

Dec 6, 2021

Annual meeting of AAMT

Learning to Describe Unknown Phrases with Local and Global Contexts

Shonosuke Ishiwatari^{1*}, Hiroaki Hayashi², Naoki Yoshinaga¹, Graham Neubig²

Shoetsu Sato¹, Masashi Toyoda¹, and Masaru Kitsuregawa¹

1



THE UNIVERSITY OF TOKYO

2



Carnegie Mellon University

Language Technologies Institute

* Moved to Mantra Inc. at Apr. 2020



New/unfamiliar phrases avoid us reading / translating smoothly



... I was in 3rd grade during the **sonic boom** tour; one...



sonic boom |'sänik bööm| noun
a loud explosive noise caused by the shock wave from an aircraft traveling faster than the speed of sound.



How do human infer the meanings?

STEP1: Search web to find other usages



“sonic boom” 🔍



... that a **sonic boom** happens ...
... the **sonic boom** kick-off concert ...
... planes cause **sonic boom** when ...
... albums are “**sonic boom**” and ...
... for the **sonic boom** bonus disc ...

STEP2: Classify the usages

... that a **sonic boom** happens ...
... the **sonic boom** kick-off concert ...
... planes cause **sonic boom** when ...
... albums are “**sonic boom**” and ...
... for the **sonic boom** bonus disc ...

Related to natural
phenomenon?

Related to
music?



How do human infer the meanings?

STEP1: Search web to find other usages



“sonic boom” 🔍



... that a **sonic boom** happens ...
... the **sonic boom** kick-off concert ...
... planes cause **sonic boom** when ...
... albums are “**sonic boom**” and ...
... for the **sonic boom** bonus disc ...

STEP2: Classify the usages

... that a **sonic boom** happens ...
... the **sonic boom** kick-off concert ...
... planes cause **sonic boom** when ...
... albums are “**sonic boom**” and ...
... for the **sonic boom** bonus disc ...

STEP3: Interpret them

... I was in 3rd grade during the **sonic boom** tour; one...



An album
by KISS?

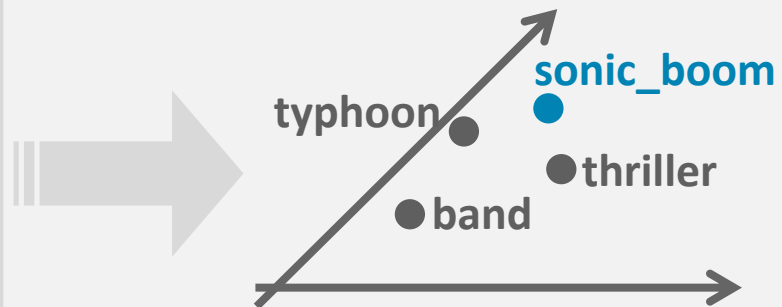




RQ: Can machines help us infer the meanings?

STEP1: Map the **usages** to vector space

... that a **sonic boom** happens ...
... the **sonic boom** kick-off concert ...
... planes cause **sonic boom** when ...
... albums are "**sonic boom**" and ...
... for the **sonic boom** bonus disc ...



STEP2: Describe the **target phrase** reading the **context**

Input: ... I was in 3rd grade **during** the **sonic_boom** **tour**...



Output: Album by KISS.





Contributions

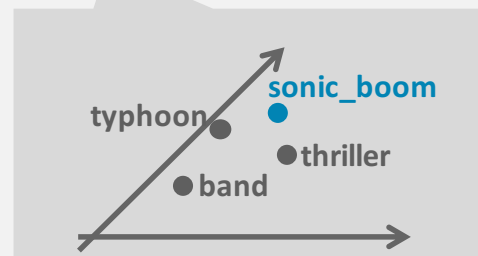
1. Context-aware description generation task

- **Large-scale dataset:** 989k entries
- **Multi-domain:** name of places, movies, persons, ...
- **Various expressions:** phrases as well as words

2. Description generation model which

- achieves **SOTA** performances on 4 datasets
- combines local & global context dynamically

... the **sonic_boom** tour ...





Task: Context-aware description generation

- **WPDD: Wikipedia Phrase Description Dataset**

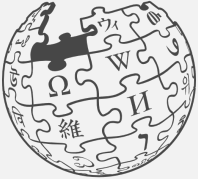
Phrase:	sonic boom
Context:	This tour is the first official tour to support the band's latest studio effort, 2009's [TRG] .
Description:	album by Kiss



Can we make this dataset automatically?



Idea: Combine Wikipedia & Wikidata



Article: *Kiss Sonic Boom Over Europe*

... This tour is the first official tour to support the band's latest studio effort, 2009's Sonic Boom. ...



Item: *Sonic Boom* (Q908201)

Description: album by Kiss
Instance of: album
Genre: hard rock

Extracted Data

Phrase:	sonic boom
Context:	This tour is the first official tour to support the band's latest studio effort, 2009's [TRG].
Description:	album by Kiss



Contributions

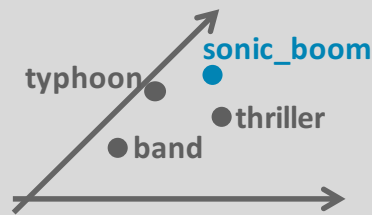
1. Context-aware description generation task

- **Large-scale:** 989k entries
- **Multi-domain:** name of places, movies, persons, ...
- **Various expressions:** phrases as well as words

2. Description generation model which

- achieves **SOTA** performances on 4 datasets
- combines local & global context dynamically

