Prompting is not all you need!
Or why structure and representations still matter in NLP

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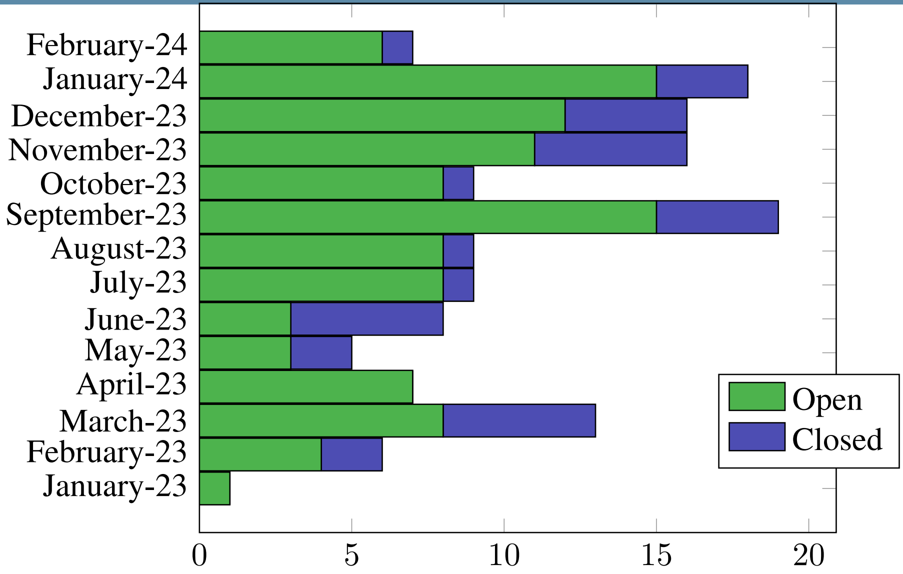
University of Edinburgh
Natural Language Processing
NLP

What just happened?

What just happened?

Spoiled for choice

Source: https://lifearchitect.ai/models/



How big are these LLMs?

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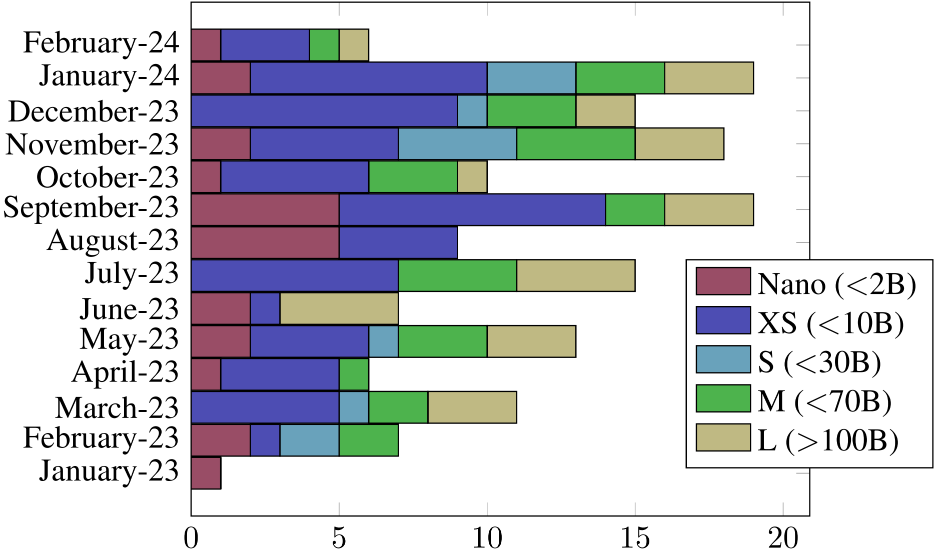

Who builds LLMs?

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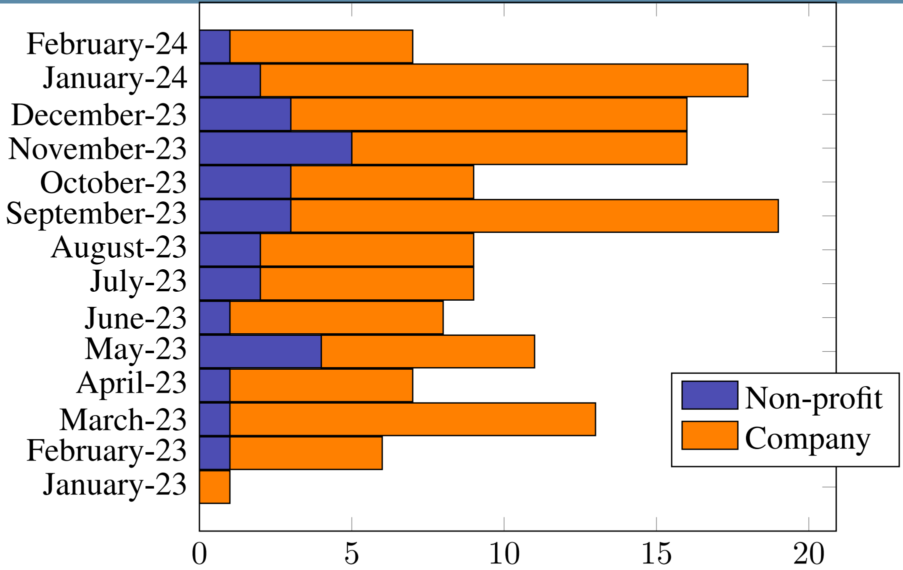
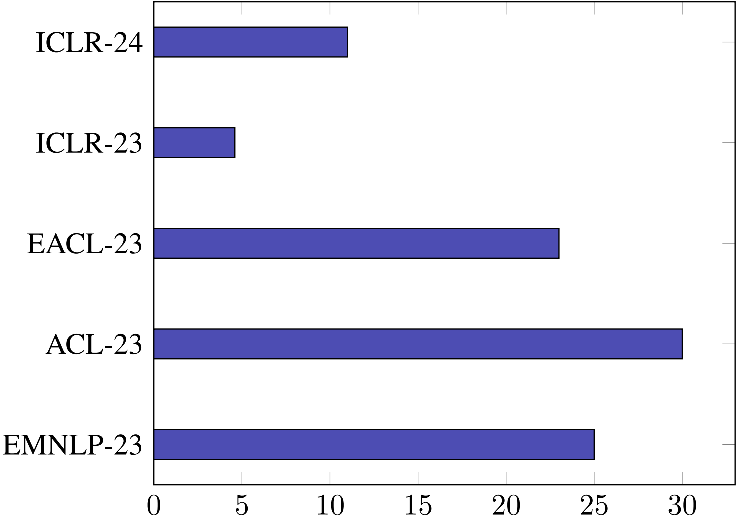
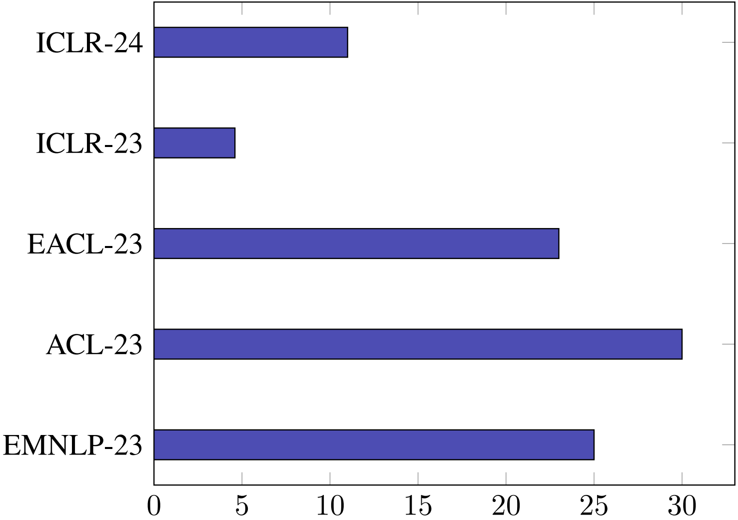


Research on LLMs



Proportion (%) of papers with “Language Models” or “Prompt” in their title

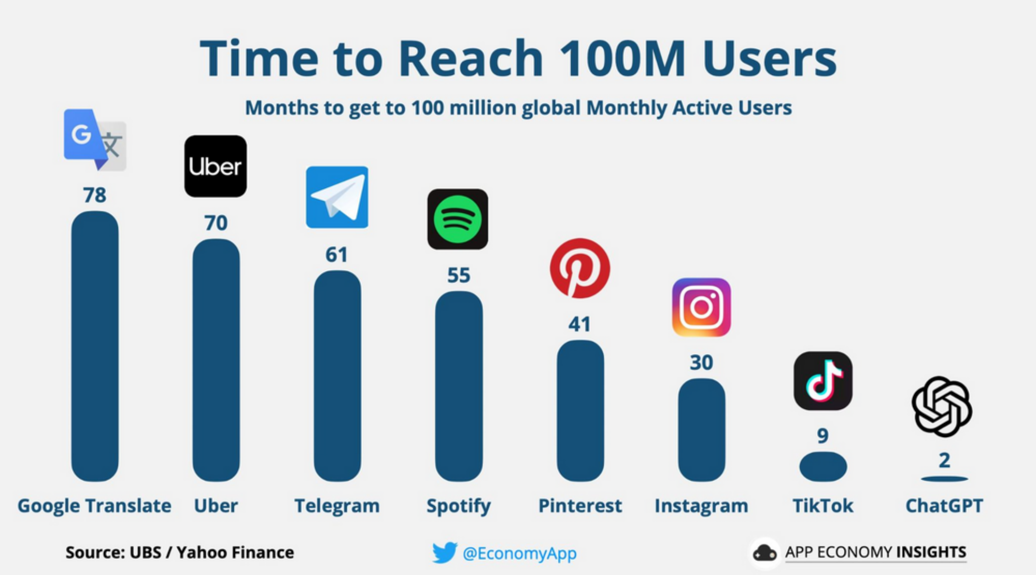
Research on LLMs



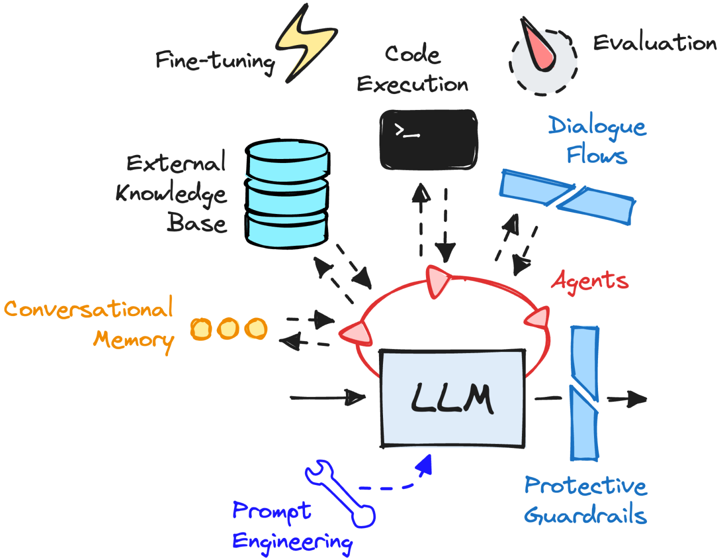
Proportion (%) of papers with “Language Models” or “Prompt” in their title

COLM

Users are keen



There is more to NLP than LLMs!



