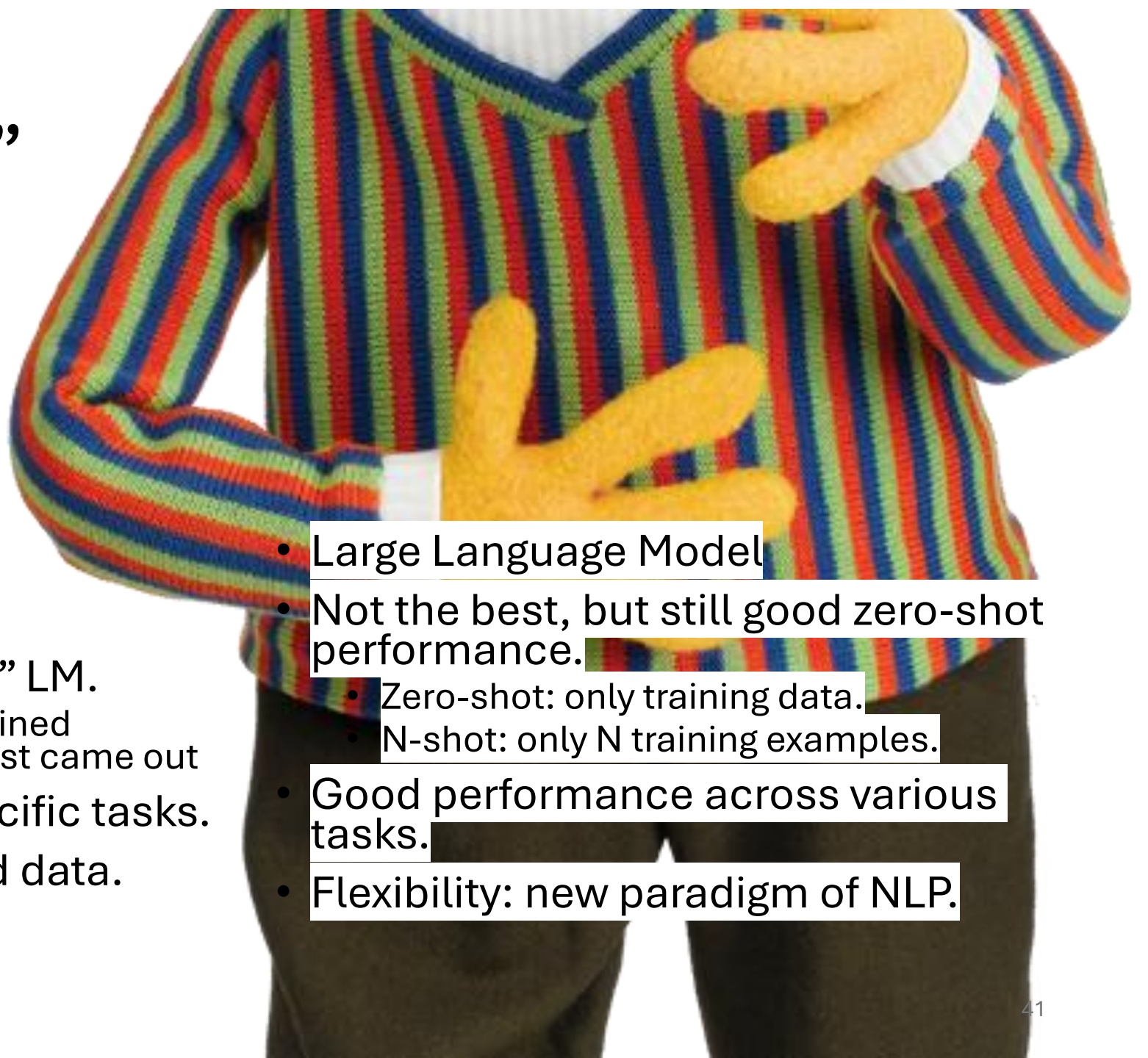
Task	Event Coreference	Temporal	Causal	Subevent
Baseline	81.7	55.8	31.6	27.2
GPT-3.5				
whole doc	23.2	7.2	2.8	1.6
1-shot	16.1	7.1	3.3	1.5
2-shot	18.4	7.1	3.2	1.2
5-shot	16.4	9.1	3.6	1.6
10-shot	11.8	12.3	5.3	2.1

“SLM” vs. “LLM”



- Pretrain-finetuned “small” LM.
 - Called **large-scale** pre-trained language model when it first came out
- Best performance on specific tasks.
- Inflexible, require labelled data.

