Neural Parsing and Generation
Two approaches from ACL 2017

presented by Michael Wayne Goodman

University of Washington

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Robust Incremental Neural Semantic Graph Parsing

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DEPARTMENT OF
COMPUTER
SCIENCE

Deep Deep parsing

Fast, accurate, robust parser for MRS

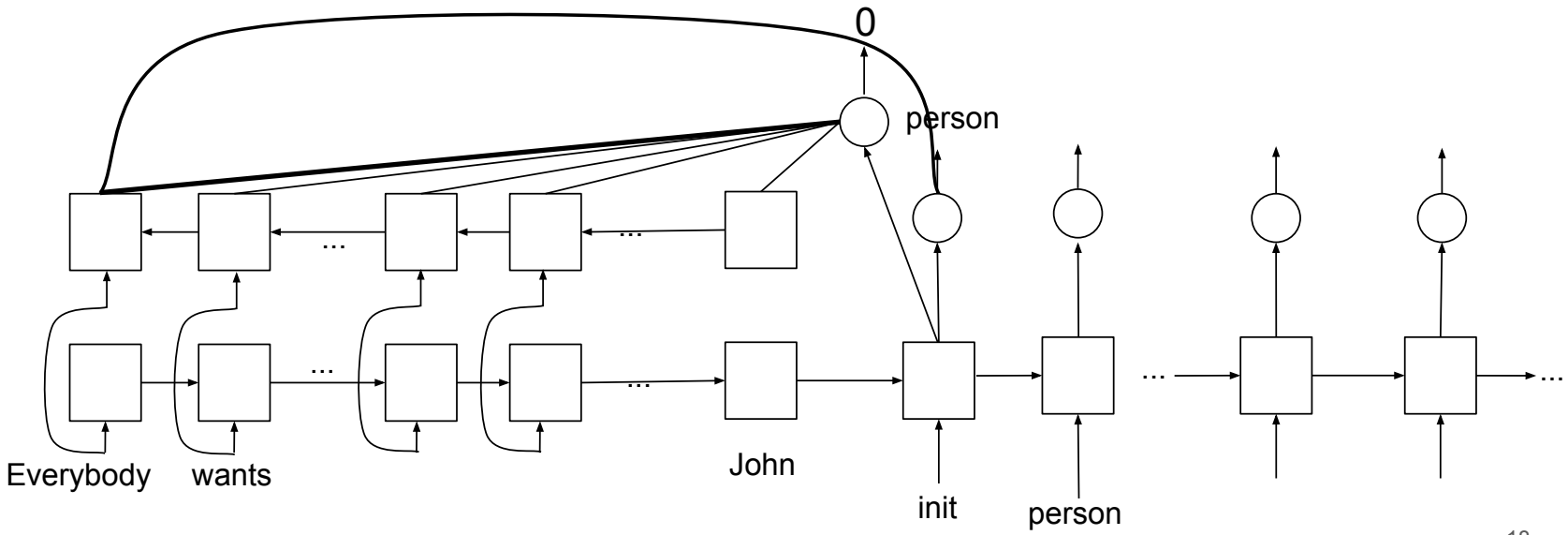
- Robust statistical parser for ERG semantics
- End-to-end semantic graph parsing
- Seq2seq RNNs with hard attention
- Transition-based parser for non-planar graphs

Transition-based graph parsing

- Arc-eager transition system for semantic graphs
- Data structures: Input sentence, stack, buffer
- Actions:
  - Shift - generate next predicate on buffer
  - Reduce
  - Left-arc
  - Right-arc
  - Cross-arc

