Discourse Representation Structure Parsing

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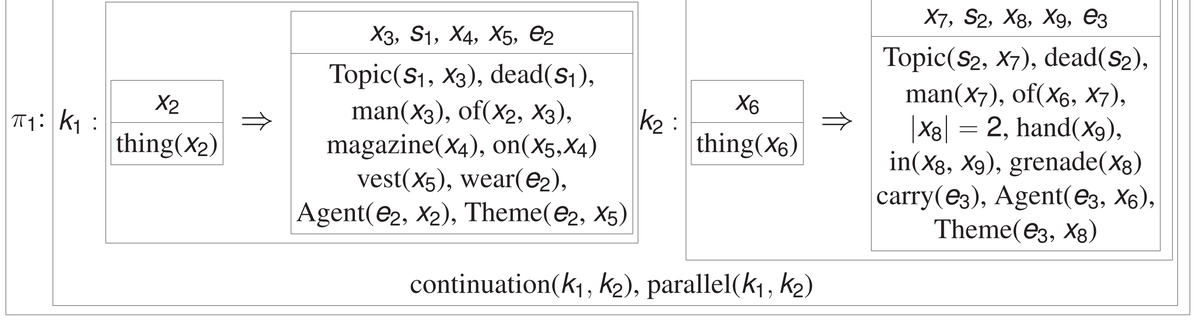
Discourse Representation Structure (DRS)

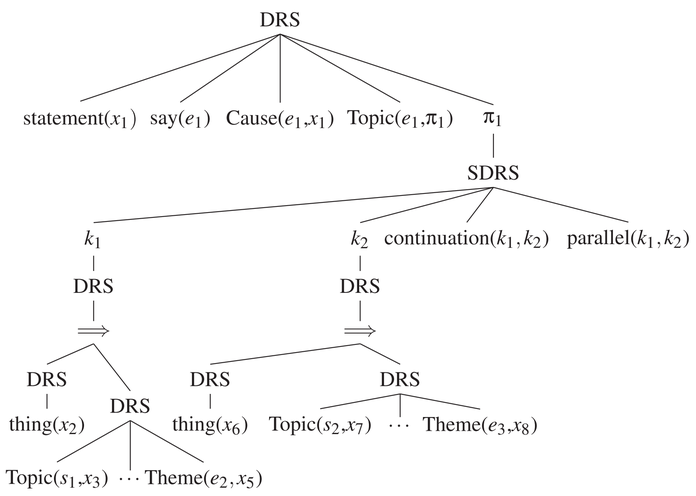
- The basic meaning-carrying unit in Discourse Representation Theory (DRT; Kamp and Reyle, 1993).
- Extended to Segmented Discourse Representation Theory (SDRT; Asher and Lascarides, 2003).
- Recursive formal meaning structures, with model-theoretic interpretation, can be translated into first-order logic.

DRSs as Boxes

The statement says each of the dead men wore magazine vests and carried two hand grenades.



