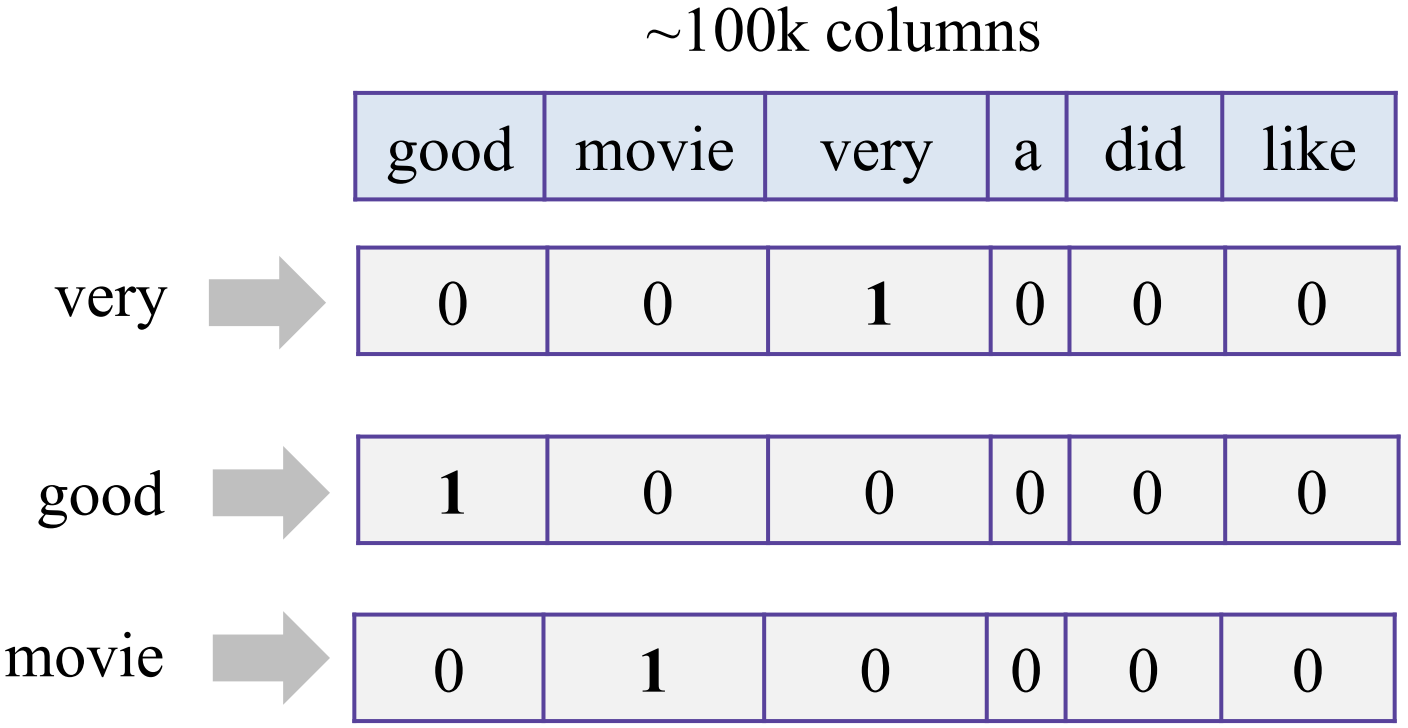
Neural networks for text

What is text?

You can think of text as a sequence of

- Characters
- **Words**
- Phrases and named entities
- Sentences
- Paragraphs
- …

Bag of words way (sparse)