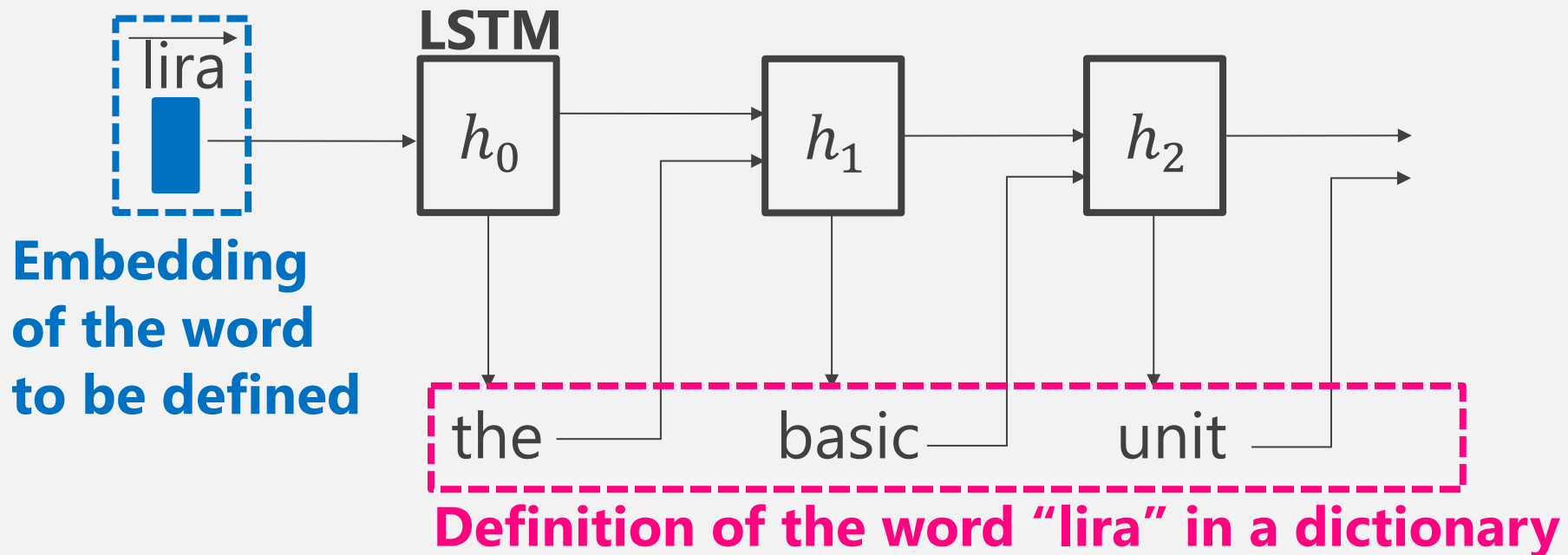
... the **sonic_boom** tour ...





Baseline: Definition-generation [Noraset+ 17]

- Seed-feeding to condition LSTM language model

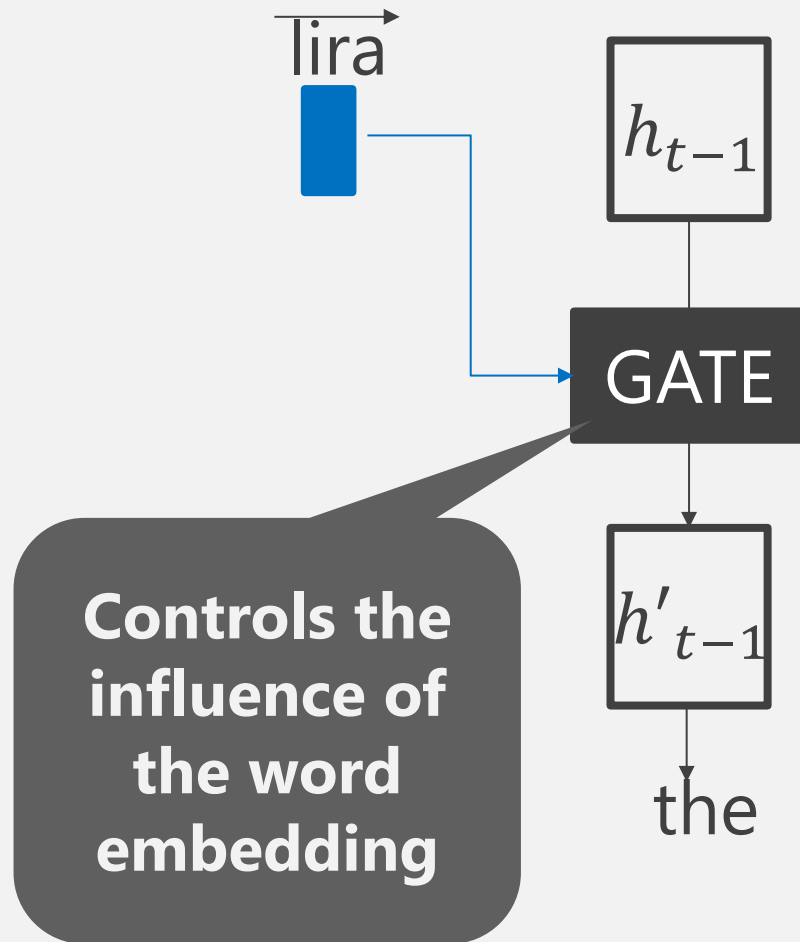


The input embedding loses its influence as the definition becomes longer



Baseline: Definition-generation [Noraset+ 17]

