Application of neural networks to discourse coherence.

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February 18, 2015

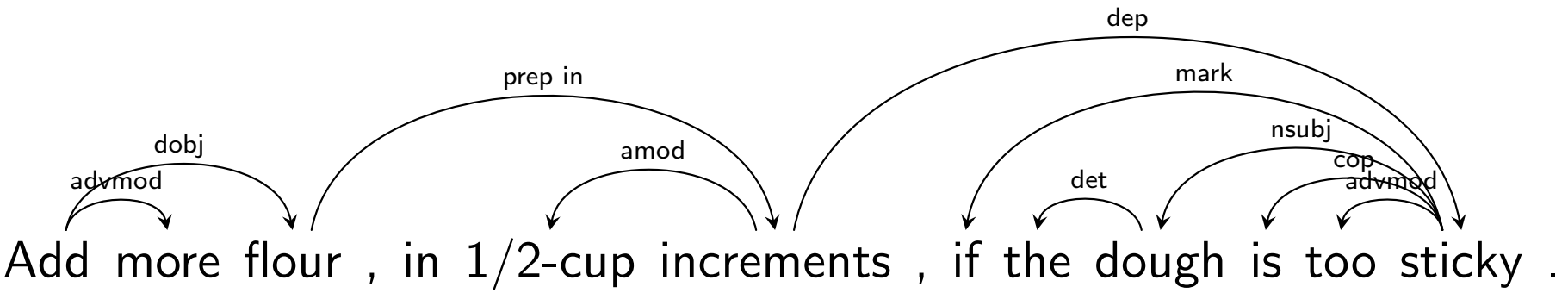
Overview

Discourse Coherence

Structure in NLP

Add more flour , in 1/2-cup increments , if the dough is too sticky .

Structure in NLP



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Structure in NLP

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! Place dough in oven and set for 400 degrees.

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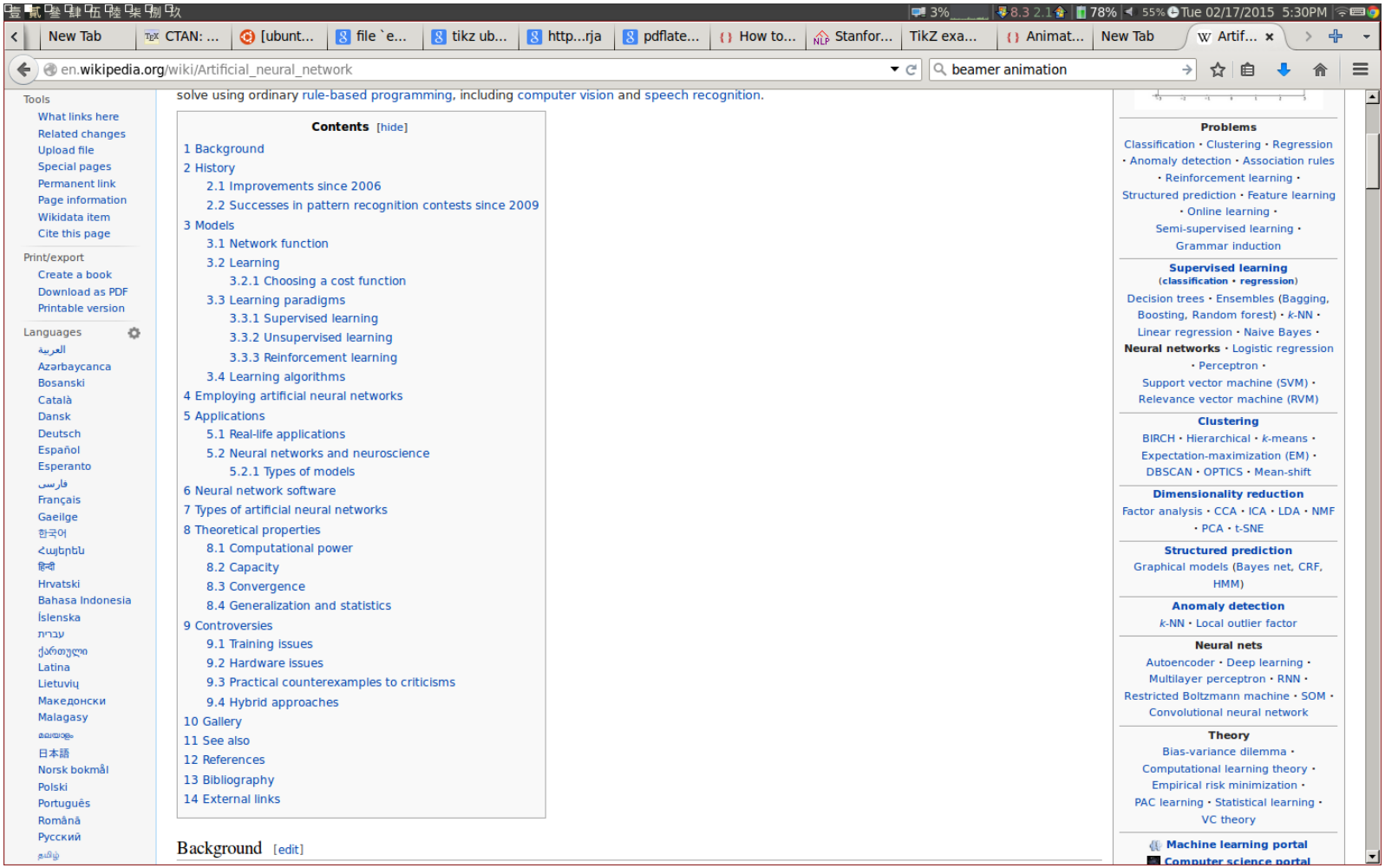
Discourse Structure is everywhere!