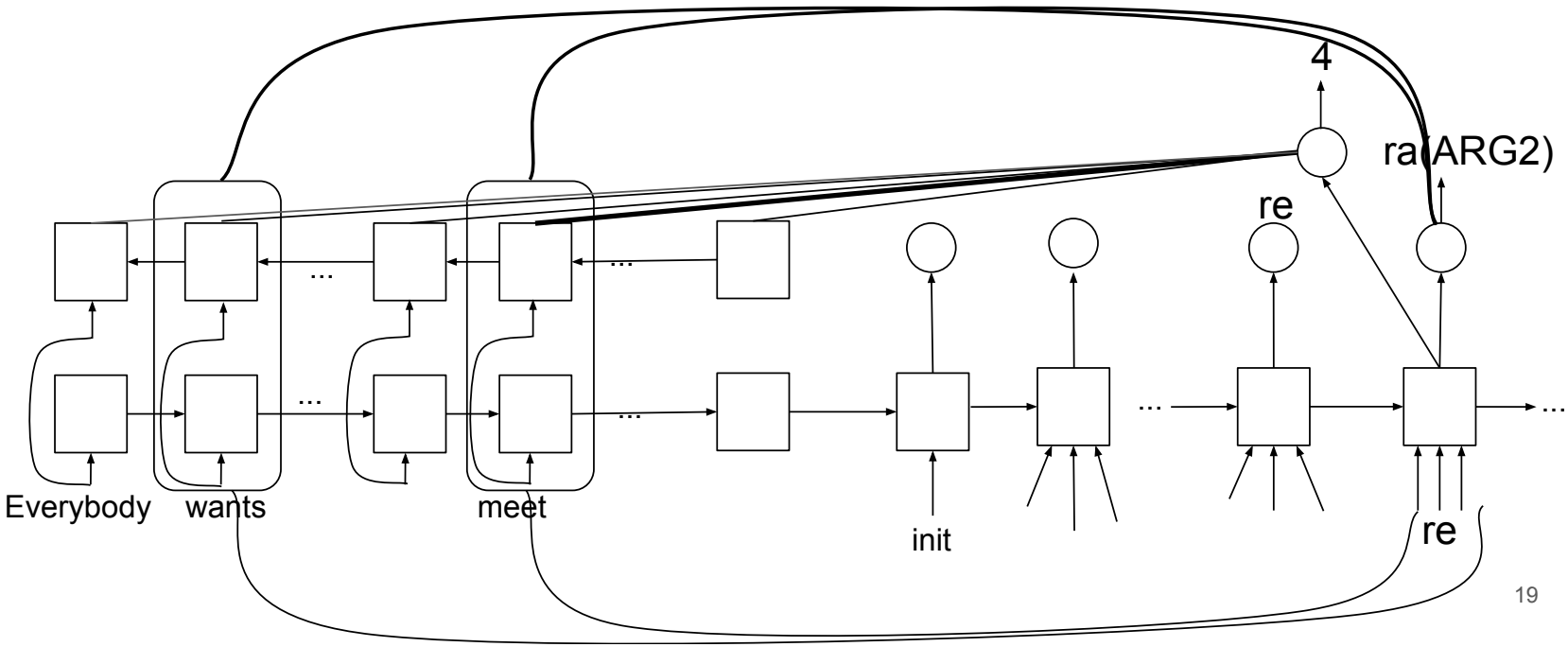
Graph parsing with stack-based encoder-decoders

RNN decoder with hard attention



Graph parsing with stack-based encoder-decoders

RNN decoder with stack-based features

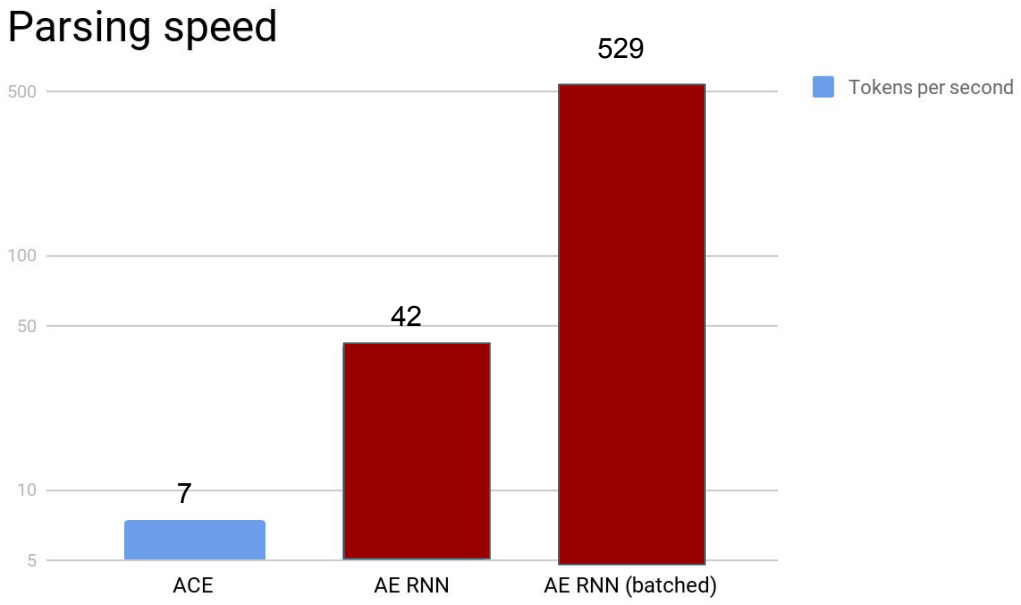


DMRS Experiments

Test results

Model	**EDM**	**EDM Predicates**	**EDM Arguments**	**Smatch**
Top-down RNN	79.68	83.36	75.16	85.28
Arc-eager RNN	**84.16**	**87.54**	**80.10**	**86.69**
ACE (ERG)	89.64	92.08	86.77	93.50

