Evaluation Text Generation from Discourse Representation Structures

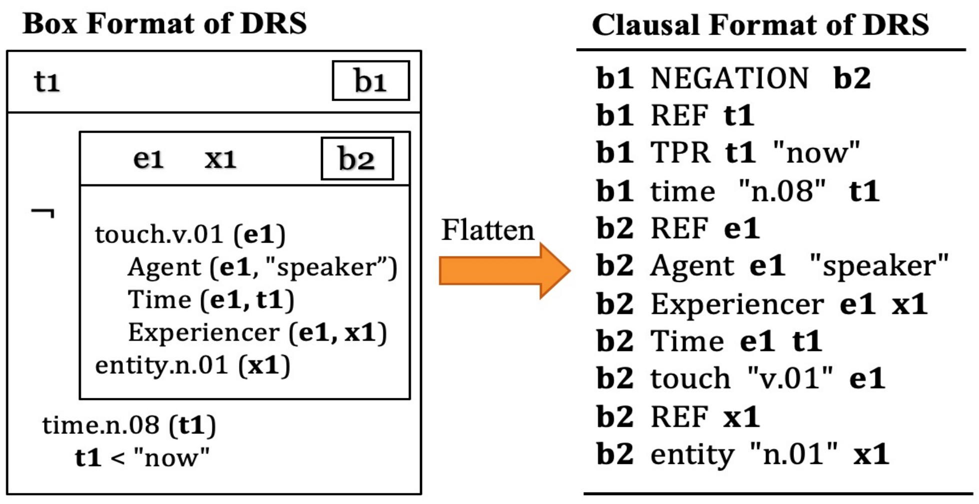
Chunliu Wang, Rik van Noord,
Arianna Bisazza, Johan Bos

University of Groningen

chunliu.wang@rug.nl, r.i.k.van.noord@rug.nl, a.bisazza@rug.nl, johan.bos@rug.nl

Introduction — Discourse Representation Structures

Example: I haven't touched anything.