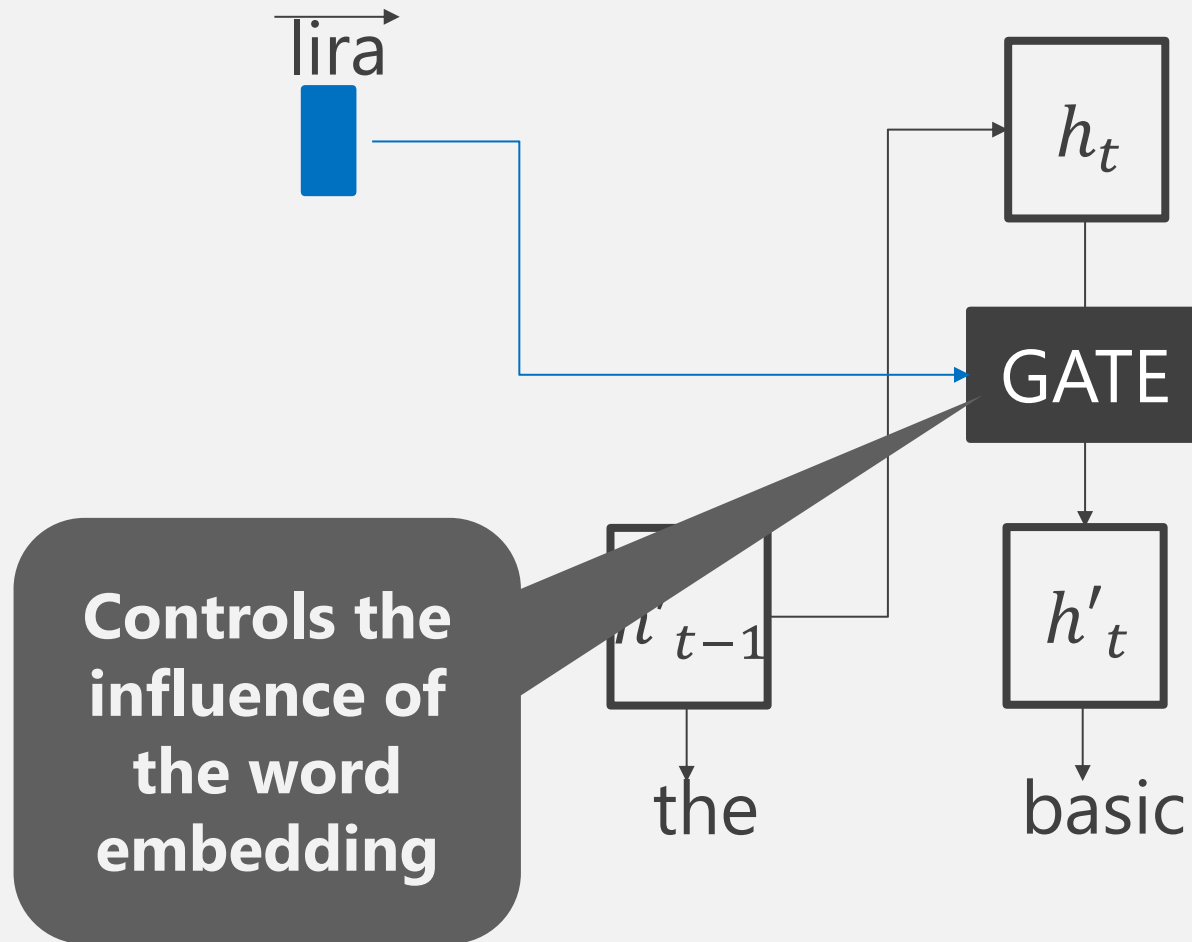
- Seed-feeding + Gate function





Baseline: Definition-generation [Noraset+ 17]