Discourse Coherence

Discourse Structure

1. Describe the relations that hold between discourse units.

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2. Varying levels of granularity.
3. Varying linguistic theories.

Discourse Parsing is Hard

1. High ambiguity.

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2. Annotation is complex.

Discourse Coherence

Task Definition

Let h be a human authored document.

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Let h be a human authored document.
Let $perm(h)$ be the set of all permutations of h.
Learn a function $rank$,

s.t. $rank(h) > rank(p)$ for all $p \in \{d \in perm(h) : d \neq h\}$.

Discourse Coherence

Entity Grid

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Entity Grid

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Entity Grid

1. dough, *direct object*
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Entity Grid

1. dough, *direct object*
2. dough, *subject*
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Entity Grid

1. dough, *direct object*
2. dough, *subject*
3. dough, *subject*; *direct object*

Entity Grid

	dough
Role. 1	S
Role. 2	O
Role. 3	S

Entity Grid

	dough	**flour**
Role. 1	S	$-$
Role. 2	O	O
Role. 3	S	$-$

Entity Grid

	dough	flour	hands
Role. 1	S	$-$	X
Role. 2	O	O	$-$
Role. 3	S	$-$	$-$

Entity Grid

	dough	**flour**	**hands**	$\cdots$
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Role. 2	O	O	$-$	$\cdots$
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Entity Grid

	dough	flour	hands	$\cdots$
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$$\mathbf{x} = [\ p(O|S) \qquad\qquad]$$

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$$\mathbf{x} = [\, p(O|S),\ p(S|S \rightarrow O), \cdots \,]$$

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$$\mathbf{x} = [\, p(O|S),\ p(S|S \rightarrow O), \cdots\,]$$

Learn a linear ranking function using this vector representation, e.g.,

$$\mathbf{w} \cdot \mathbf{x}_h > \mathbf{w} \cdot \mathbf{x}_p$$

where $\mathbf{x}_h$ and $\mathbf{x}_p$ are derived from human authored and randomly permuted documents respectively.

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5. All hail Zuul!
6. Continue to knead for another 3 minutes, remembering to dust your board with flour when necessary.

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$$p(y_3 = \text{coherent} | s_2, s_3, s_4) = .87$$

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$$p(y_4 = \text{coherent} | s_3, s_4, s_5) = .48$$

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$$p(y_5 = \text{coherent} | s_4, s_5, s_6) = .12$$

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$$p(y_6 = \text{coherent} | s_7, s_6, s_7) = .85$$