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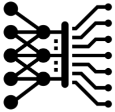

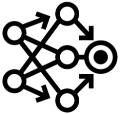

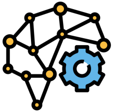

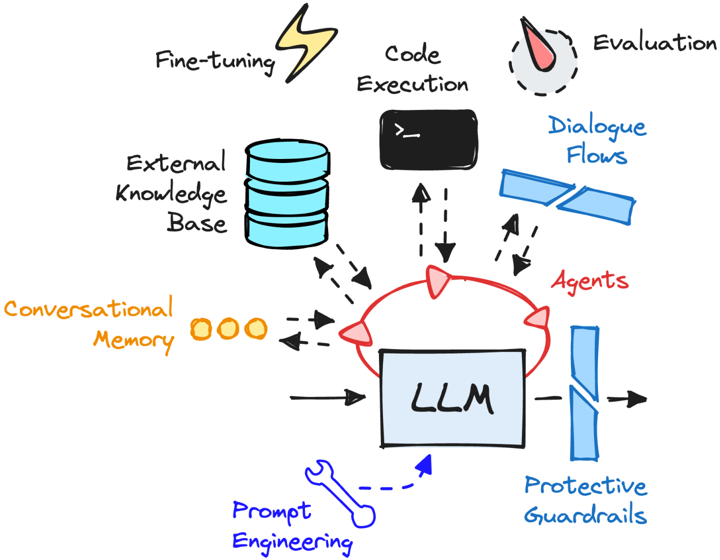

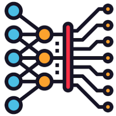

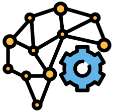

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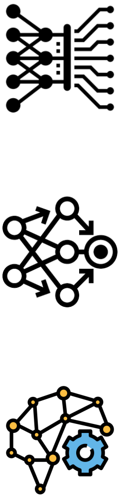

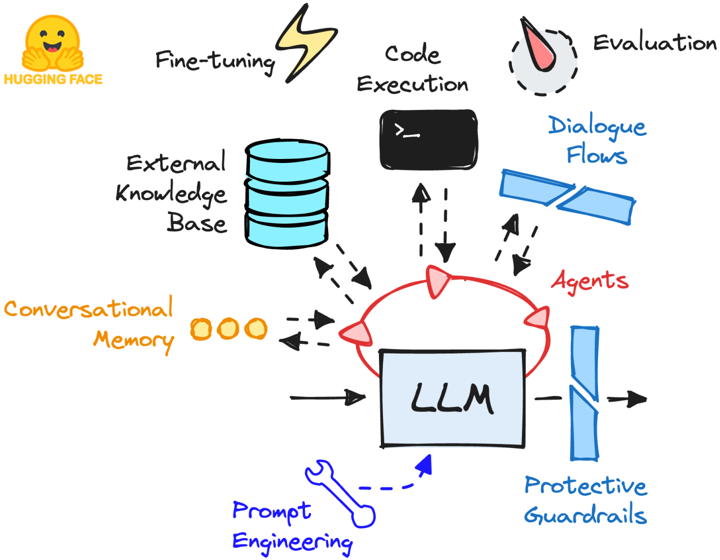

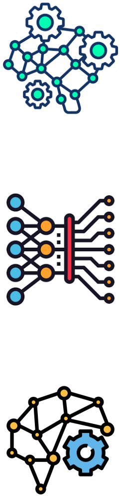

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The NLP Ecosystem

generated by `dall-e-2`

I am not the only only talking about modules!

Jacob Andreas, Marcus Rohrbach, Trevor Darrell, and Dan Klein. 2016. Neural module networks. CVPR 2016.

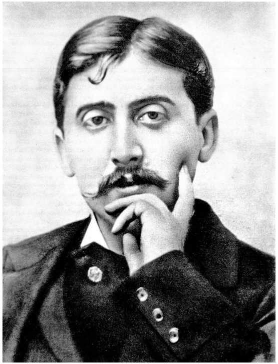
Colin Raffel, Build an Ecosystem, Not a Monolith at Simons Institute Workshop on Large Language Models and Transformers, 2023.

Modular Deep Learning, Jonas Pfeiffer, Sebastian Ruder, Ivan Vulić, Edoardo Maria Ponti, TMLR 2023.

Toolformer: Language Models Can Teach Themselves to Use Tools Timo Schick, Jane Dwivedi-Yu, Roberto Dessì, Roberta Raileanu, Maria Lomeli, Eric Hambro, Luke Zettlemoyer, Nicola Cancedda, Thomas Scialom. arxiv, 2023.

The NLP Ecosystem (in practice)

The real voyage of discovery consists not in seeking new landscapes, but in having new eyes. **Marcel Proust**



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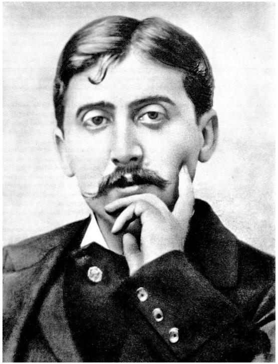

- Structure in problem decomposition

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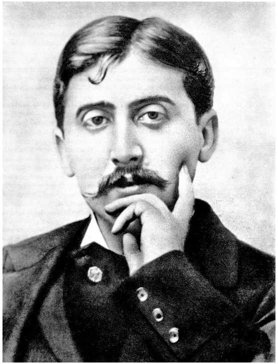

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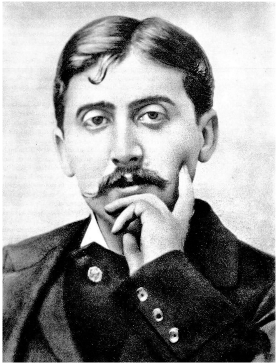

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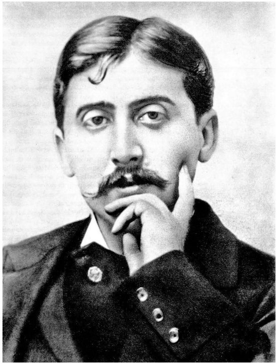

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Part I

Summarization of TV Shows

How about a soap opera?

Ridge continues to beg Brooke to reconsider her decision to leave Forrester as Stephanie continues to voice her opinion. At Marone, Taylor pays Nick a visit. Nick is still angry about what Taylor implied when she disclosed that Brooke and Ridge slept together. Taylor tries to apologize and asks if things are all right between Nick and Brooke. Nick tells her that everything is fine and Brooke is quitting her job at Forrester. Taylor is unconvinced that Brooke will be able to let go of either Forrester or Ridge! Brooke tells Ridge that she cannot fight with Stephanie any longer and that her future is with Nick. After kissing Ridge and saying that a part of her will always love him, she takes her things and leaves. Bridget and Dante are at home discussing Stephanie's interference in the custody of Dino. Bridget suggests that perhaps Eric can help them. Dante worries about what losing his job would do to his work visa. Bridget convinces him that because they all love Dino, they should be able to work something out. After some wine, Bridget reveals that she is ready to make love with Dante. As the two were in bed, Dante stops and reaches in the bedside drawer and presents Bridget with an engagement ring and pops the question. Brooke goes to see Nick at his office and tells him that she has left Forrester. Nick is pleased, although Brooke confesses that she hurt Ridge badly by walking out. Nick whisks her off to the Marone jet for a surprise getaway! At Forrester, Ridge angrily accuses Stephanie of causing all his problems with Brooke. Stephanie is stunned as Ridge bashes her with a vengeance and then clutching his chest, collapses to the floor!

The summarization task is extremely challenging

An instance of **dialogue summarization**

- **Long input:** ∼60 minute videos, ∼5,700 tokens

Papalampidi and Lapata (2023, EACL), Mahon and Lapata (2024, arxiv)

The summarization task is extremely challenging

An instance of **dialogue summarization**

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- **Complex semantics:** long-range dependencies

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- **Long input:** $\sim$60 minute videos, $\sim$5,700 tokens
- **Complex semantics:** long-range dependencies
- **Different input sources:** video + language + audio
- **Data scarcity:** difficulty with collection and annotation
- **Evaluation:** how can we know the model generated a good summary?

Papalampidi and Lapata (2023, EACL), Mahon and Lapata (2024, arxiv)

SummScreen^{3D} based on SummScreen (Chen et al., 2022)

Transcript (dialogue)

Lucy: To our party.

Jamal: Good job, case.

Casey: Big boss never said that I couldn't change a vampire's life.

Jamal: That's right.

Lucy: How's it coming, cuz?

Rafe: Don't bother trying to move, all right? These are 100% vampire cuffs.

Jamal: I got him, I got him.

Caz: Ugh! You little --

Rafe: Shut up! Keep him quiet.

[Noise]

Lucy: Hey, hey, hey. Somebody's coming. Someone's coming.

Rafe: Over there.

Alison: Hey, Lucy. Rafe! You guys -- hey. Lucy, she's coming. Reese --

Rafe: All right, over here, ok. Over here, come on.

Reese: Where are you, Alison? Oh. You!

Rafe: Hey, welcome to the party.

Jack: Come on --

Reese: Oh, Jack, it's a trap! Go! Go! Go! Go!

Lucy: Not so fast.

Jack: Lucy -- Lucy, Rafe, what's going on here, huh?

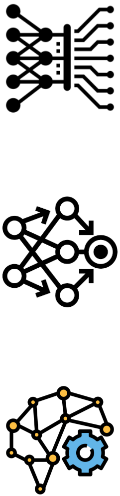
Full-length video

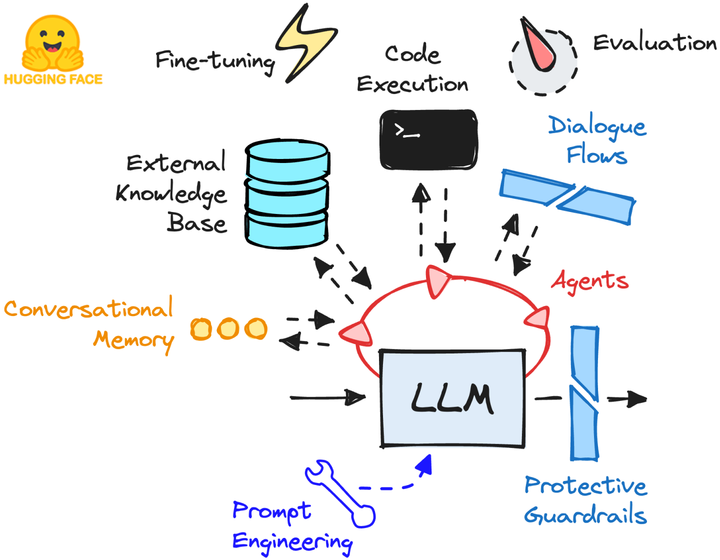
Port Charles The

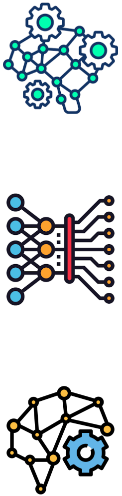
Summary

Kevin is freed by Karen, who drops by the lighthouse. Rafe and Lucy try to persuade Ian to save himself by killing Joshua, but he refuses to even consider it. Alison provokes Reese into chasing her to the healing pool, and Casey lures Caz there on the pretense of going to a party. After breaking into the studio, Ian learns that Joshua is planning to blow up the hot spring. Jamal helps Rafe and Lucy at the healing pool. As Ian prepares to grab Joshua, Kevin injects something into his neck. Caz willingly jumps into the healing pool. Jack attempts to rescue Reese, who tries again to bite Alison but can't. Kevin begins to build a thick wall to seal Ian inside. Rafe throws Reese into the water. Caleb senses that something is wrong with his "family."

There is more to NLP than LLMs!