DMRS Experiments



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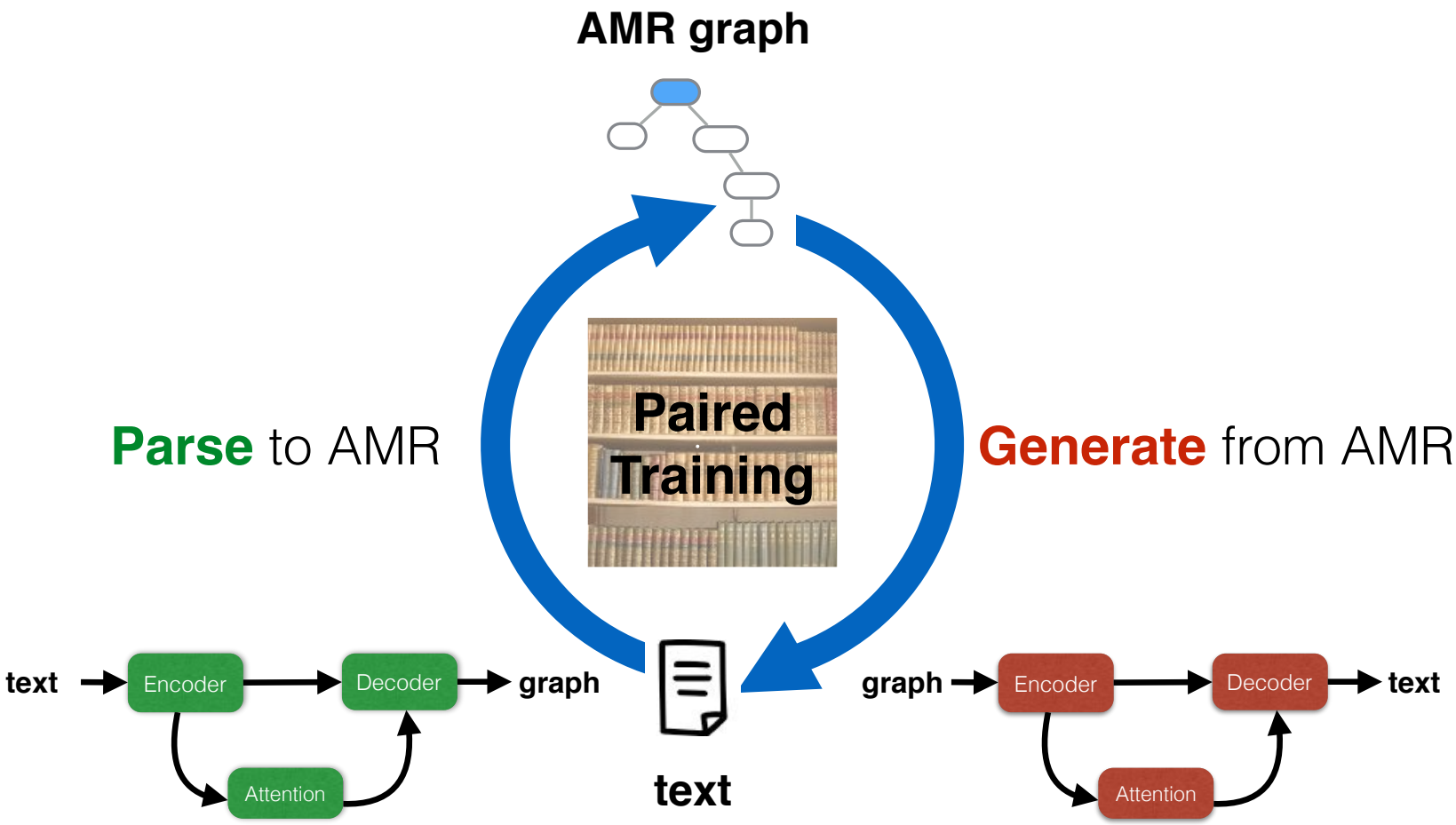
Neural AMR: Sequence-to-Sequence Models for **Parsing** and **Generation**

Ioannis Konstas, Srinivasan Iyer, Mark Yatskar, Yejin Choi, Luke Zettlemoyer

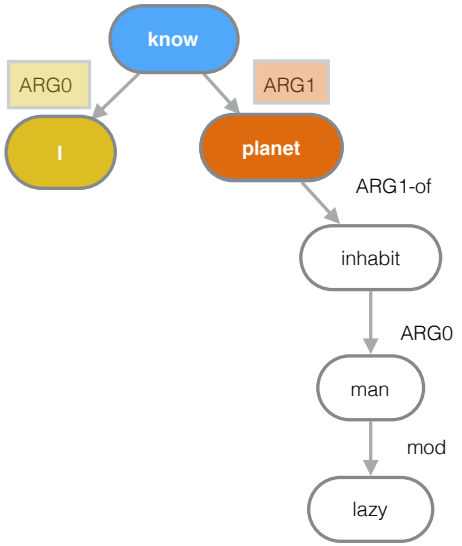

AMR graph
Parse to AMR
Paired Training
Generate from AMR
text
Encoder
Decoder
graph
Attention
text
graph
Encoder
Decoder
text
Attention

Abstract Meaning Representation

(Banarescu et al., 2013)

- Rooted Directed Acyclic Graph
- Nodes: concepts (nouns, verbs, named entities, etc)
- Edges: Semantic Role Labels

Input: AMR Graph



I knew a **planet** that was **inhabited** by a **lazy man**.

