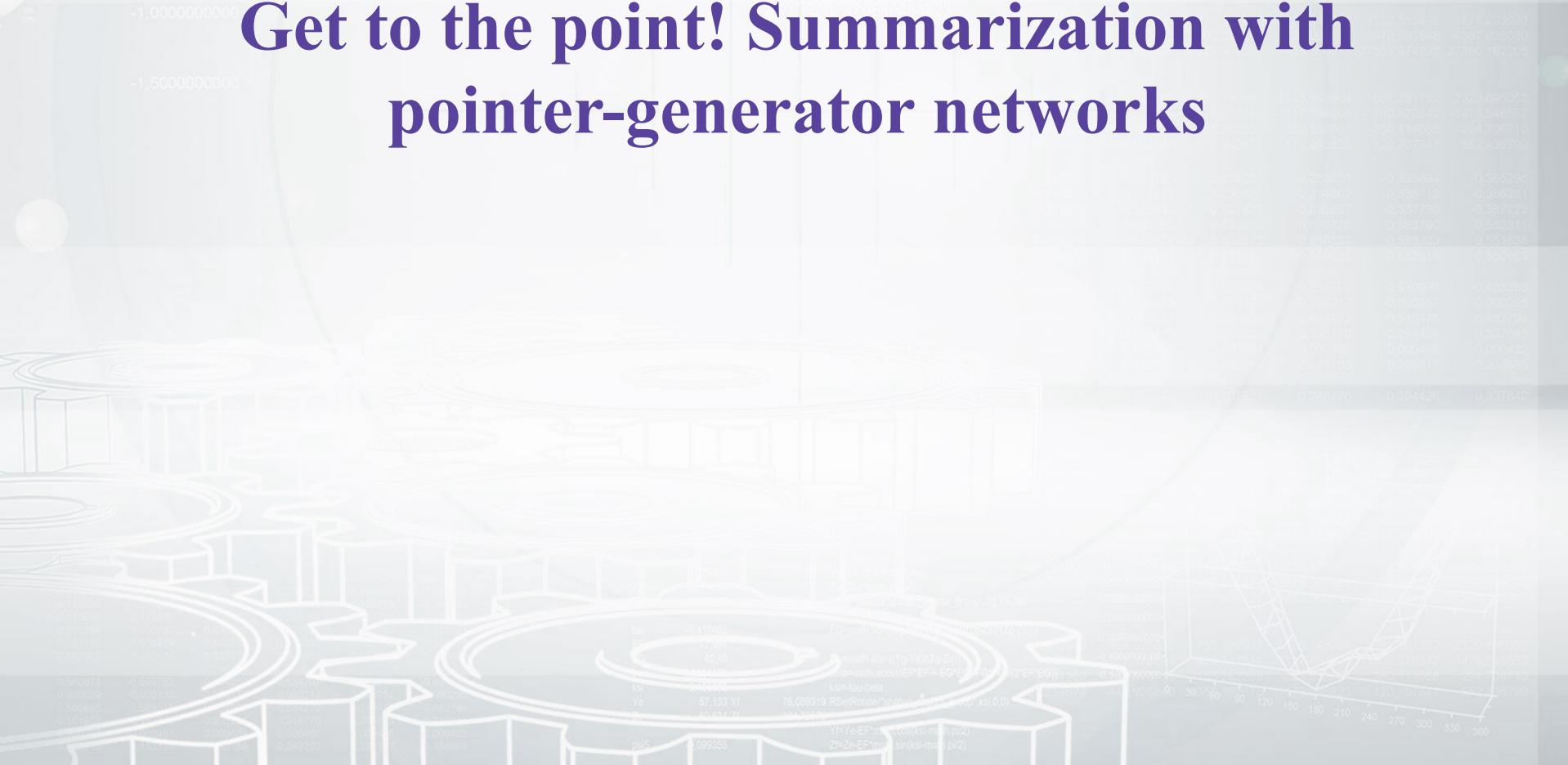


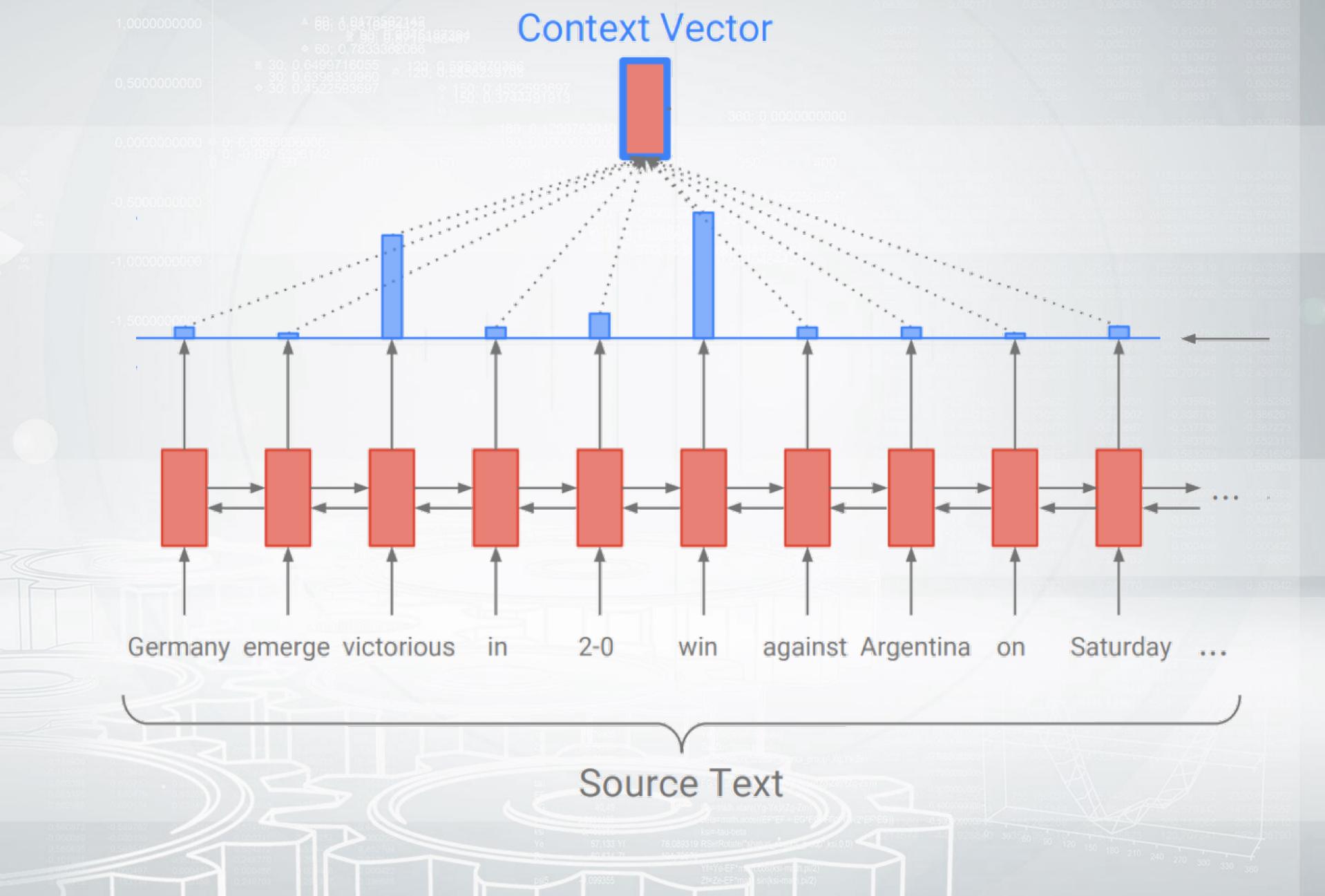
Get to the point! Summarization with pointer-generator networks



