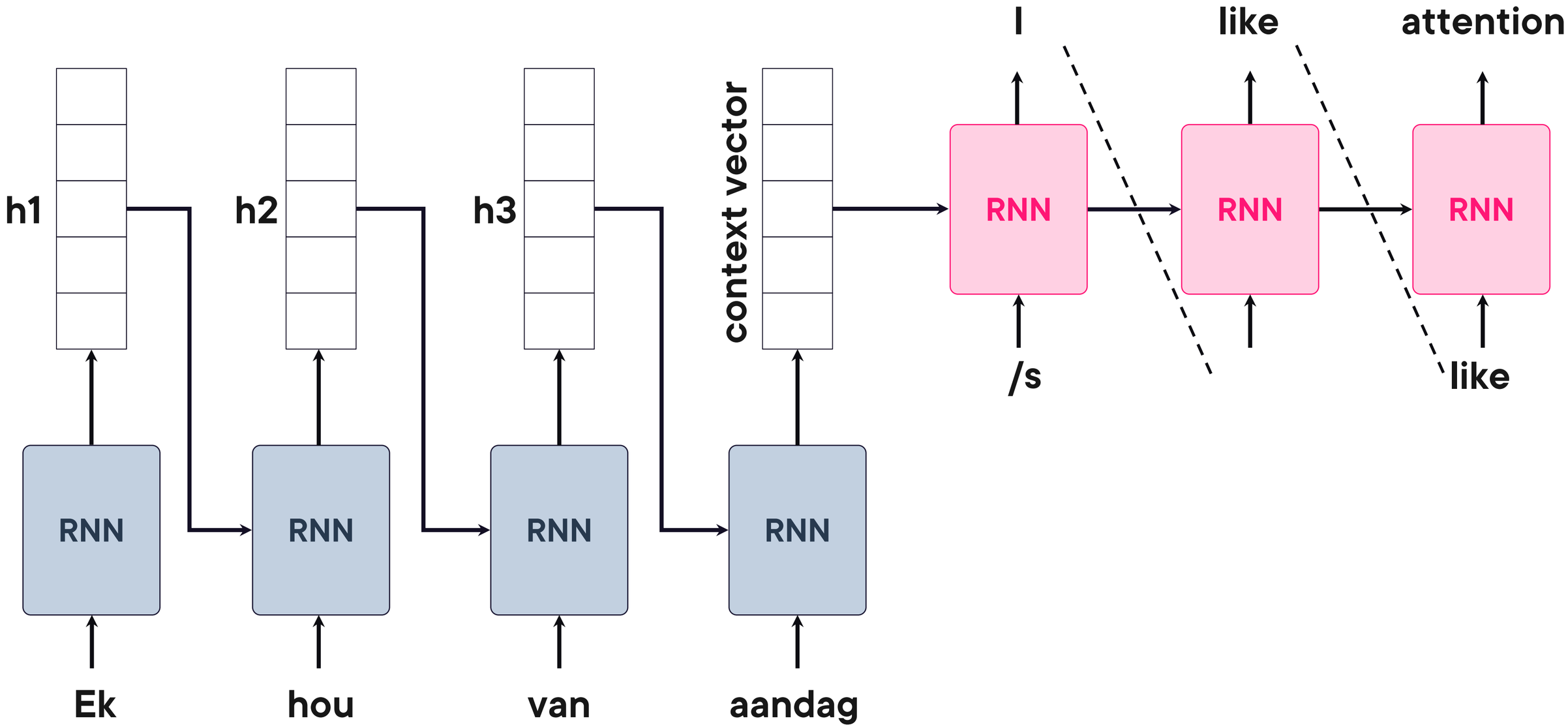
Attention is All You Need

Axel Sirota

AI and Cloud Consultant

@AxelSirota

We need to be able to provide good translations to an input text in, let’s say, Hungarian.