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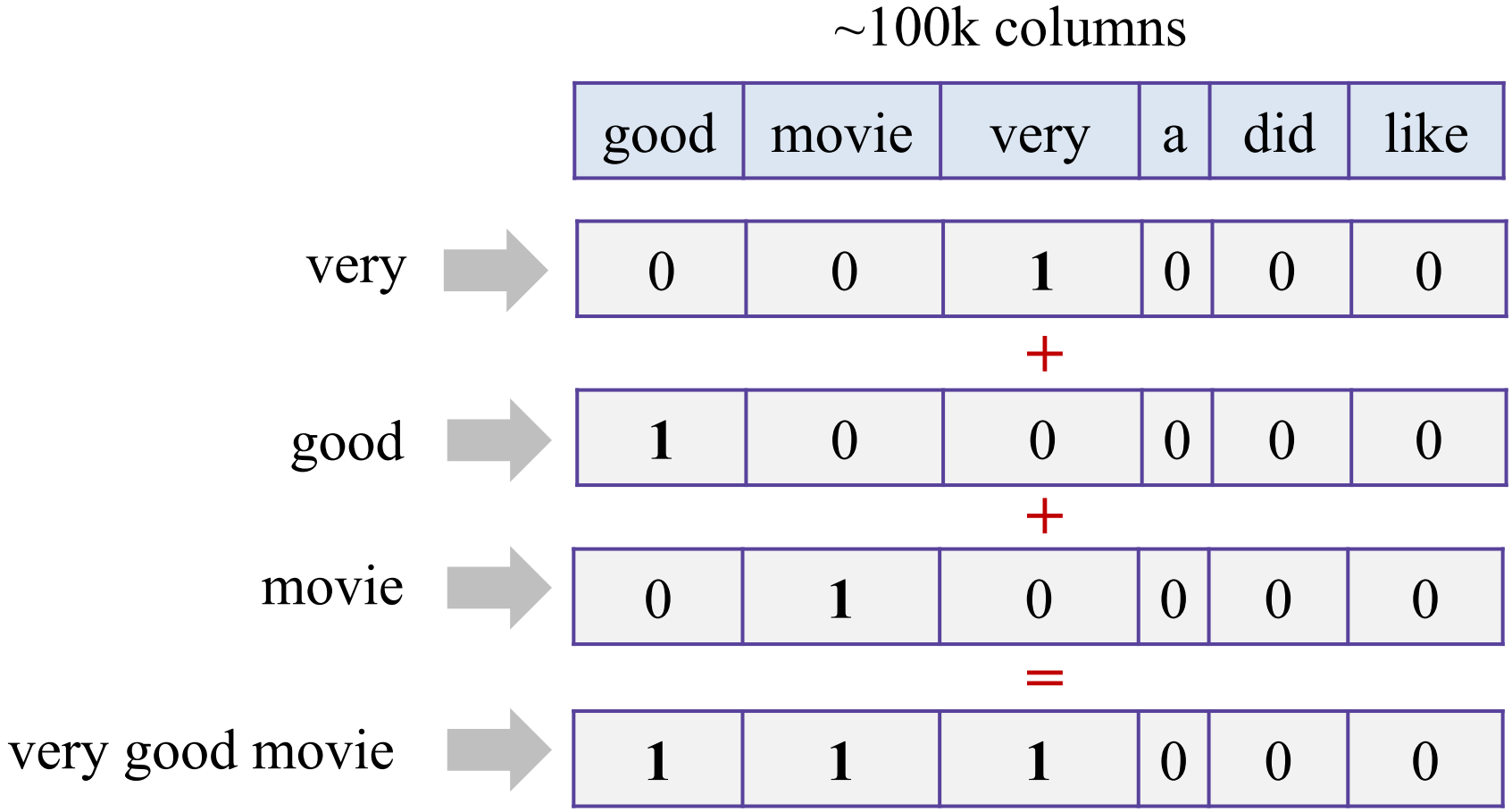
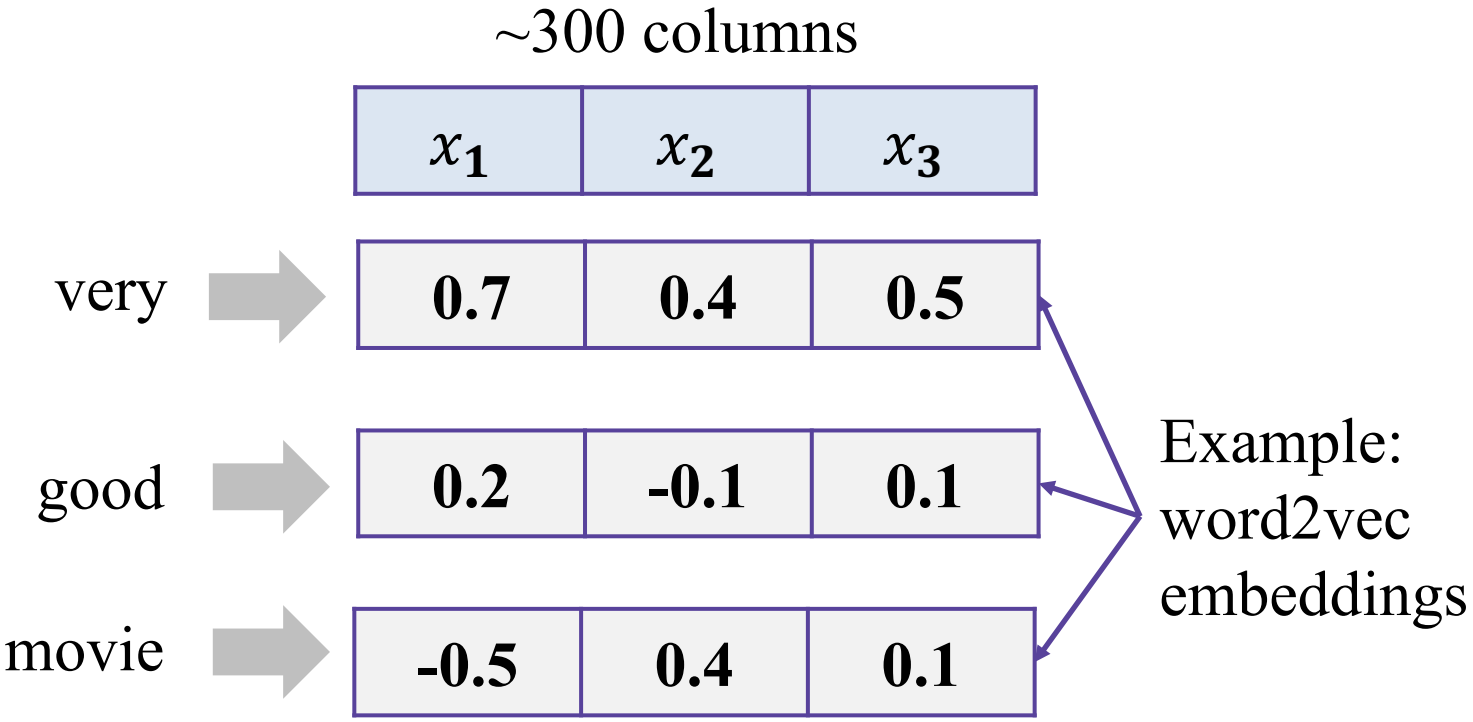


