Opinion Summarization from Customer Reviews

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Megagon Labs

Opinion Summarization

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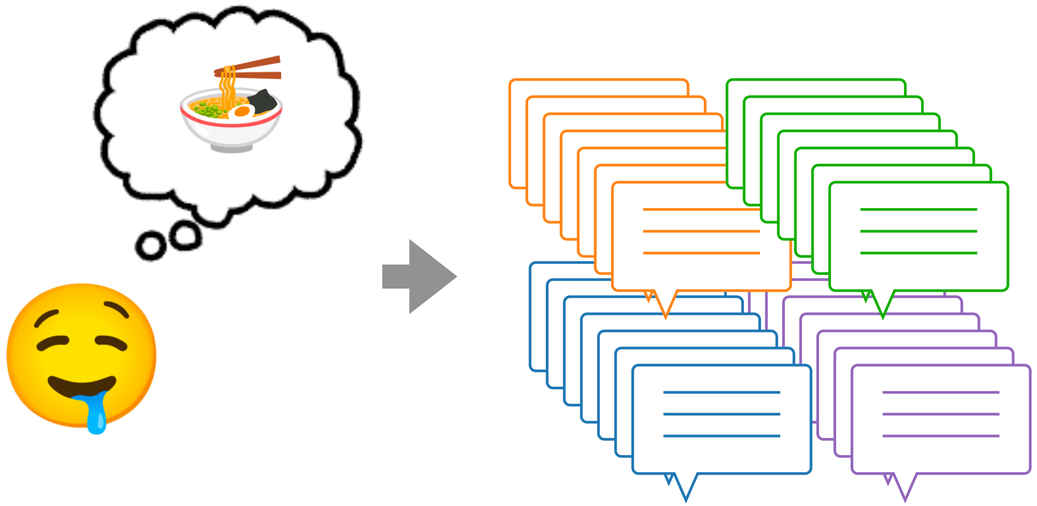

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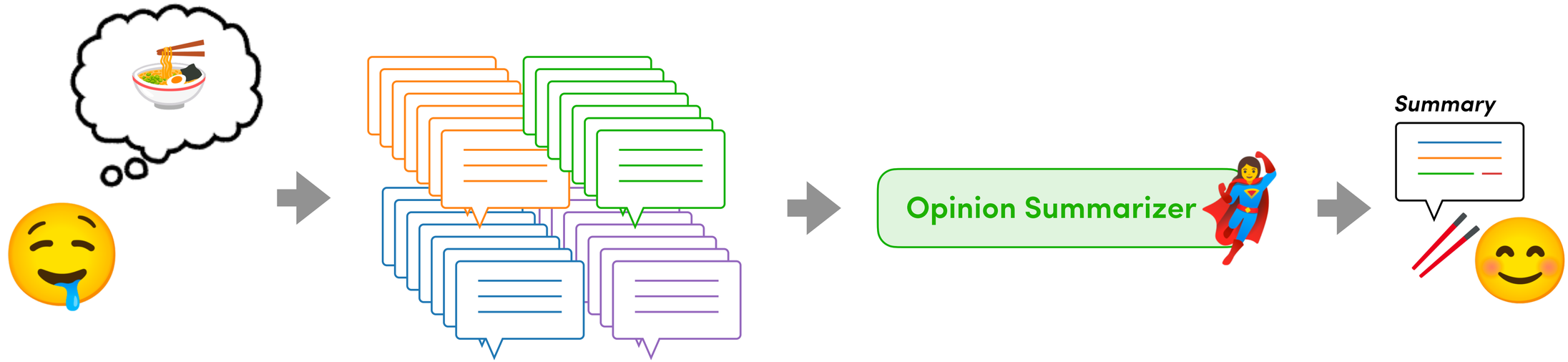

Outline

1. How to build opinion summarization system without training pairs

2. How to make it more comparable between entities

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1. How to build opinion summarization system without training pairs

