



Department of Computer Science
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Distributional Semantics

Advanced Machine Learning for NLP

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SLIDES ADAPTED FROM YOAV GOLDBERG AND OMER LEVY

What's wrong with PMI?

- PMI-based methods prefer rare words
- E.g., closest to “king”



- Jeongjo (Koryo), Adulyadej (Chakri), Coretta (MLK)
- Hard to scale
- Doesn't work as well?

Hyperparameters Matter

- Preprocessing (word2vec)
 - Dynamic Context Windows
 - Subsampling
 - Deleting Rare Words

Postprocessing (GloVe)

- Adding Context Vectors

Association Metric (SGNS)

- Shifted PMI
- Context Distribution Smoothing

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Dynamic Context Windows

saw a furry little wampimuk hiding in the tree

word2vec:	1/4	2/4	3/4	4/4		4/4	3/4	2/4
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GloVe:	1/4	1/3	1/2	1/1		1/1	1/2	1/3
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Aggressive:	1/8	1/4	1/2	1/1		1/1	1/2	1/4
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The Word-Space Model (*Sahlgren, 2006*)

Adding Context Vectors

- Skip-Gram Negative Sampling creates word vectors w
- ... and context vectors c
- Pennington et al. (2014) use $w + c$ to represent word

Smoothing

- Introduced in word2vec for negative sampling ($\alpha = 0.75$)

$$\hat{P}_\alpha(c) = \frac{\#(c)^\alpha}{\sum_{c'} \#(c')^\alpha} \quad (1)$$

- For PMI, helps remove bias toward rare words

Smoothing

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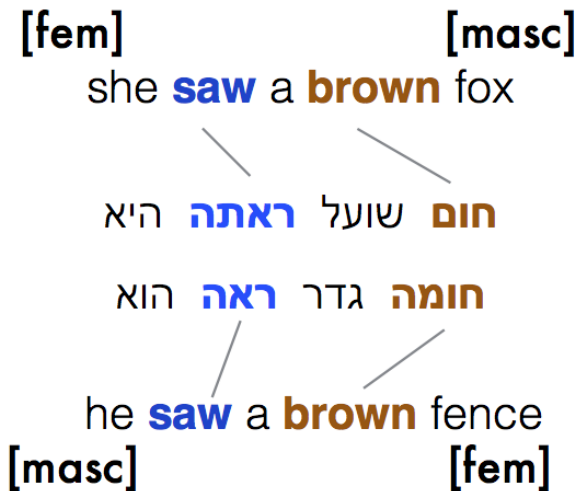
$$\hat{P}_\alpha(c) = \frac{\#(c)^\alpha}{\sum_{c'} \#(c')^\alpha} \quad (1)$$

- For PMI, helps remove bias toward rare words
- And makes it about as good as word2vec

Rant on Evaluation

- Analogy and Similarity aren't that useful
- Find a real-world task and optimize for that
- Innovation is still possible
- Just getting better word vectors is a fruitless cottage industry

Other Languages are Harder



וכשמהבית

and when from the house

בצל

in shadow

בצל

onion

Other Languages are Harder

ספר

book(N). barber(N). counted(V). tell!(V). told(V).

חומה

brown (feminine, singular)

wall (noun)

her fever (possessed noun)