KGR[4]: Retrieval, Retrospect, Refine and Rethink for Commonsense Generation

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- Commonsense Generation

Concept-Set: a collection of objects/actions.

dog, frisbee, catch, throw

Generative Commonsense Reasoning

Expected Output: everyday scenarios covering all given concepts.

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- The dog catches the frisbee when the boy throws it.
- A man throws away his dog 's favorite frisbee expecting him to catch it in the air.

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[Machines]

GPT2: A dog throws a frisbee at a football player.

UniLM: Two dogs are throwing frisbees at each other .

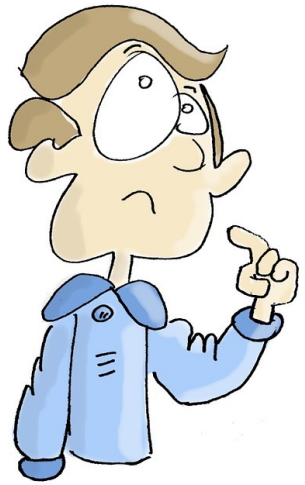
BART: A dog throws a frisbee and a dog catches it.

T5: dog catches a frisbee and throws it to a dog

Motivation

- Suppose a user write a sentence mentioning the given sentences.

hand, sink, wash, soap



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R1: A man is washing his hands in a bathroom sink.
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edit

copy

Edited: A man is washing his hands with soap in a sink with soap.
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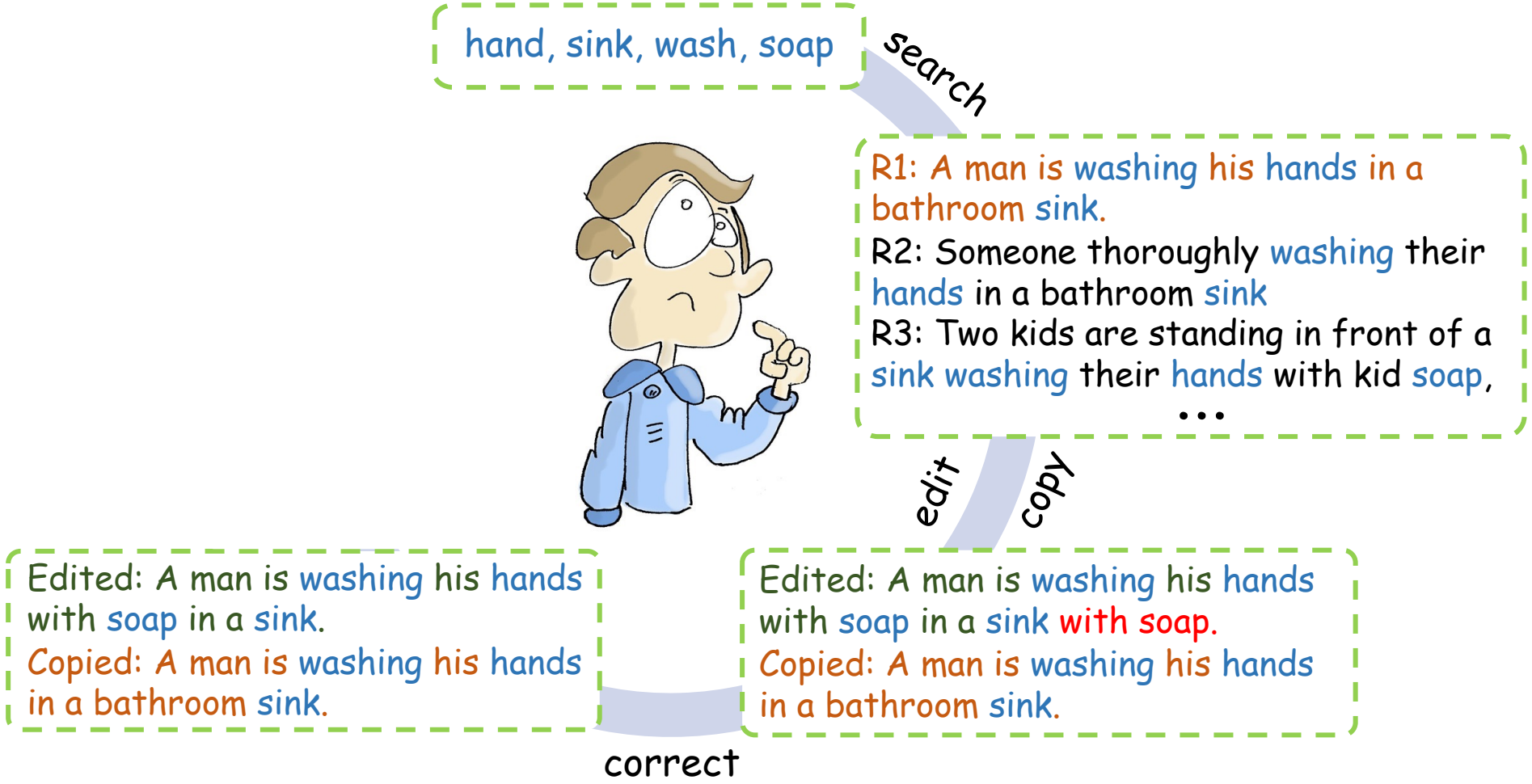