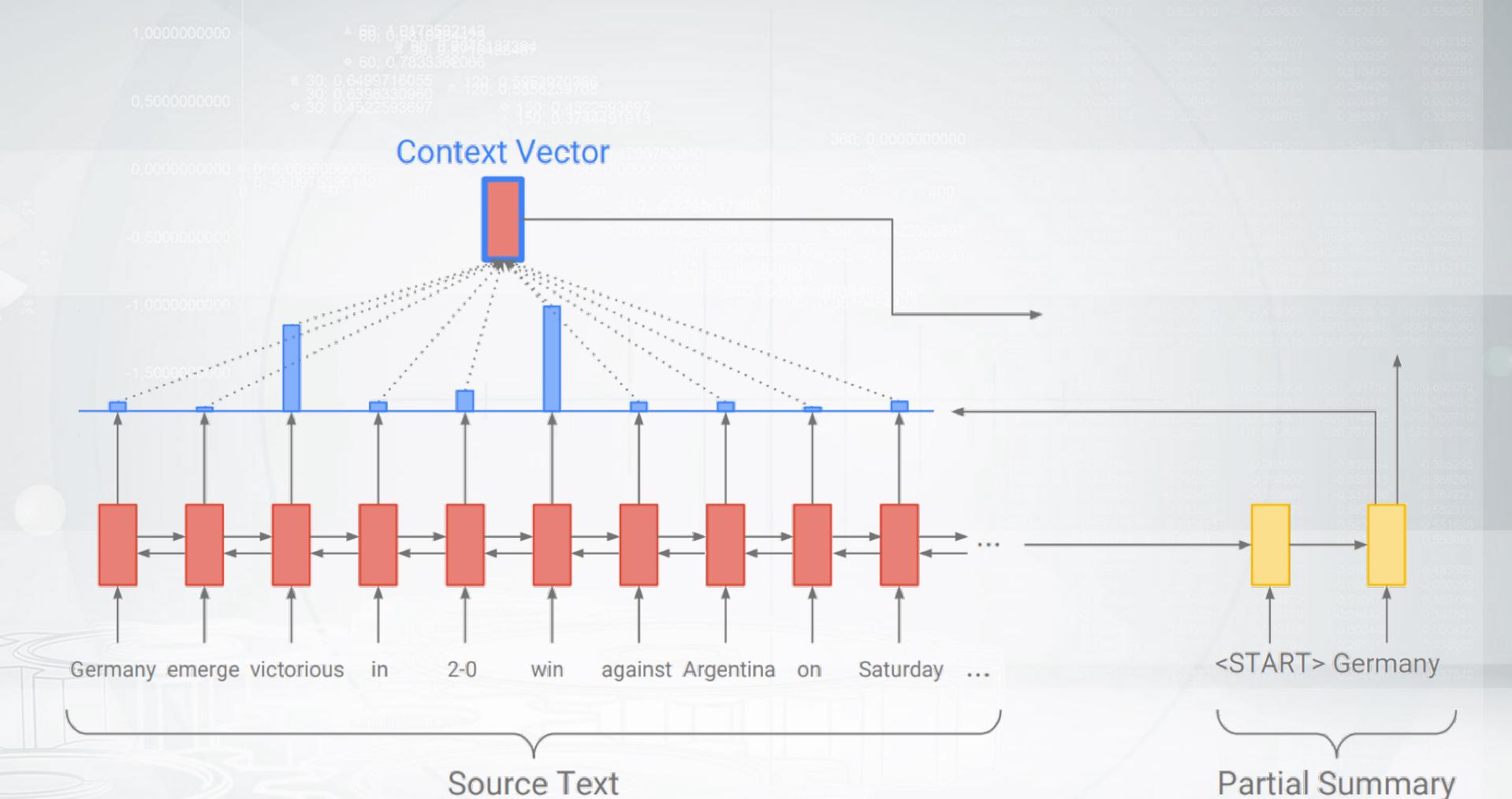
Seq2seq + attention



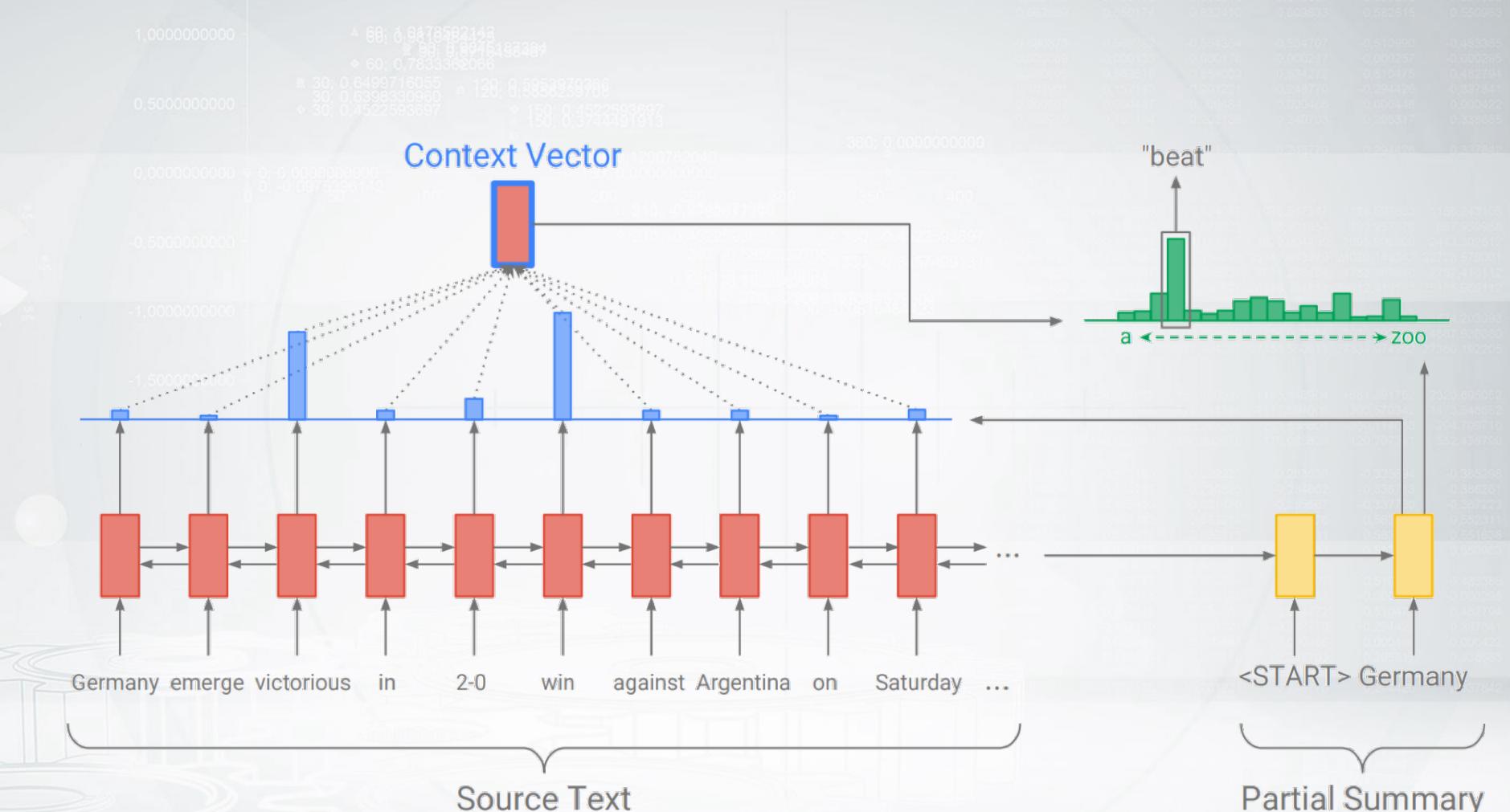
Seq2seq + attention



Seq2seq + attention



Seq2seq + attention



1.5000000000

1.0000000000

69. 0.8178582113

60. 0.7833362066

Original Text (truncated): lagos, nigeria (cnn) a day after winning nigeria's presidency, *muhammadu buhari* told cnn's christiane amanpour that he plans to aggressively fight corruption that has long plagued nigeria and go after the root of the nation's unrest. buhari said he'll "rapidly give attention" to curbing violence in the northeast part of nigeria, where the terrorist group boko haram operates. by cooperating with neighboring nations chad, cameroon and niger, he said his administration is confident it will be able to thwart criminals and others contributing to nigeria's instability. for the first time in nigeria's history, the opposition defeated the ruling party in democratic elections. buhari defeated incumbent goodluck jonathan by about 2 million votes, according to nigeria's independent national electoral commission. the win comes after a long history of military rule, coups and botched attempts at democracy in africa's most populous nation.