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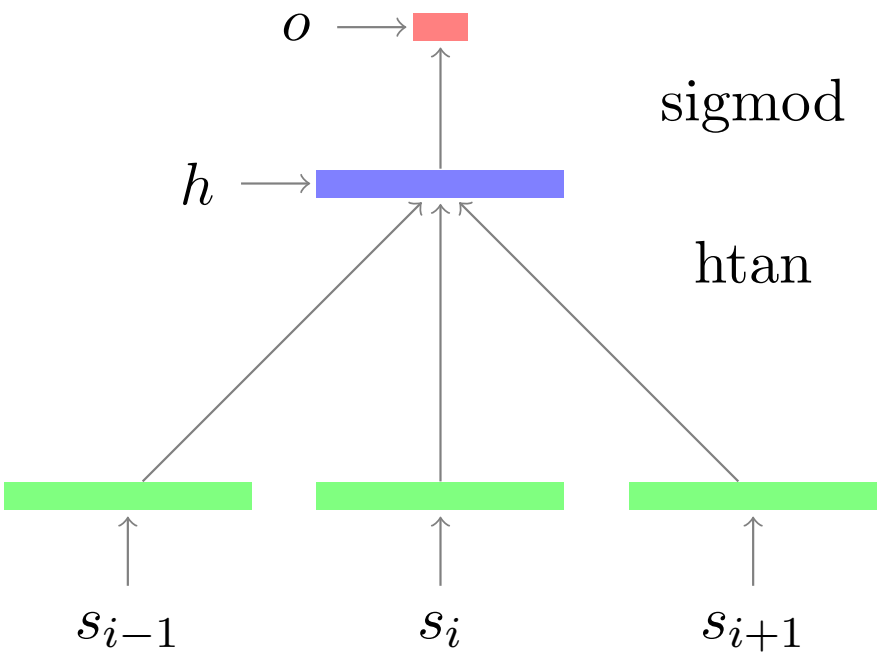
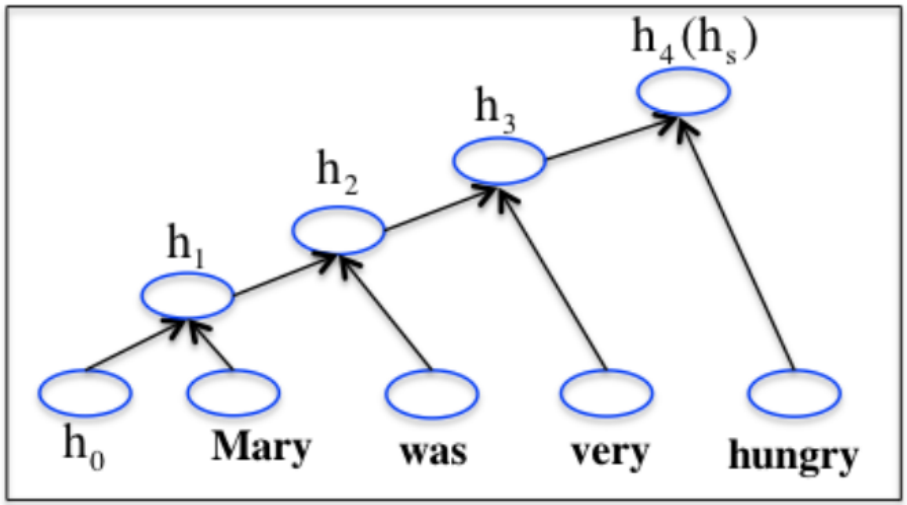
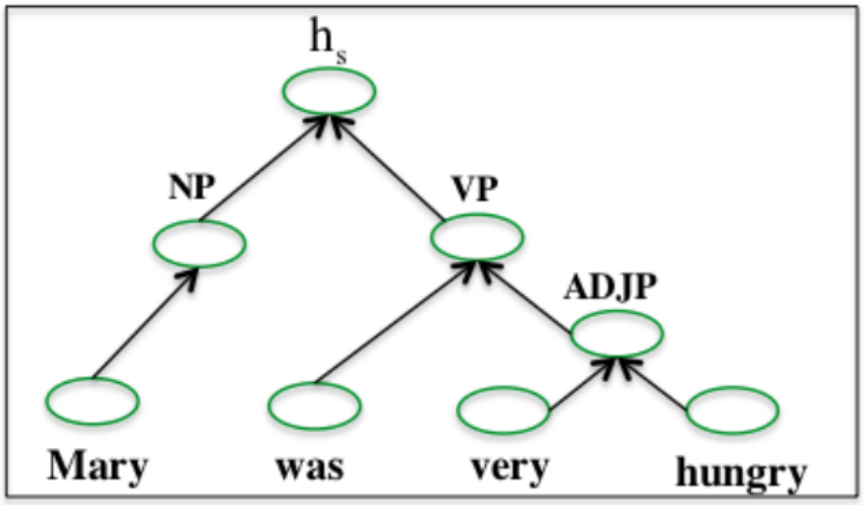


