A new model of local coherences resulting from Bayesian belief update
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Abstract
Local coherences are cases in which it appears that the parser is systematically ignoring contextual information about possible syntactic structures and pursuing analyses that are probable only locally. We describe a new model of local coherence effects under rational comprehension, proposing that they arise as a result of updating bottom-up prior beliefs about the structures for a given string to posterior beliefs about the likelihoods of those structures in context. The critical intuition embodied in the model is that larger updates in probability distributions should be more processing-intensive. An experiment demonstrates that this model makes the correct predictions for the data from the original Tabor et al. experiment.

The intuition

A new sentence composed of familiar parts
- These likely structures can be incompatible
- belief update: deciding what to throw away

The model
For each syntactic category X:
- begin with ‘bottom-up’ Prior: \( P(X_{w_i} | w_j) \)
- integrate with ‘top-down’ knowledge to reach Posterior: \( P(X_{w_i} | w_j) \)
- \( M_{ij} \) = amount of modification required to update prior to posterior when integrating \( w_i \)

The intuition (Tabor et al., 2004)
- ‘local coherence’ in the player tossed a frisbee
- makes a great sentence by itself
- this parse competes with global parse

The model (Tabor & Hutchins, 2004)
- self-organized parsing
- parsing: activating lexically anchored tree fragments
- fragments activate compatible fragments
- locally coherences make system take longer to stabilize


Motivation & Goals
Question why use such an irrational strategy?
Goal 1 present a model maintaining Tabor et al.’s intuition in a rational framework
Goal 2 show that it correctly predicts the Tabor et al. data

Conclusions
A new model
- context-independent beliefs about likely structures for words being integrated (Prior) are updated to in-context beliefs (Posterior)
- rational if prior beliefs are available more rapidly (e.g., maybe they are precomputed)
- can account for the results of the Tabor et al. experiment

References

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