

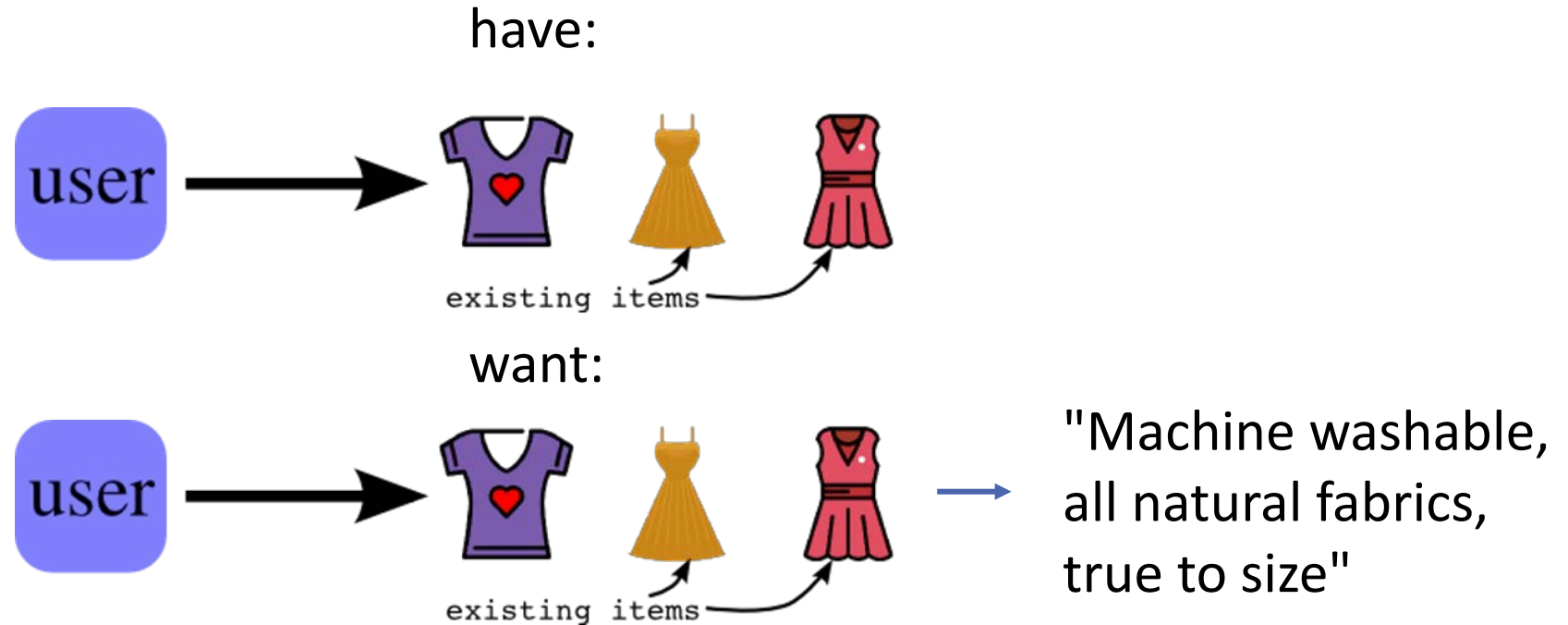
Justifying Recommendations using Distantly-Labeled Reviews and Fine- Grained Aspects

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Explainability



- Generate **explanations** of recommendations that focus on aspects a user cares about

Existing methods

- Template-based
 - Determine important features and fill in templates
 - *Ex1: Alice and 7 of your friend like this.*
 - *Ex2: You might be interested in documentary, on which this item performs well.*
- Retrieval-based
 - Select the relevant sentences from history reviews
 - *Ex: I agree with several others that this is a good companion to the movie.*
- Generation-based
 - Generate reviews/tips as explanations
 - *Ex: This is a very good movie.*

What are the challenges?