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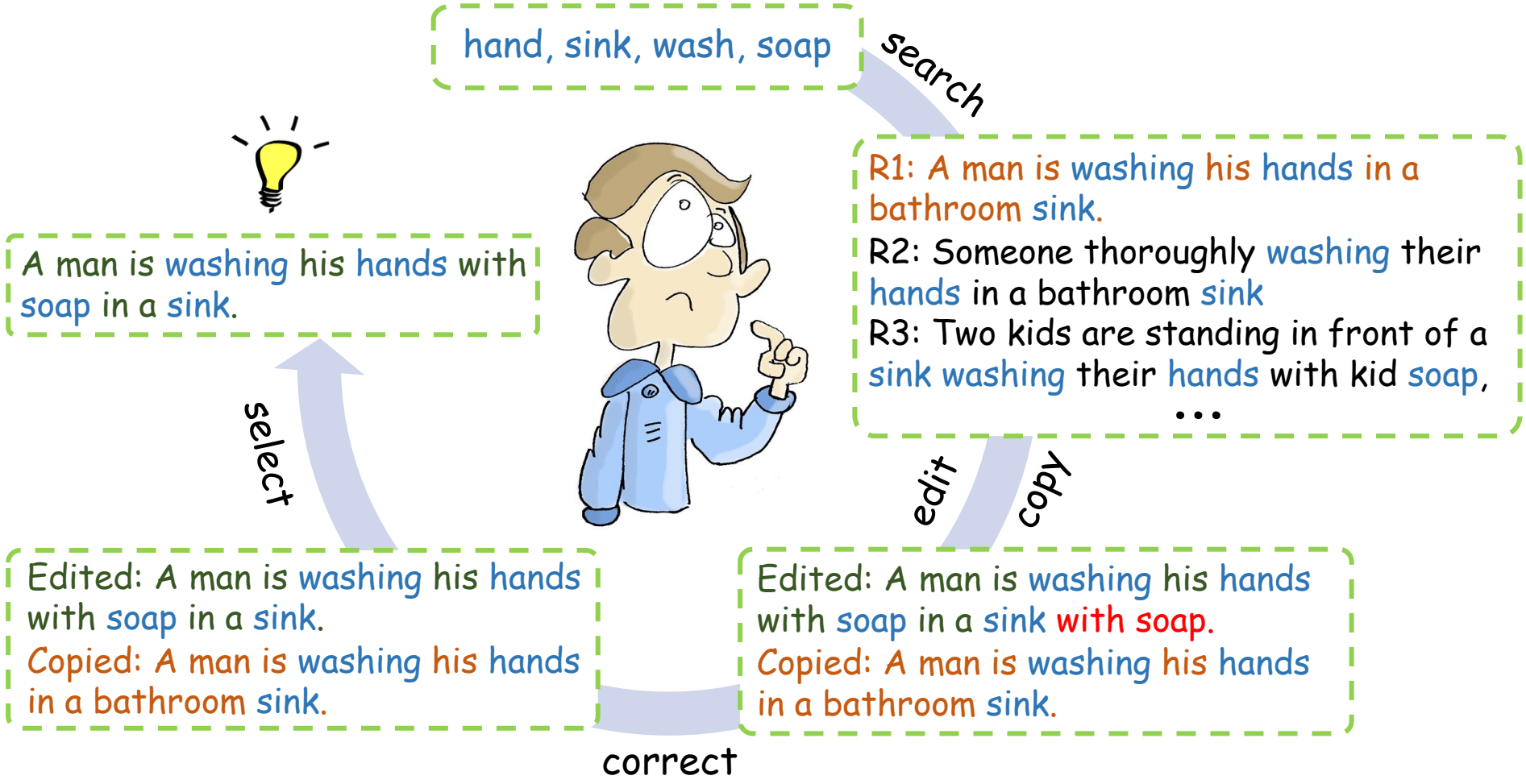