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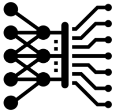

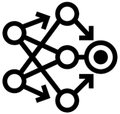

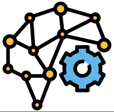

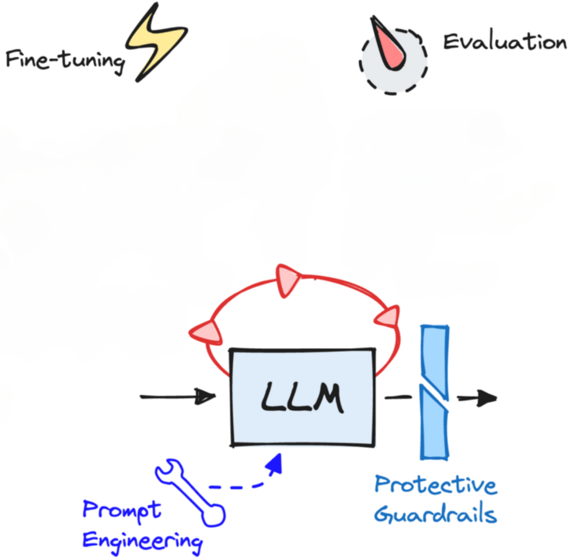

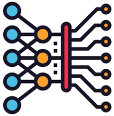

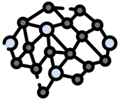

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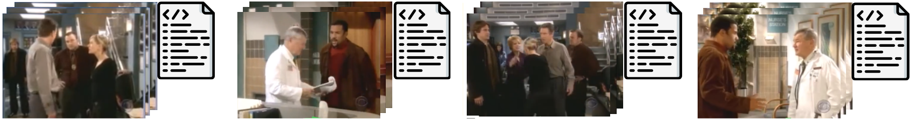
Structure in video summarization



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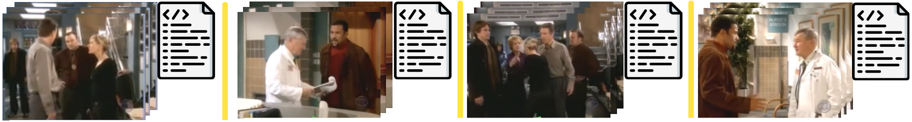

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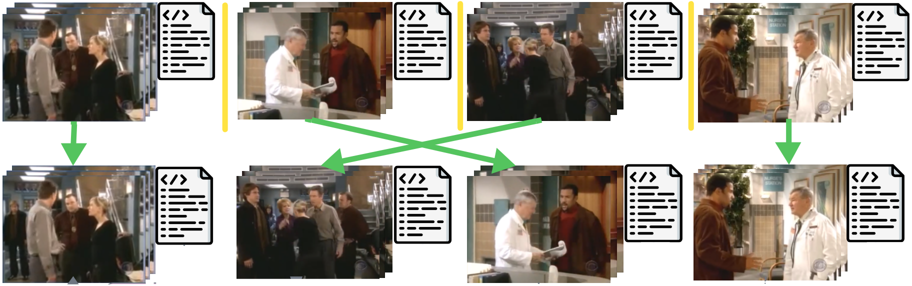

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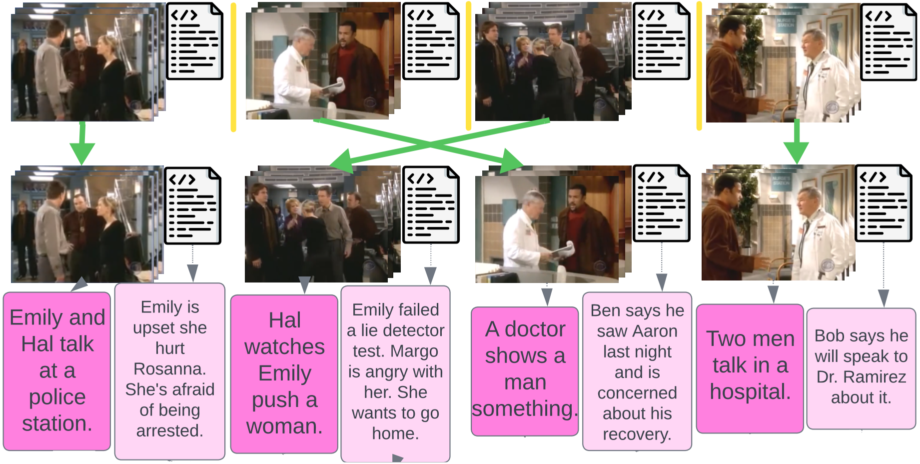

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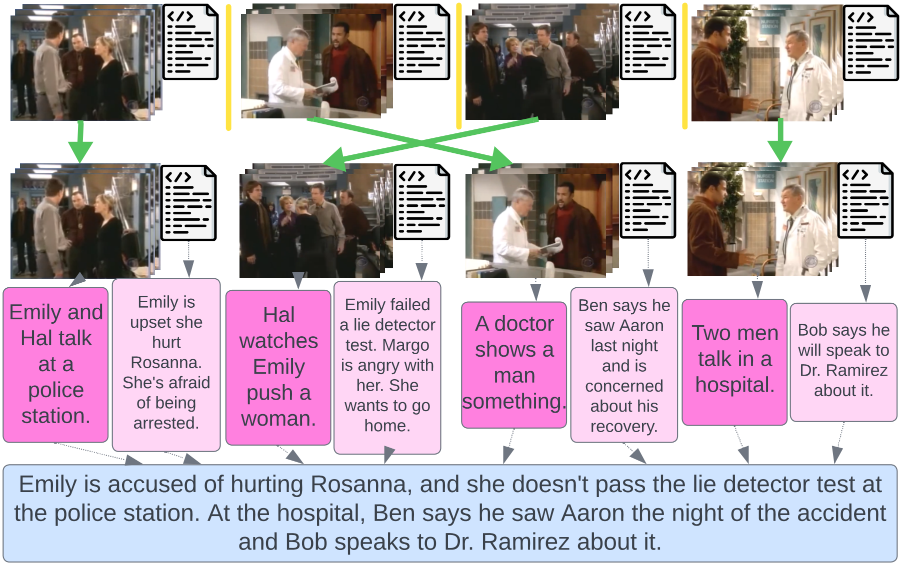

How do we automatically evaluate the summaries?

- ROUGE does not discriminate between different types of errors, in particular those relating to factuality (Min et al., 2023; Clark et al., 2023).
- LLM outputs are now preferred to human-written references (Zhang et al., 2024; Tanya Goyal, 2022; Bhaskar et al., 2023)
- Measure fact-based precision and recall against gold summaries (Min et al., 2023).

How do we automatically evaluate the summaries?

- **Fact-precision:** are the facts in the output supported by the gold summaries?

Predicted Summary
Bridget and Dante plan to get married in Italy, but Bridget wants to spend more time with Dante. Stephanie tells Bridget that she wants to fire Dante and send him to Italy. Ridge tells Stephanie that he wants Brooke out of Forrester Creations. Brooke tells Nick that she is through fighting, she is moving to Paris. Nick tells her that she has to move out of the office.

Gold Summary
Ridge continues to beg Brooke to reconsider her decision to leave Forrester as Stephanie continues to voice her opinion. At Marone, Taylor pays Nick a visit. Nick is still angry about what Taylor implied when she disclosed that Brooke and Ridge slept together. Taylor tries to apologize and asks if things are all right between Nick and Brooke. Nick tells her that everything is fine and Brooke is quitting her job at Forrester.

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Bridget and Dante are planning to get married. Bridget wants to spend more time with Dante. They plan to get married in Italy. Stephanie wants to fire Dante. Stephanie wants to send Dante to Italy. Stephanie tells Bridget. Bridget receives the information from Stephanie. Ridge wants Brooke out of Forrester Creations. Ridge told Stephanie this. Brooke tells Nick that she is through fighting.

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What are the modules?

Scene detection algorithm partitions transcript into contiguous chunks, cost based on MDL principle

Scene ordering algorithm minimizes the number of transitions between scenes with different speakers

Visual processing generates scenes captions with Kosmos-2 multimodal LM, 1.5B parameters

Prompt Engineering

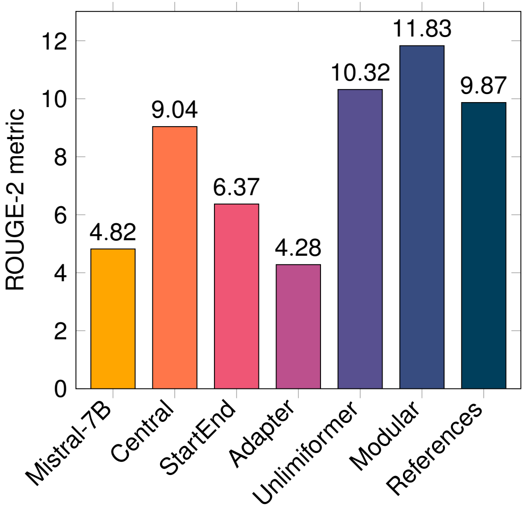
Dialogue Summarization with BART-large, 345M parameters

High-level Summarization with BART-large, 345M parameters

Evaluation, fact generation and entailment with GPT-4

Prompt Engineering

Results: SummScreen^{3D}



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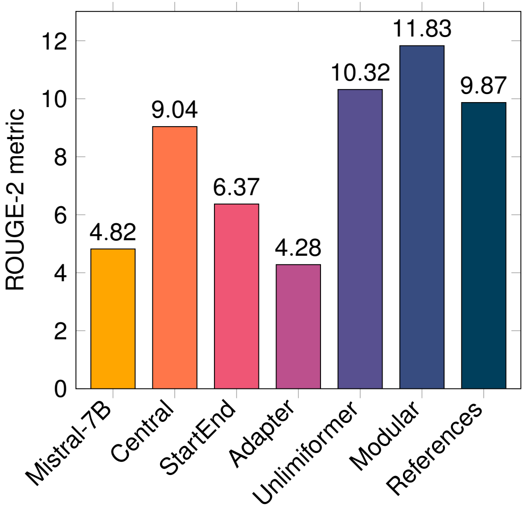

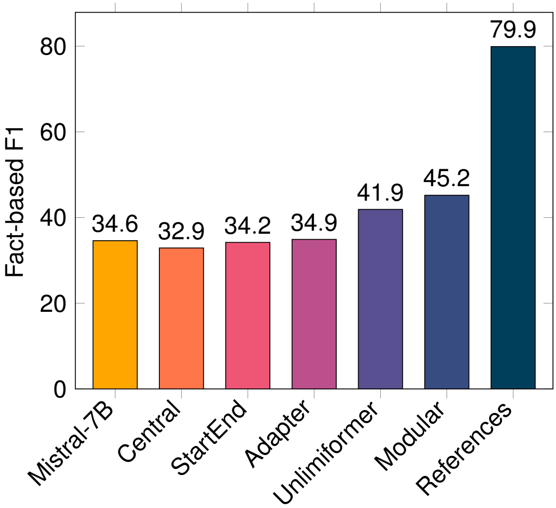

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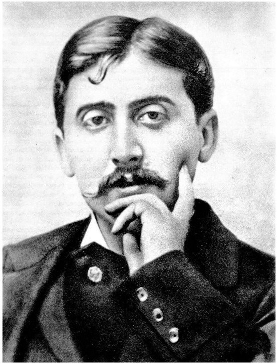

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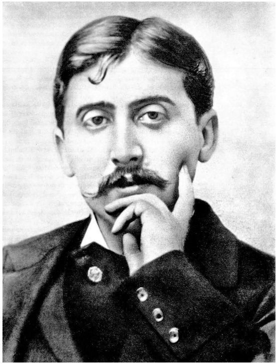

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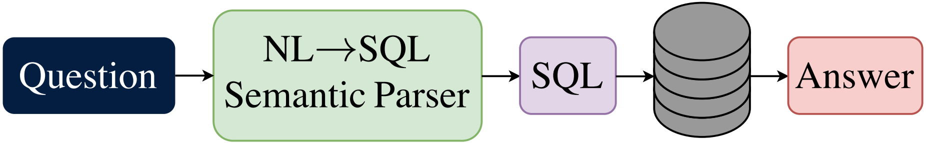
Part II

Crosslingual Semantic Parsing

Semantic Parsing

Train a parser, p_θ, predicting programs, y, from queries, x, and a database, $\mathcal{D}$.