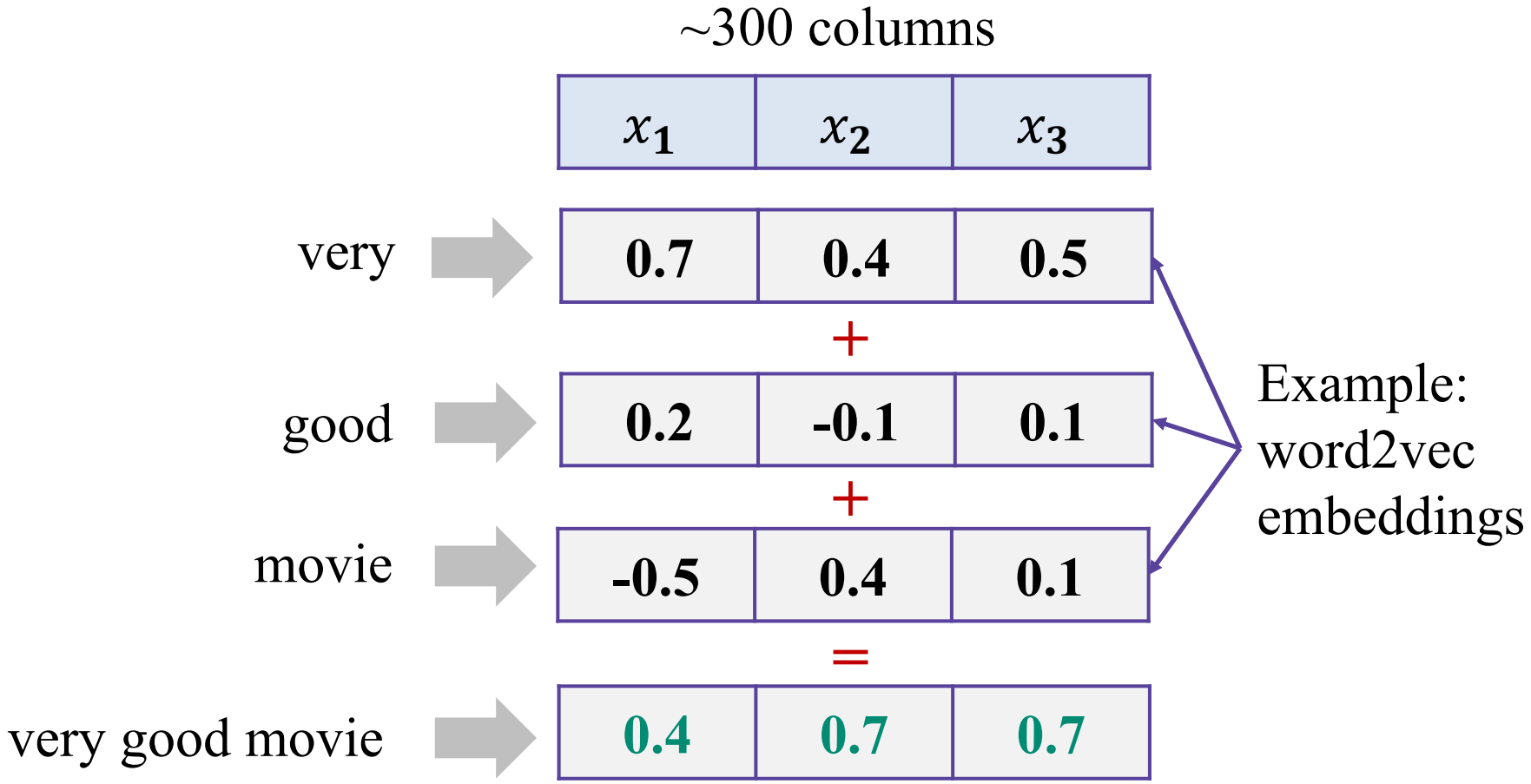
Bag of words representation
is a sum of sparse one-hot-encoded vectors

Neural way (dense)



Word2vec property:
Words that have similar context tend to have collinear vectors

Neural way (dense)



Sum of word2vec vectors
can be a good text descriptor already!