Framework

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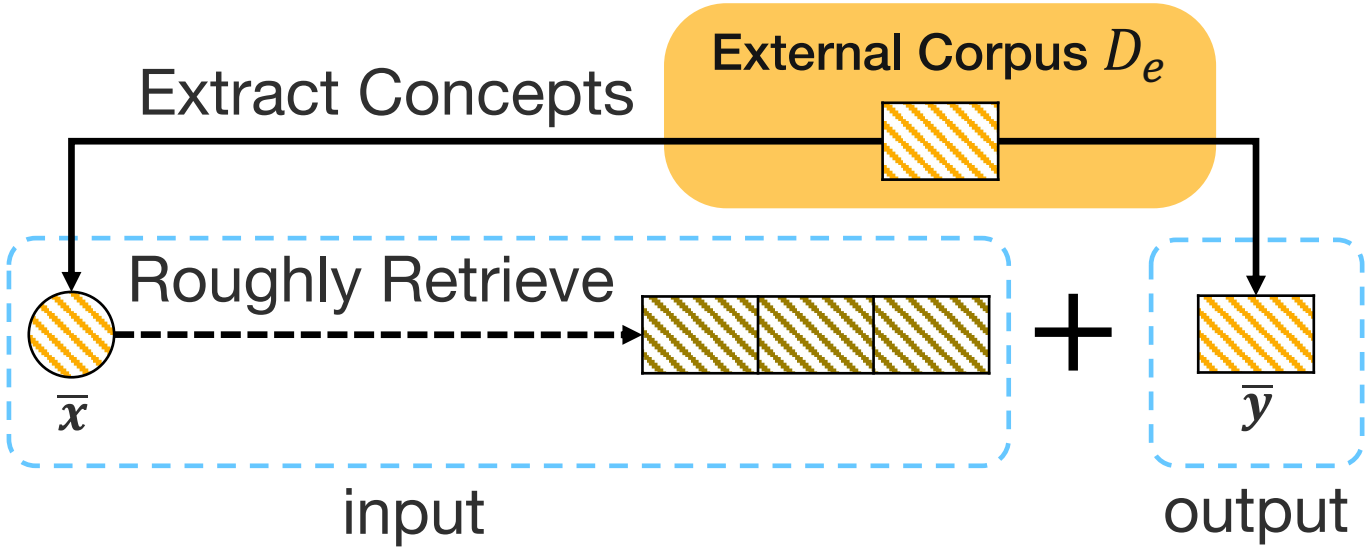
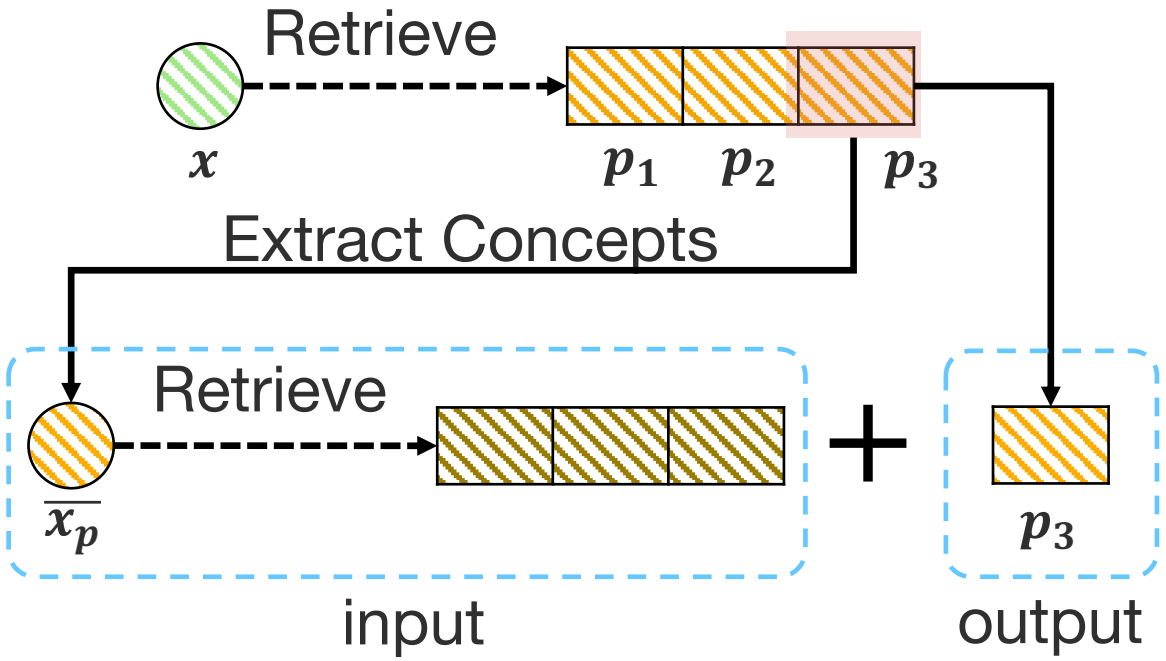