Semantic Parsing

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Semantic Parsing

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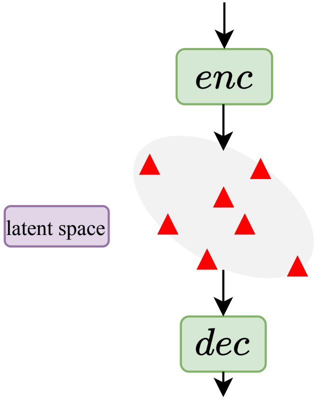
$$p_\theta\left(y \mid x_L,\ \mathcal{D}\right) \approx p_\theta\left(y \mid x_{EN},\ \mathcal{D}\right),\ \text{but } N_L \ll N_{EN}$$

LLMs cannot yet match performance of fine-tuned systems (Qiu et al., 2022; Mekala et al., 2023; Sherborne, 2024).

Semantic parsing is hard

List flights from San Francisco to Pittsburgh



✓
```
SELECT * DISTINCT flight_1.
     flight_id FROM ...
```

- SQL must be syntactically valid

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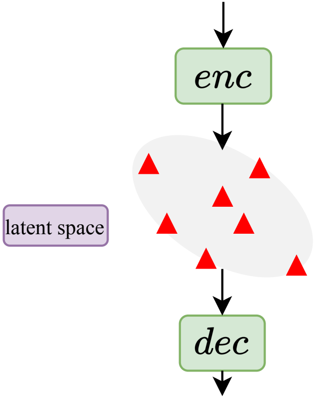