h1
h2
h3
context vector
RNN
RNN
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attention
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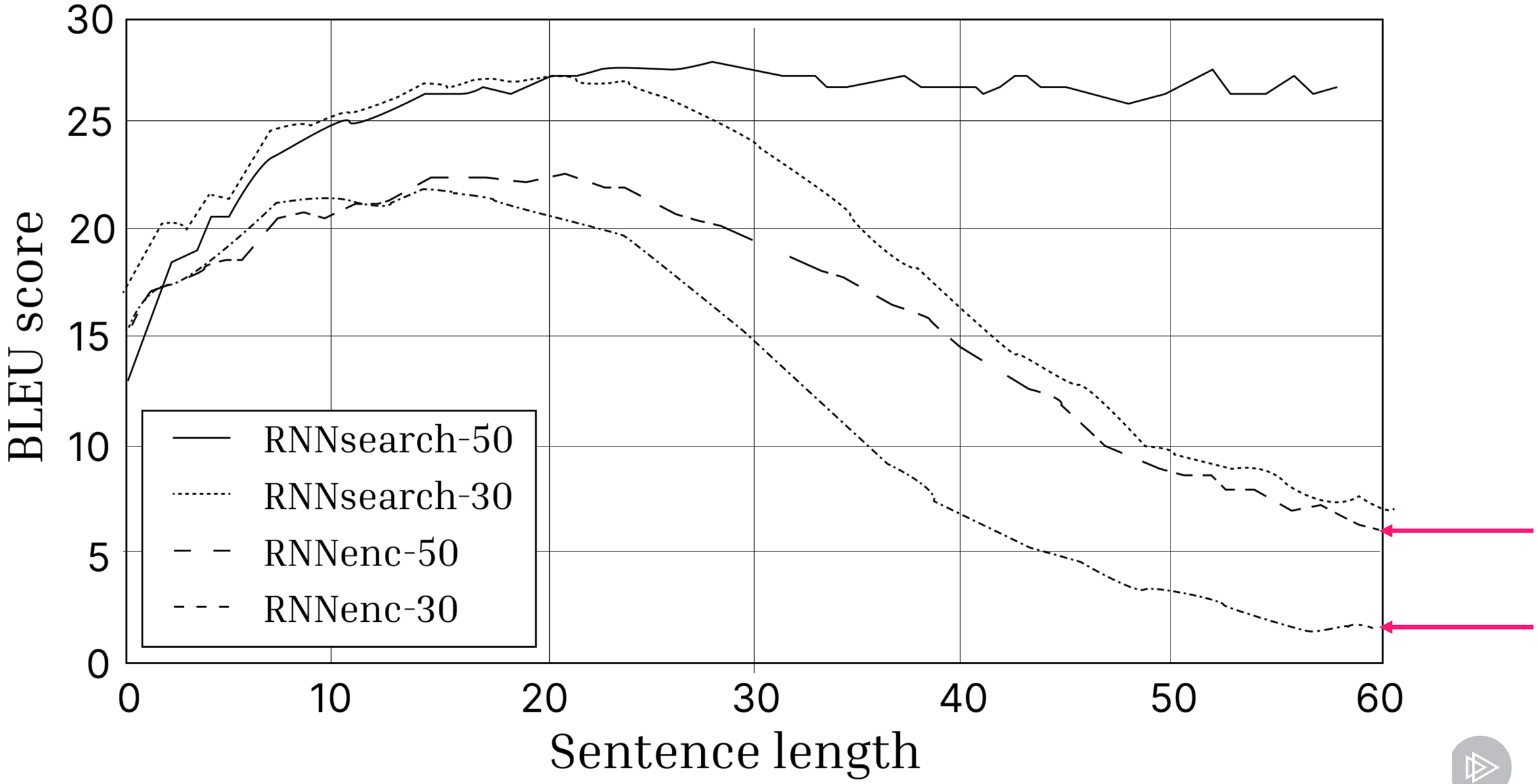

BLEU score
Sentence length
RNNsearch-50
RNNsearch-30
RNNenc-50
RNNenc-30
0
5
10
15
20
25
30
0
10
20
30
40
50
60