A better way: 1D convolutions

Word embeddings

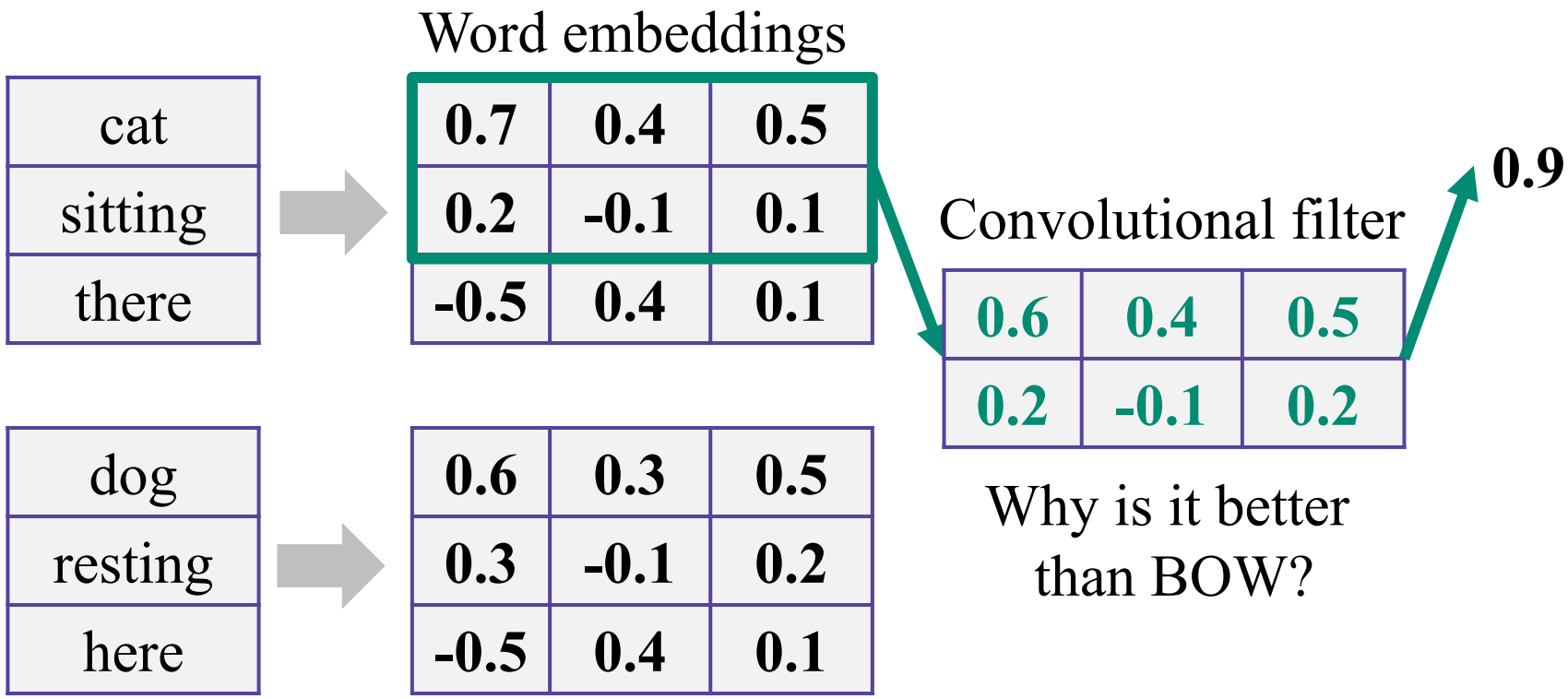
cat	**0.7**	**0.4**	**0.5**
sitting	**0.2**	**-0.1**	**0.1**
there	**-0.5**	**0.4**	**0.1**

dog	**0.6**	**0.3**	**0.5**
resting	**0.3**	**-0.1**	**0.2**
here	**-0.5**	**0.4**	**0.1**

How do we make 2-grams?