Sentence Representation





Discourse Coherence

Convolutional Neural Network

- RNN's don't propagate important features efficiently
- Hierarchical NN's require a parse (expensive)

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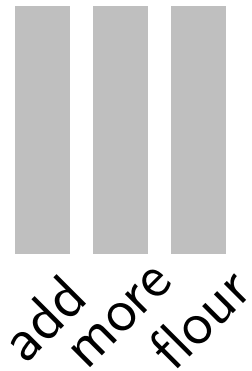
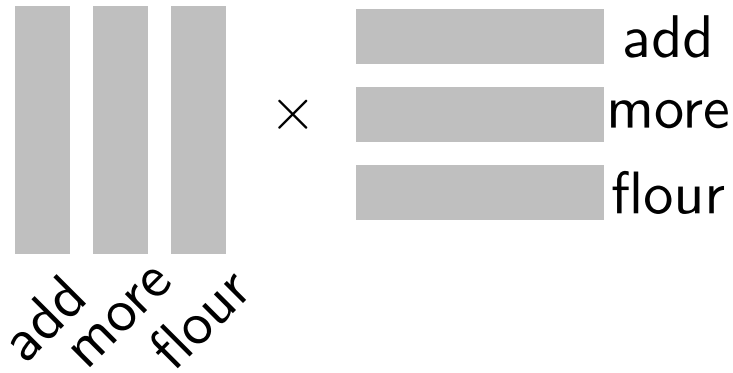
- RNN's don't propagate important features efficiently
- Hierarchical NN's require a parse (expensive)
- Perhaps there is a convolutional approach...


add
more
flour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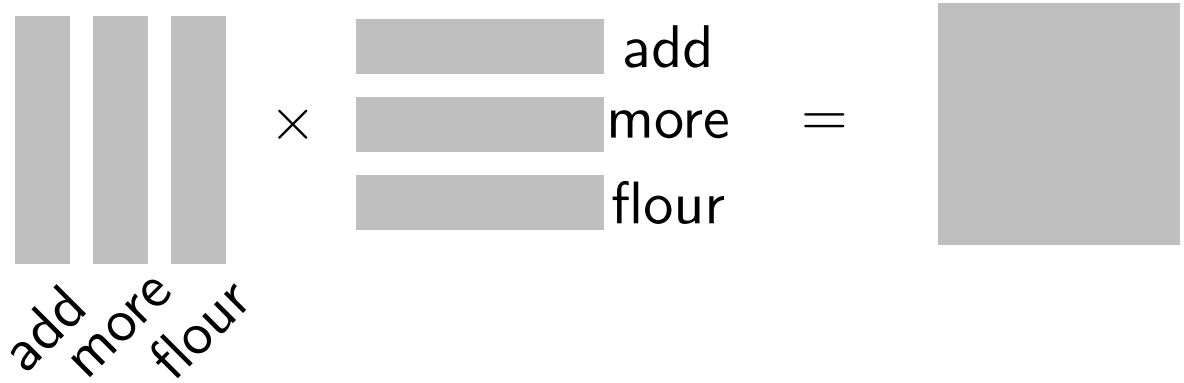
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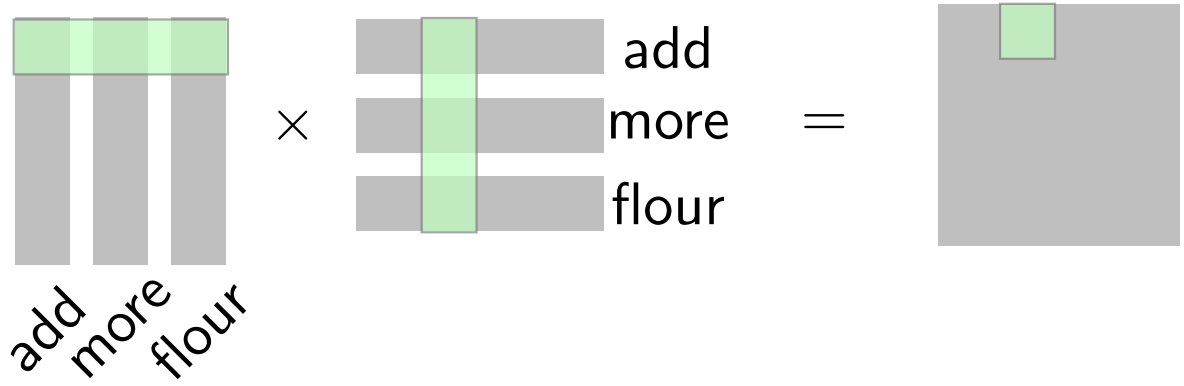
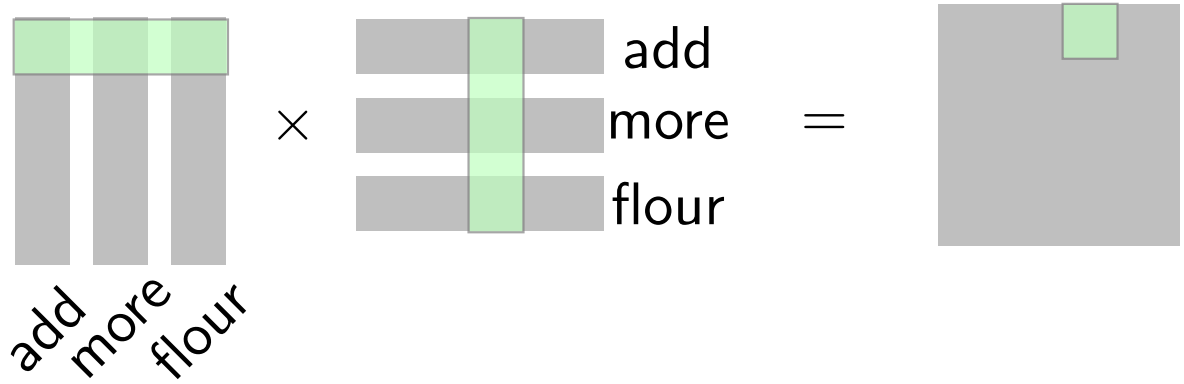
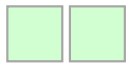


