

Structural Neural Encoders for AMR-to-text Generation

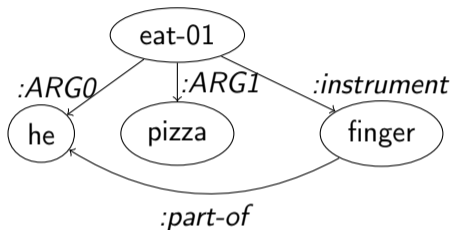
NAACL 2019

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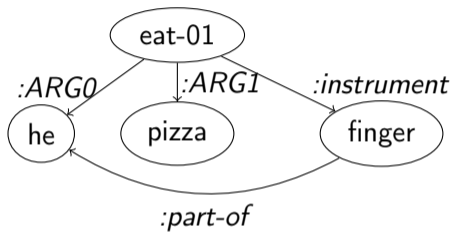


Abstract Meaning Representation (AMR)

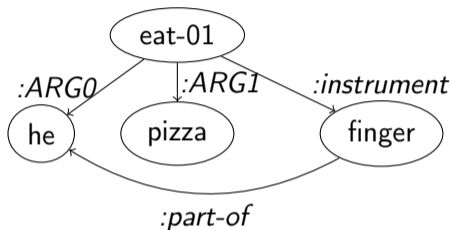


He ate the pizza with his fingers.

AMR-to-text generation (English)

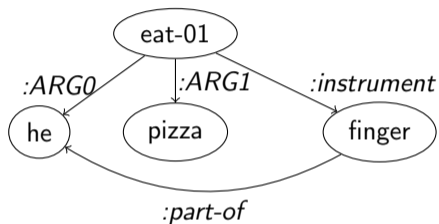


AMR-to-text generation (English)



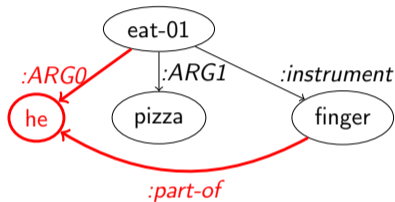
He ate the pizza with his fingers.

Previous work



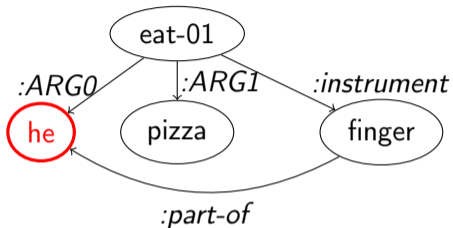
- Konstas et al. (2017): sequential encoder;
- Song et al. (2018), Beck et al. (2018): graph encoder;

He ate the pizza with his fingers.



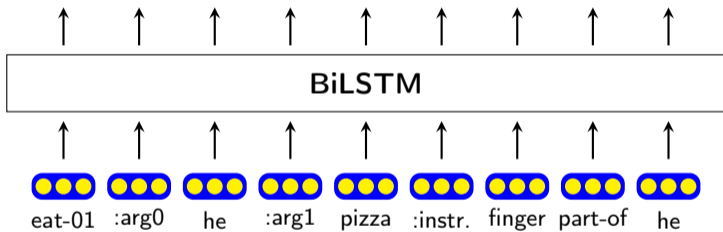
- Are improvements in graph encoders due to reentrancies?
- To answer, compare:
 - 1 Sequence: BiLSTM;
 - 2 Tree: TreeLSTM (Tai et al., 2015);
 - 3 Graph: Graph Convolutional Network (GCN; Kipf and Welling, 2017).