http://bionlp-www.utu.fi/wv_demo/

A better way: 1D convolutions



- This convolution provides high activations for 2-grams with certain meaning

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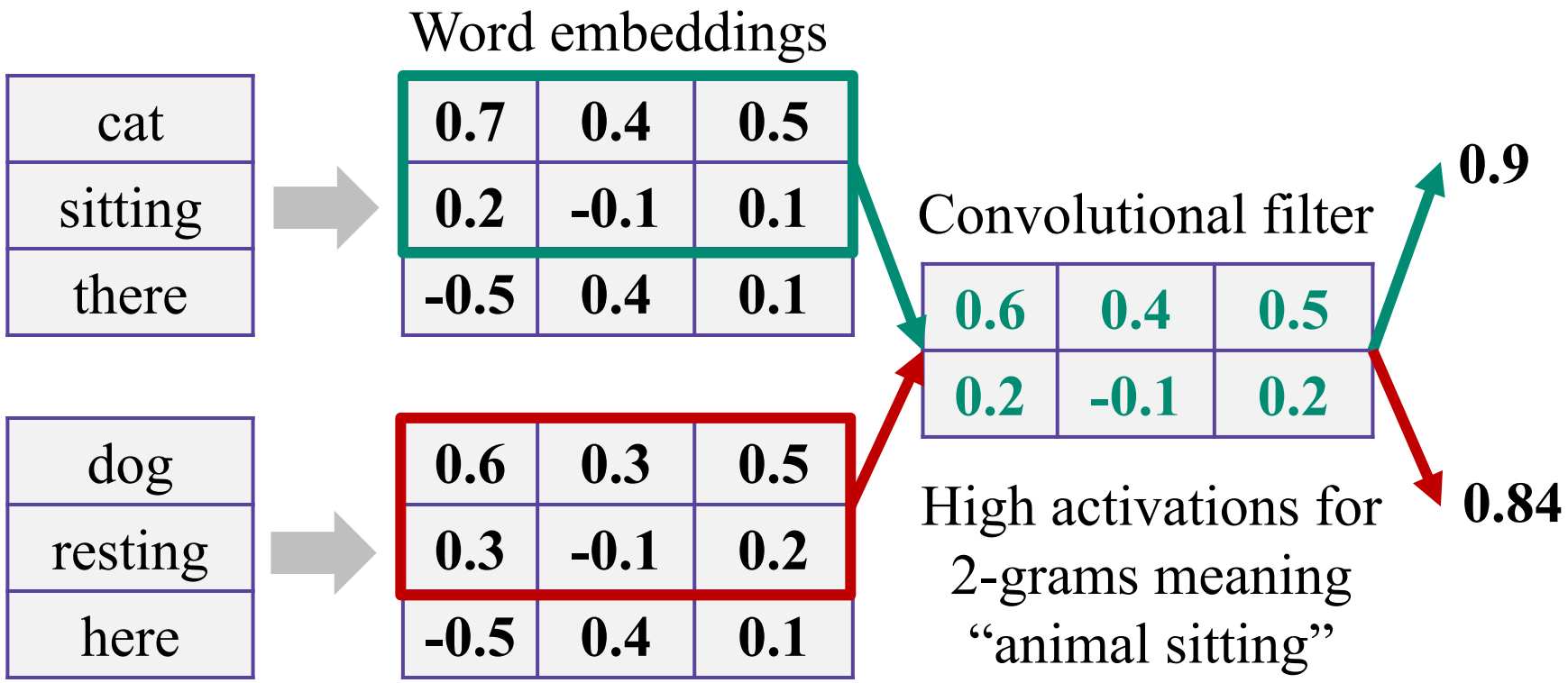
A better way: 1D convolutions

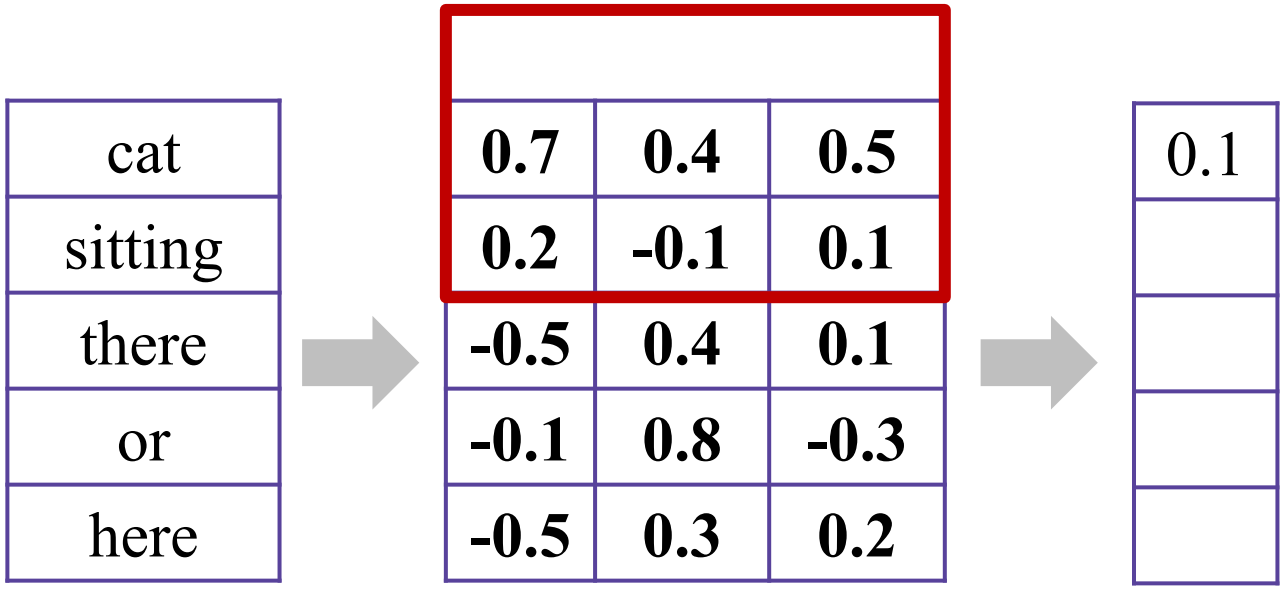


- This convolution provides high activations for 2-grams with certain meaning
- Word2vec vectors for similar words are similar in terms of cosine distance (similar to dot product)

http://bionlp-www.utu.fi/wv_demo/

1D convolutions

- Can be extended to 3-grams, 4-grams, etc.
- One filter is not enough, need to track many n-grams
- They are called 1D because we slide the window only in one direction