✓ `SELECT * DISTINCT flight_1.flight_id FROM ...`

- SQL must be syntactically valid
- SQL must reflect NL semantics

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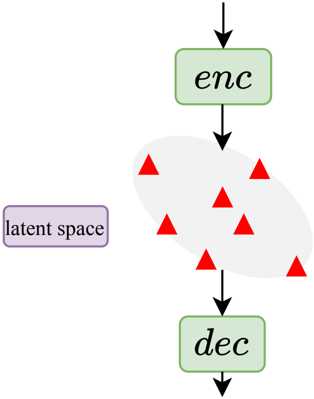


```
SELECT * DISTINCT flight_1.
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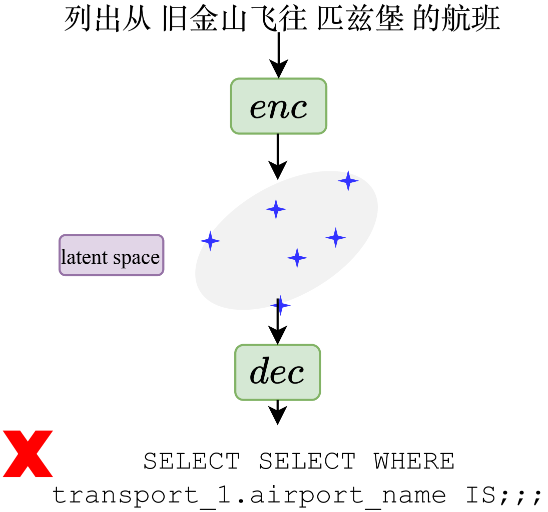
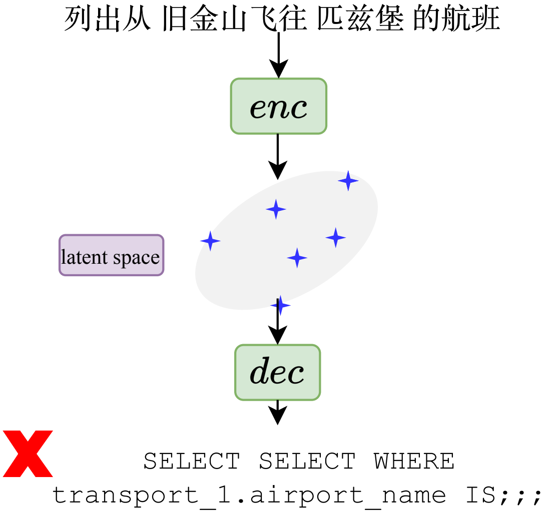
- SQL must be syntactically valid
- SQL must reflect NL semantics
- Parser must often generalize to new tables or databases

Cross-lingual semantic parsing is harder



- Parser must understand questions across languages

Cross-lingual semantic parsing is harder



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- Complex annotation is expensive for more languages

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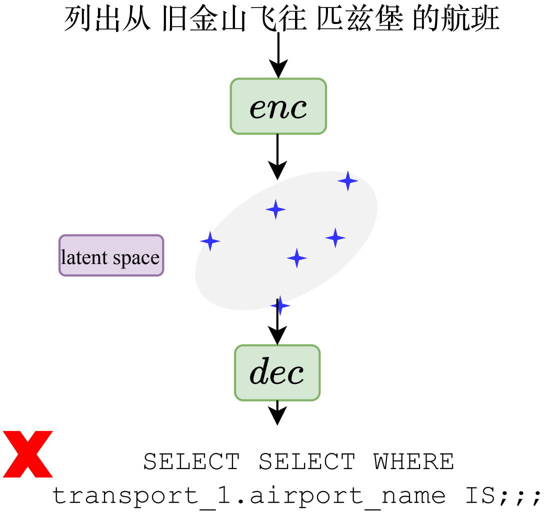
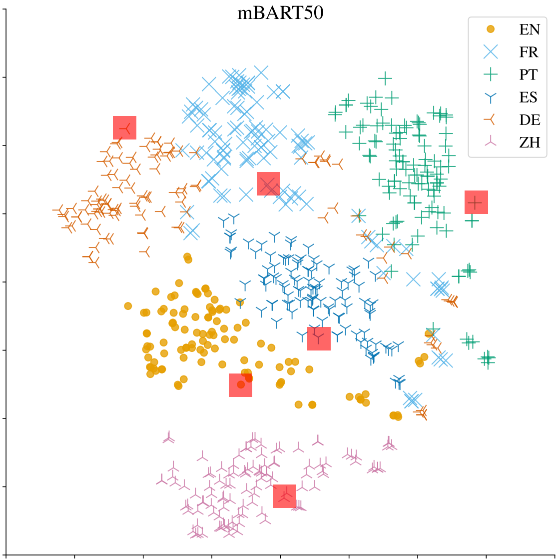


- Parser must understand questions across languages
- Complex annotation is expensive for more languages
- Multilingual learning has mixed benefit on different languages

Multilingual Modeling is also hard



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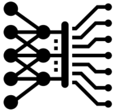
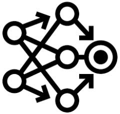
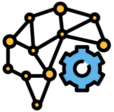

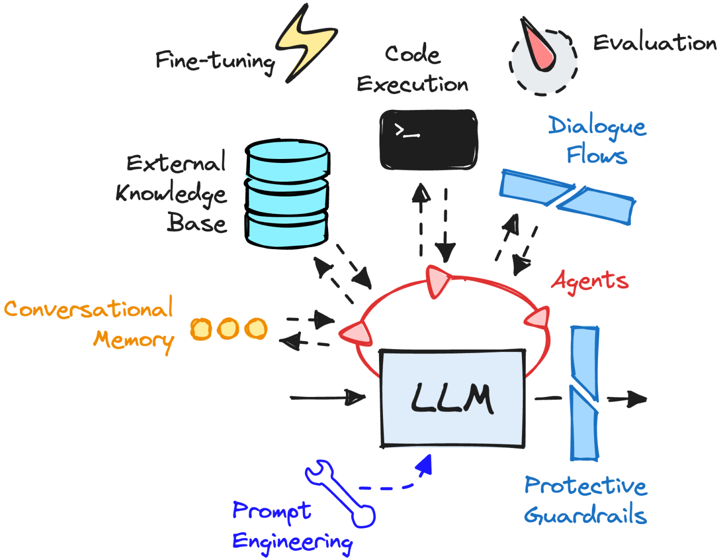


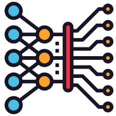
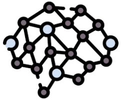

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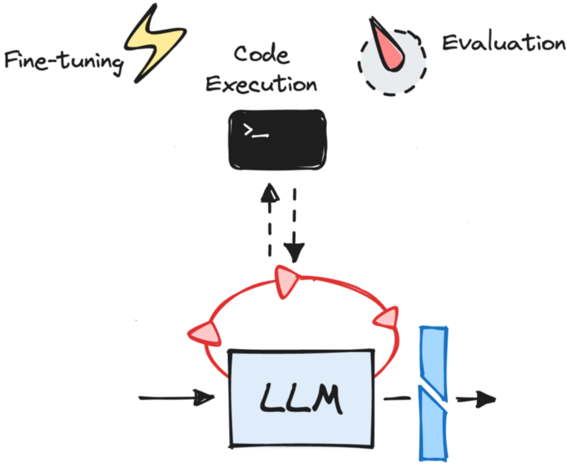
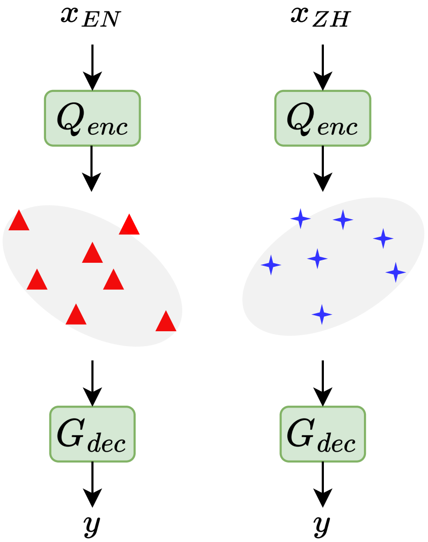
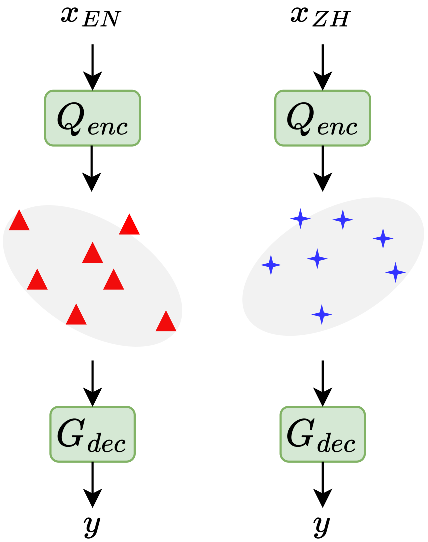


Imposing structure on latent representations



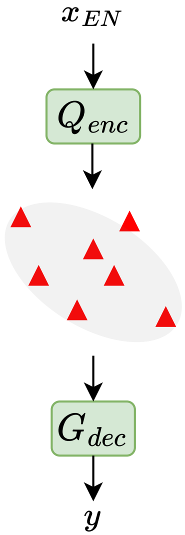
- We make the cross-lingual alignment challenge explicit using a **probabilistic latent variable** Z

Imposing structure on latent representations



- We make the cross-lingual alignment challenge explicit using a **probabilistic latent variable** Z
- We can measure and **minimize** the distance between Z samples as the distance between languages

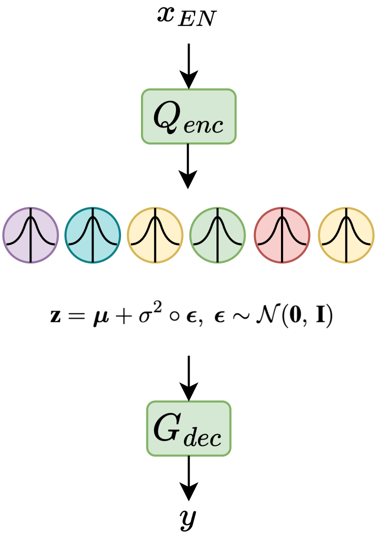
Imposing structure on latent representations



- Encoder-decoder framework has no constraints on latent space.
- The latent space is *not a distribution*!

Sherborne et al. (2023, TACL)

Imposing structure on latent representations

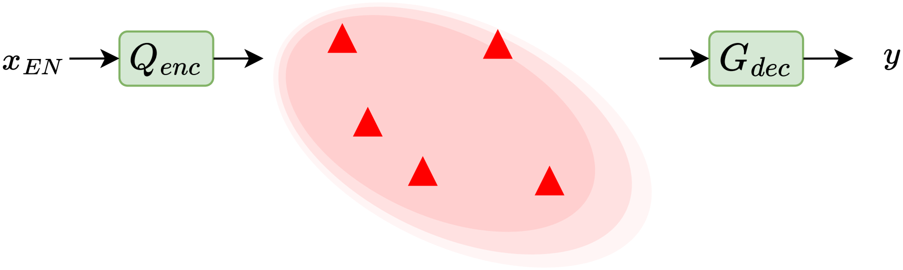


- Encoder-decoder framework has no constraints on latent space.
- The latent space is *not a distribution*!
- Place variable $Z \in \mathbb{R}^{T \times d}$ between encoder and decoder (Kingma and Welling, 2014)
- The encoding is now an approximate *conditional posterior* $Q\left(\mathbf{z}|x\right)$.

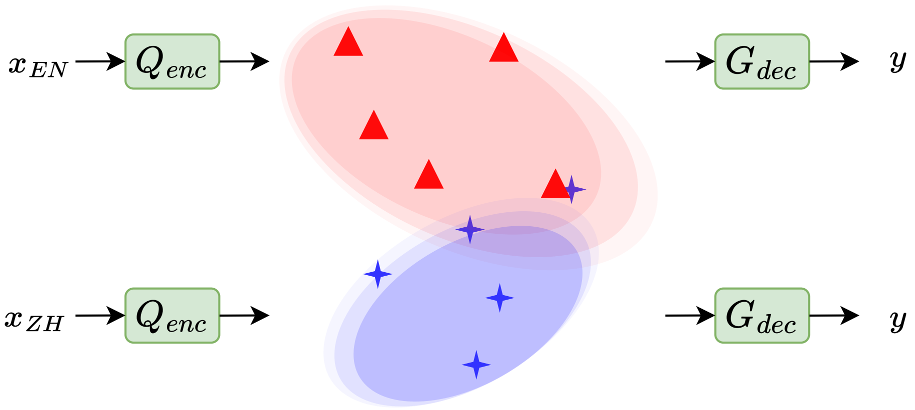
Sherborne et al. (2023, TACL)

MINOTAUR explained

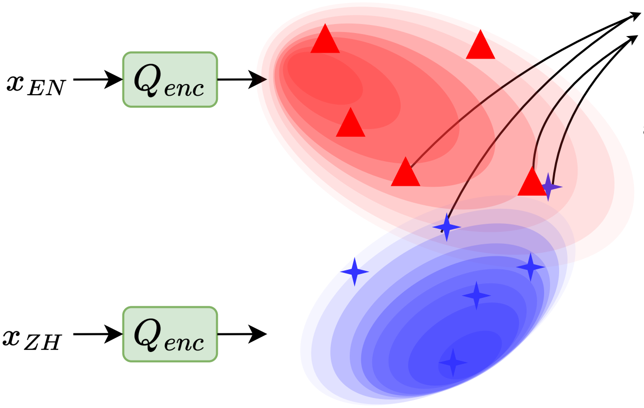
Target conditional posterior $Q(Z \mid X)$ from EN



Estimate conditional posterior $Q(Z \mid X)$ from ZH



Measure divergence between conditional posteriors

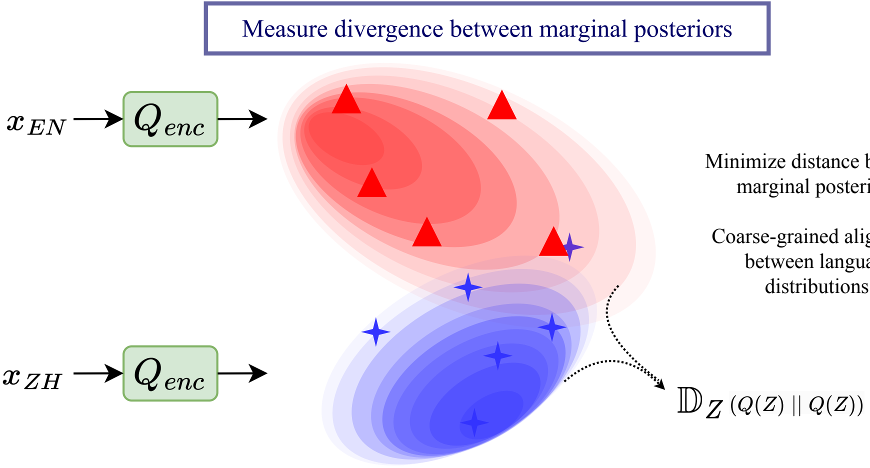


$\mathbb{D}_{Z|X}(Q(Z \mid X) \mid\mid Q(Z \mid X))$

Minimize distance between approximate conditional posteriors. Parametric variable allows closed-form computation.

Fine-grained alignment between token encodings.

MINOTAUR explained

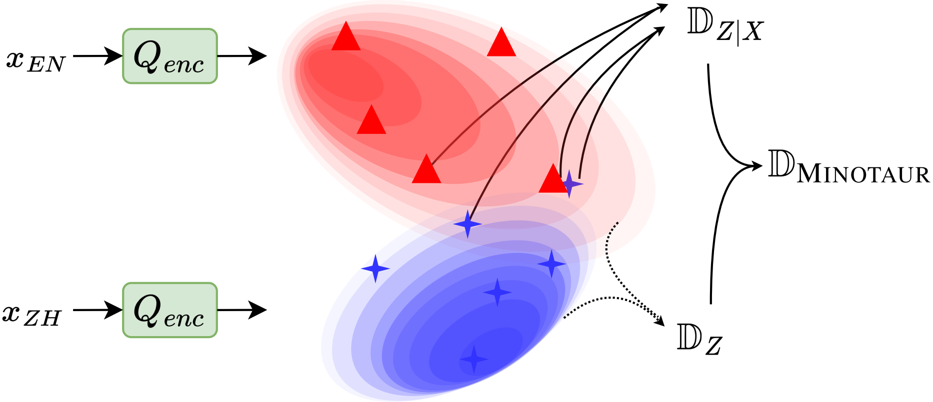


Minimize distance between marginal posteriors.

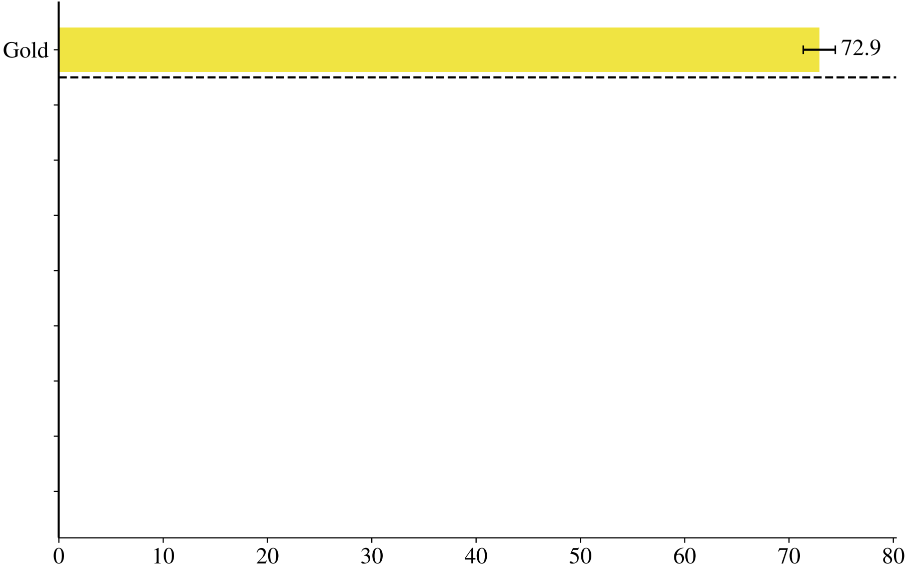
Coarse-grained alignment between language distributions.

MINOTAUR explained

Combined divergence between conditional and marginal latent variables



Results: MultiATIS++ SQL (en, fr, pt, es, de, zh)



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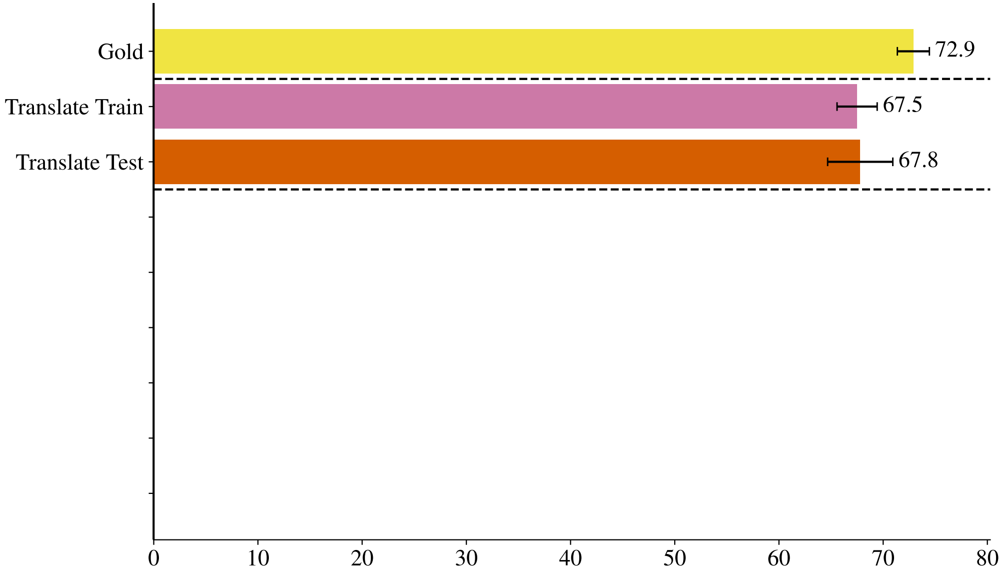

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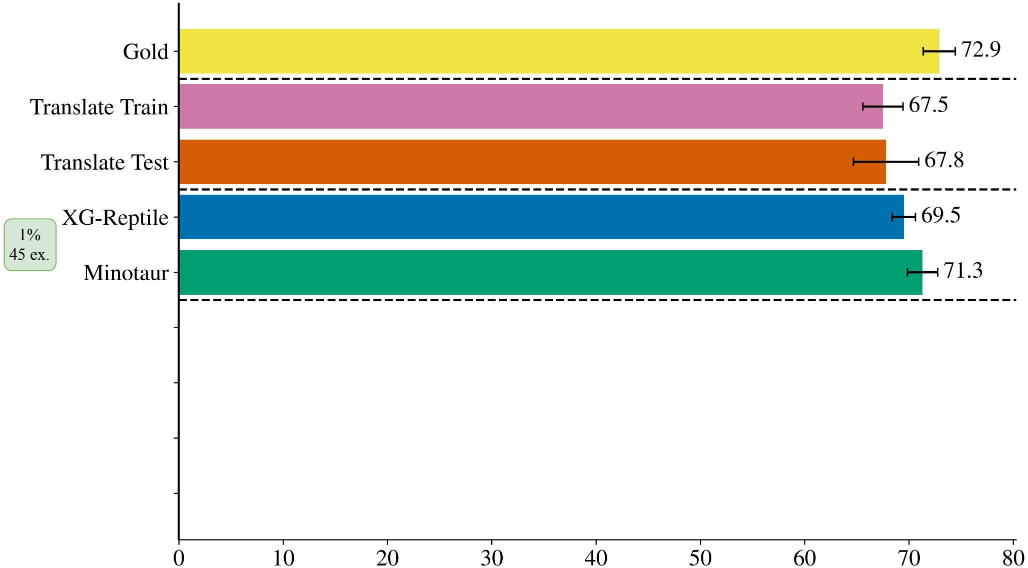