- Training data might not be appropriate
- Model needs more controllability and diversity


BESHOCK Ramen

(619) 501-9612

 915 reviews

\$\$ · Ramen, Sushi Bars

 Happy hour specials ⓘ

 Full bar

1288 Market St
East Village

“The boyfriend works at a bar just around the corner so we got to come in for dinner; something we have been meaning to do. We were greeted immediately walking in and sat by the...” [read more](#)

3. Tajima Ramen East Village

(619) 431-5820

 655 reviews

\$\$ · Ramen

901 E St
East Village

“Great **Ramen** , Great workers , & awesome customer service. Spicy Sesame **Ramen** is the way to go when visiting Tajima East Village.” [read more](#)



Building a justification dataset

Can we *automatically extract* good justifications from data?

Review 1:

First time trying this place out and I was kinda disappointed especially due to the great reviews this place has.. The sushi was pretty good and the ramen was ok... it could be better, i felt as though it was kinda bland.

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Review 1:

*First time trying this place out and I was kinda disappointed especially **due to the great reviews this place has.. The sushi was pretty good and the ramen was ok...** it could be better, i felt as though it was kinda bland.*

Dataset annotation

Reviews

First time trying this place out and I was kinda disappointed especially due to the great reviews this place has.. The sushi was pretty good and the ramen was ok...



Break

Elementary Discourse Units (EDUs)

*First time trying this place out
and I was kinda disappointed especially
due to the great reviews this place has..
The sushi was pretty good
and the ramen was ok...*

Dataset annotation

Reviews

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*First time trying this place out
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Filter



*First time trying this place out
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Dataset annotation

Reviews

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*First time trying this place out
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Label



*First time trying this place out
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Dataset annotation

Reviews

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Elementary Discourse Units (EDUs)

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Annotators label 2000 EDUs (kappa = 0.927)

- ★ *First time trying this place out*
- ★ *due to the great reviews this place has..*
- ★ *The sushi was pretty good*
- ★ *and the ramen was ok...*

Label



Filter



*First time trying this place out
due to the great reviews this place has..
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Dataset expansion

Train off-the shelf classifiers on the small annotated dataset

Method	F1	Recall	Precision
BOW-Xgboost	0.559	0.679	0.475
CNN	0.644	0.596	0.700
LSTM-MaxPool	0.675	0.703	0.650
BERT	0.747	0.700	0.800
BERT-SA (one epoch)	0.481	0.975	0.320
BERT-SA (three epoch)	0.491	1.000	0.325

BERT trained for Sentiment
Analysis

Aspect extraction

The tuna is pretty amazing

Appetizers and pasta are excellent here

Great shirt, especially for the price

The quality of the material is great

Aspect extraction

The tuna is pretty amazing

tuna

Appetizers and pasta are excellent here

appetizers, pasta

Great shirt, especially for the price

shirt, price

The quality of the material is great

quality, material

Conditional generation

How to leverage previous user textual interactions?