I have **known** a **planet** that was **inhabited** by a **lazy man**.

I know a **planet**. It is **inhabited** by a **lazy man**.

Generate from AMR

Abstract Meaning Representation

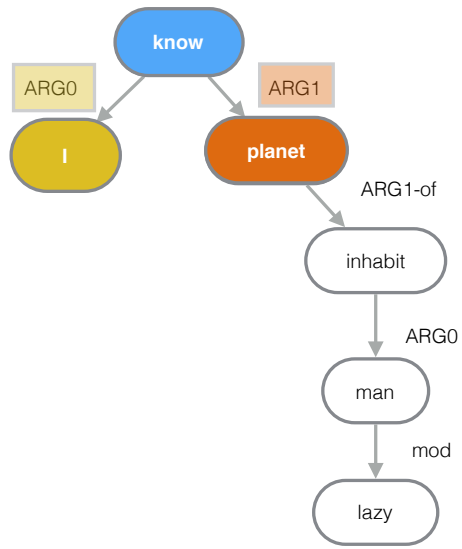
(Banarescu et al., 2013)

- Rooted Directed Acyclic Graph
- Nodes: concepts (nouns, verbs, named entities, etc)
- Edges: Semantic Role Labels

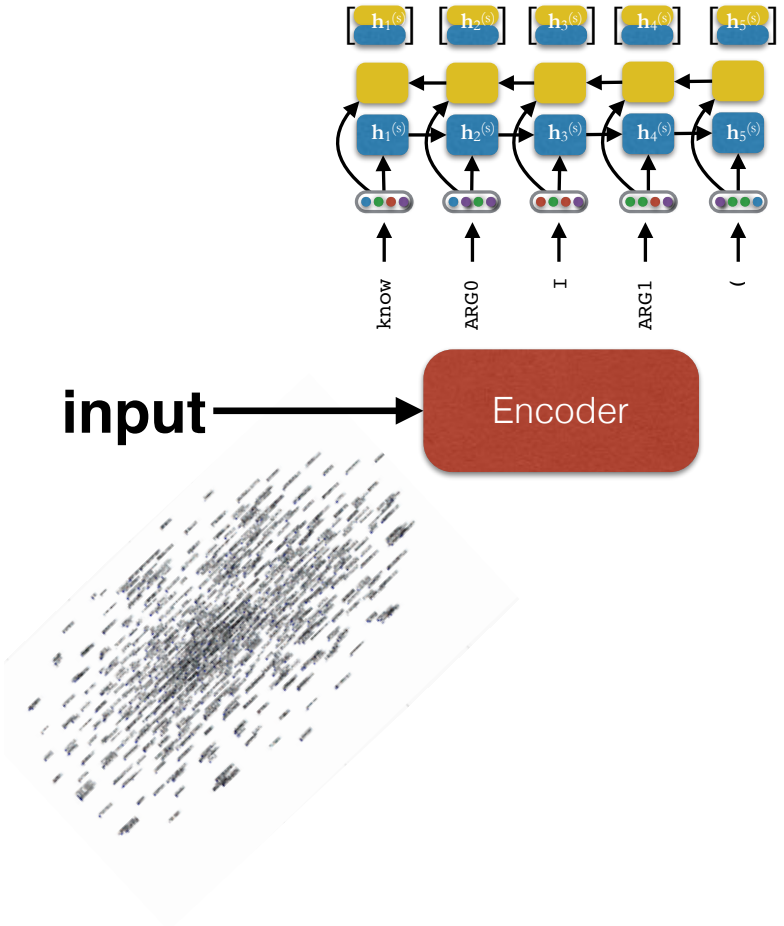
Input: Text

I have **known** a **planet** that was **inhabited** by a **lazy man**.