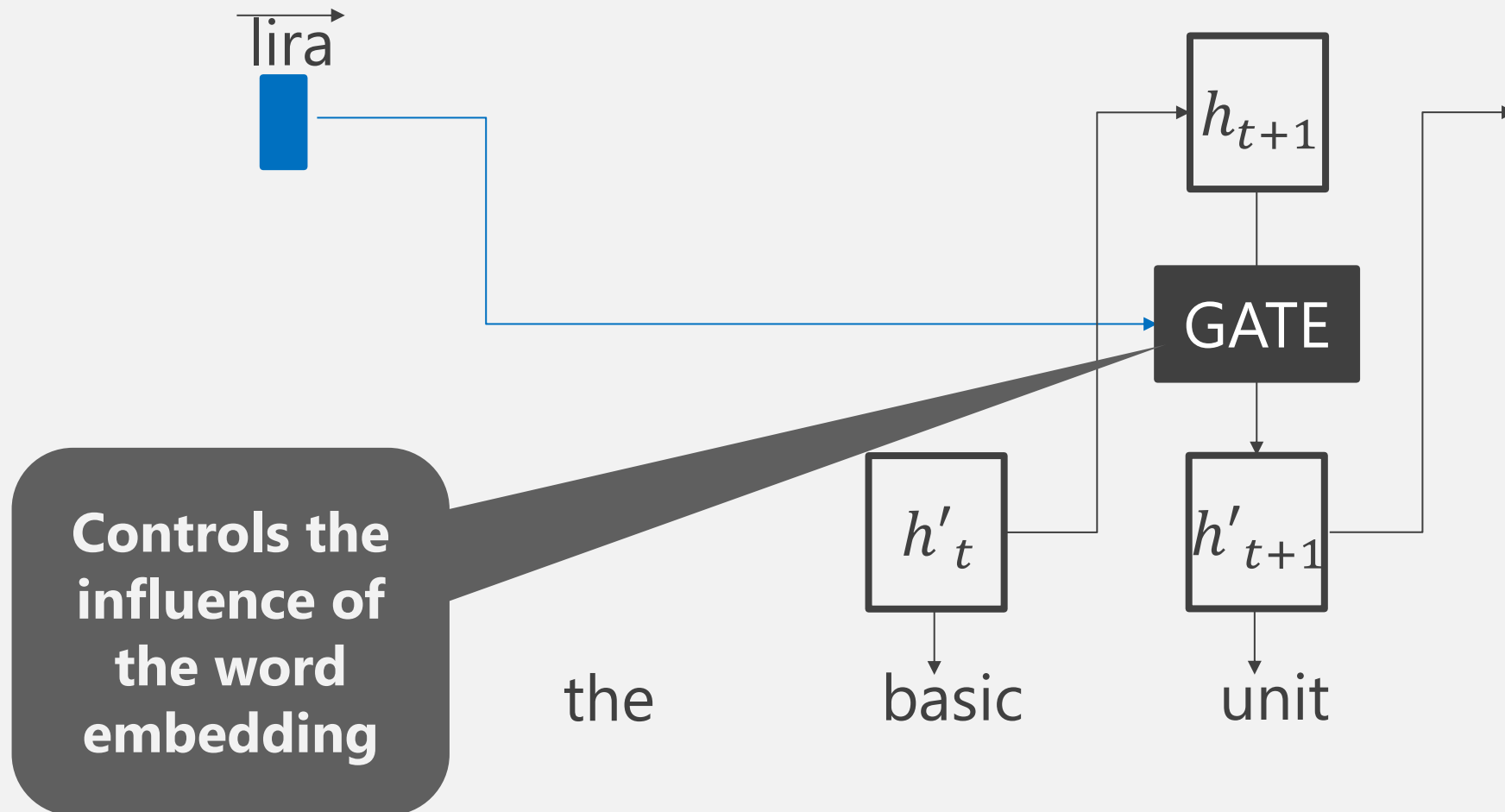
- Seed-feeding + Gate function





Baseline: Definition-generation [Noraset+ 17]