Pretraining

Framework

- KGR[4]: Retrieval, Retrospect, Refine and Rethink for Commonsense Generation.



Retrospective Augmentation

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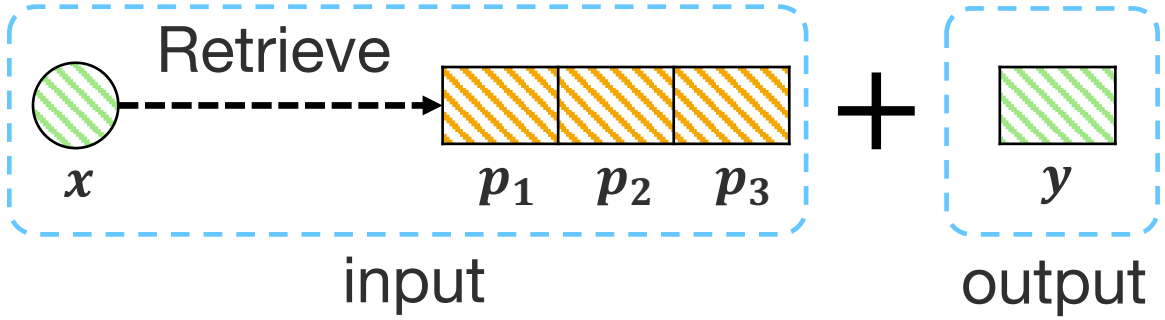
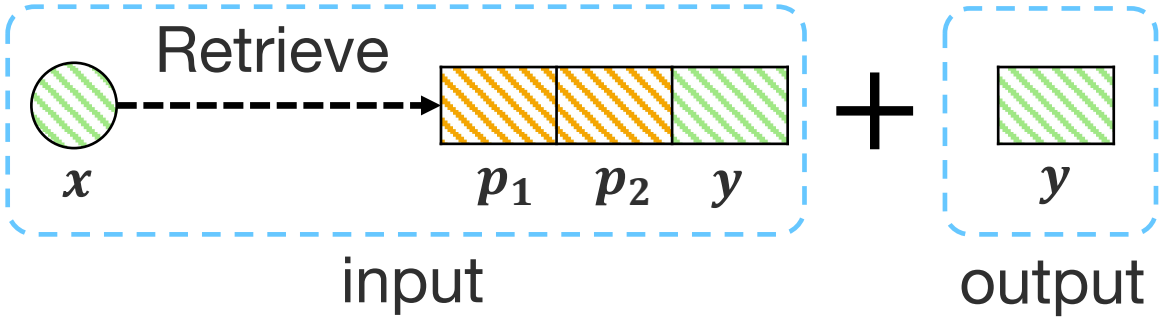


Retrospective Training (Edit)



Retrospective Training (Copy)

$$\mathcal{L}_G^{ft} = (1-\lambda)\mathcal{L}_{edit} + \lambda\mathcal{L}_{copy},$$

$$\mathcal{L}_{edit} = -\sum_{t=1}^{|\boldsymbol{y}|} \log p(y_t|\boldsymbol{x}, \{\boldsymbol{p_1}, \boldsymbol{p_2}, \boldsymbol{p_3}\}, \boldsymbol{y}_{<t}),$$

$$\mathcal{L}_{copy} = -\sum_{t=1}^{|\boldsymbol{y}|} \log p(y_t|\boldsymbol{x}, \{\boldsymbol{p_1}, \boldsymbol{p_2}, \boldsymbol{y}\}, \boldsymbol{y}_{<t}),$$