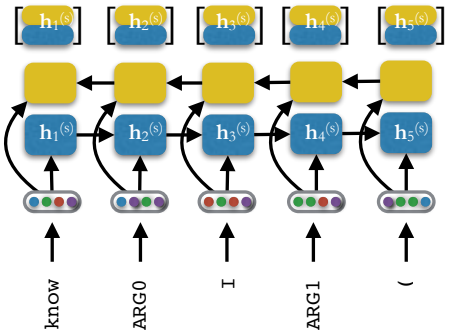
Parse to AMR

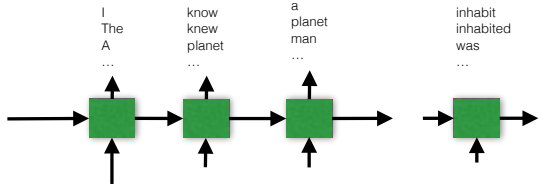


Sequence-to-sequence model

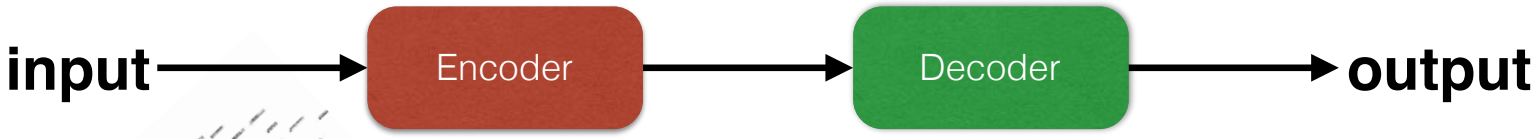


Sequence-to-sequence model

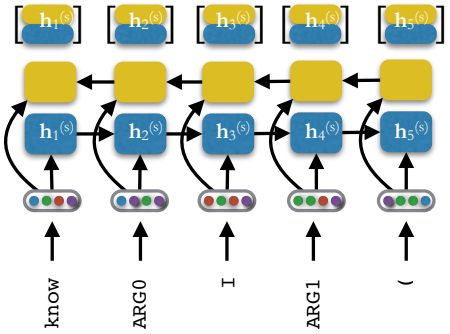


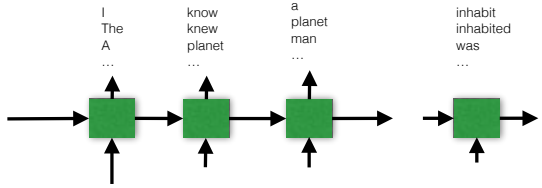


$$\hat{w} = \underset{w}{\operatorname{argmax}} \prod_i p\left(w_i | w_{<i}, \mathbf{h}^{(s)}\right)$$