1.5000000000

1.0000000000

Seq2Seq + Attention: **UNK UNK** says his administration is confident it will be able to **destabilize nigeria's economy**. **UNK** says his administration is confident it will be able to thwart criminals and other **nigerians**. **he says the country has long nigeria and nigeria's economy.**

Closer look into formulas

1. Attention distribution (over source positions):

$$e_i^j = w^T \tanh(W_h h_i + W_s s_j + b_{attn})$$

$$p^j = \text{softmax}(e^j)$$

2. Vocabulary distribution (generative model):

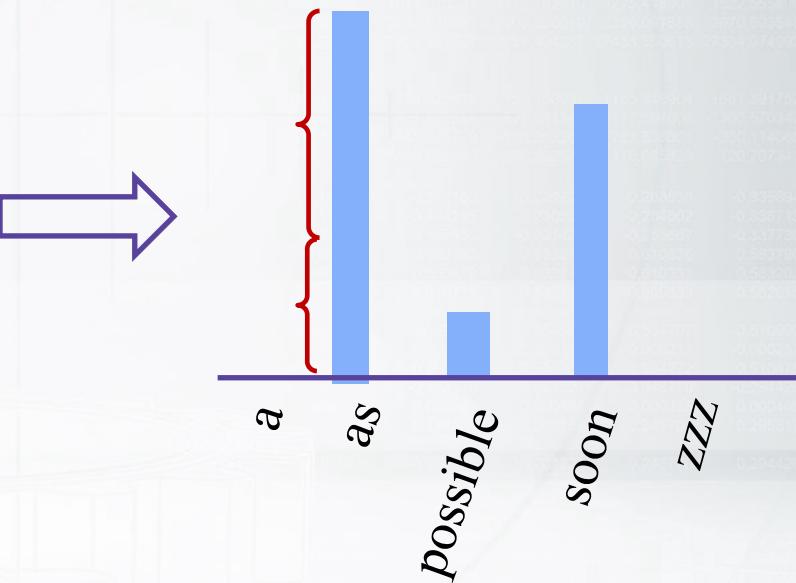
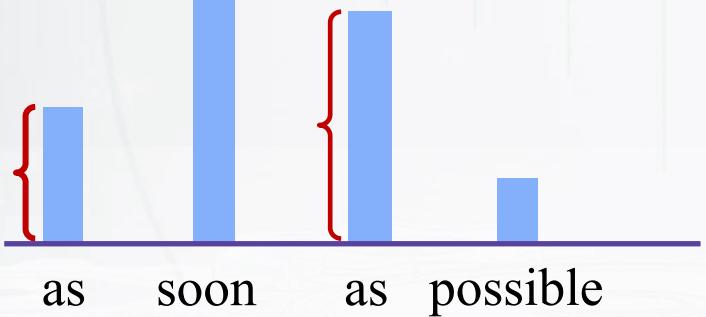
$$v_j = \sum_i p_i^j h_i$$