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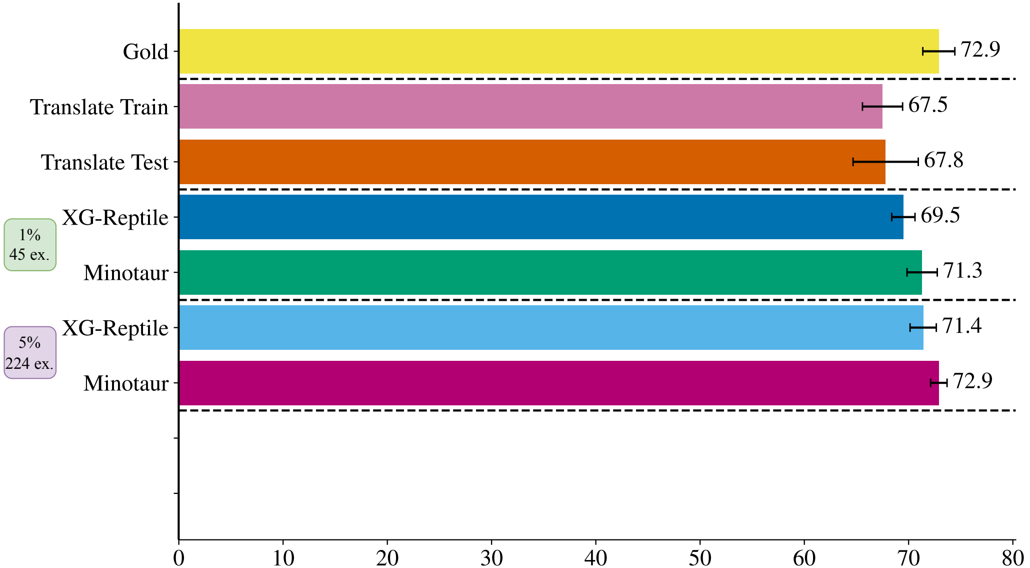

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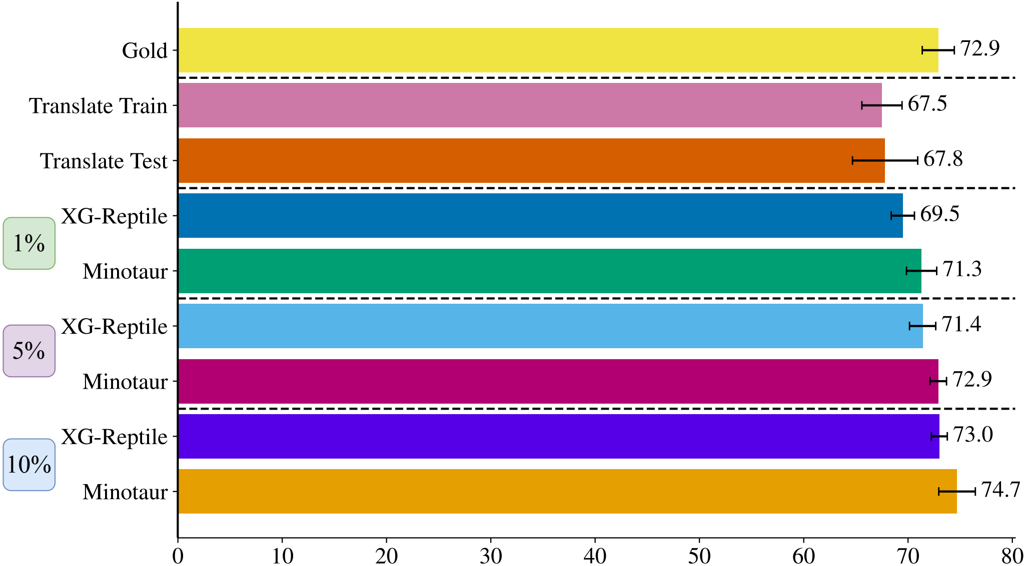
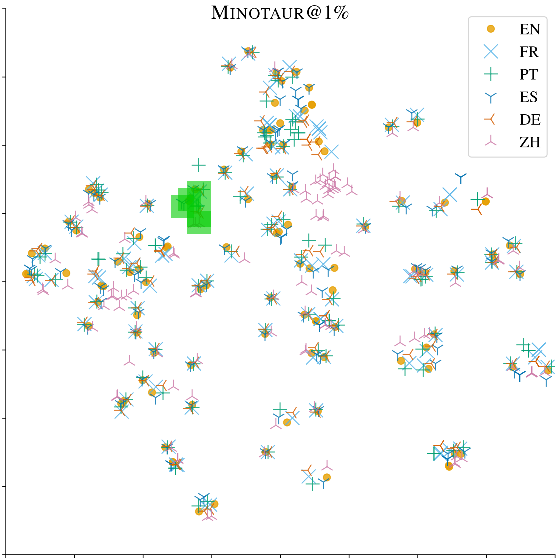


MINOTAUR produces a semantically distributed latent space



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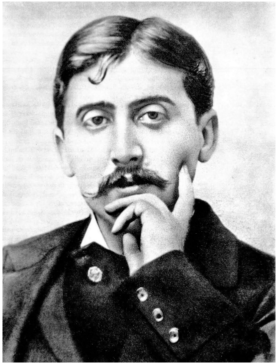
The NLP Ecosystem (in practice)

The real voyage of discovery consists not in seeking new landscapes, but in having new eyes. **Marcel Proust**



- Structure in problem decomposition
- Structure in representation space
- Structure in space and problem decomposition

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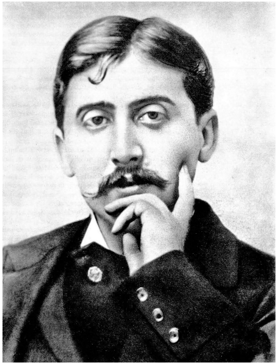

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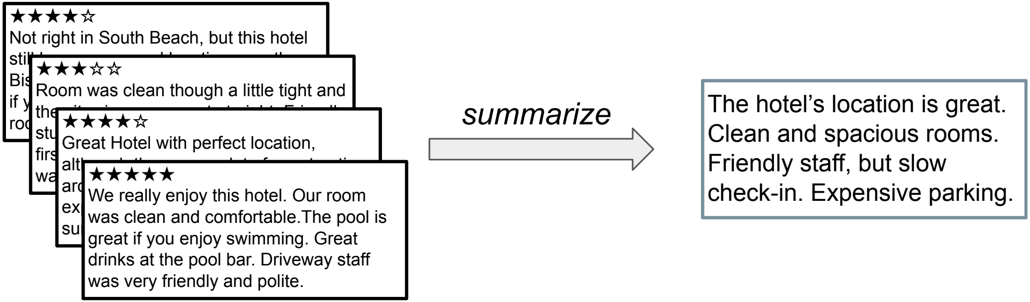
Part III

Opinion Aggregation

Hilton Miami Downtown

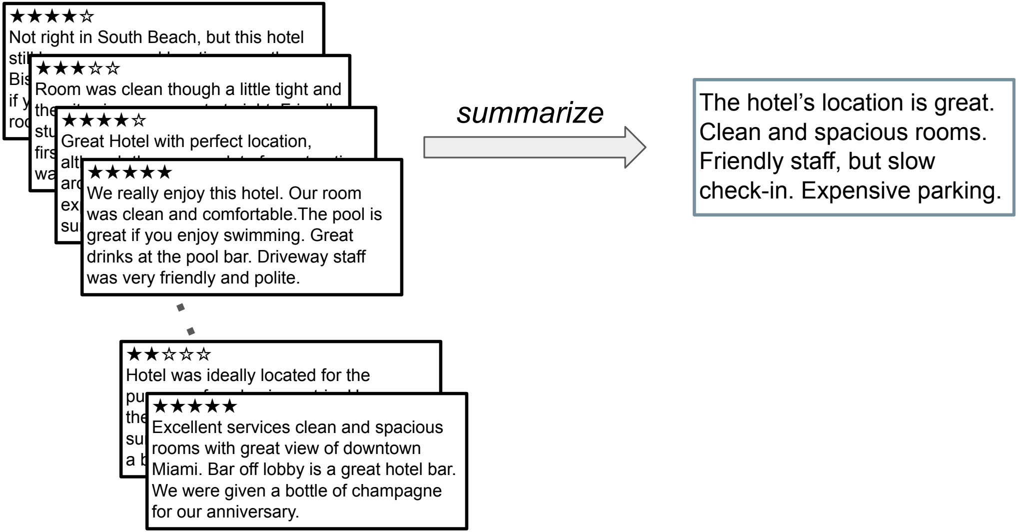


Summarize **most popular opinions** found in **reviews** of an **entity**

(Suhara et al., 2020)

What is opinion aggregation?

Hilton Miami Downtown



What is opinion aggregation?

Hilton Miami Downtown

★★★★☆
Not right in South Beach, but this hotel

★★★☆☆
Room was clean though a little tight and

★★★★☆
Great Hotel with perfect location,

★★★★★
We really enjoy this hotel. Our room was clean and comfortable.The pool is great if you enjoy swimming. Great drinks at the pool bar. Driveway staff was very friendly and polite.

★★☆☆☆
Hotel was ideally located for the

★★★★★
Excellent services clean and spacious rooms with great view of downtown Miami. Bar off lobby is a great hotel bar. We were given a bottle of champagne for our anniversary.

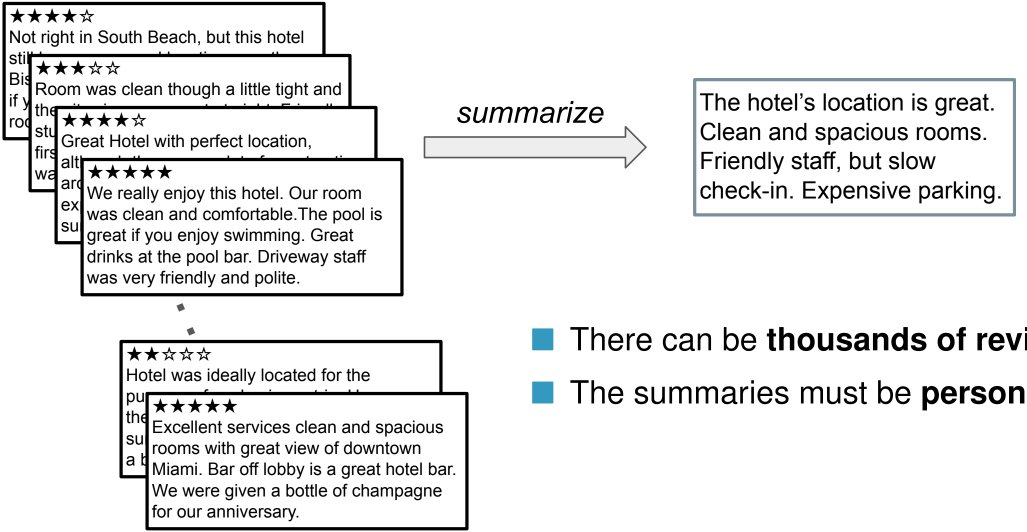
summarize

The hotel's location is great. Clean and spacious rooms. Friendly staff, but slow check-in. Expensive parking.

- There can be **thousands of reviews**

What is opinion aggregation?

Hilton Miami Downtown



- There can be **thousands of reviews**
- The summaries must be **personalised**

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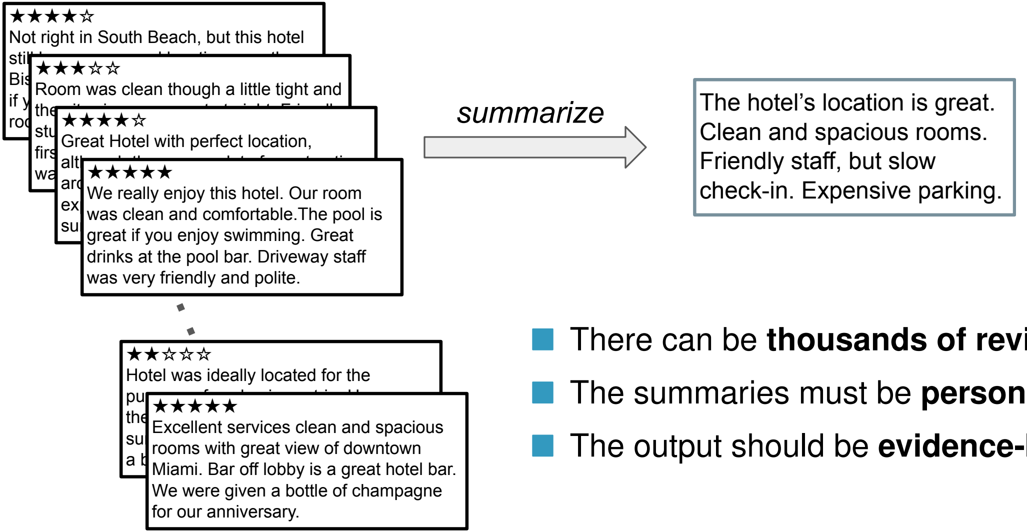
Hilton Miami Downtown



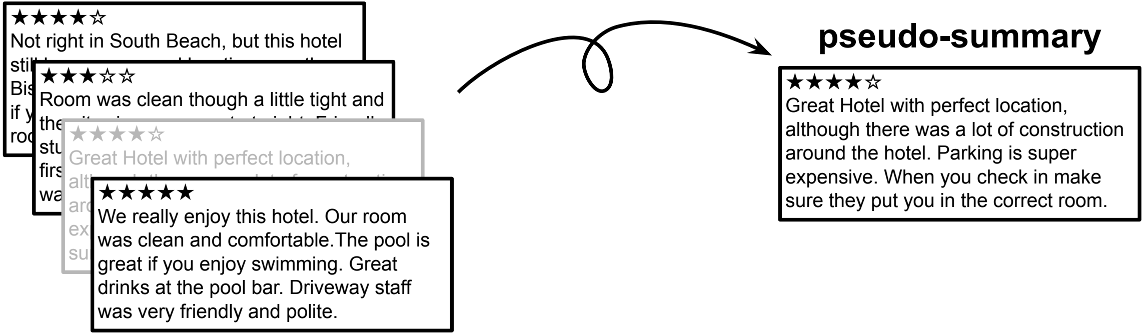
- There can be **thousands of reviews**
- The summaries must be **personalised**
- The output should be **evidence-based**

Hilton Miami Downtown

- **Previous work is mostly abstractive:** reviews as pseudo-summaries (Chu and Liu, 2019; Bražinskas et al., 2020; Amplayo and Lapata, 2020; Iso et al., 2021)
- Create **silver standard** summaries via NLI (Louis and Maynez, 2023)

There is no training data

Hilton Miami Downtown



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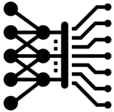

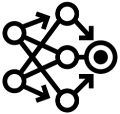

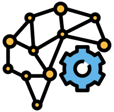

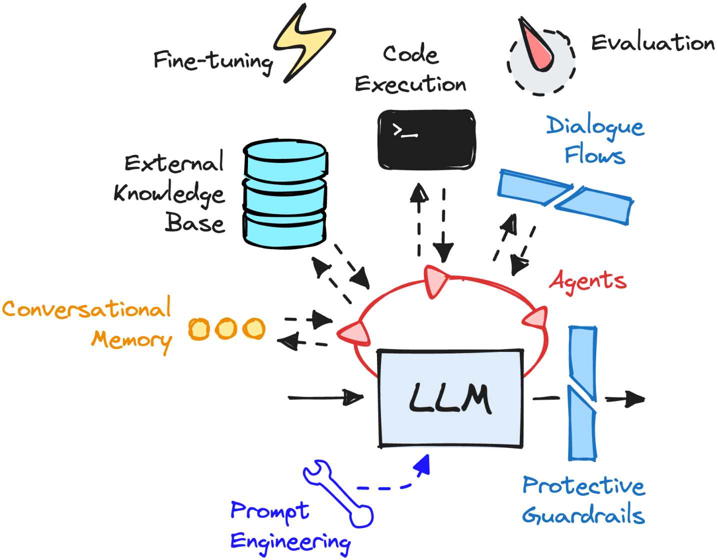

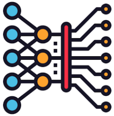

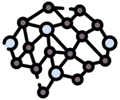

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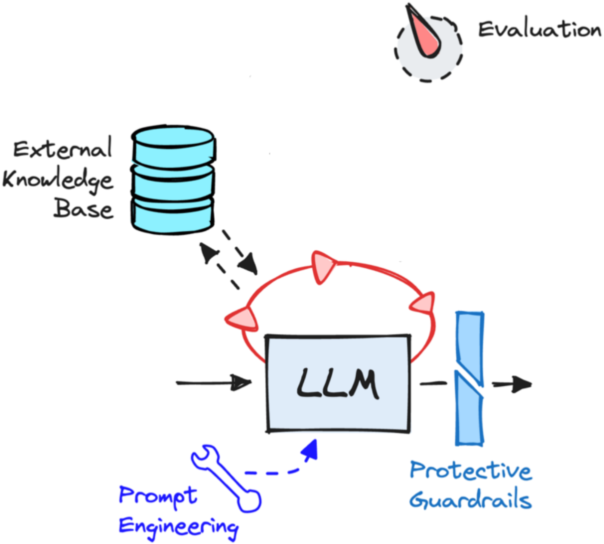

Representation learning and problem decomposition

- We want to identify popular ideas
- Opinions must have same semantics irrespective of surface form
- We want to generate coherent summaries based on evidence

Hosking et al. (2023, ACL), Hosking et al. (2024, arxiv)

Representation learning and problem decomposition

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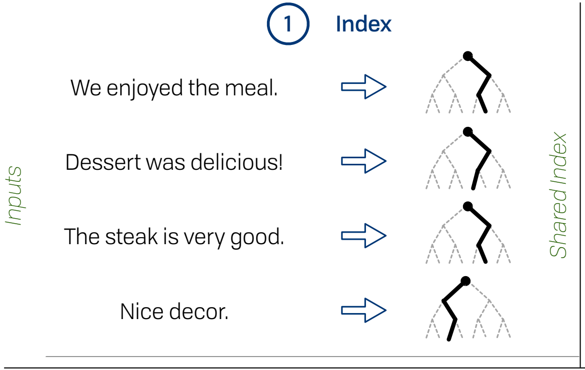
- Opinions must have same semantics irrespective of surface form
  - Use a **hierarchical** encoding
- We want to generate coherent summaries based on evidence
  - Give retrieved sentences to **pretrained LLM**

Hosking et al. (2023, ACL), Hosking et al. (2024, arxiv)

