Comparing memory-based and neural network models of early syntactic development
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PROBLEM
How syntactically productive are children’s early utterances?
- We compare models of early syntactic development, the CBL of McCauley and Christiansen (2019) and an LSTM recurrent neural network model to determine which one better reproduces the syntactic production behavior of children.

HYPOTHESIS: CBL will perform worse than the LSTM at predicting longer child utterances. Shorter utterances can be memorized by both models; Longer utterances likely require learning some intermediate structure.

DATA
- 39 English CHILDES corpora
  - At least 1:20 child/caregiver
  - At least 20 000 words
- Vocabulary size in relation to corpus size
- Average counts for each utterance length

RESULTS
Mean production score using greedy decoder
- CBL: 57, 95%CI[53.60]
- LSTM: 62, 95%CI[58.66]
Mean production score using beam search decoder
- CBL: 63, 95%CI[59.66]
- LSTM: 69, 95%CI[65.73]

PRODUCTION TASK
For CBL, tokens are chunks (multi word); For LSTM, tokens are words.

MODELS
- Chunk Based Learner (CBL) - McCauley & Christiansen (2019)
  - Learns multiword chunks using backward transition probabilities
  - No other abstraction
  - E.g. Chunk processing for ‘The dog chased the cat.’
- Long Short Term Memory Recurrent Neural Network (LSTM)
  - Straightforward NLP model used for language modelling
  - Able to learn longer dependencies (Linzen et al. 2016) and representational abstractions

CONCLUSIONS
- LSTM has better performance overall, supporting our hypothesis that abstractions learned by LSTMs better model child production behavior.
- BUT: Neither model was able to reliably predict longer child utterances, suggesting that models learning more structured grammatical representations are more suited to describe children’s syntactic acquisition.

REFERENCES

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