Framework

- KGR^4: Retrieval, Retrospect, Refine and Rethink for Commonsense Generation.
  - Generate perturbed sentences according to two types of errors:
    1. Repetition Error: *in a sink a sink*
    2. Misspelling: *wsh hands* and *washhands*
  - Train the BART-based Refiner following denoising auto-encoding training objective:

$$\mathcal{L}_R = -\log p(\bar{\boldsymbol{y}}|\hat{\boldsymbol{y}}) = -\sum_{t=1}^{|\bar{\boldsymbol{y}}|} \log p(\bar{y}_t|\hat{\boldsymbol{y}}, \bar{\boldsymbol{y}}_{<t})$$

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  - Reuse the scorer at Retrieval stage to select the best sentence among those produced by generators with various λ.

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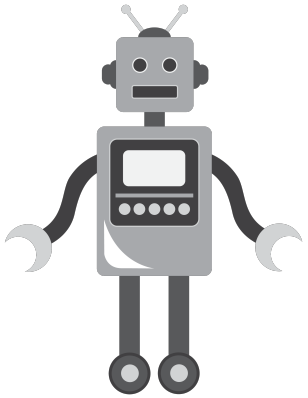

hand, sink, wash, soap

Retrieval

P1: A man is washing his hands in a bathroom sink.
P2: Someone thoroughly washing their hands with soap in a bathroom sink
P3: Two kids are standing in front of a sink washing their hands with kid soap,
...

Retrospect

Edited: A man is washing his hands with soap in a sink with soap.
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Refine

Edited: A man is washing his hands with soap in a sink.
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Rethink

A man is washing his hands with soap in a sink.

Experiments

Model	BLEU-4(lb)	CIDEr(lb)	**SPICE(lb)**	SPICE(v1.0)
GPT-2 (Radford et al. 2019)	26.833	12.187	23.567	25.90
BERT-Gen (Bao et al. 2020)	23.468	12.606	24.822	27.30
UniLM (Dong et al. 2019)	30.616	14.889	27.429	30.20
BART (Lewis et al. 2020)	31.827	13.976	27.995	30.60
T5-base (Raffel et al. 2020b)	18.546	9.399	19.871	22.00
T5-large (Raffel et al. 2020b)	31.962	15.128	28.855	31.60
EKI-BART (Fan et al. 2020)	35.945	16.999	29.583	32.40
KG-BART (Liu et al. 2021)	33.867	16.927	29.634	32.70
CALM(T5-base) (Zhou et al. 2021)	-	-	-	33.00
RE-T5 (Wang et al. 2021)	40.863	17.663	31.079	34.30
KGR[4]	**42.818**	**18.423**	**33.564**	**39.70**