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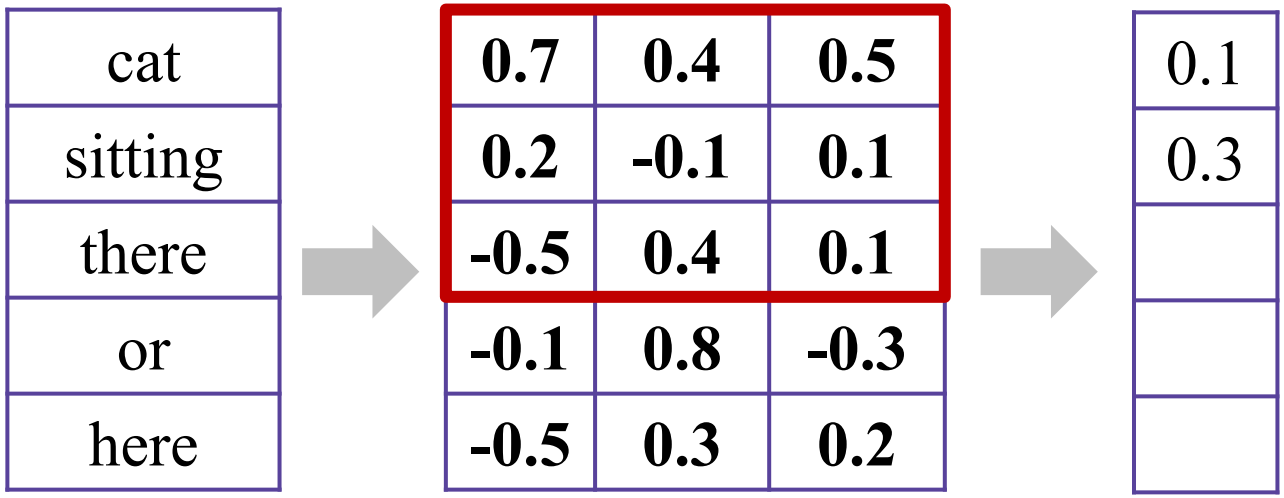

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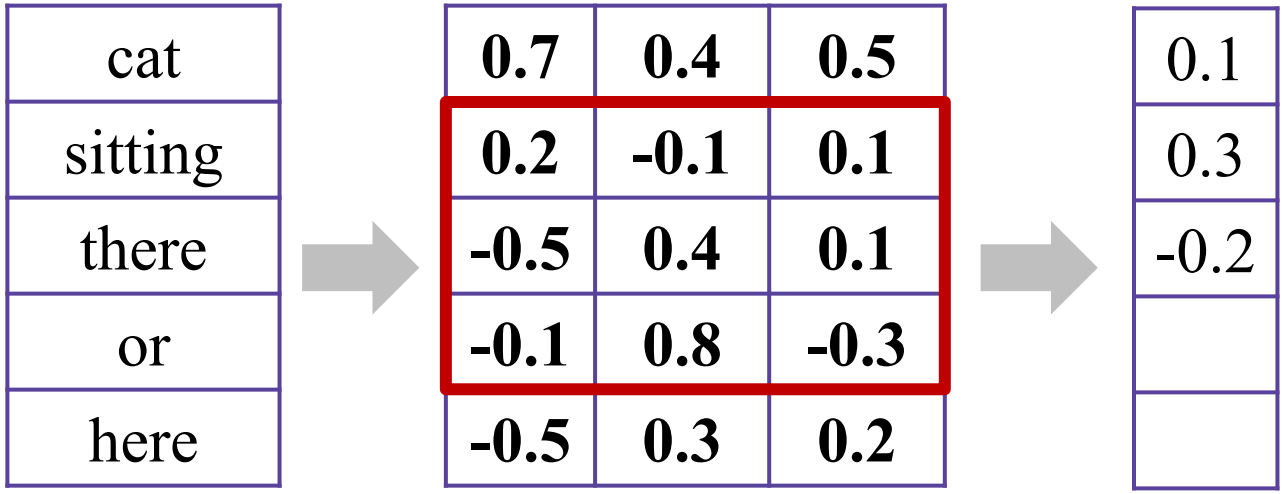