Sentence Kernel 





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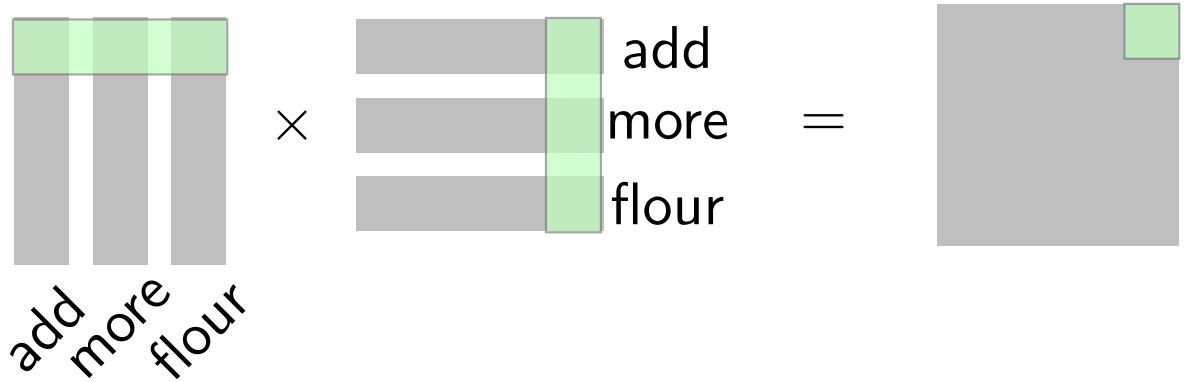