Sequential input (Konstas et al., 2017)

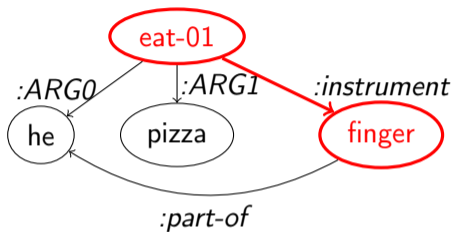


eat-01 :arg0 **he** :arg1 pizza :instrument finger :part-of **he**

Sequential input (Konstas et al., 2017)

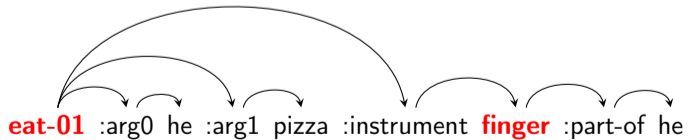
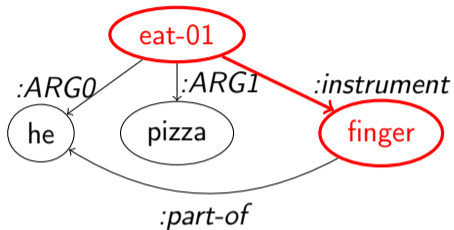


Sequential input (Konstas et al., 2017)

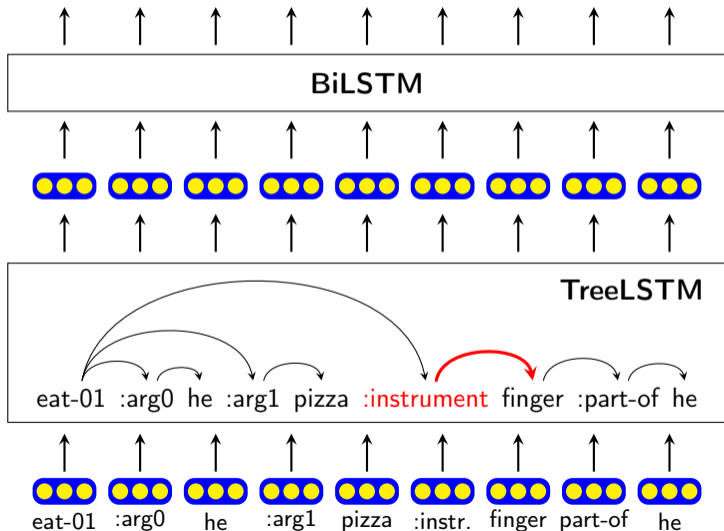


eat-01 :arg0 he :arg1 pizza :instrument **finger** :part-of he

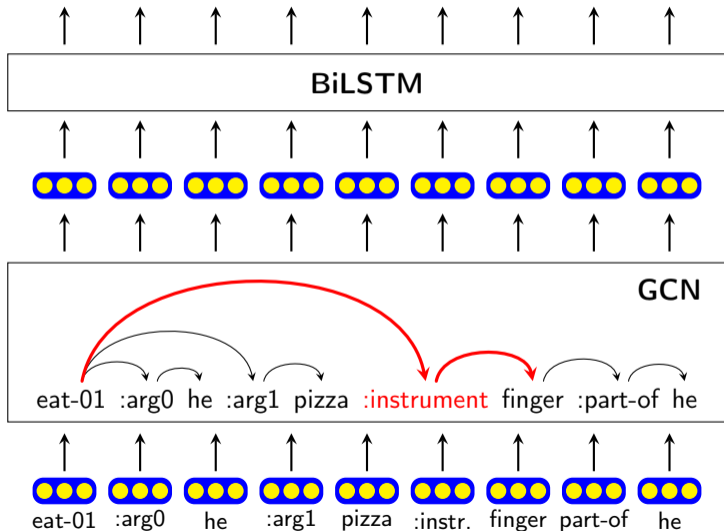
Tree-structured input



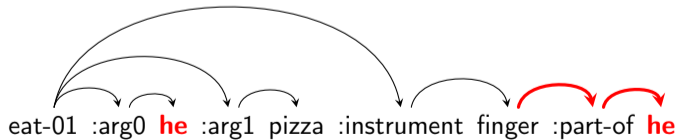
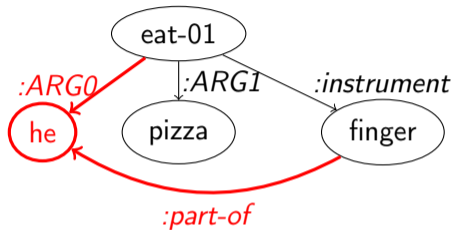
Tree-structured input