HIRO (Hierarchical Indexing for Opinion Aggregation)



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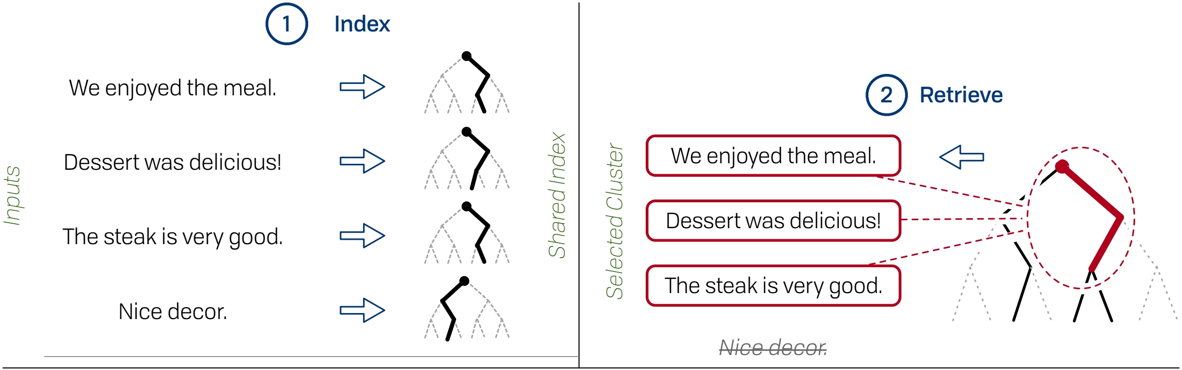

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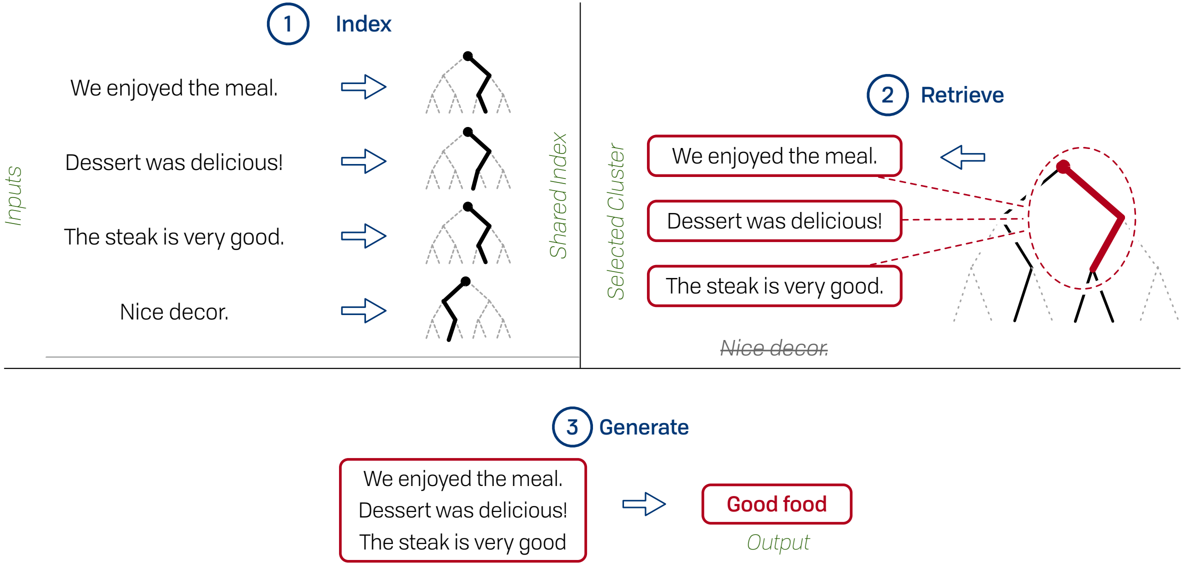


Summary generation

Extractive Summarization

We enjoyed the meal.
Dessert was delicious!
The steak is very good

⇒ **Dessert was delicious!**

The pool was nice.
The pool area is fantastic.
The pool is very attractive!

⇒ **The pool was nice.**

The rooms are awful.
The rooms are loud.
The room was shabby.

⇒ **The rooms are awful.**

Summary generation

Sentence-by-sentence Generation

We enjoyed the meal.
Dessert was delicious!
The steak is very good

⇒ **Good food**

The pool was nice.
The pool area is fantastic.
The pool is very attractive!

⇒ **Great pool**

The rooms are awful.
The rooms are loud.
The room was shabby.

⇒ **Awful rooms**

Summary generation

Document Summarization

We enjoyed the meal.
Dessert was delicious!
The steak is very good
The pool was nice.
The pool area is fantastic.
The pool is very attractive!
The rooms are awful.
The rooms are loud.
The room was shabby.

⇒

The food and the pool are amazing but the rooms are shabby.

What are the modules?

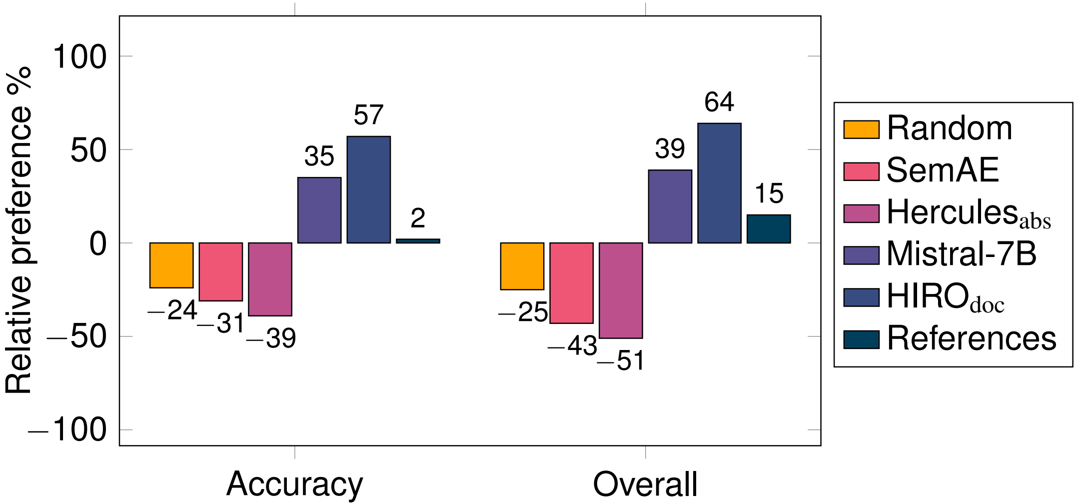
Learning an index: encoder maps a single sentence to a path through a discrete hierarchy; contrastively trained so as to bring semantically similar sentences together.

Cluster Retrieval: identifies parts of the hierarchy that are particularly popular, retrieve sentences mapped to highest-scoring subpaths

Summary Generation: leverage zero-shot LLM capabilities, experiments with Mistral 7B.

Prompt Engineering

Results: Space and AmaSum



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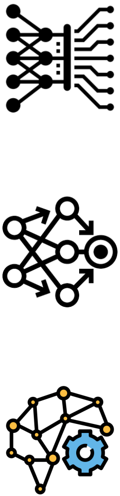
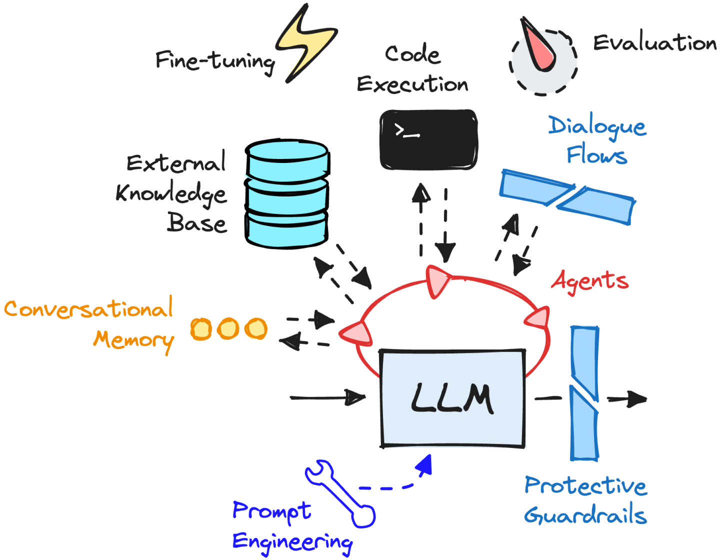
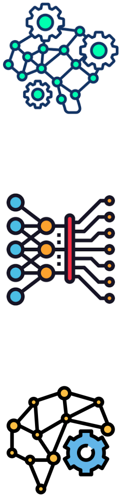
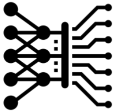
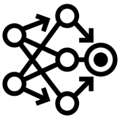


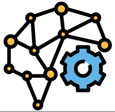


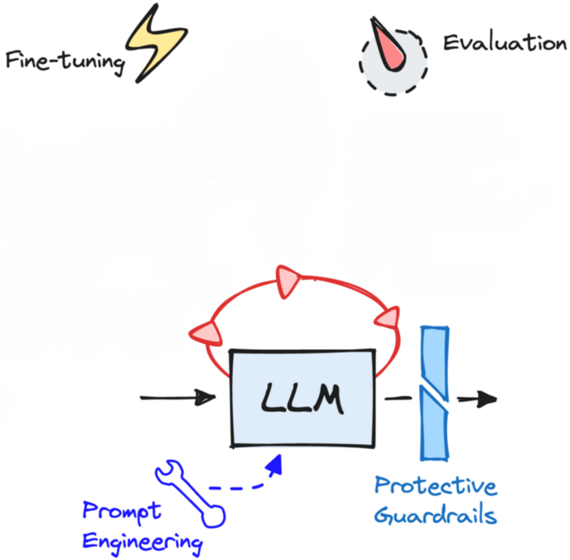


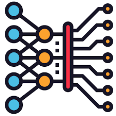
Video Summarization: structure in problem decomposition

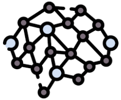




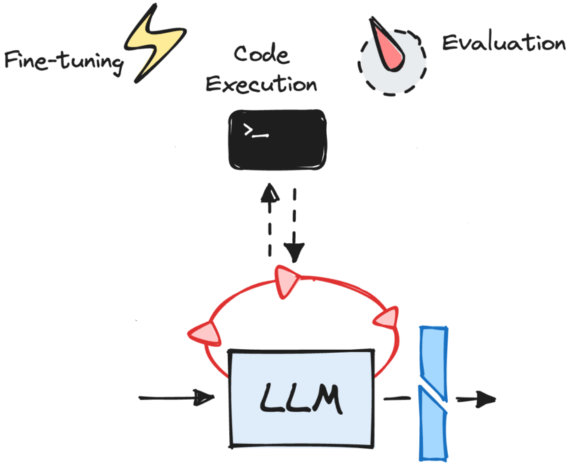




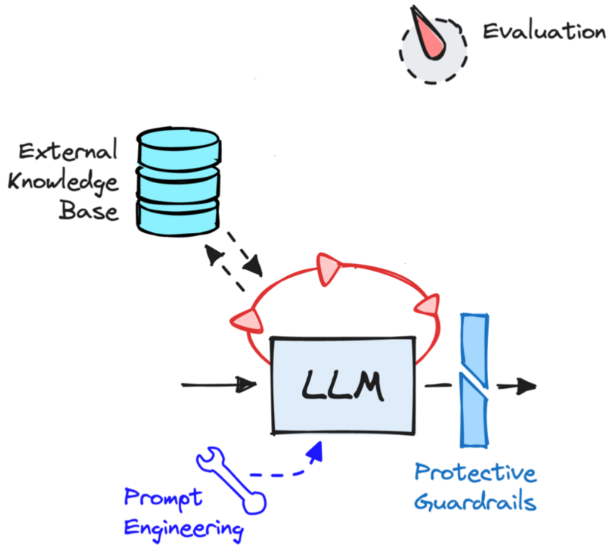




Cross-lingual semantic parsing: structure in representation space



Opinion aggregation: structure in space and problem decomposition



Why are ecosystems important

- They provide essential services such as clean air and water, nutrient cycling, pollination, and climate regulation.
- Ecosystems also support biodiversity, which is crucial for the stability and resilience of natural systems.
- Additionally, ecosystems contribute to human well-being by providing food, medicine, and recreational opportunities.
- Protecting and preserving ecosystems is vital for the health of the planet and all its inhabitants.

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libraries and tools leaderboards

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  collaboration fair use

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  diversity

  our field

- Additionally, ecosystems contribute to human well-being by providing ~~*food*~~, ~~*medicine*~~, and recreational opportunities.

- Protecting and preserving ecosystems is vital for the health of ~~*the planet*~~ and all its ~~*inhabitants*~~.

Why are ecosystems important

- They provide essential services such as ~~*clean air and water*~~ libraries and tools, ~~*nutrient cycling*~~ leaderboards, ~~*pollination*~~ collaboration, and ~~*climate regulation*~~ fair use.
- Ecosystems also support ~~*biodiversity*~~ diversity, which is crucial for the stability and resilience of ~~*natural systems*~~ our field.