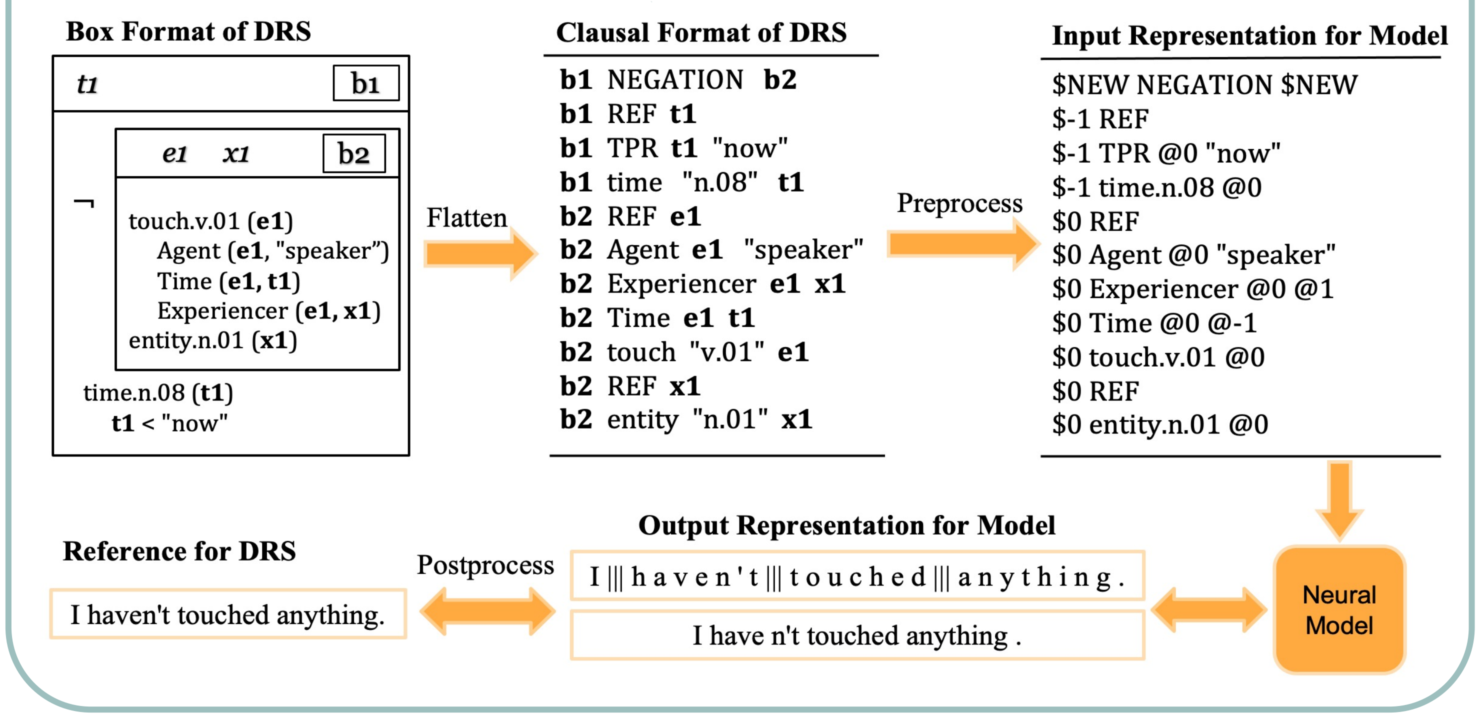


Box Format of DRS

Clausal Format of DRS

```
b1 NEGATION b2
b1 REF t1
b1 TPR t1 "now"
b1 time "n.08" t1
b2 REF e1
b2 Agent e1 "speaker"
b2 Experiencer e1 x1
b2 Time e1 t1
b2 touch "v.01" e1
b2 REF x1
b2 entity "n.01" x1
```

Methodology — DRS-to-Text Generation



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```
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b2 Agent e1 "speaker"
b2 Experiencer e1 x1
b2 Time e1 t1
b2 touch "v.01" e1
b2 REF x1
b2 entity "n.01" x1
```

Input Representation for Model

```
$NEW NEGATION $NEW
$-1 REF
$-1 TPR @0 "now"
$-1 time.n.08 @0
$0 REF
$0 Agent @0 "speaker"
$0 Experiencer @0 @1
$0 Time @0 @-1
$0 touch.v.01 @0
$0 REF
$0 entity.n.01 @0
```

Output Representation for Model

I ||| h a v e n ' t ||| t o u c h e d ||| a n y t h i n g .

I have n't touched anything .

Reference for DRS

I haven't touched anything.

Semantic Challenge sets — DRSs

DRS: Original

```
b1 REF x1
b1 Name x1 "tom"
b1 PRESUPPOSITION b2
b1 male "n.02" x1
b2 REF e1
b2 REF t1
b2 EQU t1 "now"
b2 Pivot e1 x1
b2 Theme e1 x2
b2 Time e1 t1
b2 have "v.04" e1
b2 time "n.08" t1
b2 REF x2
b2 Quantity x2 "3000"
b2 book "n.02" x2
```

Reference:
Tom has three thousand books.

DRS: Tense change

```
b1 REF x1
b1 Name x1 "tom"
b1 PRESUPPOSITION b2
b1 male "n.02" x1
b2 REF e1
b2 REF t1
b2 TPR t1 "now"
b2 Pivot e1 x1
b2 Theme e1 x2
b2 Time e1 t1
b2 have "v.04" e1
b2 time "n.08" t1
b2 REF x2
b2 Quantity x2 "3000"
b2 book "n.02" x2
```

Reference:
Tom had three thousand books.

DRS: Polarity change

```
b1 REF x1
b1 Name x1 "tom"
b1 PRESUPPOSITION b2
b1 male "n.02" x1
b2 REF e1
b2 REF t1
b2 EQU t1 "now"
b2 NEGATION b3
b3 REF e1
b3 Pivot e1 x1
b3 Theme e1 x2
b3 Time e1 t1
b3 have "v.04" e1
b3 REF x2
b3 Quantity x2 "3000"
b3 book "n.02" x2
```

Reference:
Tom does not have three thousand books..

DRS: Number change