I love coding on my Apple computer

I code on my computer, while eating an apple

In math terms, this means that there exists a Tensor

$$a_{i,j} = f(h_i, s_j)$$

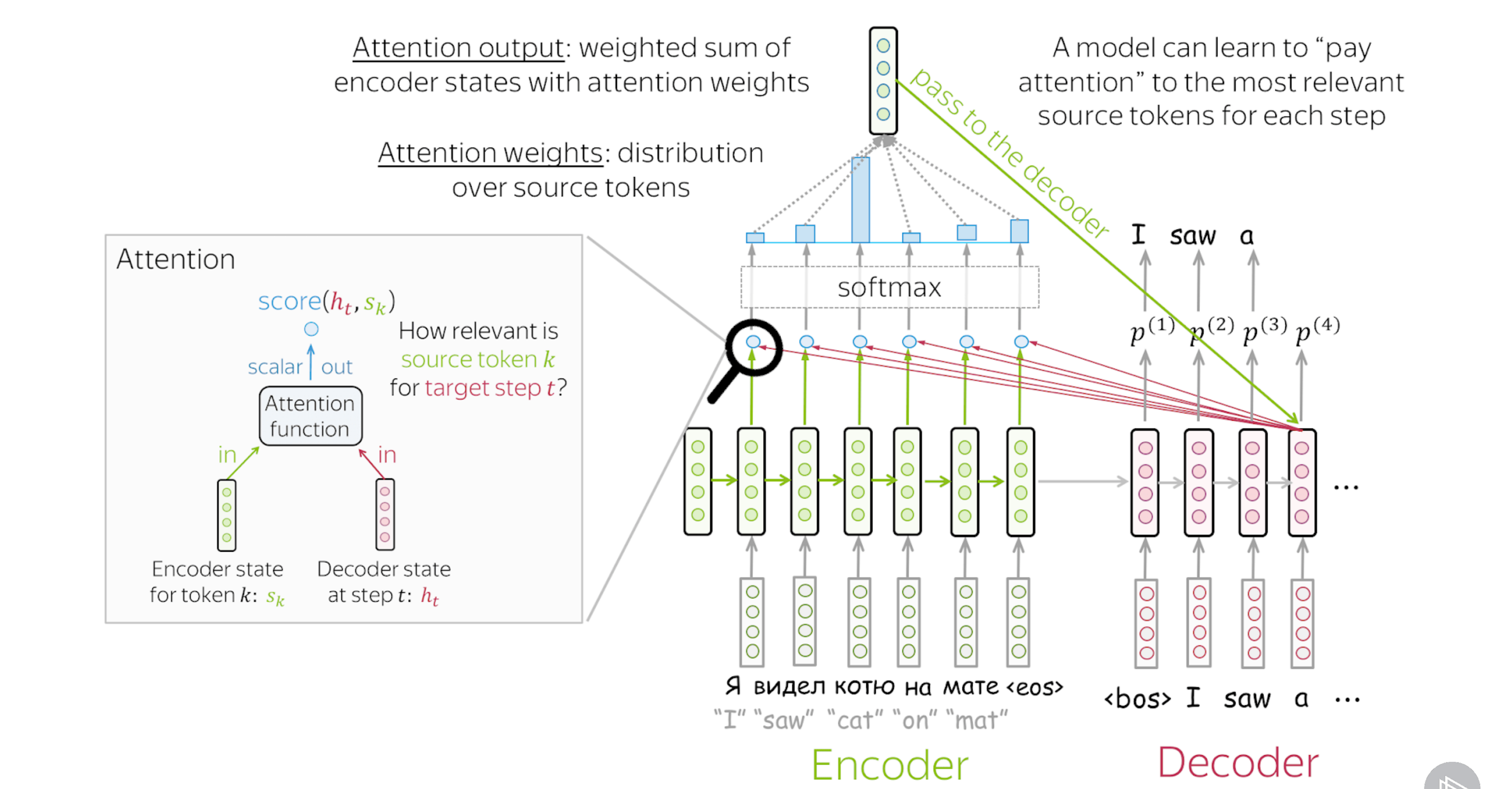
Neural Machine Translation by Jointly Learning to Align and Translate by Bahdanau