User profile

Great burgers but amazing salads here

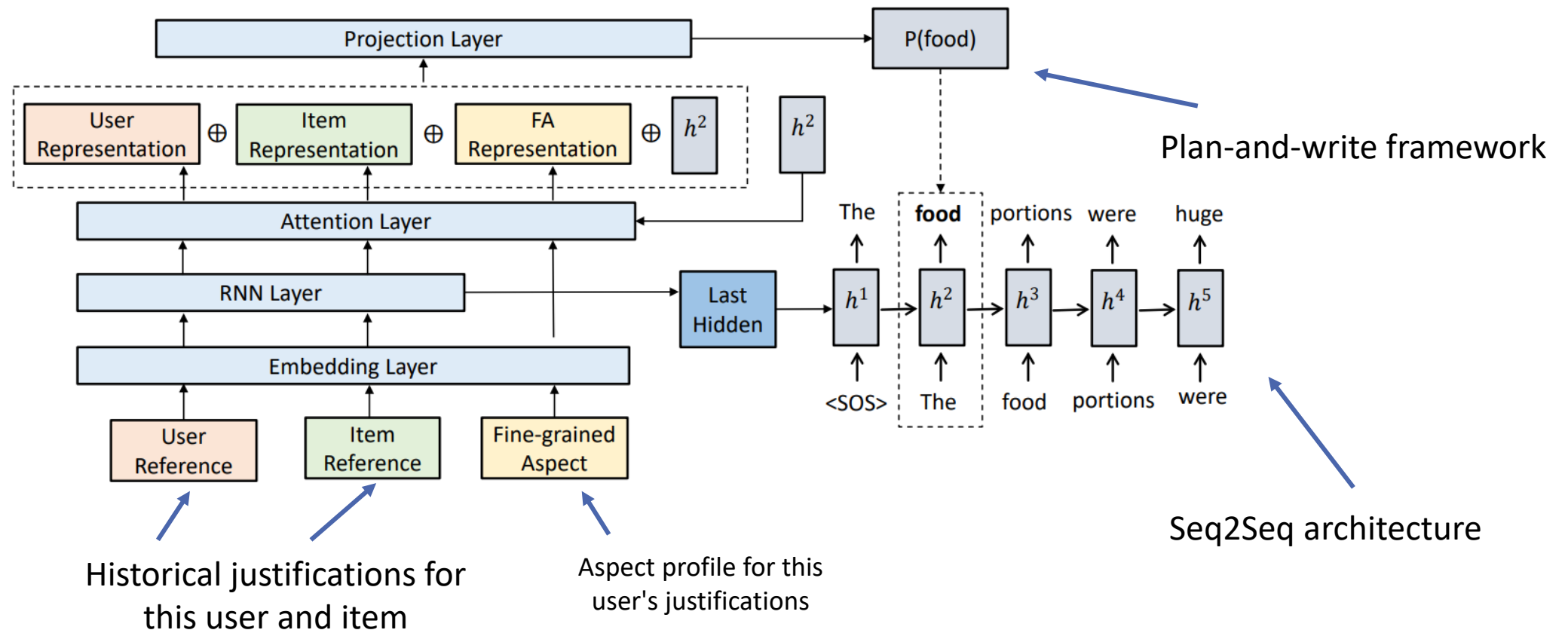
Best croissant sandwich ever !!!

Staff is super friendly and very informative .

This place has some of the best burgers!