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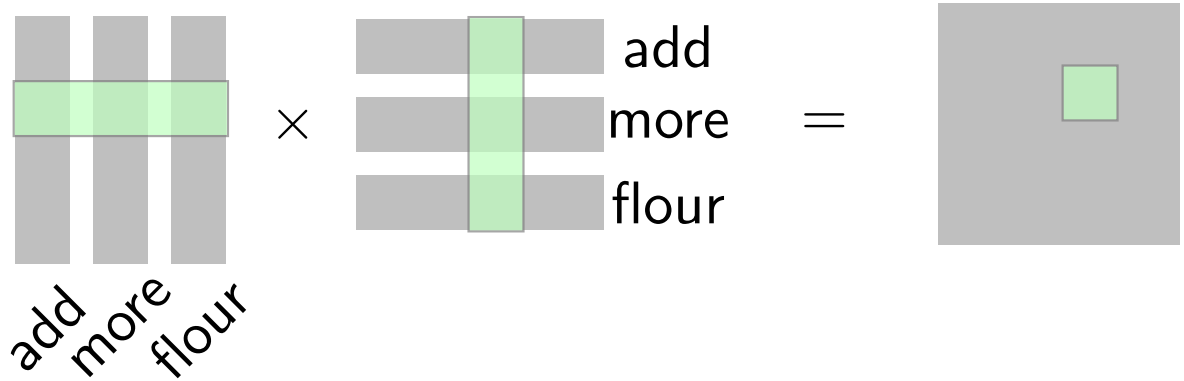
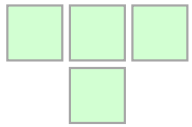
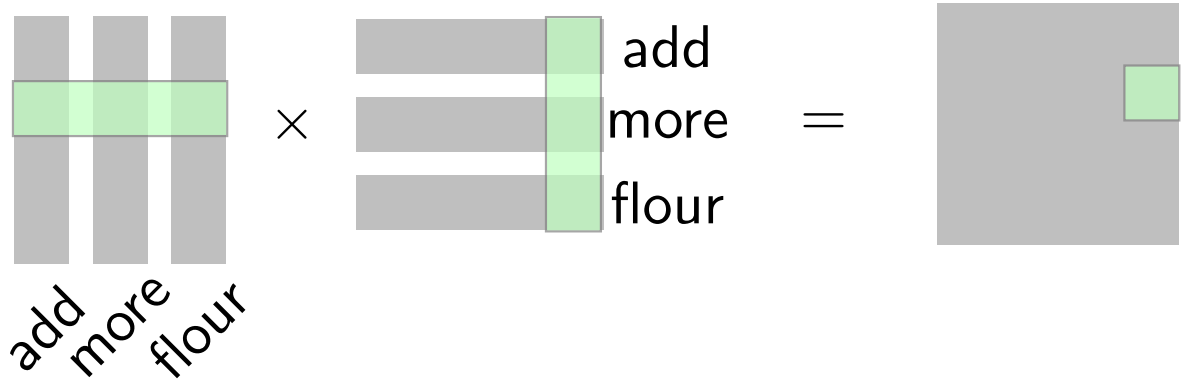
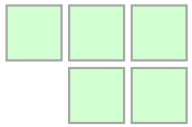
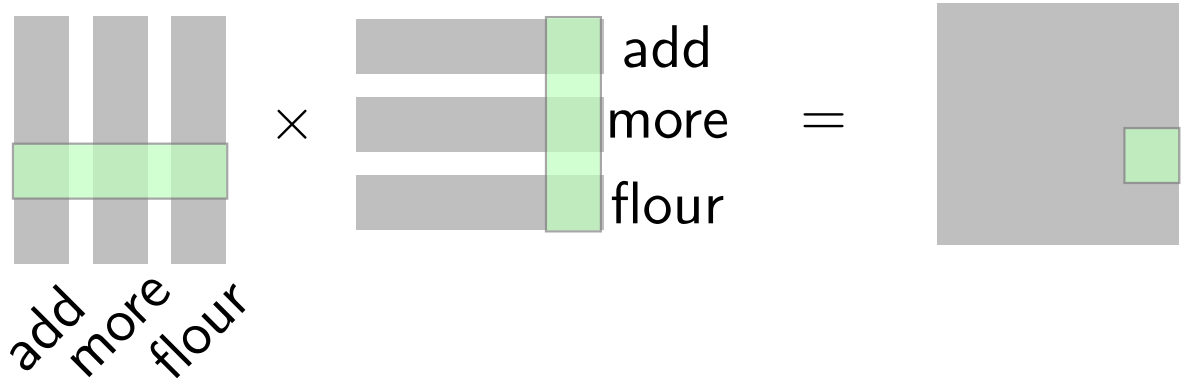
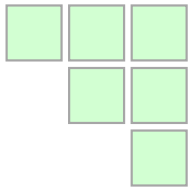


Sentence Kernel 



Sentence Kernel 



Sentence Kernel 

The End