2. How to make it more comparable between entities

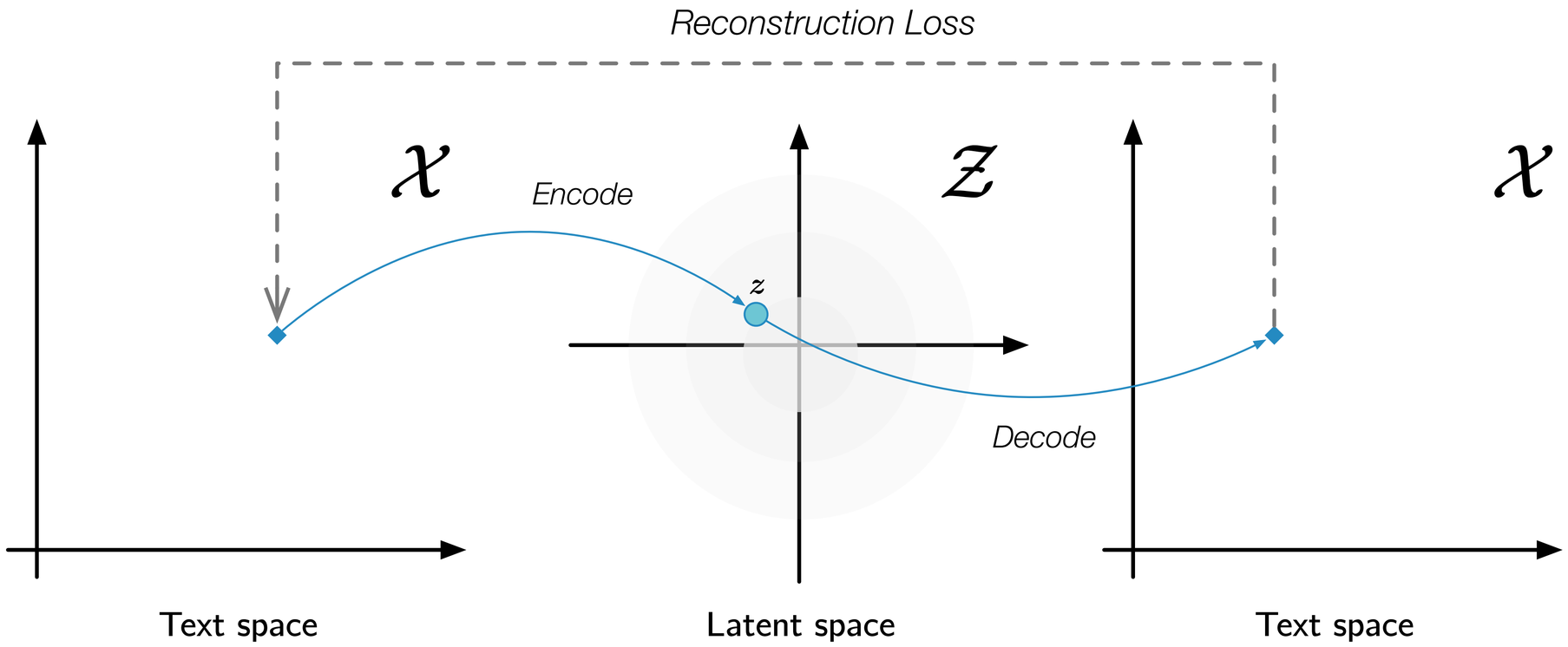
Not Enough Data for Supervised Learning

- Human written reference summaries are extremely limited

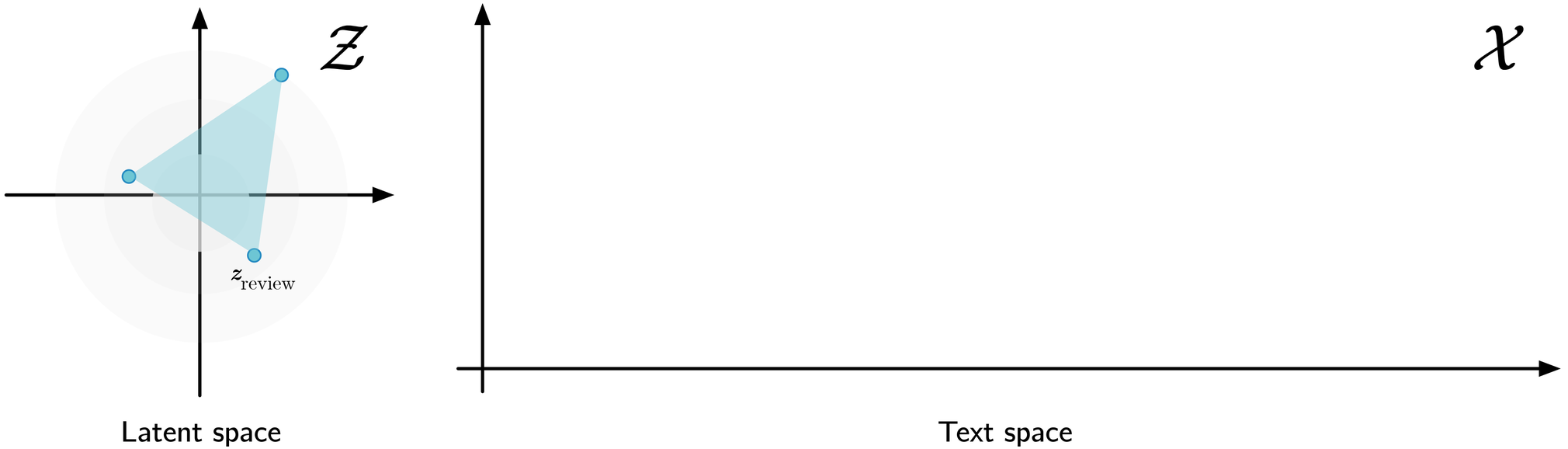
- Large amounts of reviews are available

Unsupervised Learning for Opinion Summarization

Standard Approach: Auto Encoder



Standard Approach: Summarizing in Latent Space



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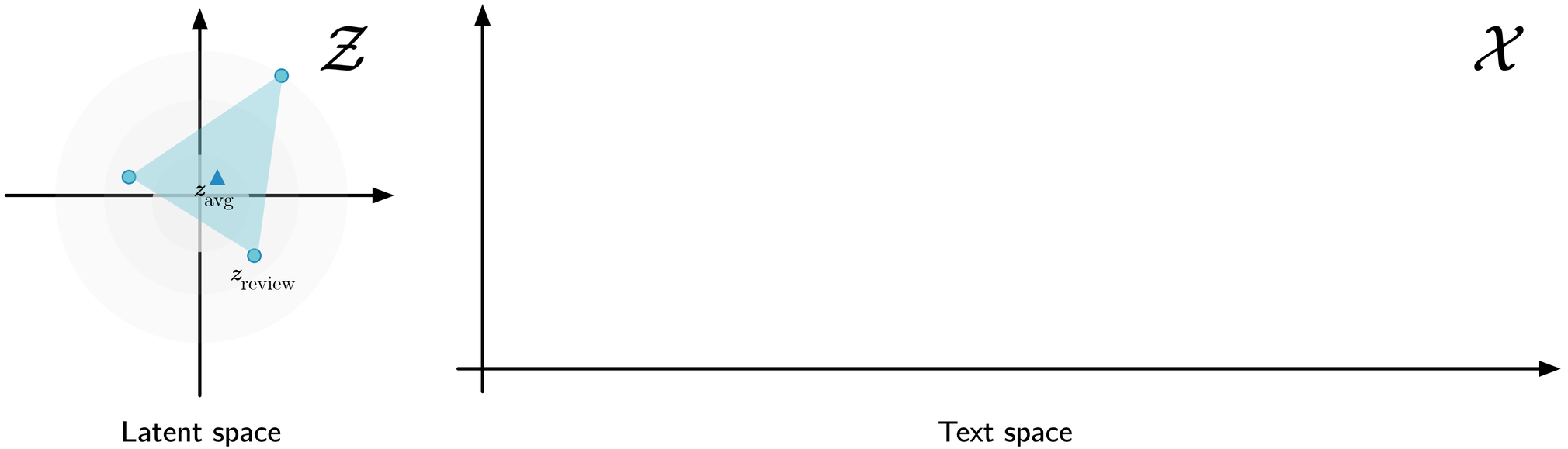