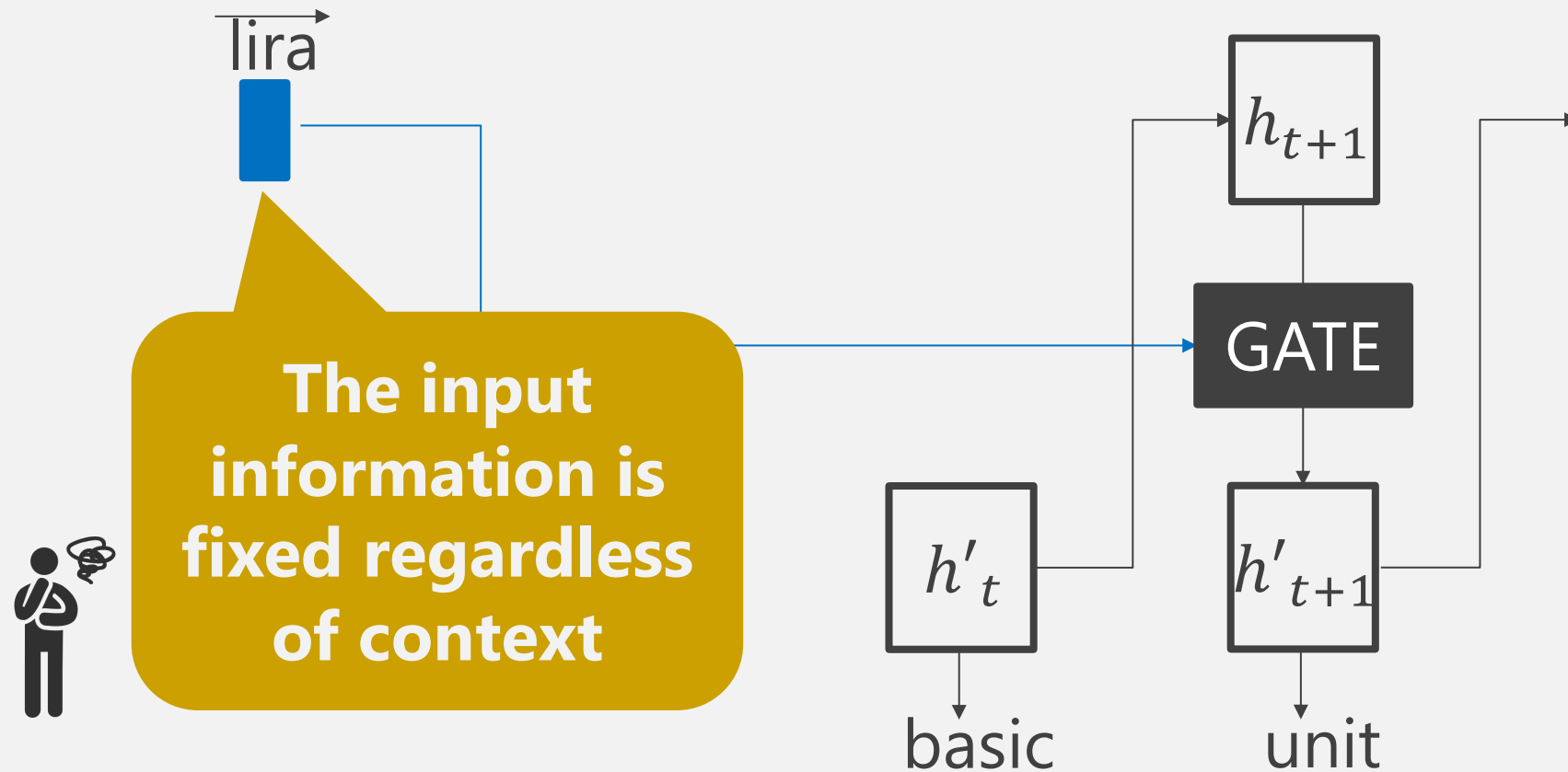
- Seed-feeding + Gate function





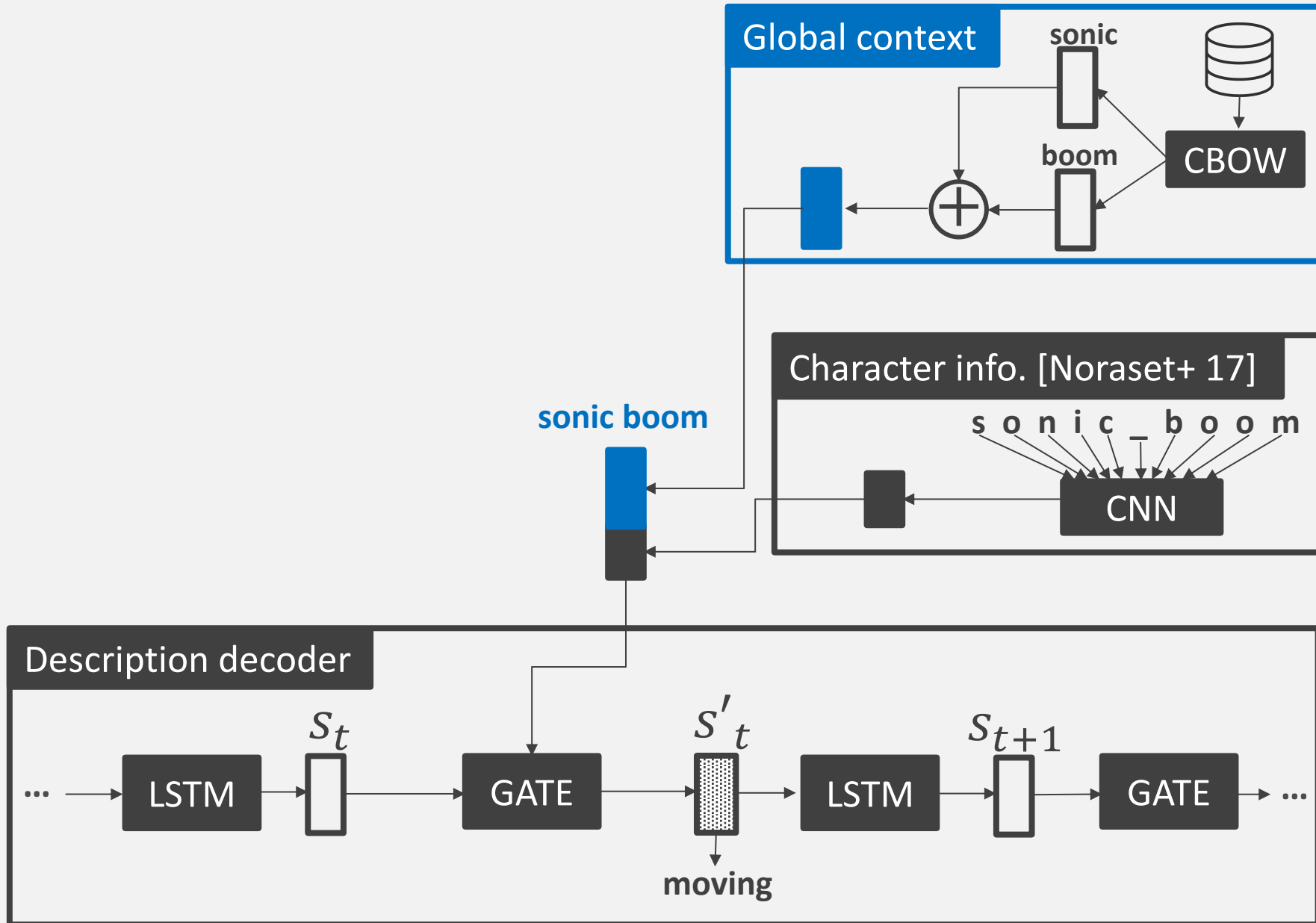
Baseline: Definition-generation [Noraset+ 17]