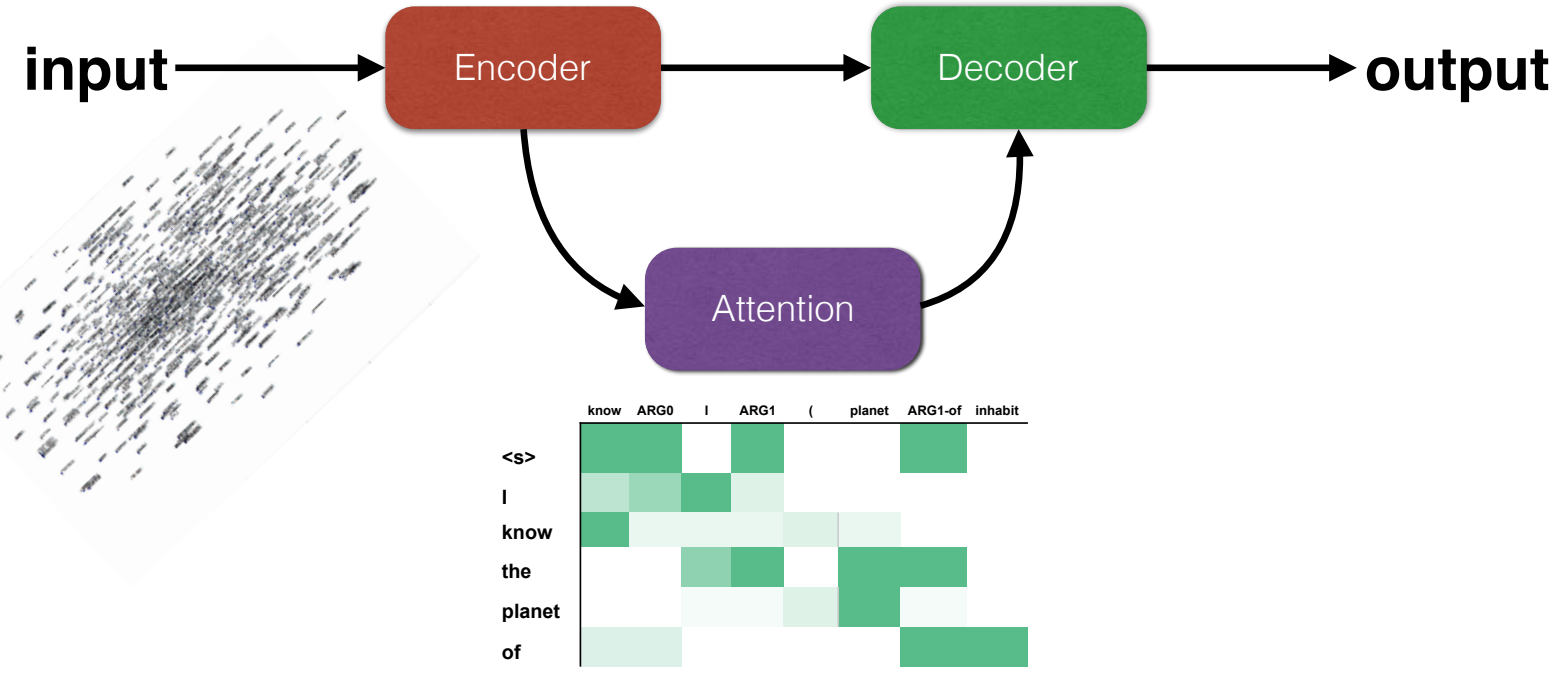


Sequence-to-sequence model



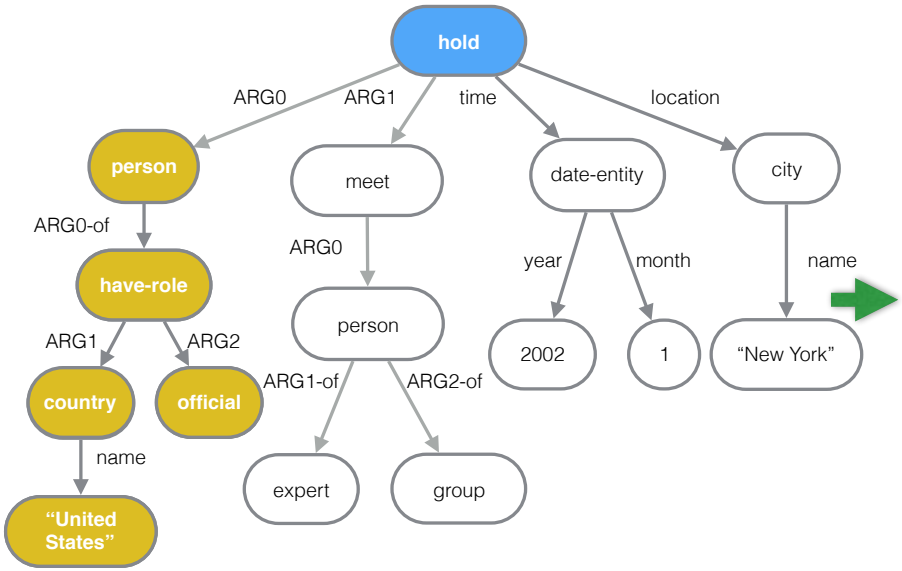


$$\hat{w} = \underset{w}{\operatorname{argmax}} \prod_i p\left(w_i | w_{<i}, \mathbf{h}^{(s)}\right)$$



Linearization

Graph —> Depth First Search (Human-authored annotation)

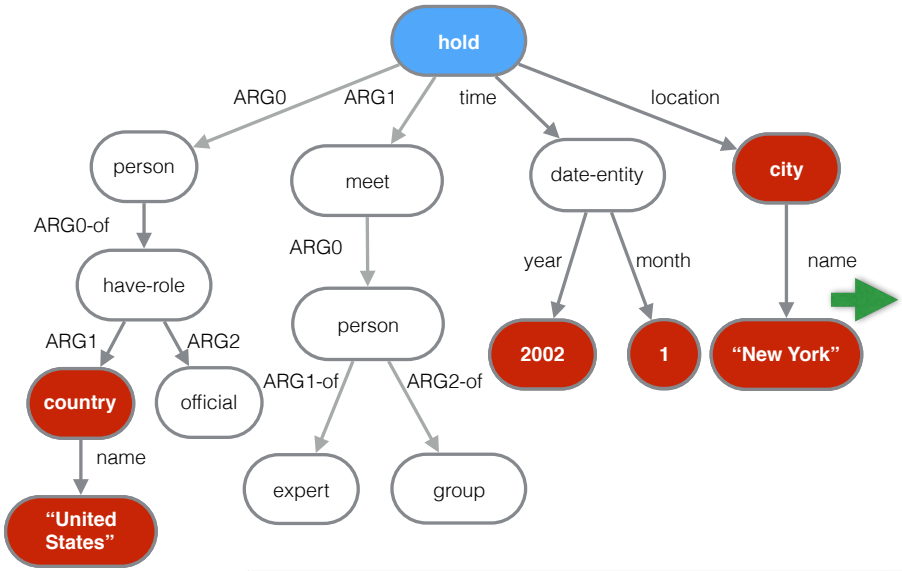



```
hold
   :ARG0 (person
            :ARG0-of (have-role
               :ARG1 United_States
               :ARG2 official)
         )
   :ARG1 (meet
            :ARG0 (person
               :ARG1-of expert
               :ARG2-of group)
         )
   :time (date-entity 2002 1)
   :location New_York
```

US officials held an expert group meeting in January 2002 in New York .