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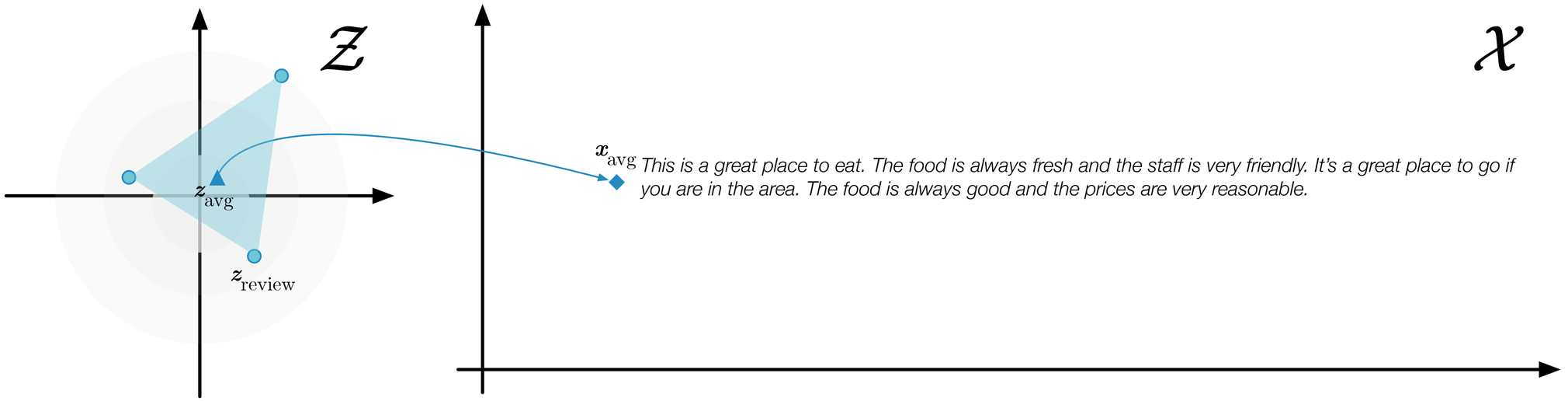
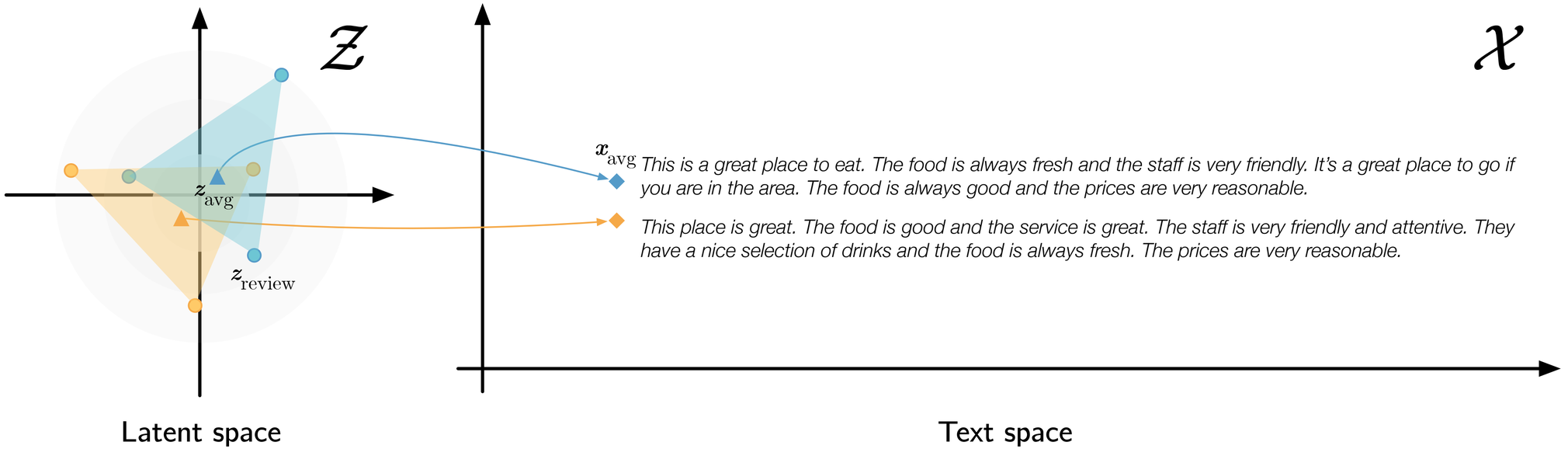


