Student Abstract & Poster Session AAAI-21

Comparing Symbolic Models of Language via Bayesian Inference

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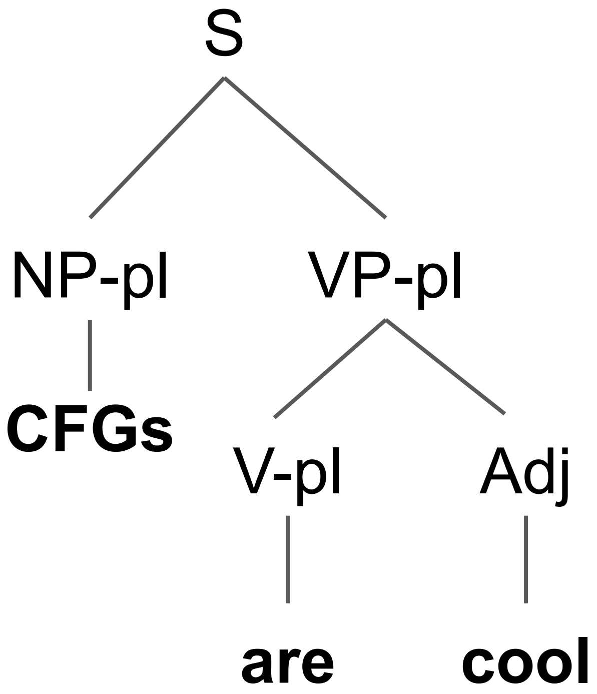
Context-free grammars (CFGs) - Symbolic Models



Probabilistic CFGs (PCFGs)

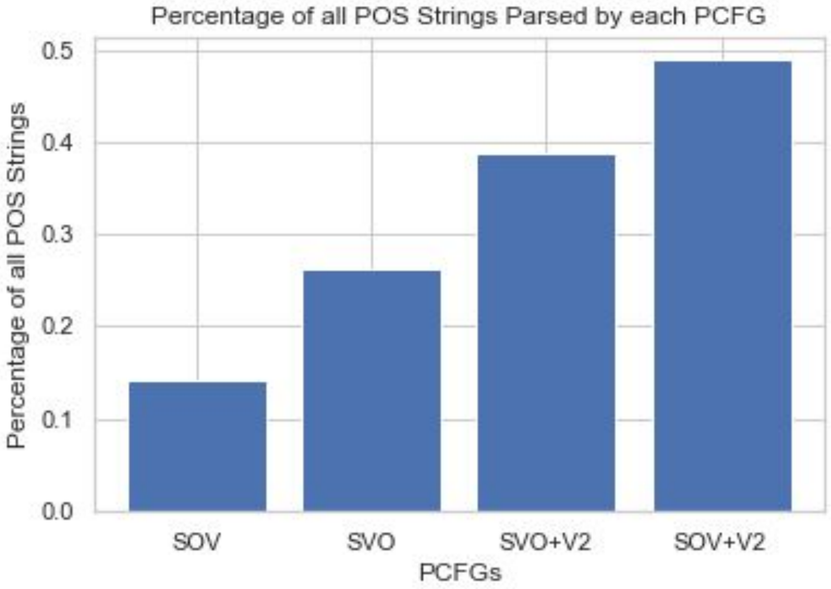
S -> NP-pl VP-pl 0.5
S -> NP-s VP-s 0.5

[1], [2], [5]

Our PCFG hypotheses cannot be compared directly

$$P(\text{CFG, Type} \mid \text{Data}) \propto P(\text{Data} \mid \text{CFG, Type})\, P(\text{CFG} \mid \text{Type})\, P(\text{Type})$$

Posterior Likelihood Priors



P(Data | CFG, Type) =

Product of each PCFG rule needed to parse each sentence

[4], [6], [8]

Challenges & Proposed Solutions

Errors in data: 31.65% of the total POS strings are ungrammatical

Different data subset sizes → Normalize by number of sentences in subset

PCFGs penalized for parsing more sentences because:

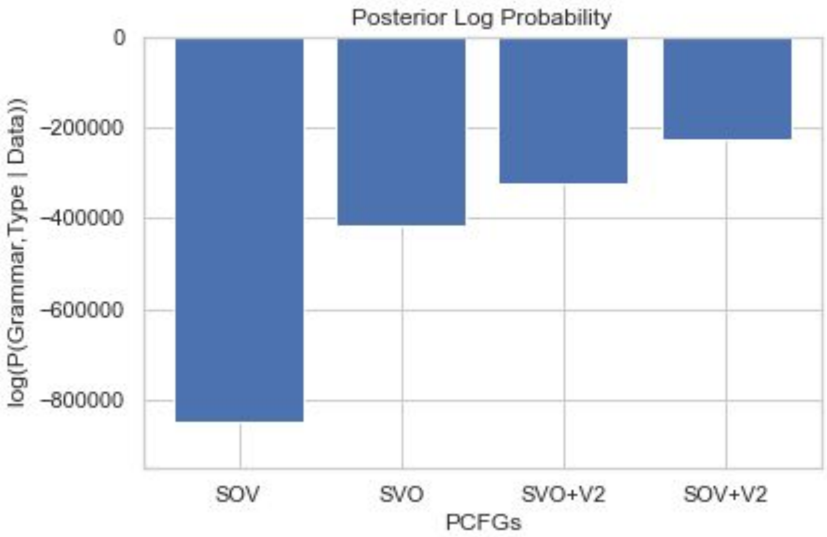
1. Longer sentences = lower likelihood → Normalize by sentence length
2. More generalizable = less probability mass per sentence type → Weight by proportion of parseable sentence types

[4], [6]

Contributions

- Revealed troubling number of errors resulting from transcription and part-of-speech (POS) tagging

- Method of comparing CFGs that account for different subsets of data



[6], [7]

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[7] Tenenbaum, J. B.; Kemp, C.; Griffiths, T. L.; and Goodman, N. D. 2011. How to grow a mind: Statistics, structure, and abstraction. *Science* 331(6022): 1279–1285.

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