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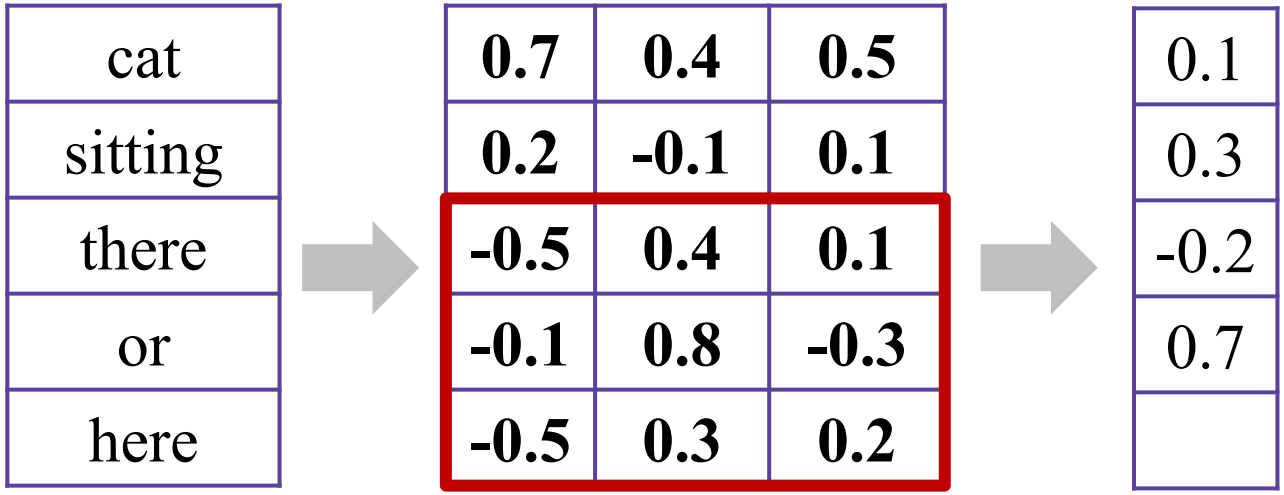

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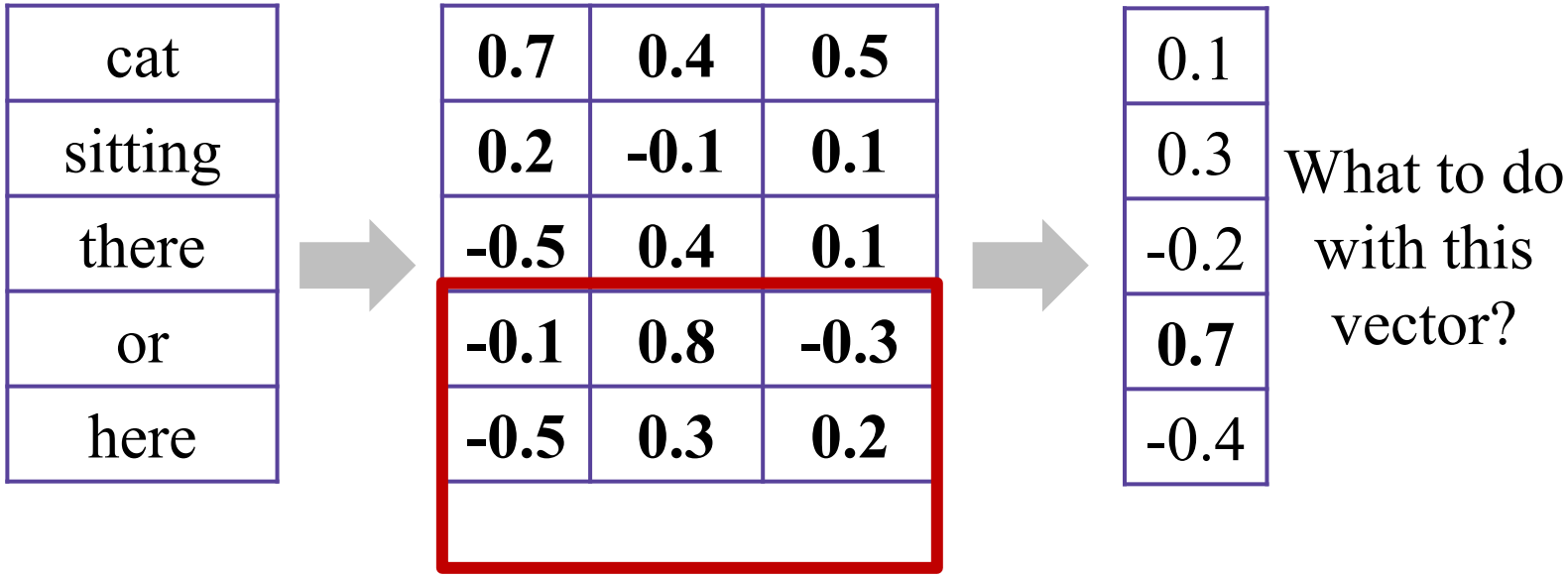