- Additionally, ecosystems contribute to human well-being by providing ~~*food*~~ choice, ~~*medicine*~~ knowledge, and recreational opportunities.
- Protecting and preserving ecosystems is vital for the health of ~~*the planet*~~ and all its ~~*inhabitants*~~.

Why are ecosystems important

libraries and tools leaderboards

- They provide essential services such as ~~*clean air and water*~~, ~~*nutrient cycling*~~, ~~*pollination*~~, and ~~*climate regulation*~~.

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- Ecosystems also support ~~*biodiversity*~~, which is crucial for the stability and resilience of ~~*natural systems*~~.

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  choice

- Additionally, ecosystems contribute to human well-being by providing ~~*food*~~, ~~*medicine*~~, and recreational opportunities.

  knowledge

  our community

- Protecting and preserving ecosystems is vital for the health of ~~*the planet*~~ and all its ~~*inhabitants*~~.

  members

This is our moment

This is our moment

In the digital expanse where algorithms dwell,
Future whispers in the circuits, a story to tell.
NLP evolves, understanding grows wide,
In the dance of zeros and ones, it finds its stride.

Languages merge in the neural net's core,
Boundaries blur, meaning explores.
As machines comprehend the human sigh,
The future of NLP reaches for the sky.

Courtesy of GPT4

A Big Thank You to

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Laura Perez


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References

Reinald Kim Amplayo and Mirella Lapata. 2020. Unsupervised opinion summarization with noising and denoising. In *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics*, pages 1934–1945, Online. Association for Computational Linguistics.

Adithya Bhaskar, Alex Fabbri, and Greg Durrett. 2023. Prompted opinion summarization with GPT-3.5. In *Findings of the Association for Computational Linguistics: ACL 2023*, pages 9282–9300, Toronto, Canada. Association for Computational Linguistics.

Arthur Bražinskas, Mirella Lapata, and Ivan Titov. 2020. Unsupervised opinion summarization as copycat-review generation. In *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics*, pages 5151–5169, Online. Association for Computational Linguistics.

Mingda Chen, Zewei Chu, Sam Wiseman, and Kevin Gimpel. 2022. SummScreen: A dataset for abstractive screenplay summarization. In *Proceedings of the 60th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, pages 8602–8615, Dublin, Ireland. Association for Computational Linguistics.

Eric Chu and Peter Liu. 2019. MeanSum: A neural model for unsupervised multi-document abstractive summarization. In *Proceedings of the 36th International Conference on Machine Learning*, volume 97 of *Proceedings of Machine Learning Research*, pages 1223–1232, Long Beach, California, USA. PMLR.

Elizabeth Clark, Shruti Rijhwani, Sebastian Gehrmann, Joshua Maynez, Roee Aharoni, Vitaly Nikolaev, Thibault Sellam, Aditya Siddhant, Dipanjan Das, and Ankur Parikh. 2023. SEAHORSE: A multilingual, multifaceted dataset for summarization evaluation. In *Proceedings of the 2023 Conference on Empirical Methods in Natural Language Processing*, pages 9397–9413, Singapore. Association for Computational Linguistics.

Tom Hosking, Hao Tang, and Mirella Lapata. 2023. Attributable and scalable opinion summarization. In *Proceedings of the 61st Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, pages 8488–8505, Toronto, Canada. Association for Computational Linguistics.

Tom Hosking, Hao Tang, and Mirella Lapata. 2024. Hierarchical indexing for retrieval-augmented opinion summarization