$$p_{vocab} = \text{softmax}(V'(V[s_j, v_j] + b') + b')$$

Closer look into formulas

3. Copy distribution (over words from source):

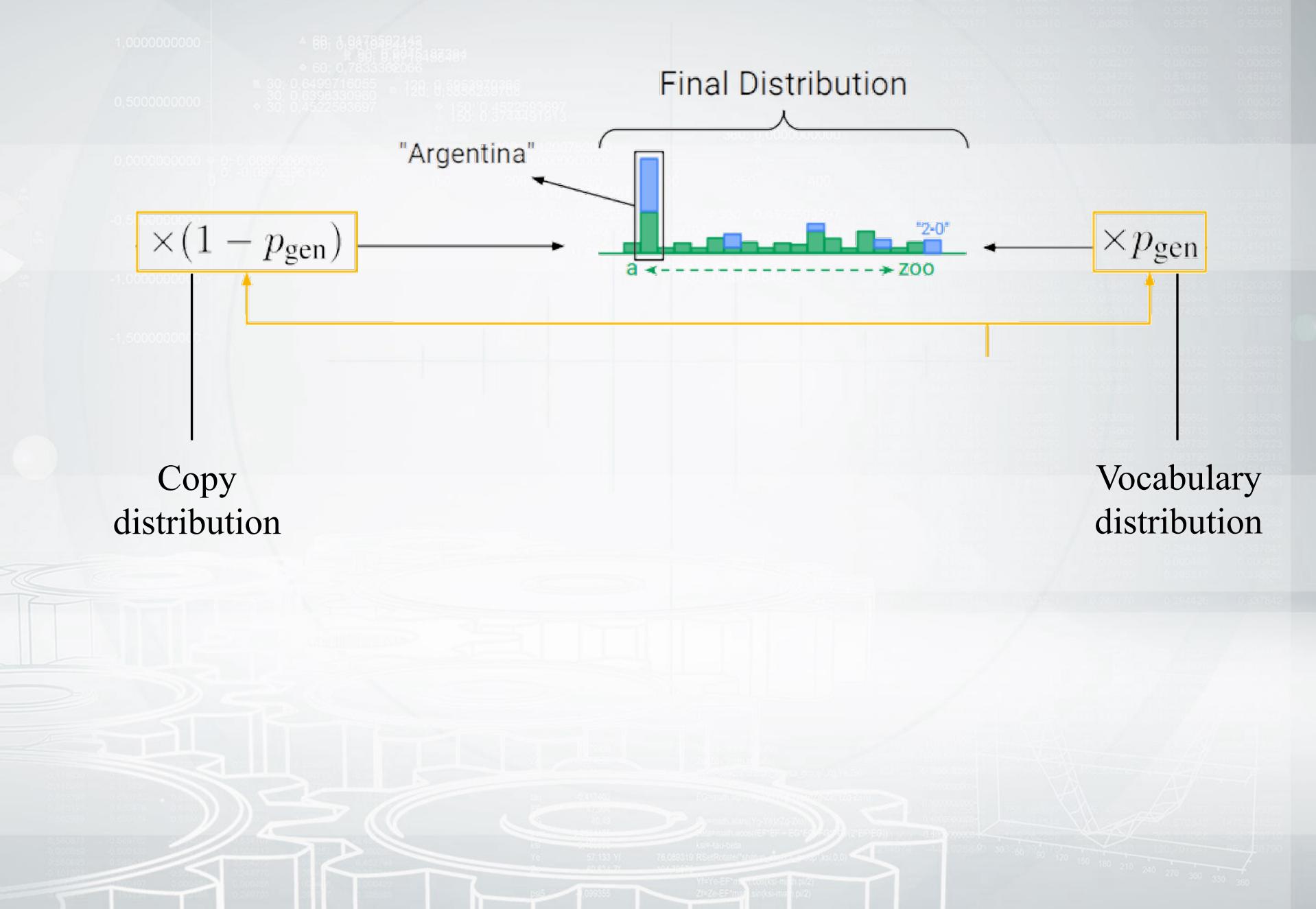
$$p_{copy}(w) = \sum_{i: x_i=w} p_i^j$$



Attention distribution

Copy distribution

Pointer-generator network



Closer look into formulas

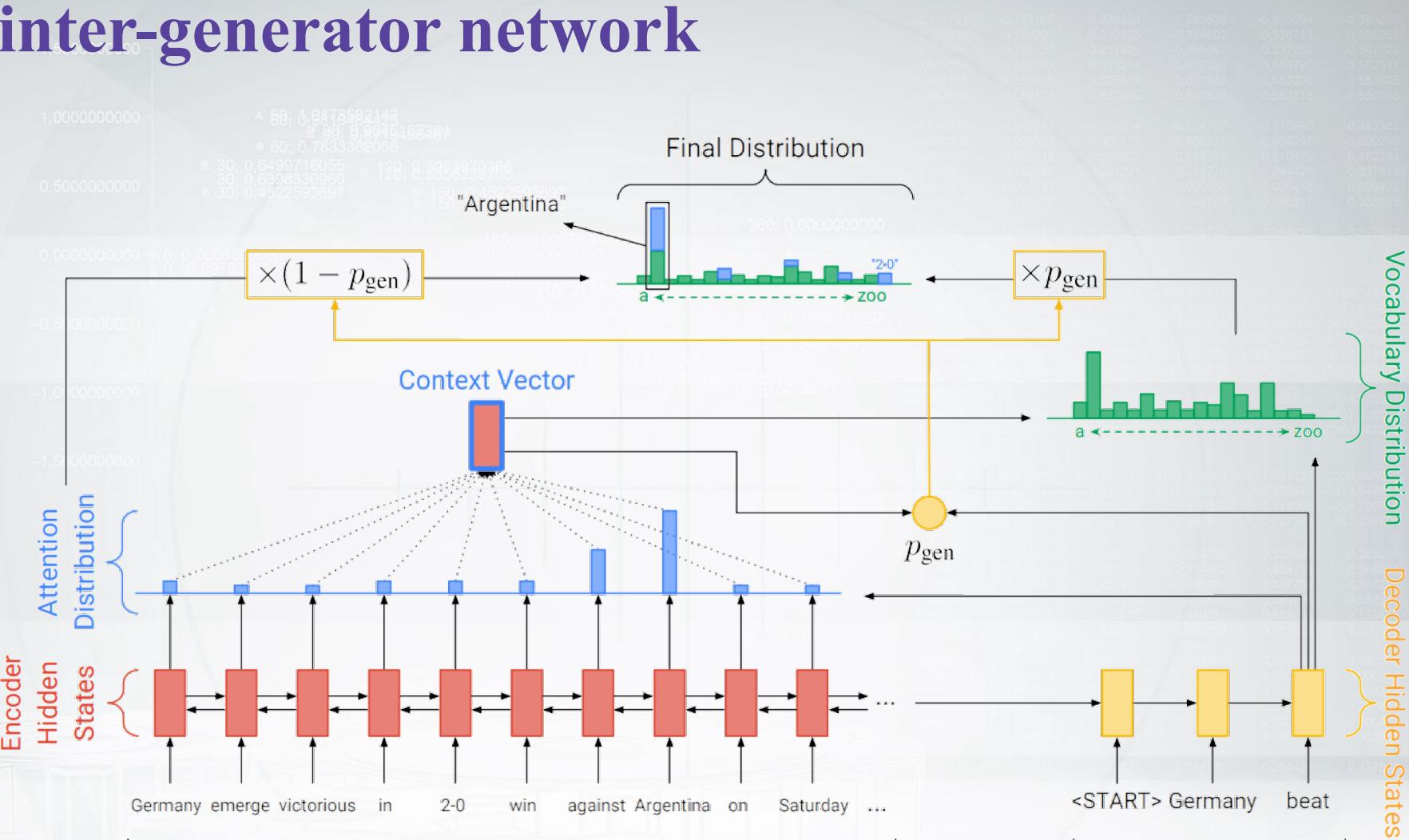
4. Final distribution:

$$p_{final} = p_{gen} \cdot p_{vocab} + (1 - p_{gen}) \cdot p_{copy}$$

5. Training:

$$\text{Loss} = -\frac{1}{J} \sum_{j=1}^J \log p_{final}(y_j)$$

Pointer-generator network



1.5000000000

Pointer-Gen: *muhammadu buhari* says he plans to aggressively fight corruption **in the northeast part of nigeria.** he says he'll "rapidly give attention" to curbing violence **in the northeast part of nigeria.** he says his administration is confident it will be able to thwart criminals.