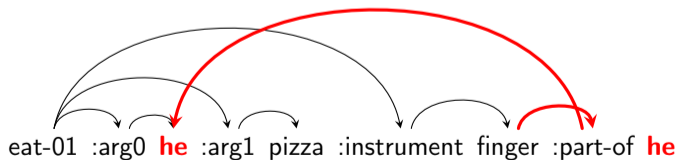
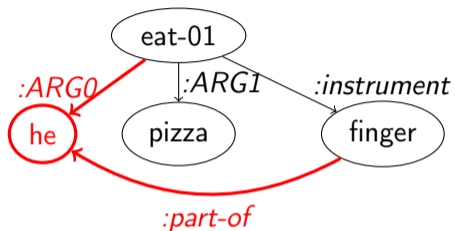
Tree-structured input



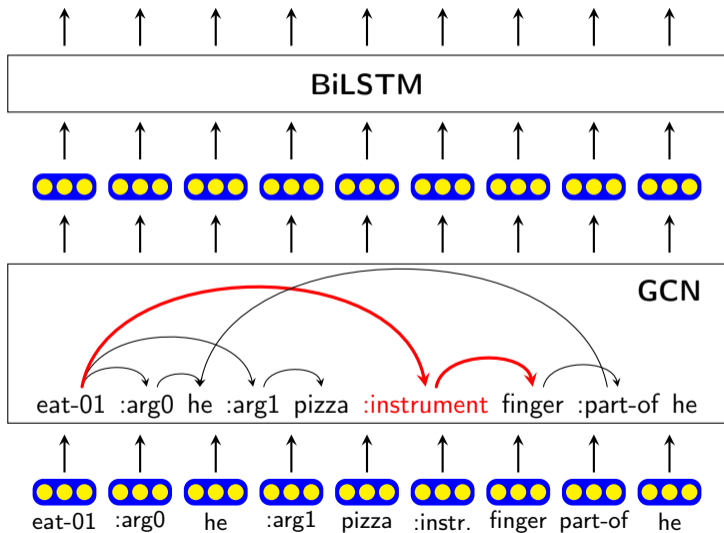
Tree-structured input



Graph-structured input

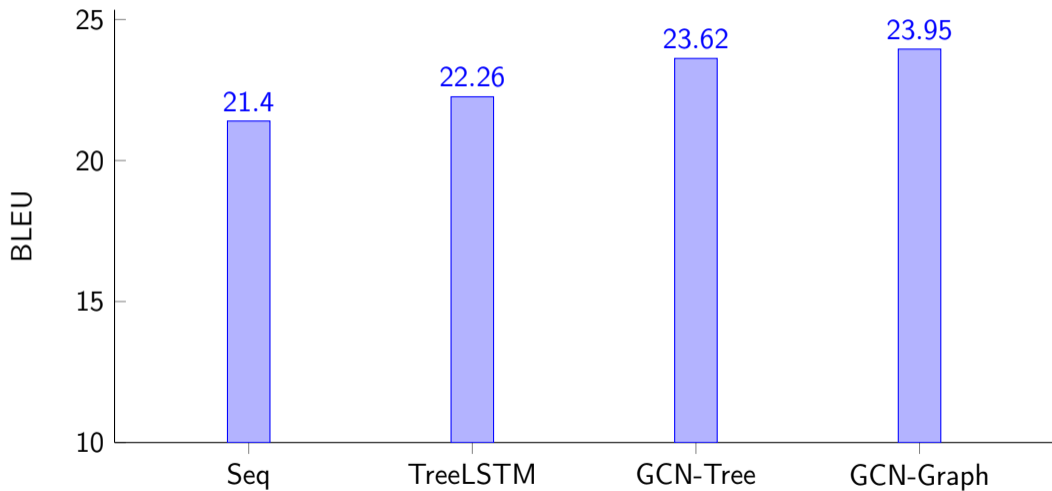


Graph-structured input

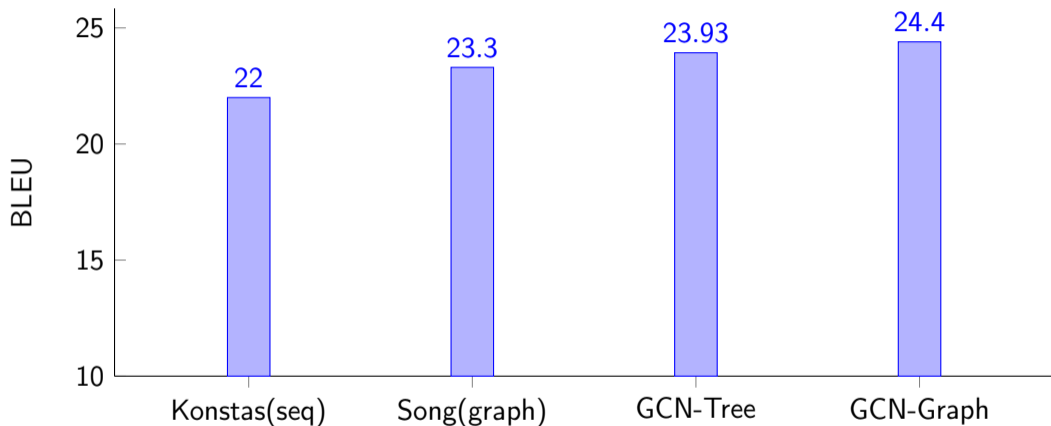