DRSs as Trees

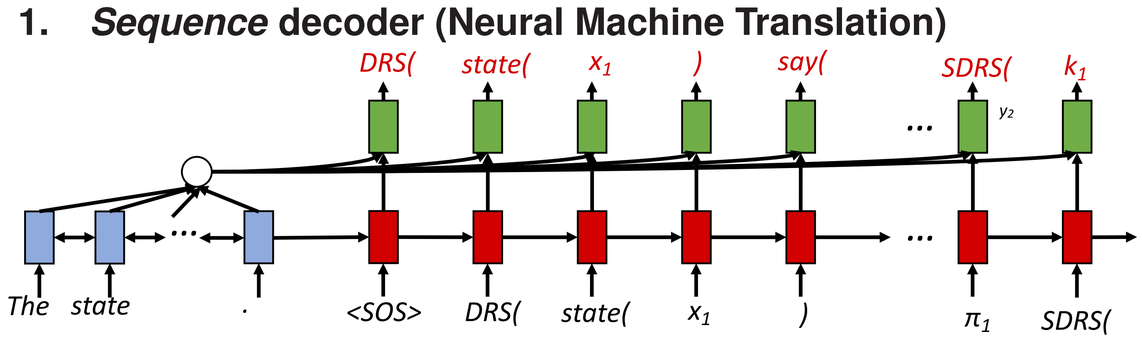


DRS(statement(x_1) say(e_1) Cause(e_1, x_1) Topic(e_1, π_1) π_1(SDRS(k_1 (DRS (⟹(DRS(thing(x_2)) DRS (Topic(s_1, x_3) dead(s_1) man(x_3) of(x_2, x_3) magazine(x_4) on(x_5, x_4) vest(x_5) wear(e_2) Agent(e_2, x_2) Theme(e_2, x_5))))) k_2(DRS ⟹(DRS(thing(x_6)) DRS(Topic(s_2, x_7) dead(s_2) man(x_7) of(x_6, x_7) card(x_8,NUM) hand(x_9) in(x_8, x_9) carry(e_3) Agent(e_3, x6) Theme(e3, x8))))) continuation(k_1, k_2) parallel(k_1, k_2)

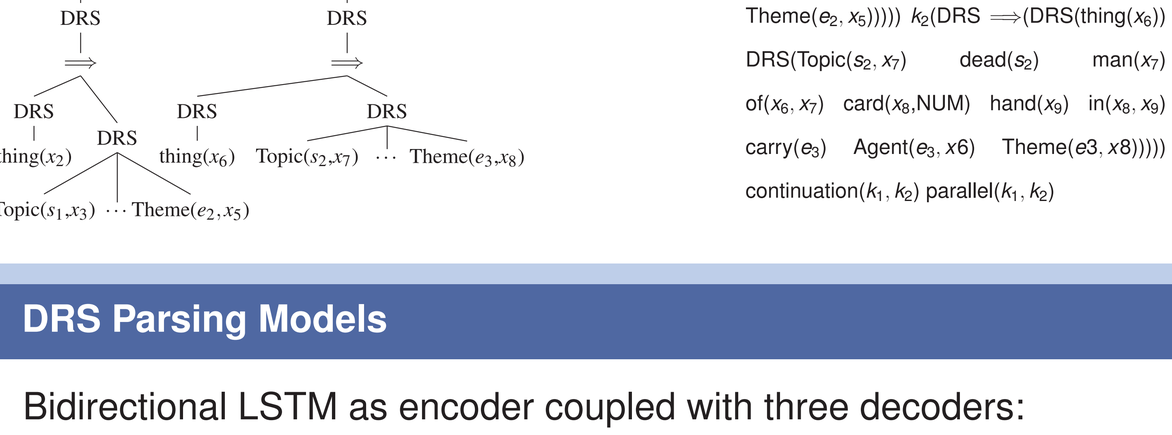
DRS Parsing Models

Bidirectional LSTM as encoder coupled with three decoders:

1. ***Sequence*** **decoder (Neural Machine Translation)**



2. ***Shallow structure*** **decoder (Copy strategy)**



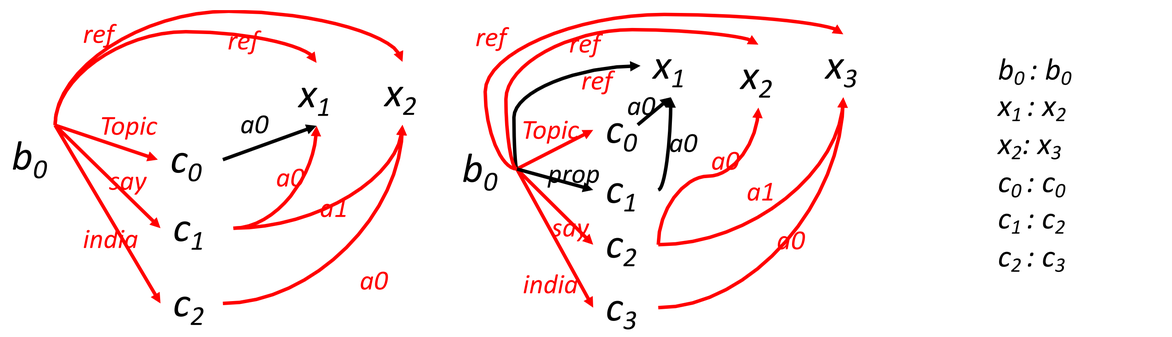
3. ***Deep structure*** **decoder (Structure-sensitive)**

Groningen Meaning Bank (GMB; Bos et al., 2017)

- GMB is a large collection of English texts annotated with Discourse Representation Structures.
- 52,268/5,172/5,440 sentences for training/development/testing.