Pre-processing

Linearization —> Anonymization




```
hold
   :ARG0 (person
            :ARG0-of (have-role
               :ARG1 loc_0
               :ARG2 official)
         )
   :ARG1 (meet
            :ARG0 (person
               :ARG1-of expert
               :ARG2-of group)
         )
   :time (date-entity year_0 month_0)
   :location loc_1
```

US officials held an expert group meeting in January 2002 in New York .

loc_0 officials held an expert group meeting in **month_0 year_0** in **loc_1** .

Experimental Setup

AMR LDC2015E86 (SemEval-2016 Task 8)

- Hand annotated MR graphs: newswire, forums
- ~16k **training** / 1k **development** / 1k **test** pairs

Train

- Optimize cross-entropy loss

Evaluation

- BLEU n-gram precision (**Generation**)
  (Papineni et al., 2002)
- SMATCH score (**Parsing**)
  (Cai and Knight, 2013)

Paired Training

Train AMR Parser **P** on Original Dataset

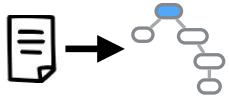
(,)

for i = 0 … N

Self-train Parser

S_i =Sample **k** 10^i sentences from Gigaword

Parse S_i sentences with **P**

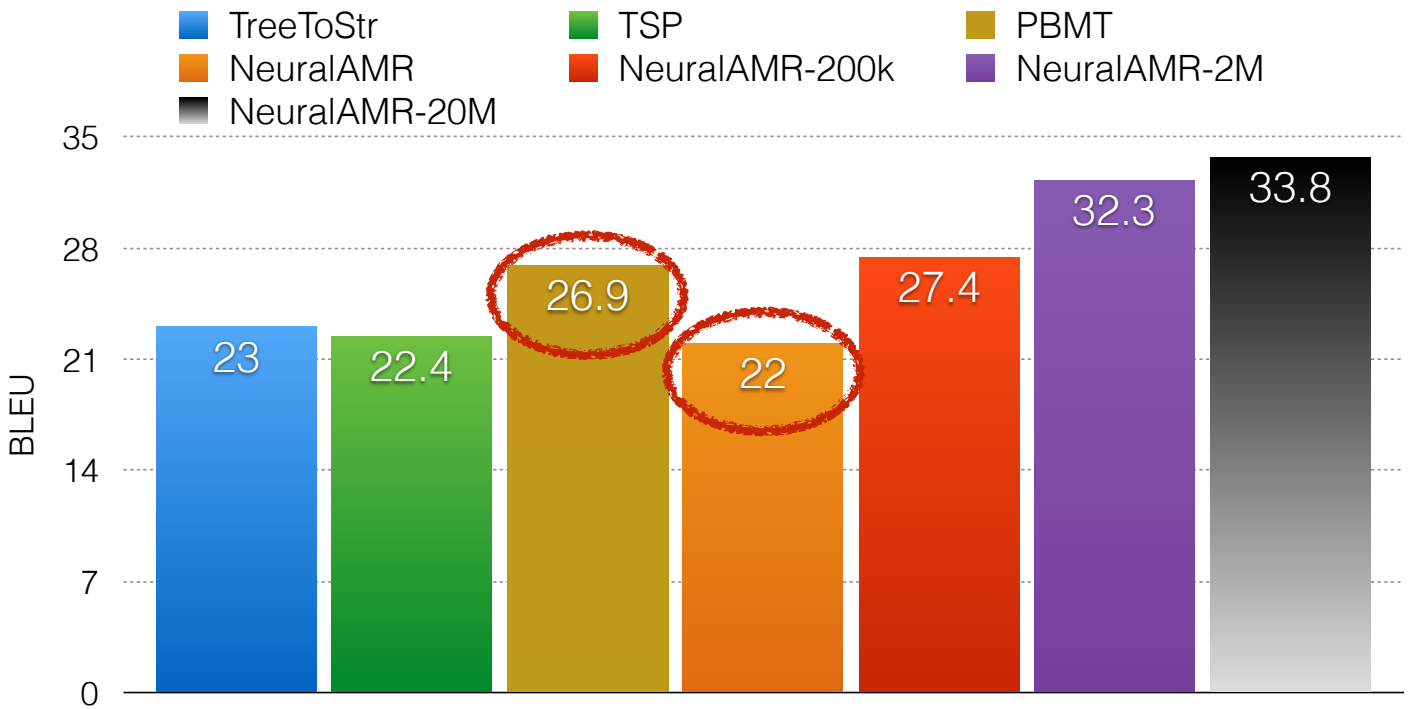


