Sparsity in Dependency Grammar Induction

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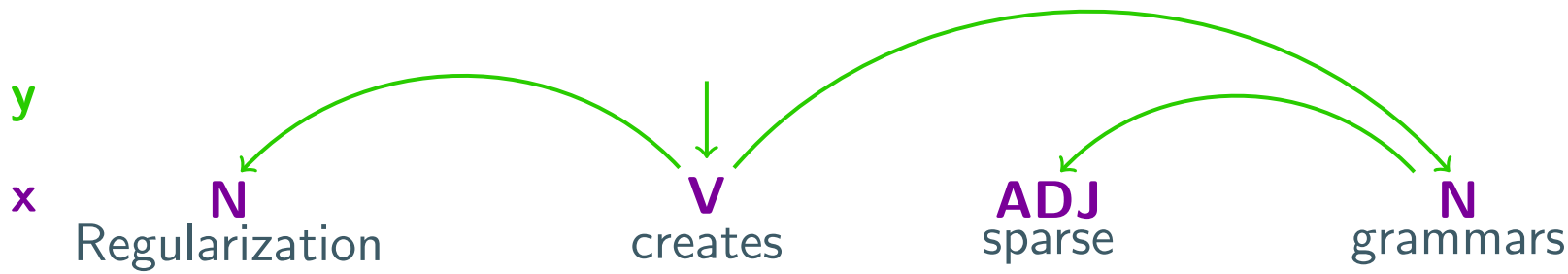
Dependency model with valence (Klein and Manning, ACL 2004)

$$p_\theta(\mathbf{x}, \mathbf{y})$$



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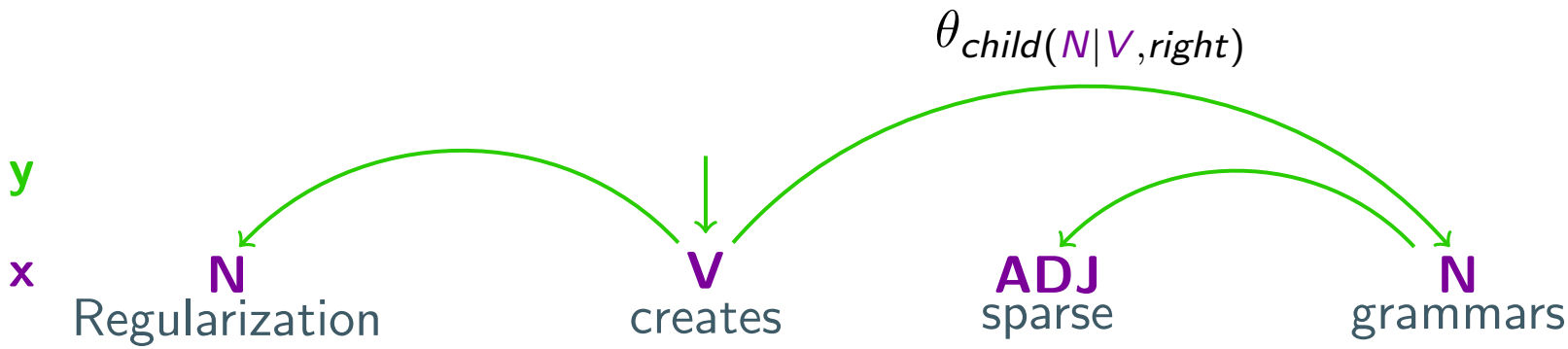