DRS Evaluation

Based on comparison between Discourse Representation Graphs:

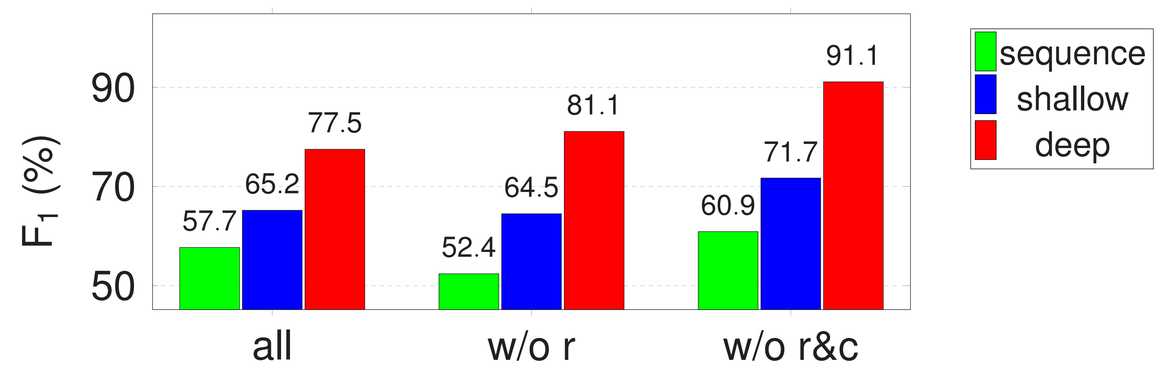


gold predicted variable matches

Variable matches are obtained by D-match[1]; red arcs are correctly predicted, so recall (R) is $\frac{8}{9}$, precision (P) is $\frac{8}{12}$, and F_1 is 76.19.

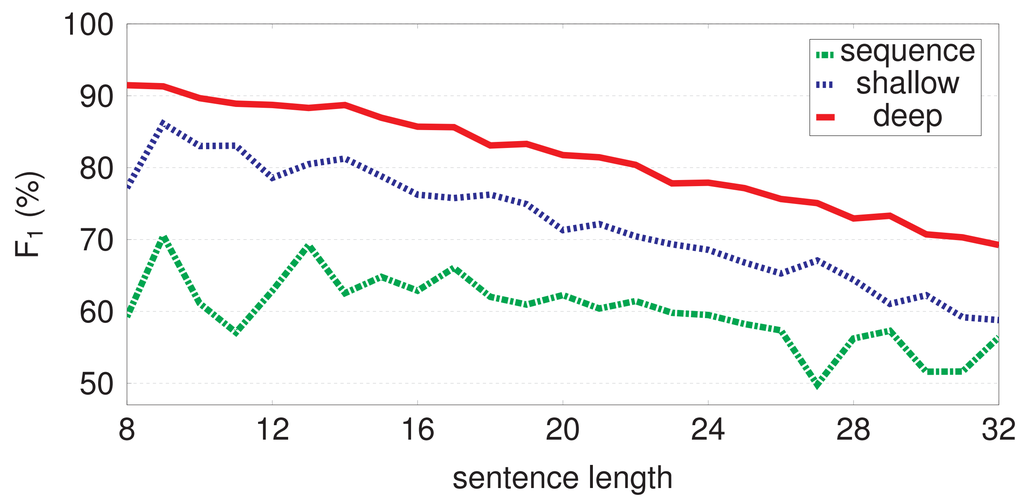
[1] https://github.com/RikVN/D-match

Results: Performance across Different Settings



- in *all* the full graph predicted by the models is evaluated.
- in *w/o r* the graph without referents is evaluated
- in *w/o r&c* the graph without referents and conditions is evaluated.

Results: Performance across Different Sentence Lengths



- *Deep* performance is stable across various sentence lengths.
- *Deep* good at copying (83.22 F_1) and inserting conditions (80.63 F_1).
- *Deep* predicts SDRS reasonably well (e.g. Continuation, Parallel).

Conclusions

- We transform DRSs to tree-based representations which can be further linearized to bracketed string format.
- We Introduce a new end-to-end model for open-domain scoped discourse representation structure parsing.
- Results on the GMB show that our decoder is able to recover DRSs to a good degree (77.54 F_1).
- **Code/Data**: https://github.com/EdinburghNLP/EncDecDRSparsing

Acknowledgments

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