Re-train AMR Parser **P** on S_i

Train Generator **G** on S_N

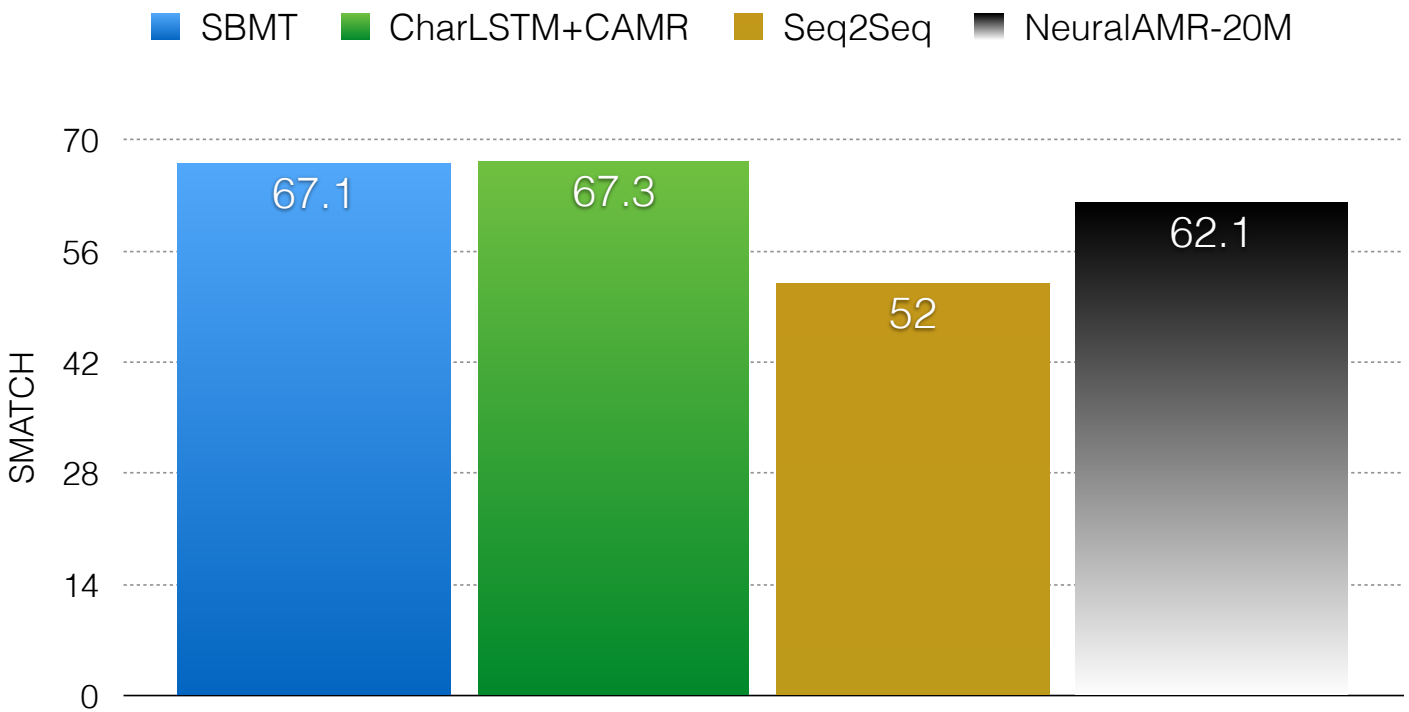
(,)

Final Results (**Generation**)



TreeToStr: Flanigan et al, NAACL 2016
TSP: Song et al, EMNLP 2016
PBMT: Pourdamaghani and Knight, INLG 2016

Final Results (**Parsing**)



SBMT: Pust et al, 2015
CharLSTM+CAMR: Noord and Bos, 2017
Seq2Seq: Peng et al., 2017

For generation results on MRS instead of AMR, stay tuned for the upcoming discussion...

Jan Buys and Phil Blunsom. 2017. Robust incremental neural semantic graph parsing. In *Proceedings of the 55th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, pages 1215–1226. Association for Computational Linguistics, Vancouver, Canada. URL `http://aclweb.org/anthology/P17-1112`.

Ioannis Konstas, Srinivasan Iyer, Mark Yatskar, Yejin Choi, and Luke Zettlemoyer. 2017. Neural amr: Sequence-to-sequence models for parsing and generation. In *Proceedings of the 55th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, pages 146–157. Association for Computational Linguistics, Vancouver, Canada. URL `http://aclweb.org/anthology/P17-1014`.