They proposed the dot product

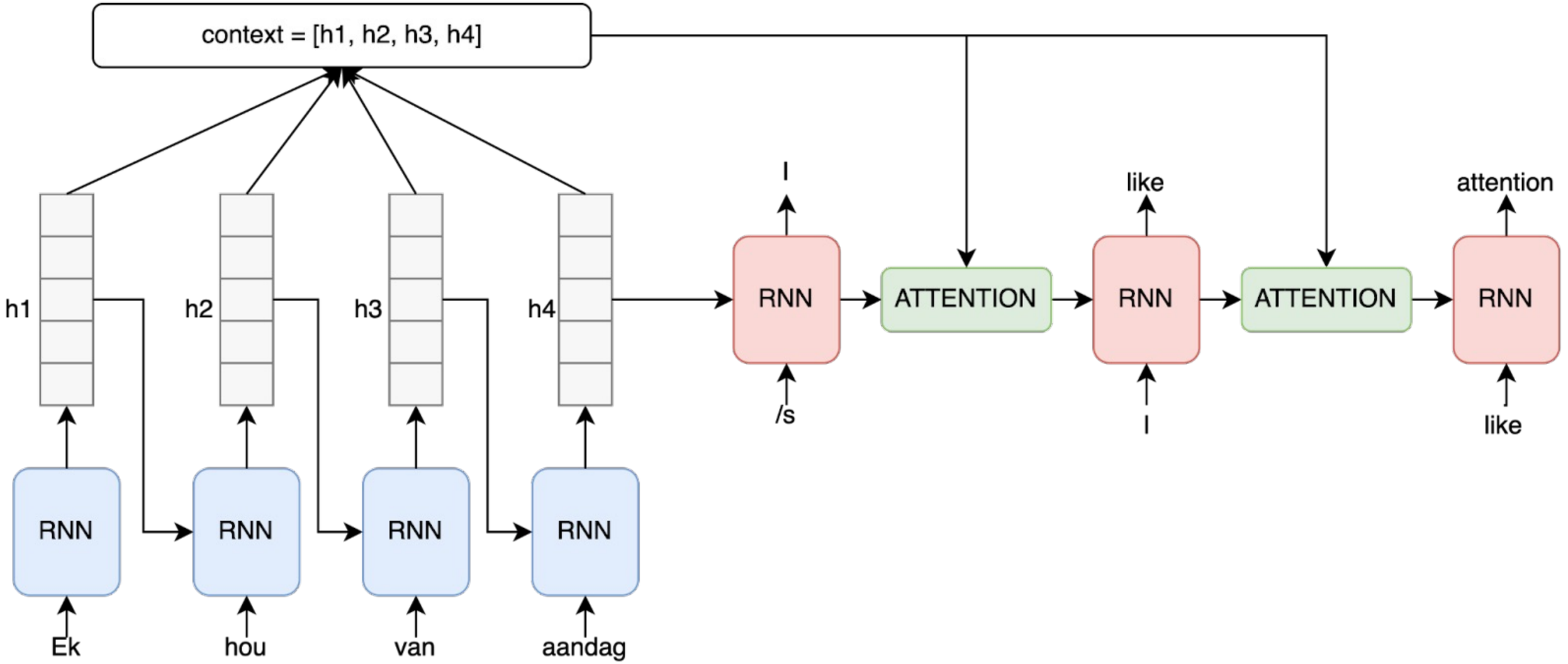
$$a_{i,j} = h_i^T * s_j$$

We get a new tensor but the weights are not probabilities, so we get softmax

$$c_k = softmax(\sum_i a_{i,k} * h_i)$$



Source: https://lena-voita.github.io/nlp_course/seq2seq_and_attention.html#attention_intro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Calculating Attention By Hand

Calculating Self-Attention By Hand

ID	Item	Price
1	Shampoo	4,99
2	Conditioner	2,99

First, we will calculate the similarity between Q and K

$$a_{i,j} = similarity(Q,K)$$

Here **we will have for each row many values different from zero**, so later the output context vector is:

$$c_i = \sum_i a_{i,k} * h_i$$

Two Peculiarities

K = V

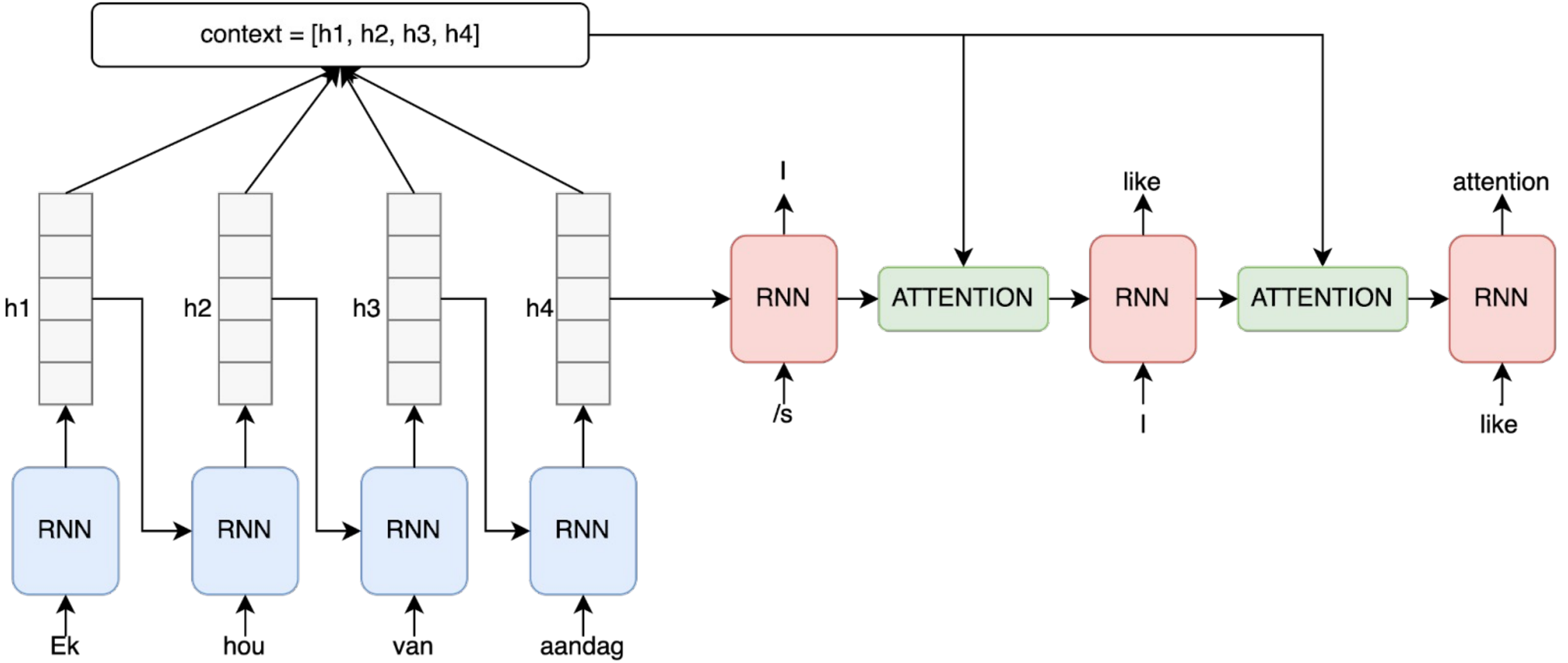
This is why we say it is self-attention, because we do attention of the tensor with itself.

The similarity function is the following:

$$\text{Attention}(Q, K, V) = \text{softmax}\left(\frac{QK^T}{\sqrt{d_k}}\right)V$$