Summary Vector Degeneration

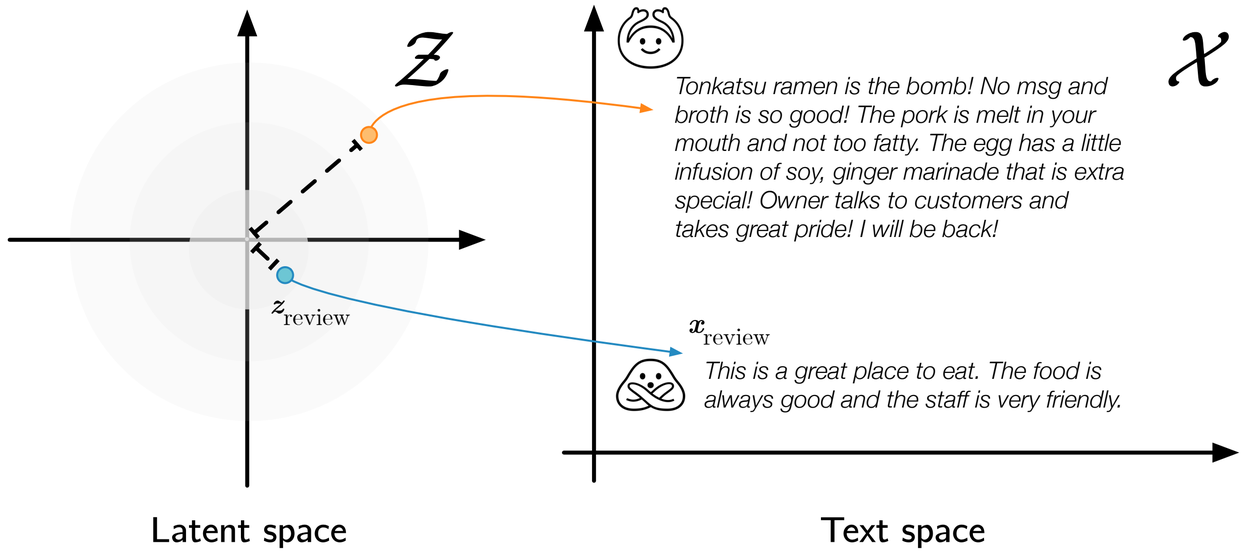


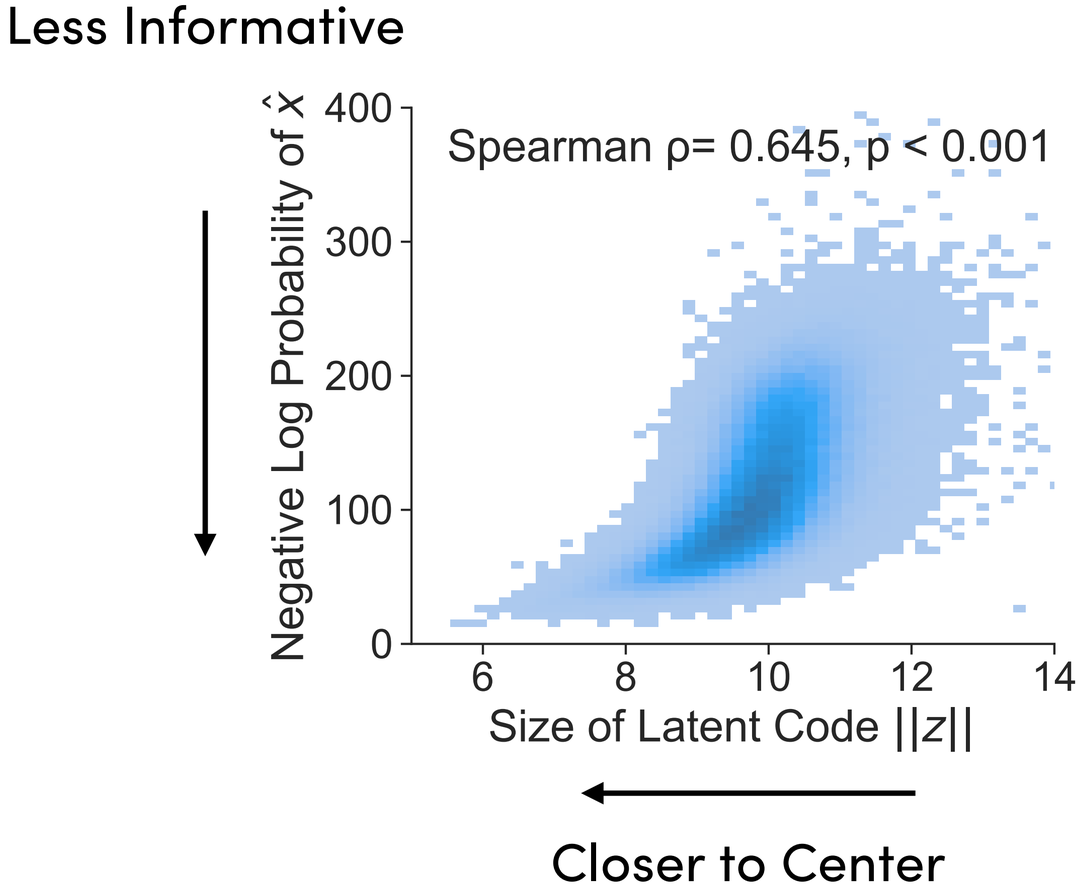
😩 Models tend to generate *generic summaries* from *averaged vector*

Objective:

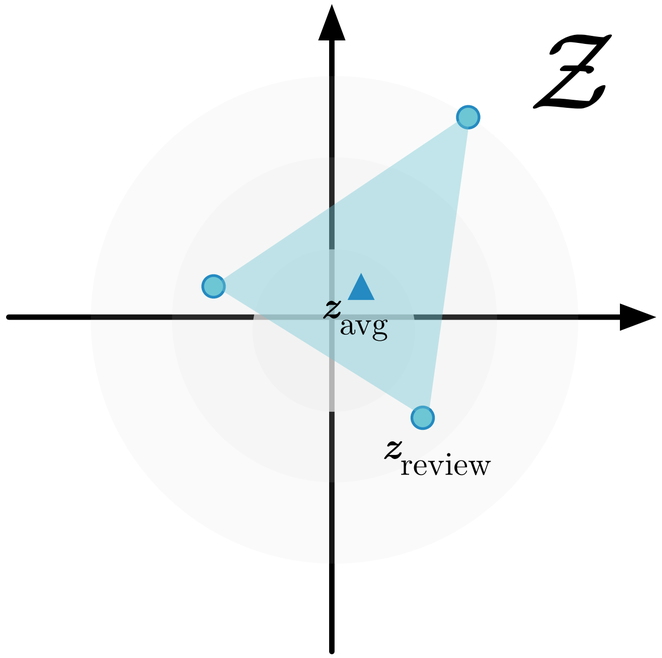
- Why *summary vector degeneration* happen?
- How to generate more *informative* opinion summaries?