```
b1 REF x1
b1 Name x1 "tom"
b1 PRESUPPOSITION b2
b1 male "n.02" x1
b2 REF e1
b2 REF t1
b2 EQU t1 "now"
b2 Pivot e1 x1
b2 Theme e1 x2
b2 Time e1 t1
b2 have "v.04" e1
b2 time "n.08" t1
b2 REF x2
b2 Quantity x2 "1"
b2 book "n.02" x2
```

Reference:
Tom has one book.

DRS: Name change

```
b1 REF x1
b1 Name x1 "kirk"
b1 PRESUPPOSITION b2
b1 male "n.02" x1
b2 REF e1
b2 REF t1
b2 EQU t1 "now"
b2 Pivot e1 x1
b2 Theme e1 x2
b2 Time e1 t1
b2 have "v.04" e1
b2 time "n.08" t1
b2 REF x2
b2 Quantity x2 "3000"
b2 book "n.02" x2
```

Reference:
Kirk has three thousand books.

DRS: Quantity change

```
b1 REF x1
b1 Name x1 "tom"
b1 PRESUPPOSITION b2
b1 male "n.02" x1
b2 REF e1
b2 REF t1
b2 EQU t1 "now"
b2 Pivot e1 x1
b2 Theme e1 x2
b2 Time e1 t1
b2 have "v.04" e1
b2 time "n.08" t1
b2 REF x2
b2 Quantity x2 "3200"
b2 book "n.02" x2
```

Reference:
Tom has 3,200 books.

Semantic Challenge sets — References

Original	Tom has three thousand books.
Tense	Tom had three thousand books.
Polarity	Tom does not have three thousand books.
Number	Tom has one book.
Names	Kirk has three thousand books.
Quantity	Tom has 3,200 books.

Expert Assessment: ROSE

Semantics
- score 1 if the meaning of the output reflects that of the underlying meaning representation

Phenomenon
- score 1 if the phenomenon of control is generated at all

Grammaticality
- score 1 if the sentence is grammatical and free of spelling mistakes

Results — Expert Assessment Results

Performance of the character-level model for five different challenge sets.

		BLEU		METEOR		ROUGE		Sem.		Gram.		Phen.		ROSE	
	#	Orig	Chal	Orig	Chal	Orig	Chal	Orig	Chal	Orig	Chal	Orig	Chal	Orig	Chal
Tense	200	68.4	55.8	50.9	44.8	85.0	76.1	80.0	71.0	92.0	87.5	99.5	86.5	78.0	64.0
Polarity	100	68.1	37.4	50.8	37.9	85.0	66.1	80.0	52.0	96.0	81.0	100.0	99.0	78.0	49.0
Number	100	72.5	69.2	53.7	53.4	85.7	86.4	80.0	79.0	95.0	84.0	100.0	95.0	77.0	69.0
Names	50	69.1	71.9	53.0	53.5	87.2	87.8	82.0	76.0	94.0	84.0	100.0	98.0	82.0	74.0
Quantity	50	69.7	68.0	56.4	50.6	86.0	83.4	88.0	72.0	98.0	90.0	92.0	84.0	86.0	70.0

Examples of generated texts from the challenge set DRSs, compared with reference texts.

	Reference text	Generated text	Sem.	Gram.	Phen.	ROSE
(a)	She liked short skirts.	She liked short tomical.	0	0	1	0
(b)	Tom does not have three thousand books.	Tom never has three thousand books.	0	1	1	0
(c)	The small skirt will be pink.	The small skirt was pink.	0	1	0	0
(d)	He left 157 minutes ago.	He left fifteen minutes ago.	0	1	0	0
(e)	I checked it nine times.	I checked it nine.	0	0	1	0
(f)	We are painting the house green.	I paint the house green.	1	1	1	1
(g)	That hat cost around fifty dollars.	This hat cost about 50 dollars.	1	1	1	1
(h)	When I painted this picture, I was 23 years old.	I painted the picture when I was twenty-three years old.	1	1	1	1

Results — Standard Automatic Metrics Results

	BLEU	METEOR	ROUGE
Char-level (raw)	69.3	51.8	84.9
Word-level (tok)	64.7	47.8	81.8

Conclusion

➢ Character-level achieves higher standard automatic metrics scores than word level

➢ Negation and tense are the most challenging phenomena

➢ Changes in grammatical number and generalizations to unseen quantities or names are well handled by the model.