Traditional objective optimization

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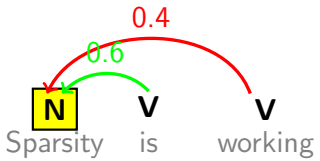
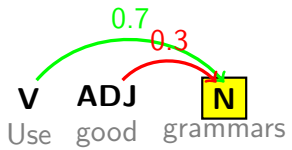
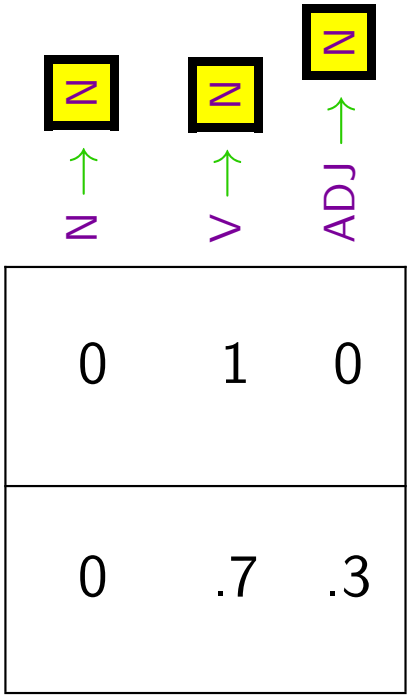
- **Problem**: EM may learn a very ambiguous grammar
  - V $\rightarrow$ N should have non-zero probability, but ...
  - V $\rightarrow$ DET, V $\rightarrow$ JJ, V $\rightarrow$ PRP$, etc. should be 0

Measuring ambiguity on distributions over trees







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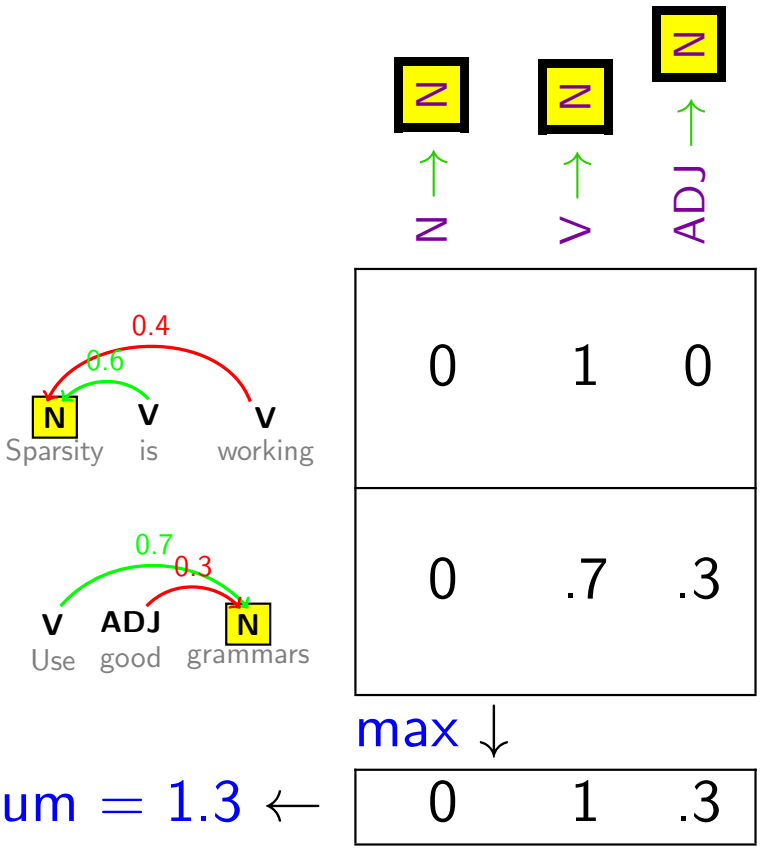

Minimizing ambiguity through posterior regularization

E-Step $q^t(\mathbf{y} \mid \mathbf{x}) = \arg\min_{q(\mathbf{y}|\mathbf{x})} KL(q \parallel p_{\theta^t})$

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E-Step $$q^t(\mathbf{y} \mid \mathbf{x}) = \arg\min_{q(\mathbf{y}|\mathbf{x})} KL(q \parallel p_{\theta^t}) + \sigma L_{1/\infty}(q(\mathbf{y} \mid \mathbf{x}))$$

Experimental results

- English from Penn Treebank: state-of-the-art accuracy

	Accuracy		
Learning Method	≤ 10	≤ 20	all
EM	45.8	40.2	35.9
Sparsifying Dirichlet Prior	46.4	40.9	36.5
PR ($\sigma = 140$)	**62.1**	**53.8**	**49.1**

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- **Come see the poster for more details**