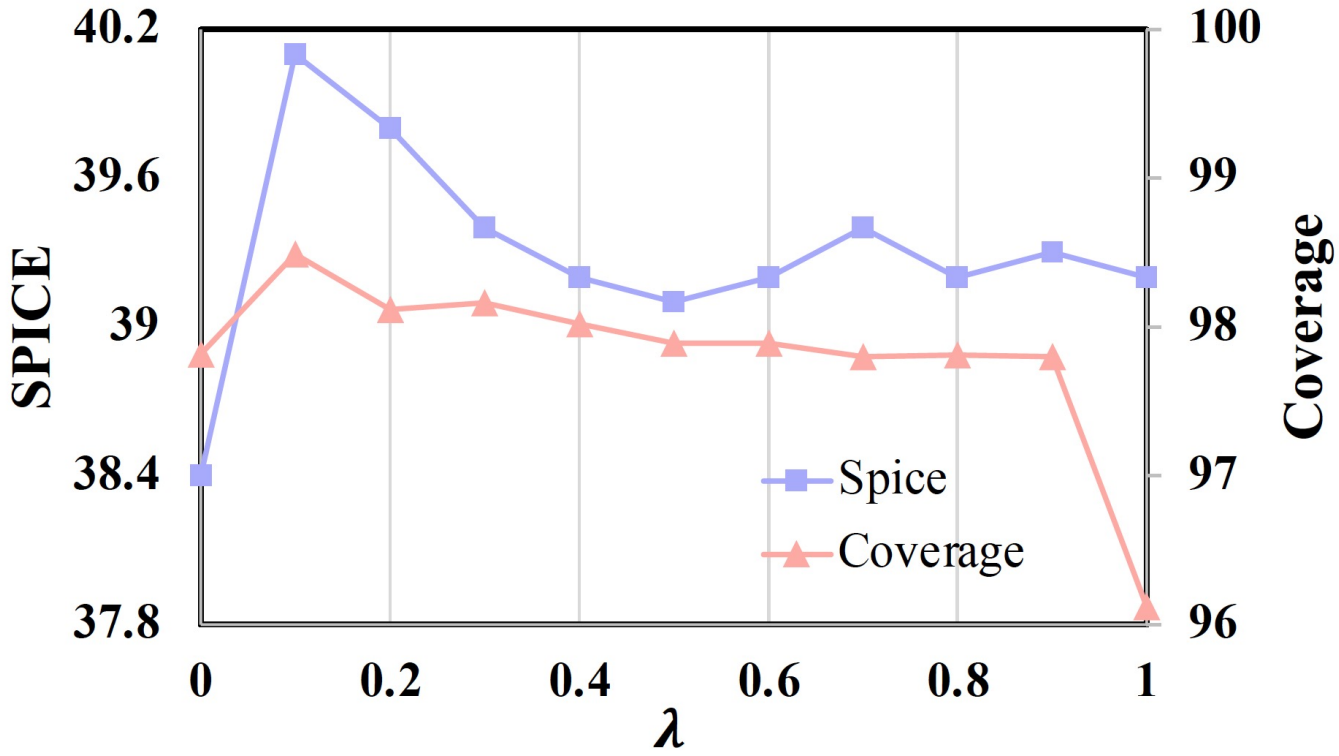
Overall Performance

model	SPICE(v1.0)
BART	30.60
+pretraining	33.10
+retrieval	36.60
+retrospective training	38.30
+retrospective augmentation	39.20
+refine	39.40
+rethink	**39.70**

Ablation Study

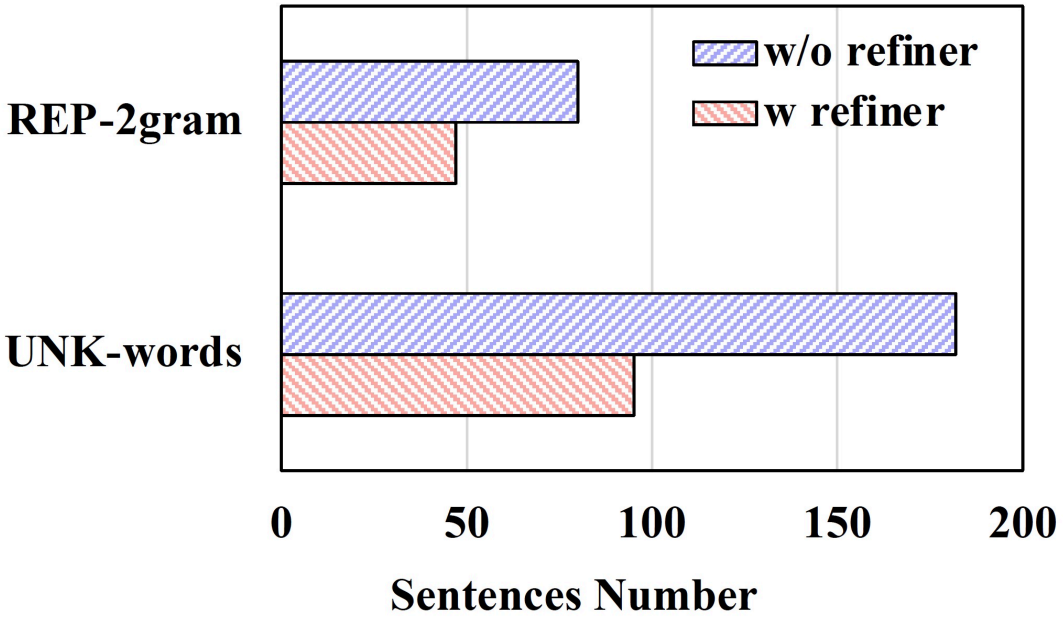
Experiments

- Effect of Hyper-parameter λ



Experiments

- Impact of the Refine Stage



w/o refiner:
A *dog splashes* through a *puddle* of *water* in a *puddle* in the *rain* .
w refiner:
A *dog splashes* through a *puddle* of *water* in the *rain* .

w/o refiner:
Bearded manin white shirt *demonstrates steps* to *tying necktie*.
w refiner:
Bearded man in white shirt *demonstrates steps* to *tying necktie*.

THANK YOU!

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