Smaller vectors are less informative

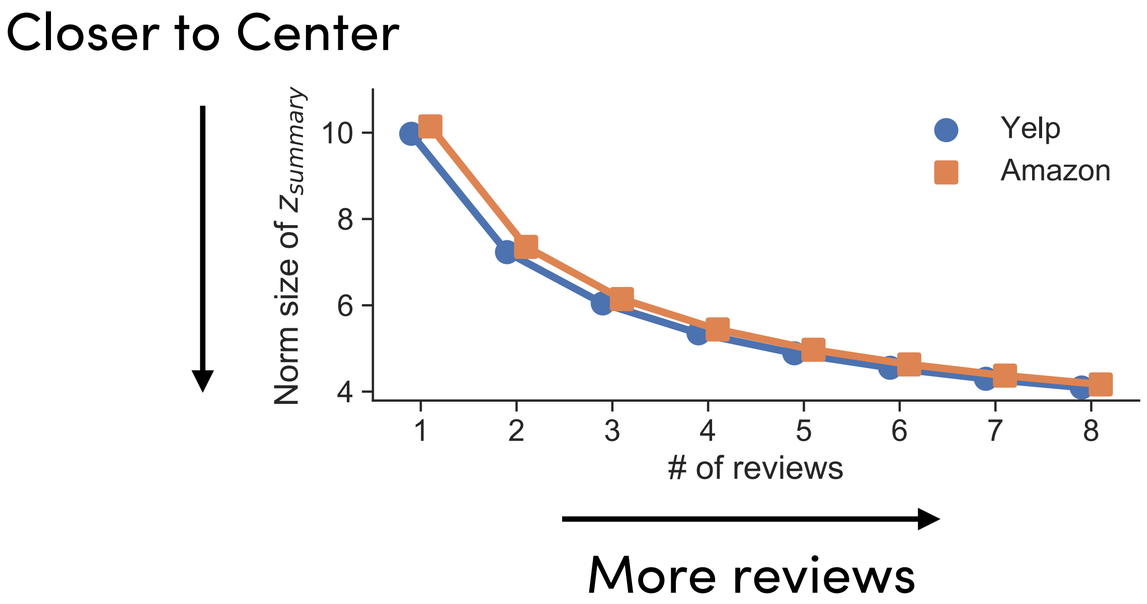




Averaged vectors are small

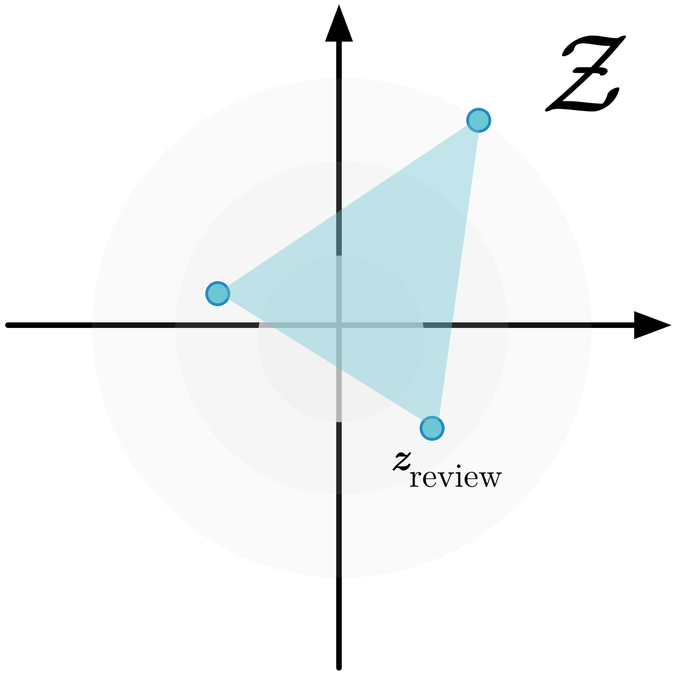


Latent space



😩 Averaged vector tends to generate less informative summary

Our Approach: *Finding Better Summary Vector*



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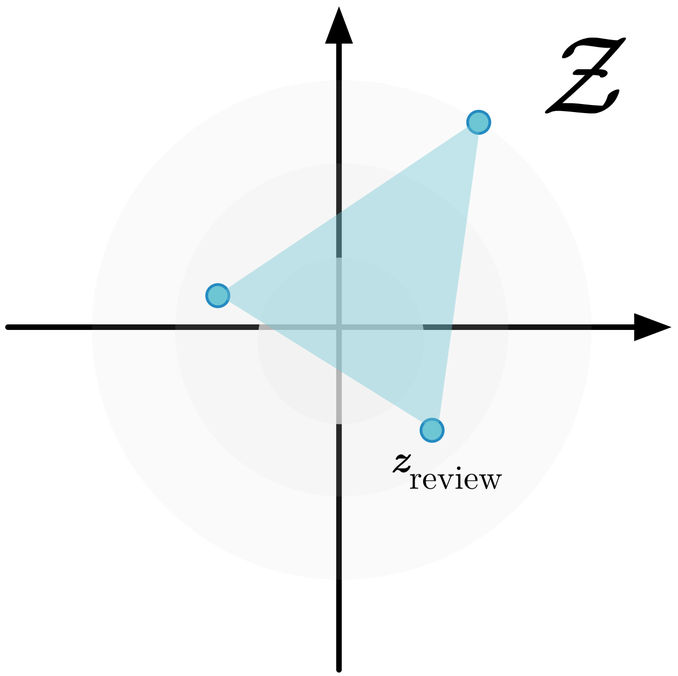

Latent space

🤔

Assumption:
Good summary vector would be in the convex hull of reviews.

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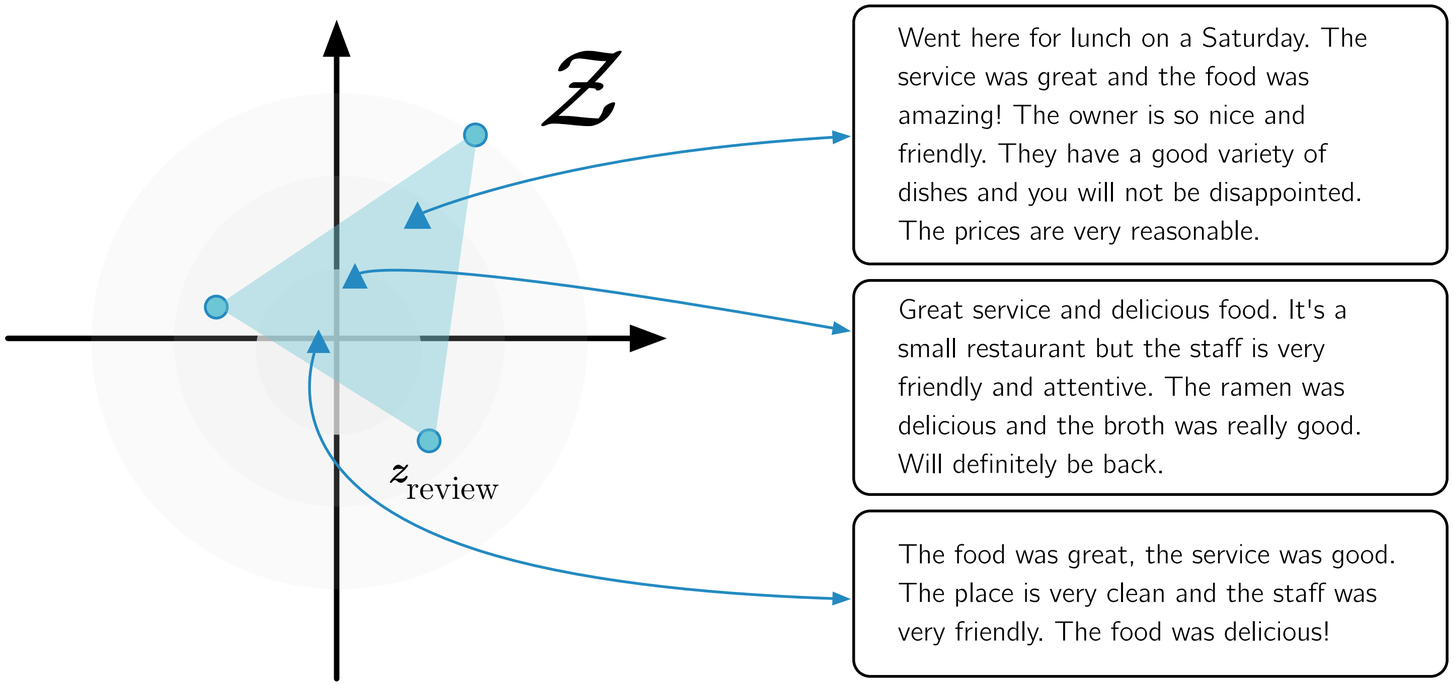