- Large Language Model
- Not the best, but still good zero-shot performance.
 - Zero-shot: only training data.
 - N-shot: only N training examples.
- Good performance across various tasks.
- Flexibility: new paradigm of NLP.



“Building Blocks” of CL Systems

- Information extraction
 - Chunking (instead of parsing).
 - Template filling.
 - Named-entity recognition.

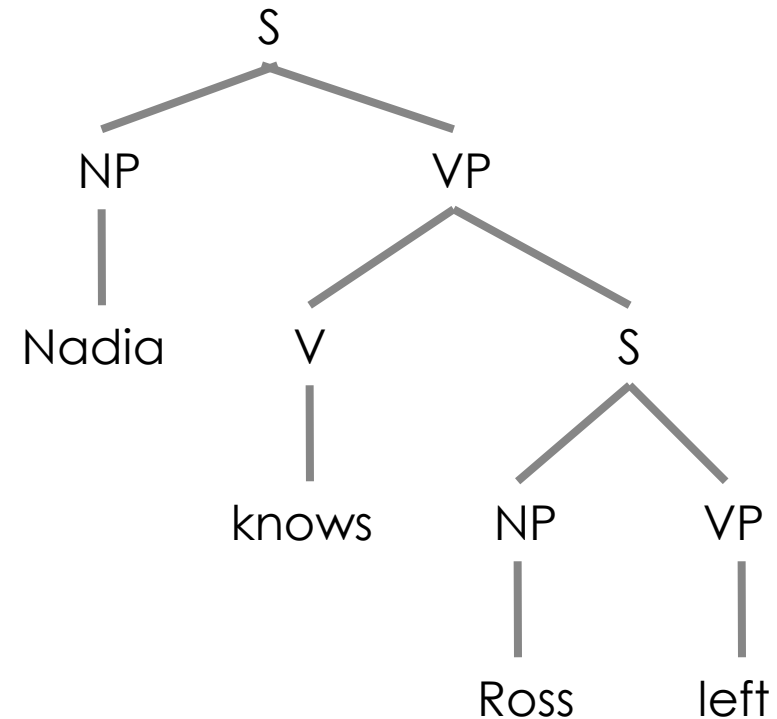
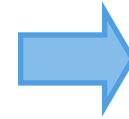
“Building Blocks” of CL Systems

- Lexical semantics
 - Word sense disambiguation (WSD).
 - Taxonomies of word senses.
 - Analysis of verbs and other predicates
 - Embeddings of words into continuous vector space (word2vec, BERT, XLNet, etc.) .
- Computational morphology.

Why is Understanding Hard?

- The structures that we are interested in are richer than strings – often *hierarchical* or *scope-bearing*.

Nadia knows Ross left.



KNOWS(Nadia, LEFT(Ross))



Why is Understanding Hard?

- Mapping from ***surface-form*** to meaning is **many-to-one**:
Expressiveness.

Nadia kisses Ross.

Ross is kissed by Nadia.

KISS(Nadia, Ross)

Nadia gave Ross a kiss.

Nadia gave a kiss to Ross.

Why is Understanding Hard?

- Mapping is **one-to-many**:
Ambiguity at all levels.
 - Lexical
 - Syntactic
 - Semantic
 - Pragmatic