- AMR R2: 39260 sentences
- AMR R1: 19572 sentences (subset of R1)

Comparison between models (dev set R1)



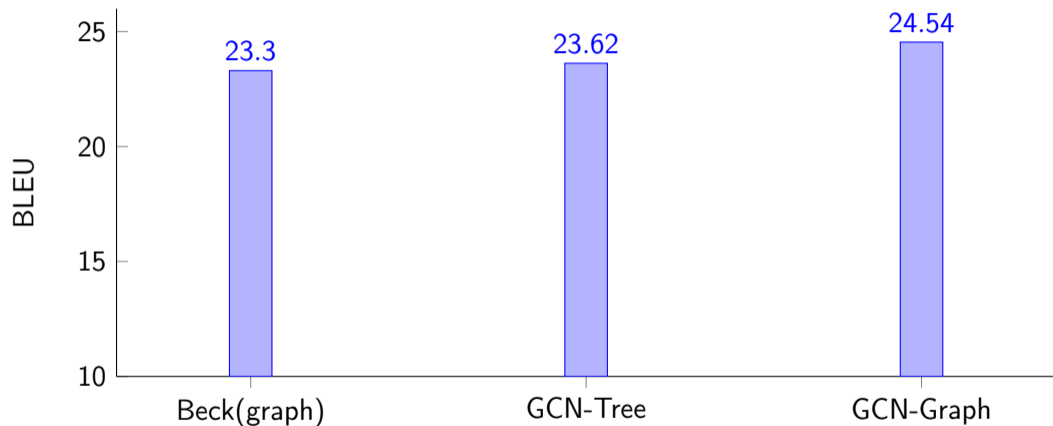
Comparison with previous work (test set R1)



Konstas: sequential baseline, Konstas et al. (2017)

Song: graph encoder (GRN), Song et al. (2018)