$P(\text{justification} \mid \text{user_history, item history})$

Generation model



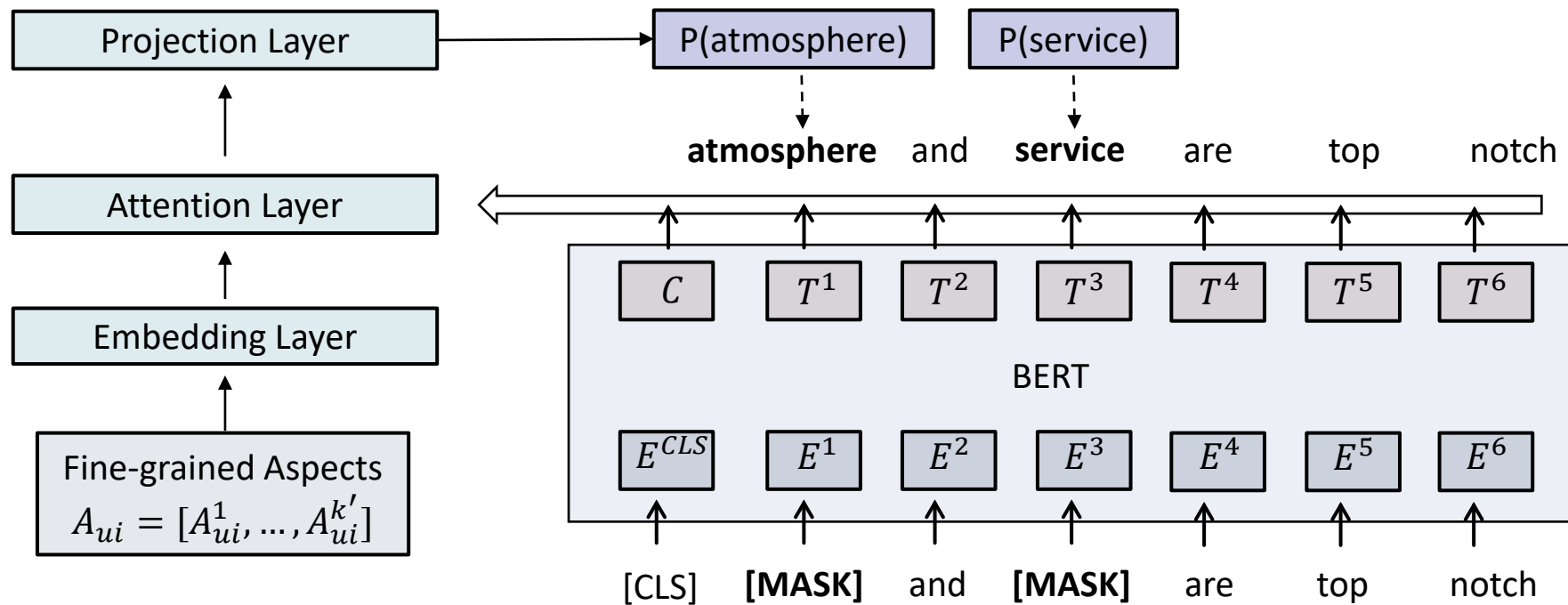
Decoding strategies

Compare different strategies and the impact of generation diversity

- Beam search
- Top-k sampling

Aspect conditional masked language model

Fine-tuned BERT on domain-specific text where aspect terms are masked (at a higher rate than other tokens)



Sampling

Start from an aspect-masked historical justification, repeatedly mask on token and sample, until convergence

Iteration	Generated sentence
Iter 0	universe [MASK] is extremely friendly and persona ##ble
Iter 5	<u>the</u> [MASK] is extremely friendly and persona ##ble
Iter 10	the [MASK] is extremely friendly and persona ##ble
Iter 15	the <u>staff</u> are extremely <u>cool</u> and persona ##ble
Iter 20	the staff are <u>extra kind</u> , persona ##ble

Datasets



Dataset	Train	Dev	Test	# of users	# of items	# of aspects
Yelp	1.220 M	115.9 K	115.9 K	115.9 K	51.9 K	2,041
Amazon Electronics	0.202 M	57.9 K	57.9 K	57.9 K	59.0 K	581

Automatic evaluation

- Trade-off between BLEU and Distinct metric

Dataset	Yelp				Amazon Clothing			
Model	BLEU-3	BLEU-4	Distinct-1	Distinct-2	BLEU-3	BLEU-4	Distinct-1	Distinct-2
Item-Rand	0.440	0.150	2.766	20.151	1.620	0.680	2.400	11.853
LexRank	2.290	0.920	1.738	8.509	3.480	2.250	2.407	14.956
Attr2seq	7.890	0.000	0.049	0.095	1.720	0.560	0.076	0.352
Ref2Seq	4.380	2.450	0.188	1.163	8.780	5.670	0.141	1.240
AP-Ref2Seq	3.390	1.830	0.326	2.094	13.910	12.500	0.557	3.661
Ref2Seq (Top-k)	1.630	0.700	0.818	11.927	3.960	2.130	0.697	10.858
ACMLM	0.700	0.280	1.322	14.319	2.420	1.590	0.942	9.312

Some examples

Model	Shake Shack	Teharu Sushi
Ground Truth	The burger was good	The rolls are pretty great , typical rolls not that many specials
Lex Rank Short	A great burger and fries.	Sushi ? Long but general
Ref2Seq (Review)	i love trader joe 's , i love trader joe 's	the food was good and the service was great

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Ref2Seq	this place has some of the best burgers	the sushi is delicious

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Ref2Seq (Review)	i love trader joe 's , i love trader joe 's	the food was good and the service was great
Ref2Seq	this place has some of the best burgers	the sushi is delicious
Ref2Seq (Top K)	the fries are amazing	fresh and delicious sushi
ACMLM	breakfast sandwiches are overall very filling	overall fun experience with half price sushi

Thanks!

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- Dataset and Code

https://github.com/nijianmo/recsys_justification

- We have released a new Amazon Review Dataset (2018)!!!

<https://nijianmo.github.io/amazon/index.html>