Lexical Ambiguity

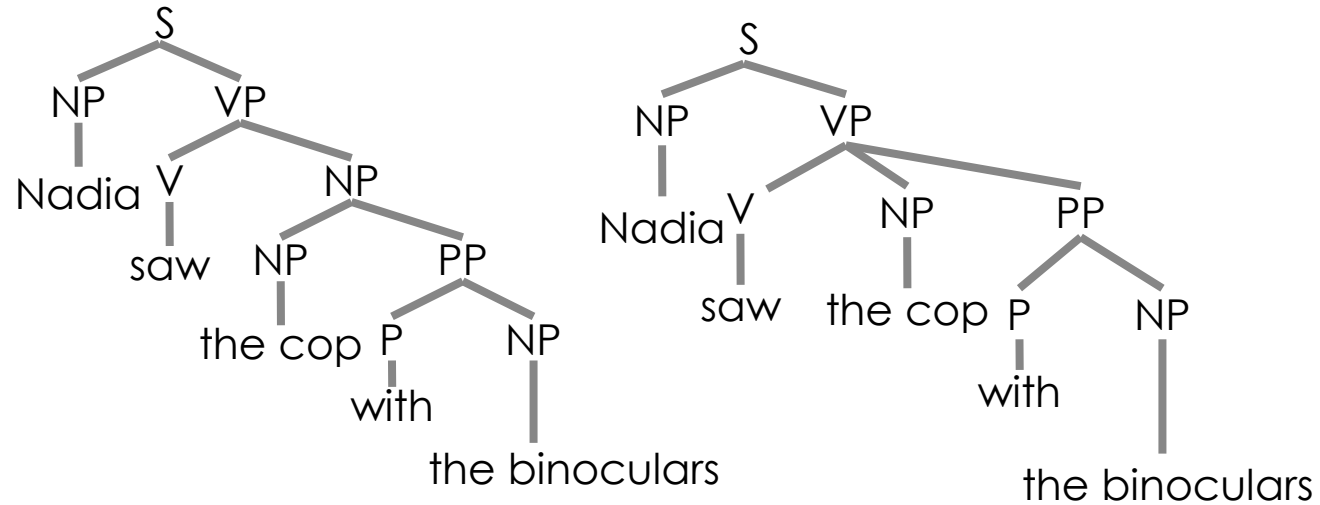
*The lawyer walked to the **bar** and addressed the jury.*

*The lawyer walked to the **bar** and ordered a beer.*

- Computational issues
 - Representing the possible **meanings** of words, and their **frequencies** and their **indications**.
 - Representing **semantic relations** between words.
 - Maintaining adequate **context**.

Syntactic Ambiguity

Nadia saw the cop with the binoculars.



Syntactic Ambiguity

[[[Put the book in the box on the table.]]]
[[[[[]]]]]]

Noun phrase

Adj Noun

Visiting relatives can be trying.

Verb Noun

Verb phrase

Syntactic Ambiguity

- These are absolutely everywhere. Some real headlines:
 - *Juvenile Court to Try Shooting Defendant*
Teacher Strikes Idle Kids
Stolen Painting Found by Tree
Clinton Wins on Budget, but More Lies Ahead
Hospitals are Sued by 7 Foot Doctors
Ban on Nude Dancing on Governor's Desk
- Usually we don't even notice – we're that good at this kind of resolution.

Syntactic Ambiguity

- Most syntactic ambiguity is **local** — resolved by syntactic or semantic context.

Visiting relatives is trying.

Visiting relatives are trying.

Nadia saw the cop with the gun.

- Sometimes, resolution comes too fast!

[[[[[????
The cotton clothing is made from comes from Mississippi.
[[[]]] []]

“Garden-path” sentences.

Syntactic Ambiguity

- Computational issues
 - Representing the possible **combinatorial structure** of words.
 - Capturing syntactic **preferences** and frequencies.
 - Devising **incremental parsing** algorithms.

Semantic Ambiguity

- Sentence can have more than one meaning, even when the words and structure are agreed on.

Nadia wants a dog like Ross's.

Everyone here speaks two languages.

Iraqi Head Seeks Arms.

DCS Undergrads Make Nutritious Snacks.

Pragmatic Ambiguity

- A sample dialogue
 - Nadia: Do you know who's going to the party?
Emily: Who?
Nadia: I don't know.
Emily: Oh ... I think Carol and Amy will be there.
- Computational issues
 - Representing intentions and beliefs.
 - Planning and plan recognition.
 - Inferencing and diagnosis.