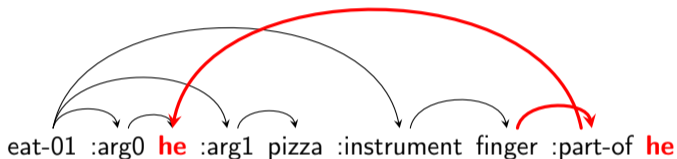
Comparison with previous work (test set R2)



Beck: graph encoder (GGNN), Beck et al. (2018)

Reentrancies

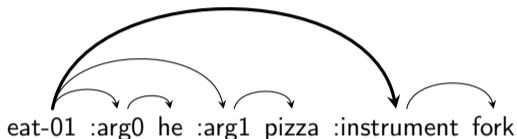
He ate the pizza with his fingers.



Model	Number of reentrancies		
	0	1-5	6-20
	(619)	(679)	(70)
Seq	42.94	31.64	23.33
Tree	+0.63	+1.41	+0.76
Graph	+1.67	+1.54	+3.08

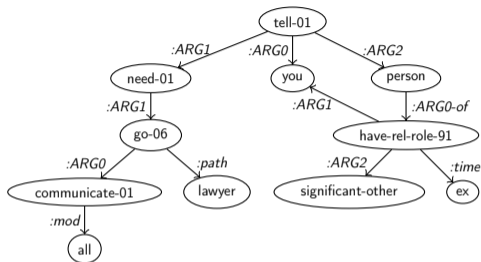
Long-range dependencies

He ate the pizza with a fork.



Model	Max dependency length		
	0-10 (307)	11-50 (297)	51-200 (18)
Seq	50.49	36.28	24.14
Tree	-0.48	+1.66	+2.37
Graph	+1.22	+2.05	+3.04

Generation example



- REF **tell your ex** that all communication needs to go through the lawyer
- Seq **tell** that all the communication go through lawyer
- Tree **tell your ex, tell your ex,** the need for all the communication
- Graph **tell your ex** the need to go through a lawyer

Conclusions

- Graph encoders based on GCN and BiLSTM gives best results for AMR-to-text generation;
- Reentrancies and long-range dependencies contribute to the improvements of graph encoders;
- Demo and source code: <http://cohort.inf.ed.ac.uk/amrgen.html>

Do reentrancies help with generating pronouns?

He ate the pizza with **his** fingers → *He ate the pizza with **he** fingers*

→ *He ate the pizza with **him** fingers*

→ *He ate the pizza with **their** fingers*

→ *He ate the pizza with **her** fingers*

Model	Antecedent (251)	Type (912)	Num. (1840)	Gender (95)
Seq	96.02	97.70	94.89	94.74
Tree	96.02	96.38	93.70	92.63
Graph	96.02	96.49	95.11	95.79

Input	Model	BLEU	Meteor
Seq	Seq	21.40	22.00
Tree	SeqTreeLSTM	21.84	22.34
	TreeLSTMSeq	22.26	22.87
	TreeLSTM	22.07	22.57
	SeqGCN	21.84	22.21
	GCNSeq	23.62	23.77
	GCN	15.83	17.76
Graph	SeqGCN	22.06	22.18
	GCNSeq	23.95	24.00
	GCN	15.94	17.76

More examples

$$h_i^{(k+1)} = \sigma \left(\sum_{j \in \mathcal{N}(i)} W_{\text{dir}(j,i)}^{(k)} h_j^{(k)} + b^{(k)} \right), \quad (1)$$

More examples

REF i dont tell him but **he finds out.**

Seq i didn't tell him but **he was out.**

Tree i don't tell him but **found out.**

Graph i don't tell him but **he found out.**

More examples

REF if **you tell people** they can help you ,
Seq if **you tell him**, you can help you !
Tree if **you tell person_name you**, you can help you .
Graph if **you tell them**, you can help you .

More examples

REF **i 'd recommend** you go and see your doctor too.

Seq **i recommend** you go to see your doctor who is
going to see your doctor.

Tree **you recommend** going to see your doctor too.

Graph **i recommend** you going to see your doctor too.