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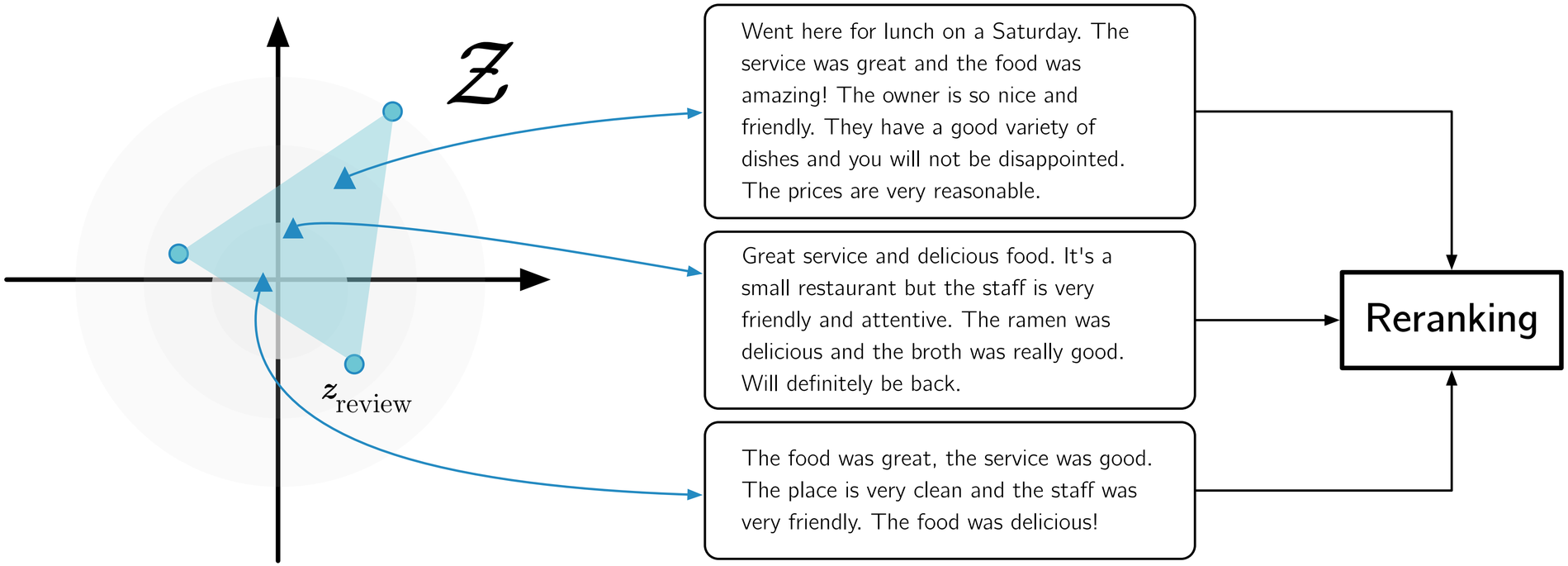

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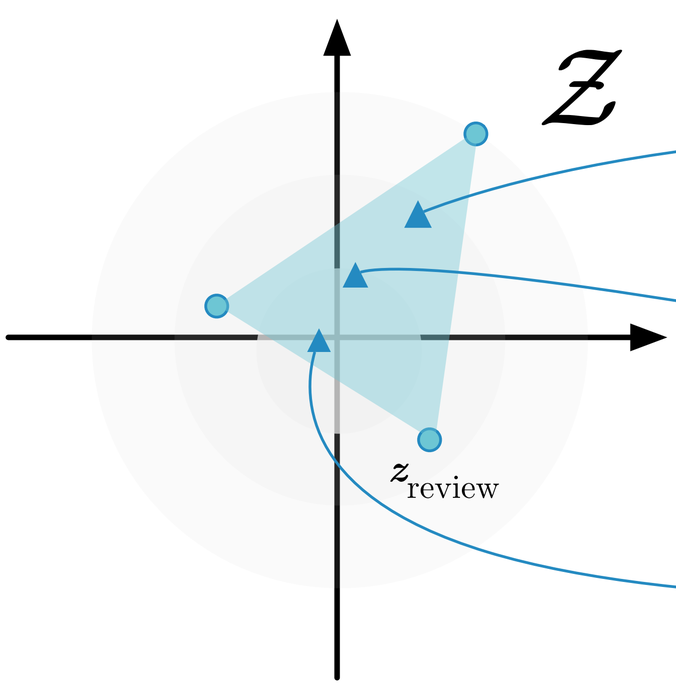

Latent space

Went here for lunch on a Saturday. The service was great and the food was amazing! The owner is so nice and friendly. They have a good variety of dishes and you will not be disappointed. The prices are very reasonable.

Great service and delicious food. It's a small restaurant but the staff is very friendly and attentive. The ramen was delicious and the broth was really good. Will definitely be back.

The food was great, the service was good. The place is very clean and the staff was very friendly. The food was delicious!

Reranking

👑

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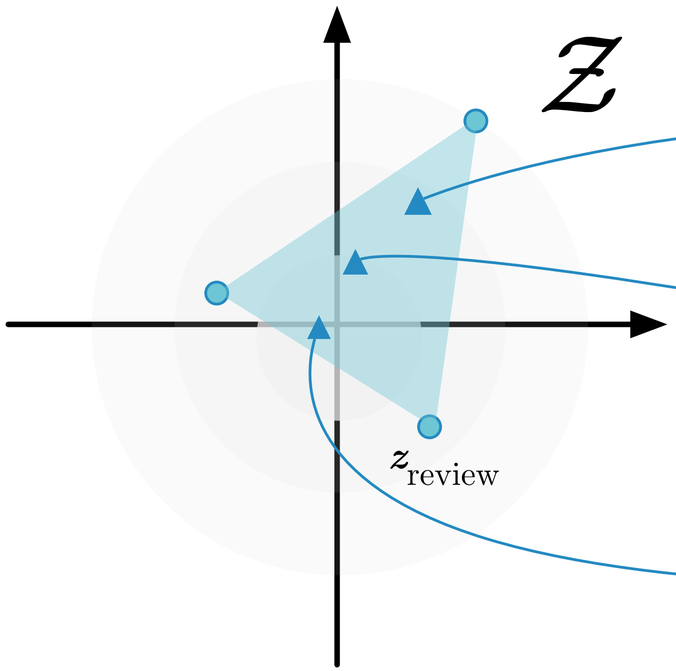

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Generate summaries from averaged vectors of all combinations of reviews

Reranking summaries by Input-output overlap

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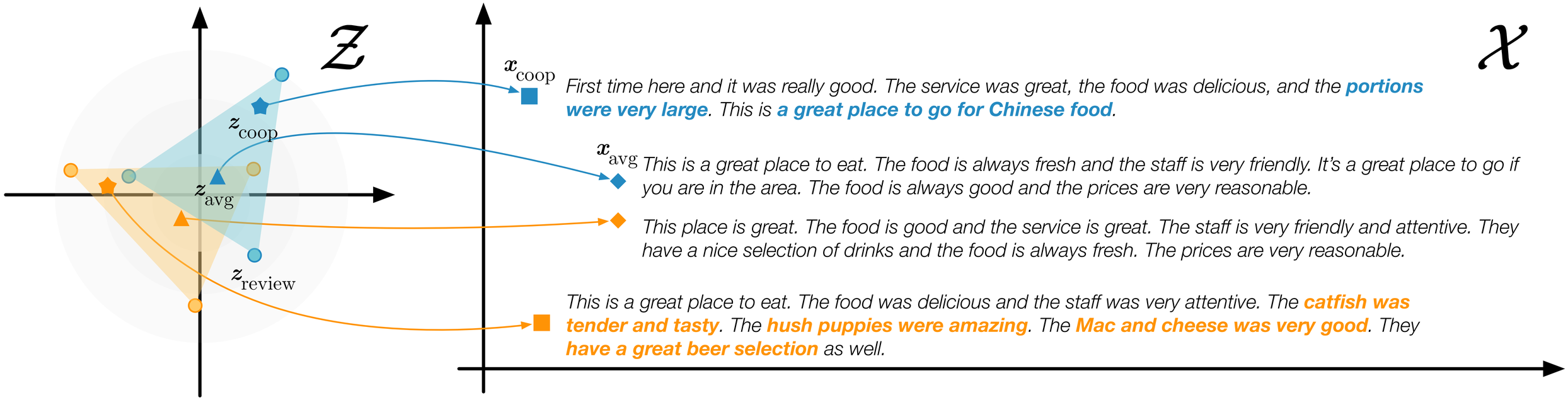