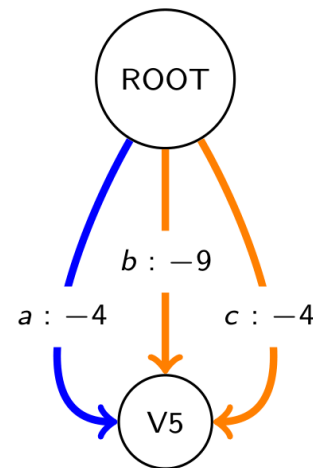
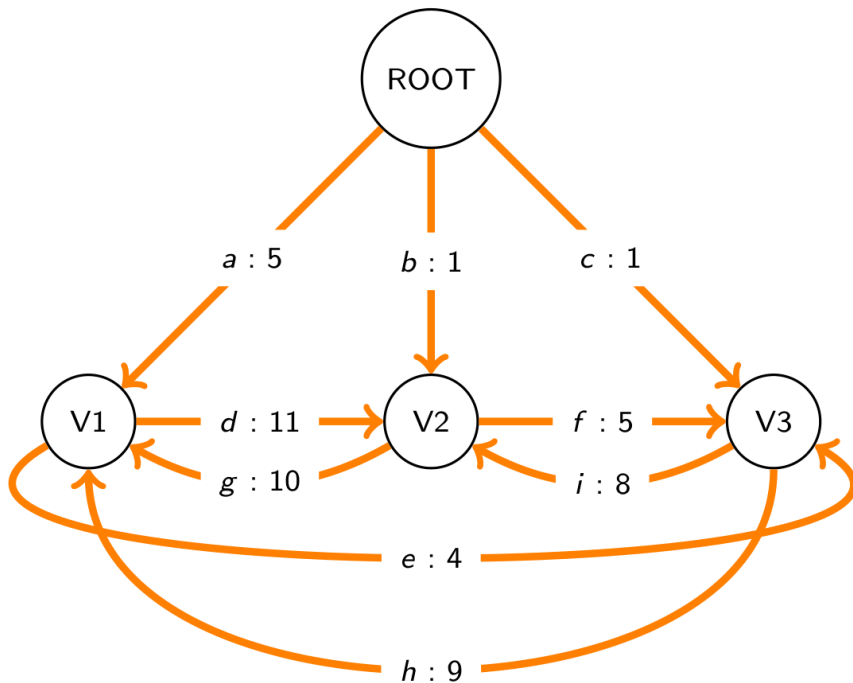
Need for Domain Knowledge

Derivatization of the carboxyl function of retinoic acid by fluor-escent or electroactive reagents prior to liquid chromatography was studied. Ferrocenylethylamine was synthesized and could be coupled to retinoic acid. The coupling reaction involved activation by diphenylphosphinyl chloride. The reaction was carried out at ambient temperature in 50 min with a yield of ca. 95%. The derivative can be detected by coulometric reduction (+100 mV) after on-line coulometric oxidation (+400 mV). The limit of detection was 1 pmol of derivative on-column, injected in a volume of 10 µl, but the limit of quantification was 10 pmol of retinoic acid.

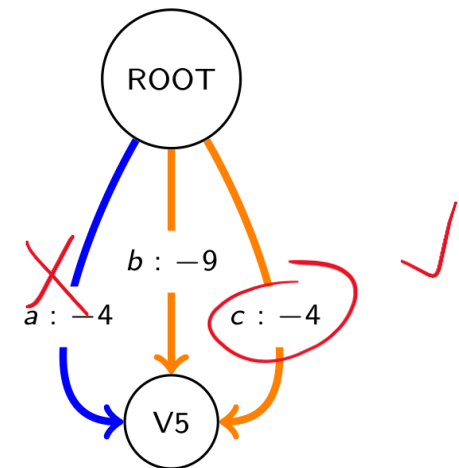
S. El Mansouri, M. Tod, M. Leclercq, M. Porthault, J. Chalom,
"Precolumn derivatization of retinoic acid for liquid
chromatography with fluorescence and coulometric detection."
Analytica Chimica Acta, 293(3), 29 July 1994, 245–250.

Quiz

- In the example we saw in the last lecture, we encountered a tie at the end of the expanding phase, where both edges a and c have a weight of -4. Last time, we chose edge a. What would happen if we chose edge c instead? Which edges would be included in the final maximum spanning tree?



Last lecture: we chose a.



What if we didn't choose a and chose c instead?