- Seed-feeding + Gate function



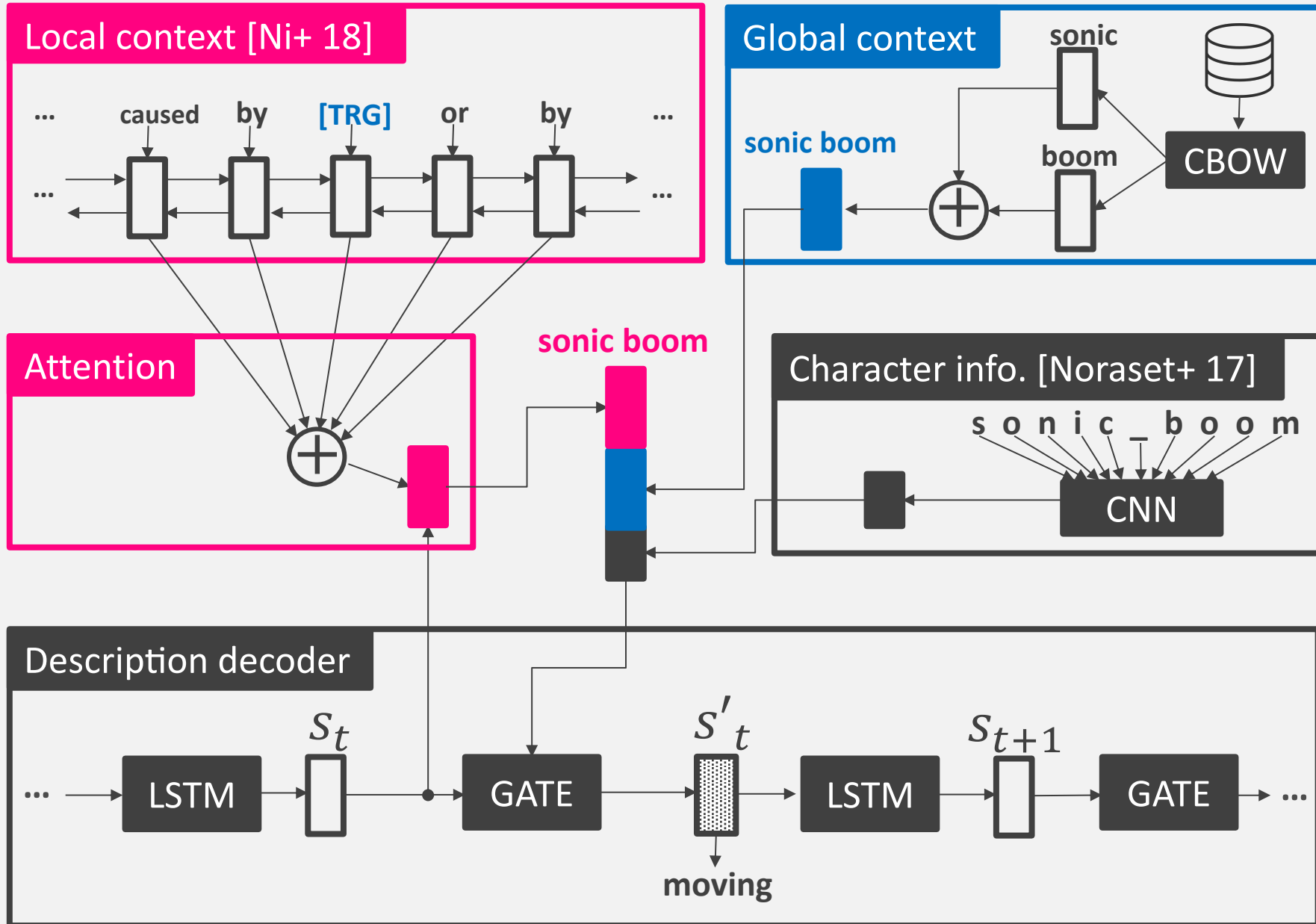


Proposed: Local & Global Context-aware model



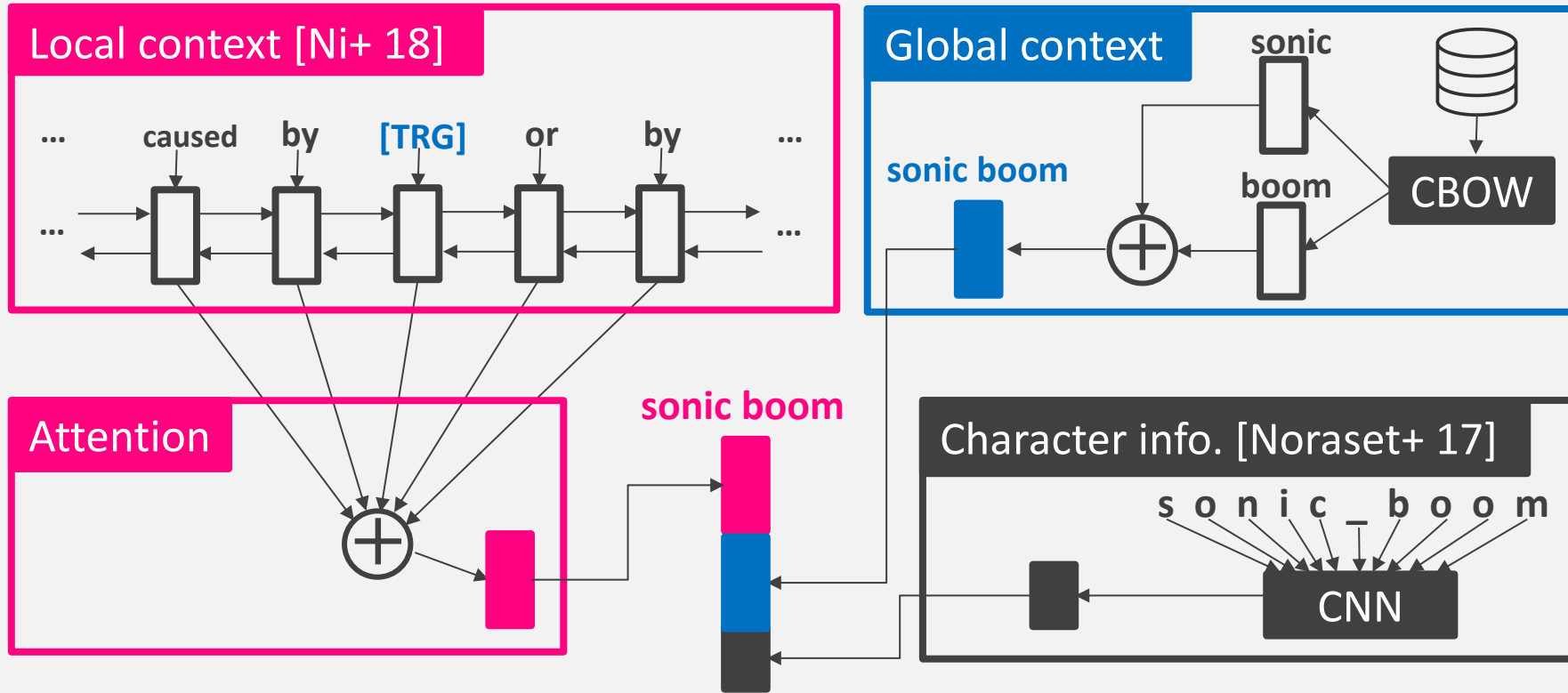


Proposed: Local & Global Context-aware model





Proposed: Local & Global Context-aware model



Global cont.

: general meaning in large corpus

Local cont.

: specific usage in a sentence



Experiments: Can the model utilize both contexts?

Dataset

- **WPDD (Proposed)**
- **WordNet [Noraset+ AAI17]**
- **Oxford Dictionary [Gadetsky+ ACL18]**
- **Urban Dictionary [Ni+ IJCNLP17]**

Methods

- **LOG-CaD (Proposed):** Local & Global Context-aware Desc. Gen.
- **Global:** Uses word embedding as context [Noraset+ 17]
- **Local:** Uses local context as context [Ni+ 17]

Evaluation


- Automatic (BLEU) & Manual (5-levels, 3 En. speakers) eval.



Result: SOTA on four datasets

100% of the words have global context (i.e., word embeddings)

Only **27%** of the words have global context

BLEU ↑	WordNet	Oxford	Urban	Wikipedia
Global	24.10	15.05	6.05	44.77
Local	22.34	17.90	9.03	52.94
 Proposed	24.79	18.53	10.55	53.85
	+0.69			+9.08

Local cont. is essential if global context is unavailable



Example

Input : "daniel o' neil"

Cont. #1	after being enlarged by publisher daniel o'neill it was reportedly one of the largest and most prosperous newspapers in the united states .
Cont. #2	in 1967 he returned to belfast where he met fellow belfast artist daniel o'neill.




Method	Output #1	Output #2
Global	american musician	american musician
Local	american publisher	british musician
Proposed	american writer	british musician
Reference	american journalist	Irish artist

Same outputs for different contexts 😞



Result: Manual evaluation

Score	
Local	2.7
Proposed	 3.0

Annotated Scores:

- 1: completely wrong
- 2: correct topic w/ wrong info.
- 3: correct but incomplete**
- 4: small details are missing
- 5: correct

Input: "auto race"

Context	the regulating body for pari-mutuel keirin and <u>auto race</u> competitions in japan .
Local	a type of sports equipment
Proposed	type of motor racing