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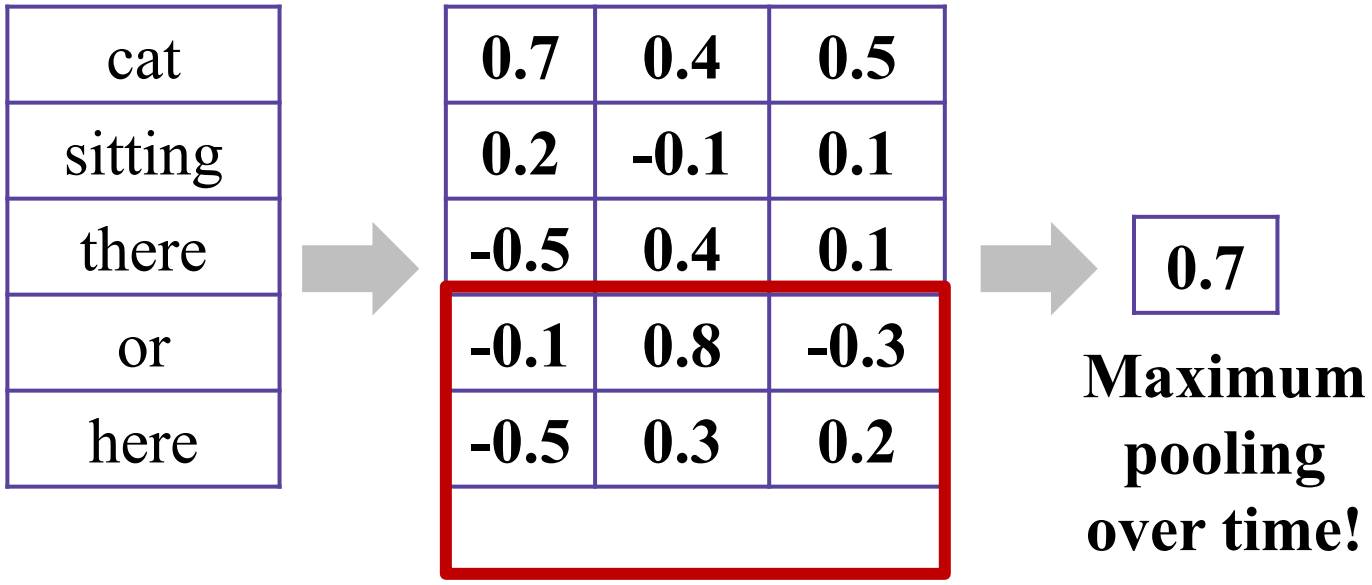


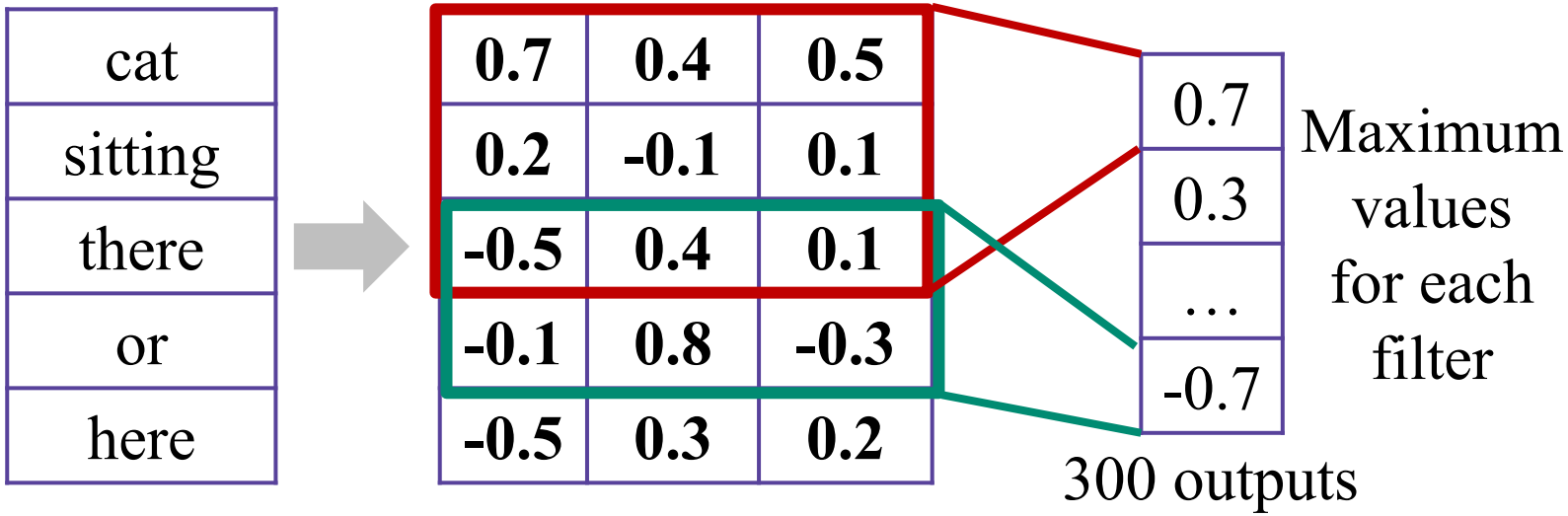
Let's train many filters

Final architecture

- 3,4,5-gram windows with 100 filters each
- MLP on top of these 300 features

Quality comparison on customer reviews (CR)

- Naïve Bayes on top of 1,2-grams – 86.3% accuracy
- 1D convolutions with MLP – 89.6% (+3.8%) accuracy



http://www.jmlr.org/papers/volume12/collobert11a/collobert11a.pdf https://arxiv.org/pdf/1408.5882.pdf

Summary

- You can just average pre-trained word2vec vectors for your text
- You can do better with 1D convolutions that learn more complex features
- In the next video we'll continue to apply convolutions to text