Results

Method	Yelp R1	Yelp R2	Yelp RL	Amazon R1	Amazon R2	Amazon RL	#Param
COOP							
👑 BIMEANVAE	**35.37**	**7.35**	**19.94**	**36.57**	**7.23**	**21.24**	13M
SimpleAvg							
BIMEANVAE	32.87	6.93	<u>19.89</u>	33.60	6.64	<u>20.87</u>	13M
MeanSum†	28.46	3.66	15.57	29.20	4.70	18.15	28M
CopyCat†	29.47	5.26	18.09	31.97	5.81	20.16	21M
Weakly Supervised							
PlanSum‡	<u>34.79</u>	<u>7.01</u>	19.74	32.87	6.12	19.05	

※BiMeanVAE: Text VAE (Bowman+, 2016) with BiLSTM and MeanPooling

Few lines to run VAE-based Summarizer!

```
# pip install git+https://github.com/megagonlabs/coop.git
from coop import VAE

# Automatically download from Huggingface🤗 model hub
vae = VAE("megagonlabs/bimeanvae-yelp")

# Encode List[str] into Tensor
reviews = [
    "I love this ramen shop!! Highly recommended!!",
    "Here is one of my favorite ramen places! You must try!"
]
zs = vae.encode(reviews) # Tensor: [num_reviews * latent_size]

# Averaging to summarize!
z = zs.mean(dim=0, keepdim=True)
vae.generate(zs)

# Output
['I love this place! Food is amazing!!']
```

https://github.com/megagonlabs/coop

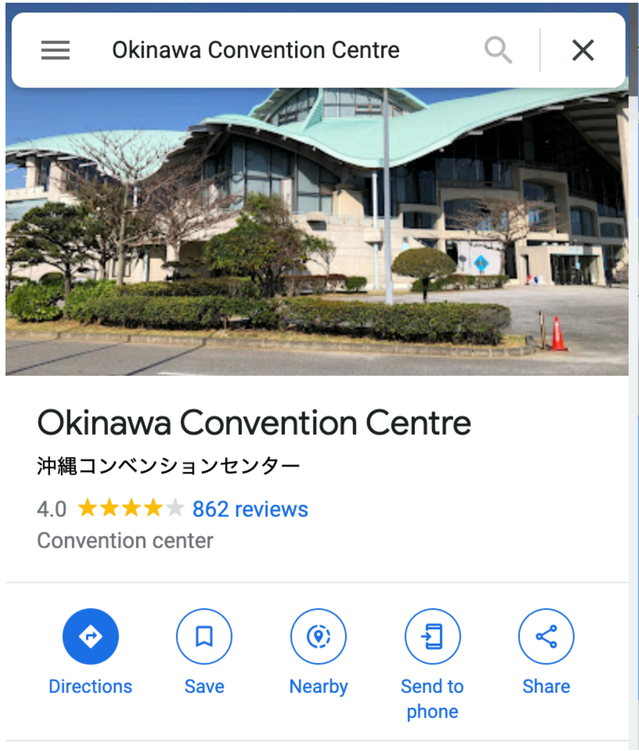
Outline

1. How to build a good opinion summarization system without training pairs

2. How to make it more comparable between entities

Comparison is the key in decision making process

Where should I stay for NLP2023??



Comparison is the key in decision making process

Laguna Garden Hotel Okinawa

ラグナガーデンホテル

4.2 ★★★★☆ 1,636 reviews · 4-star hotel

Directions Save Nearby Send to phone Share

CHECK AVAILABILITY

These two sound reasonable, but **which one should I pick?**

🤔

Moon Ocean Ginowan Hotel & Residence

ムーンオーシャン宜野湾 ホテル＆レジデンス

4.4 ★★★★½ 1,137 reviews · 4-star hotel

Directions Save Nearby Send to phone Share

CHECK AVAILABILITY

Single entity summarization models are not sufficient!

Laguna Garden Hotel Okinawa
ラグナガーデンホテル
4.2 ★★★★☆ 1,636 reviews · 4-star hotel

Directions Save Nearby Send to phone Share

CHECK AVAILABILITY

“Large and clean rooms with great views. Convenient location near city center.”

“Good location near city center and shopping. Rooms are large and clean. Rooms have views.”

Moon Ocean Ginowan Hotel & Residence
ムーンオーシャン宜野湾 ホテル＆レジデンス
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CHECK AVAILABILITY

Single entity summarization models often generates generic opinions

Summaries FAIL to include common/contrastive opinions

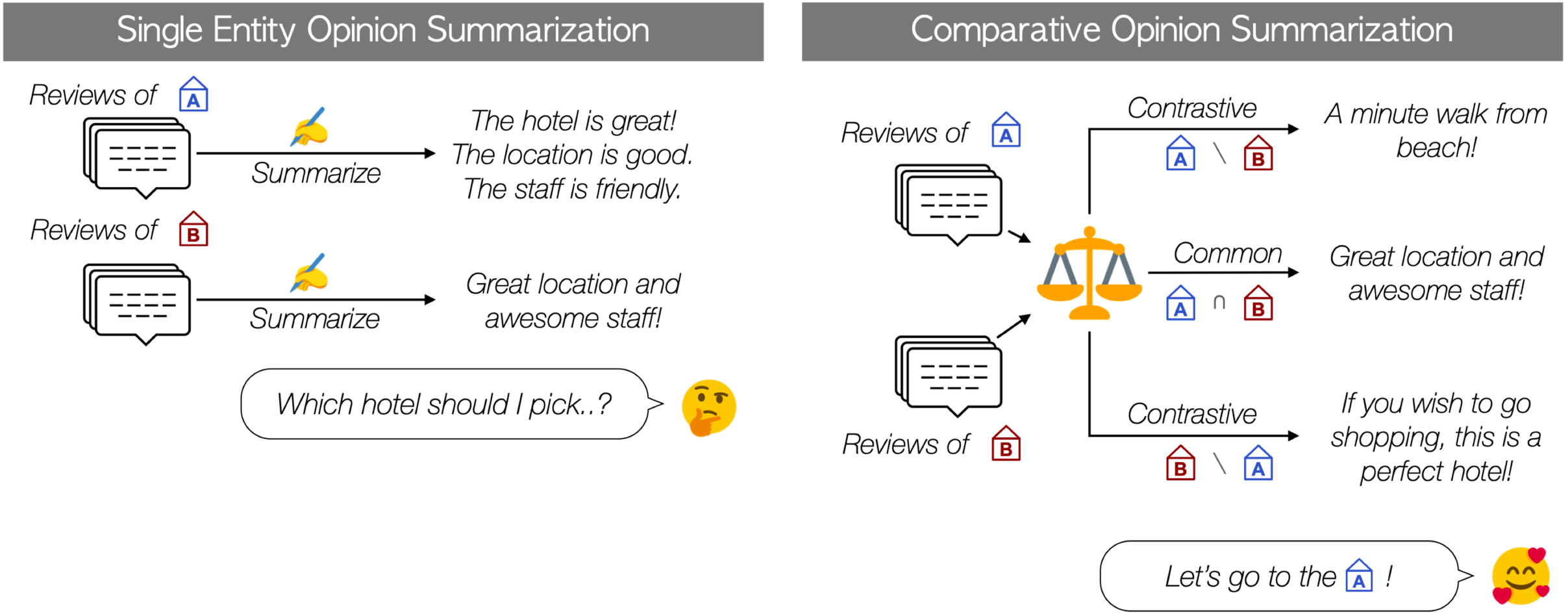
Contrastive summary contain many common opinions and vise versa.