Adding Attention Layers with Frameworks

Recap: Seq2Seq With Attention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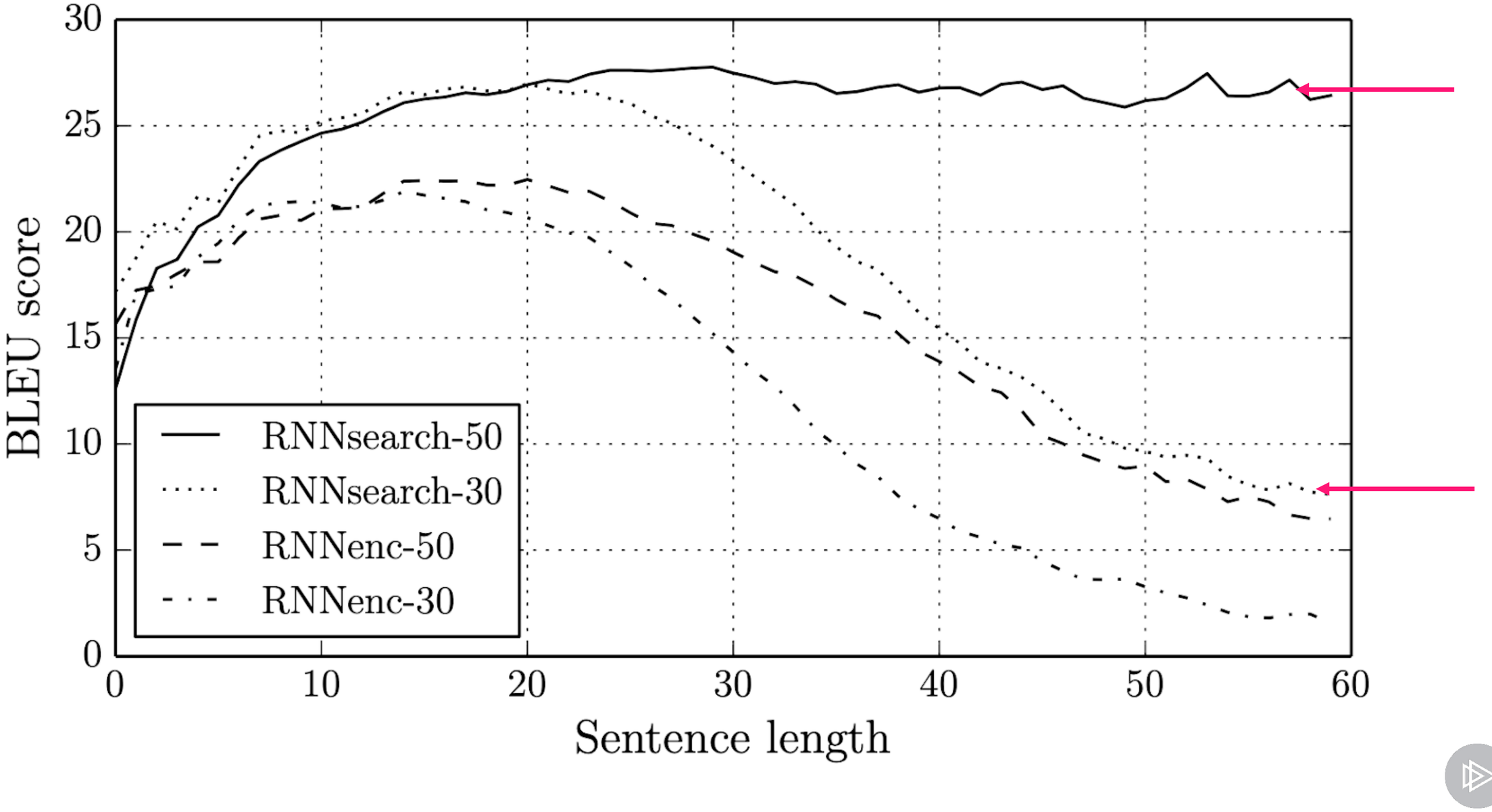
There Are Many Ways:

One is to pick the máximum probability – greedy search it is called and has one issue: it over picks simple words like the, a, and such

Another one is called beam search, which you can take as a homework to learn. I don’t want to make this module even longer!

Finally, the one we will use is picked according to the distribution of probability, so maybe we don’t pick the highest scored word at a given point in time.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Implementing Neural Machine Translation with Attention

Keys, Takeaways and Tips

Takeaways

Attention is just a mechanism that enables for each output token to treat, get different personalised context

Dot product attention, being as simple as it is, is still able to detect relationships of words and is used in models nowadays

We have built a full encoder decoder model, for that we needed to create the necessary layers

These ideas actually generalise to any NLP task and pretty much everywhere. However after the next module that will become clearer

Keys

Practice creating the input Tensor for a given text corpus! This step is fundamental.

Try to do all of the homework I've been giving you to check for dimensions on every layer created

Practice freezing the embedding matrix by using some pretrained embedding into our model. Remember: it should be an embedding of the language you care about on each stage!

Up Next:

Use Hugging Face