Averaged score

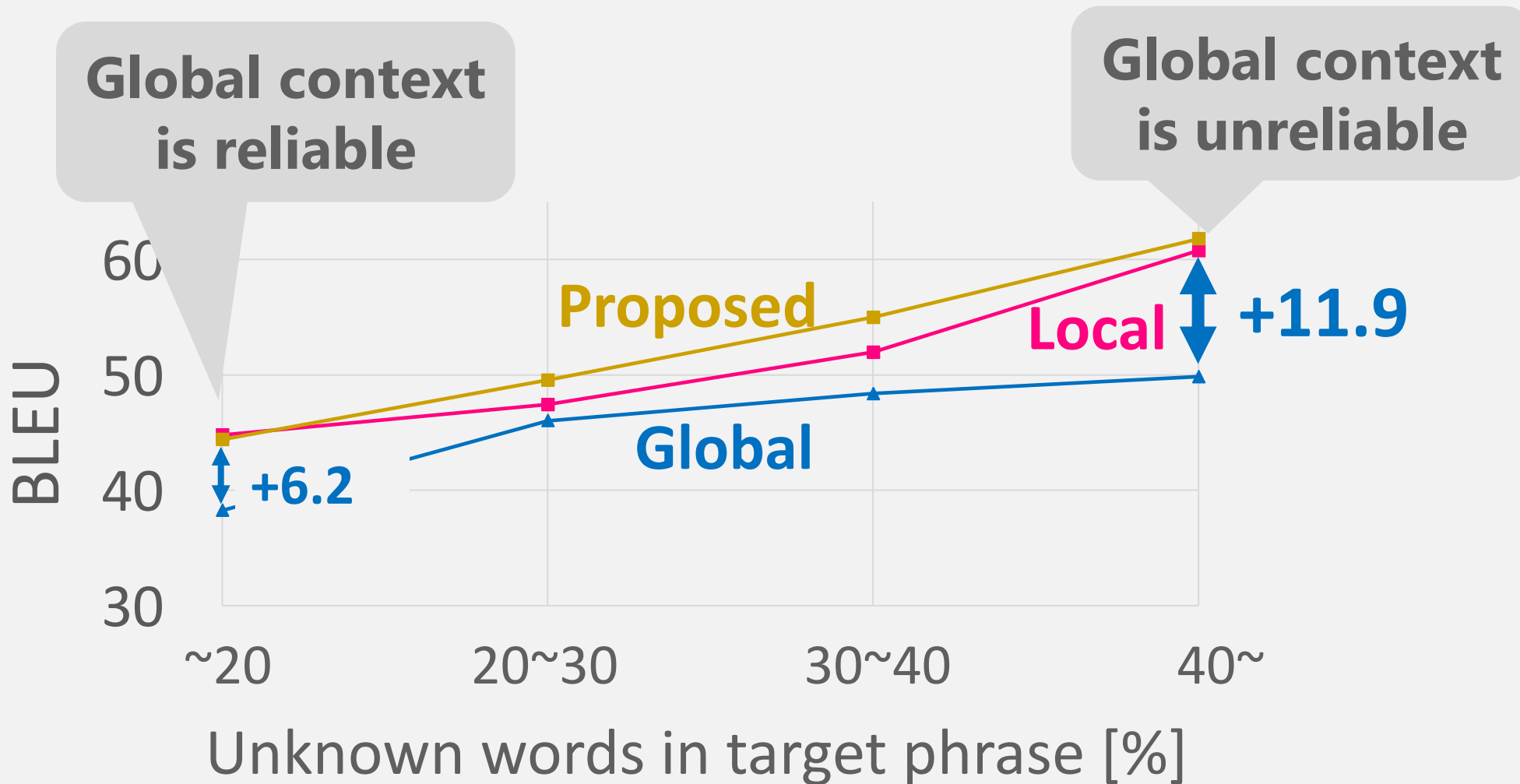
1.3/5

4.0/5



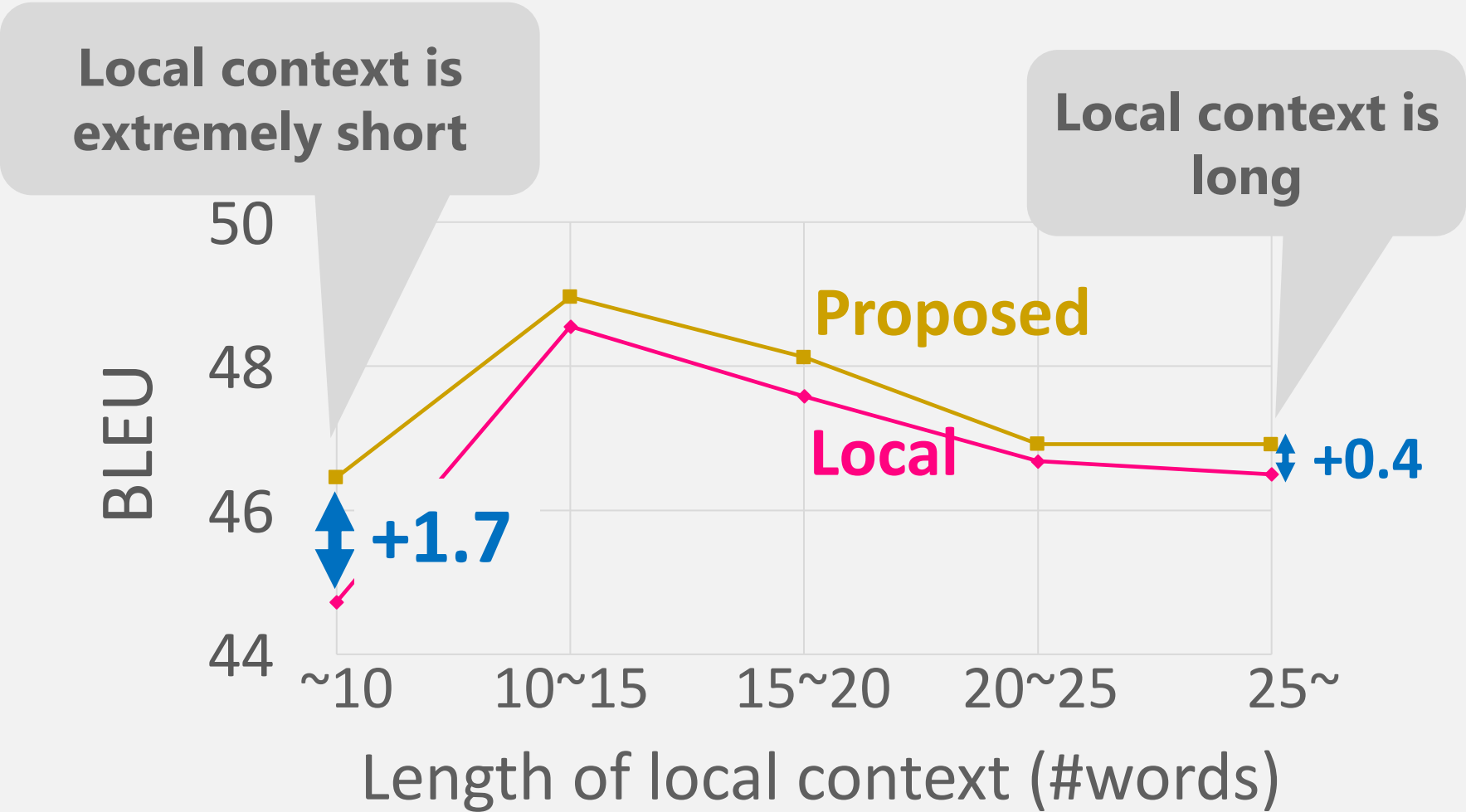


How do the models utilize local context?



Local context provides more gain if global context is unreliable

How do the models utilize global context?



Global context is essential if the local context is not informative



Summary

- **Research Question**

- Can machines help us describe unknown phrases?

- **Answer to RQ**

- Yes. In average, the generated descriptions are correct but incomplete

- **Contributions**

- Large, multi-domain phrase description dataset
- SOTA model that captures local & global context

- **Future work**

- Use multiple local contexts to describe phrases
- Incorporate the method into machine translation

Thank you