Text highlighted refers to common opinions (Bad content)

This is a perfect hotel for any type of stay and you will want to keep coming back for the tranquillity, *unbeatable price* and the great service. This hotel is in a really bustling area of Rome and close to the main sights of the city. **The rooms in the hotel are a good size, with spacious bathrooms and even some really great chocolates on the bed.** The hotel staff are very helpful and always willing to help out with their polite manners. The breakfast provided by the hotel was really good, *although a little bit basic.* **The elevator in this hotel is a little bit old but it's in good condition.**

Text in blue refers to contrastive opinions (Good content)

Introducing *Comparative Opinion Summarization*



Use Collaborative-Decoding for summary generation

Input reviews for entity A

Single Entity Summarization Model

very good __

A. location? ✔
B. room?
C. service?

Use Collaborative-Decoding for summary generation

Input reviews for entity A

Single Entity Summarization Model

very good __

A. location? ✔
B. room?
C. service?

Problem: “very good location” may also appear in entity B’s reviews!

Use Collaborative-Decoding for summary generation

Input reviews for entity A

Single Entity Summarization Model

very good __

A. location? ✔
B. room?
C. service?

How do we know if "very good location" also appear in entity B or not?

Problem: "very good location" may also appear in entity B's reviews!

Use Collaborative-Decoding for summary generation

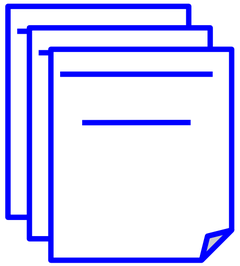
Input reviews for entity A

Single Entity Summarization Model

very good __

A. location?
B. room?
C. service?

Input reviews for entity B



Single Entity Summarization Model

very good __

A. location?
B. room?
C. service?

Use Collaborative-Decoding for sum

Input reviews for entity A

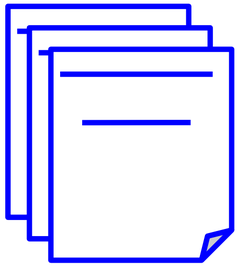
Single Entity Summarization Model

very good __

A. location?
B. room?
C. service?

“very good location” has high probability for both entity, so let’s skip it

Input reviews for entity B



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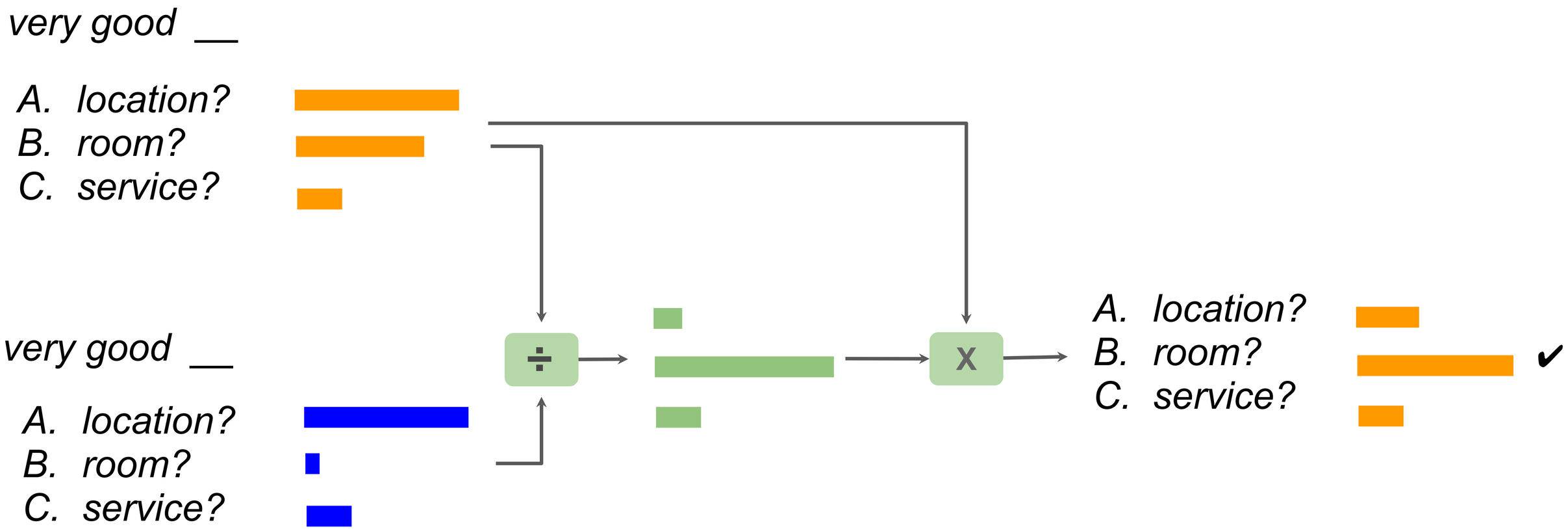

Use Collaborative-Decoding for summary generation

- Encourage models to produce contrastive summaries via the decoding step.

Automatic Evaluation on CoCoTrip

	BERTScore		Distinct. Score
	Contrastive	Common	
$\text{LexRank}_{\text{BERT}}$	20.51	24.83	65.56
OpinionDigest [2]	21.77	17.06	64.87
BiMeanVAE [1]	24.33	50.98	42.55
👑 **CoCoSum**	**35.63**	**61.52**	**74.02**
w/o Co-decoding	35.42	59.32	71.69

Dataset & Code are available!

https://github.com/megagonlabs/cocosum

Takeaways

- Autoencoder is a great model to build an opinion summarizer but keep in mind to choose a “good” summary vector

- Collaborative-Decoding is an inference time decoding algorithm that encourages generating more distinctive summaries