Does Referent Predictability Affect the Choice of Referential Form? A Computational Approach Using Masked Coreference Resolution

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Research question

- Do speakers (and writers) produce less informative referring expressions (e.g., pronouns vs. full NPs) when the context is more informative about the referent ?

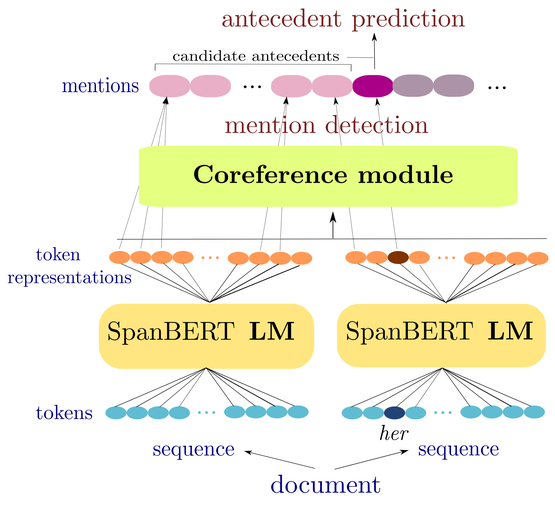
less predictable → more informative expression (e.g., *the first female chancellor of Germany*)

more predictable → less informative expression (e.g., *she*)

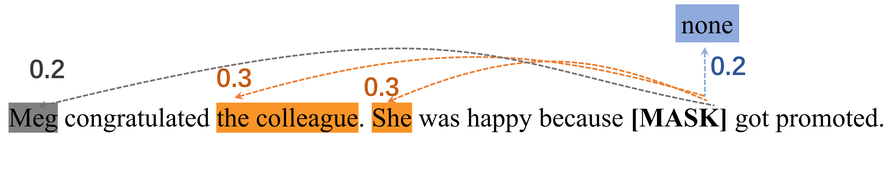
Problem

- Previous work offers contradictory conclusions.
- Previous experimental approach does not scale well.

Solution



- We train a variant of an existing coreference resolution system (Joshi et al., 2020, shown above) to carry out *masked coreference resolution* - a setup resembling those of cloze tasks used in psycholinguistics to estimate referent predictability.



Is the system sufficiently human-like?

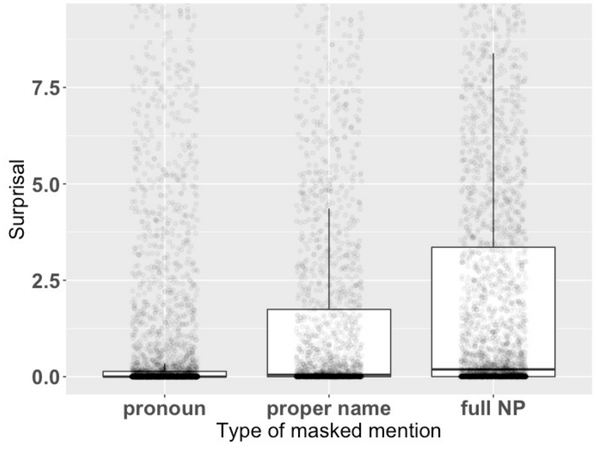
- OntoNotes test set: Our variant retains the same performance of the original system on unmasked mentions (ordinary coreference resolution), but improves substantially on masked mentions.

		Unmasked mentions						Masked mentions		
		Coreference			Antecedent			Antecedent		
	boundaries	P	R	F1	P	R	F1	P	R	F1
$\mathbf{M}_u$	predicted	.78	.77	.77	.86	.82	.84	.42	.39	.4
	gold	.91	.85	.88		.90			.50	
$\mathbf{M}_m$	predicted	.78	.76	.77	.86	.82	.84	.69	.69	.69
	gold	.91	.86	.88		.91			**.74**	

- The system yields a better estimate of human-derived referent predictability (data from Modi et al., 2017) than previous attempts.

Predictability and mention form

Predictability operationalized information-theoretically as surprisal (x): $-\log_2 P(E_x = e_{true}|c_x)$

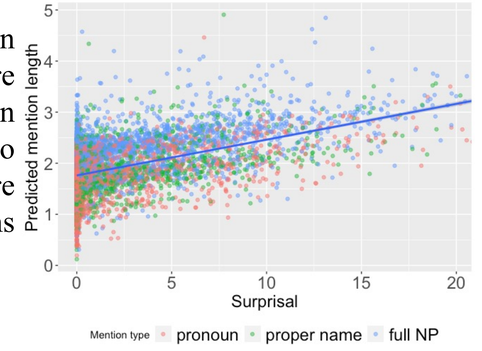


- A multinomial logistic regression shows that pronouns are used for more predictable referents, while names and full NPs tend to have higher surprisal (i.e., their referent is less predictable).

Predictability? Or something else?

Shallow features
recency: num. sentences between target mention and its closest antecedent
frequency: num. mentions of the target mention's referent so far
closest antecedent is previous subject
target mention is subject
closest antecedent type

- Predictability still affects mention choice when shallow linguistic features are controlled for.
- Using mention length as a measure of information content, we also found that more surprising mentions tend to be longer.



Conclusion and discussion

- Our results support the hypothesis that predictability affects the form of a mention, both its morphosyntactic type and its length.
- Referent predictability seems to play a partially overlapping but complementary role on referential choice with features affecting the salience of an entity.
- We defined the masked coreference resolution task and showed how training a state-of-the-art model on this task gives us human-like judgments of predictability, but in a scalable way.