-1.0000000000

-1.5000000000

Coverage mechanism

Coverage vector:

$$c^j = \sum_{j'=0}^{j-1} p^{j'}$$

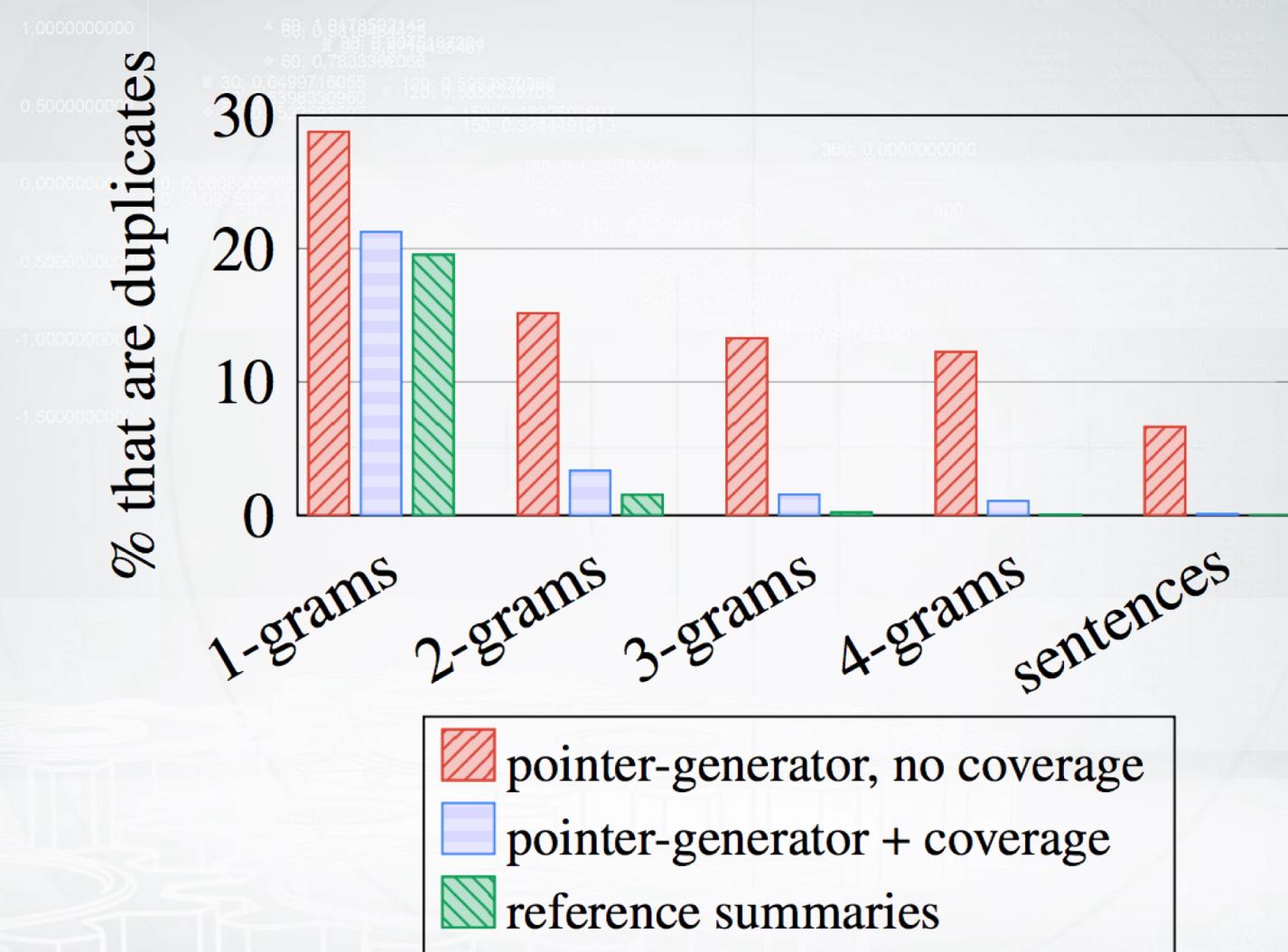
Modified attention:

$$e_i^j = w^T \tanh(W_h h_i + W_s s_j + w_c c_i^j + b_{attn})$$

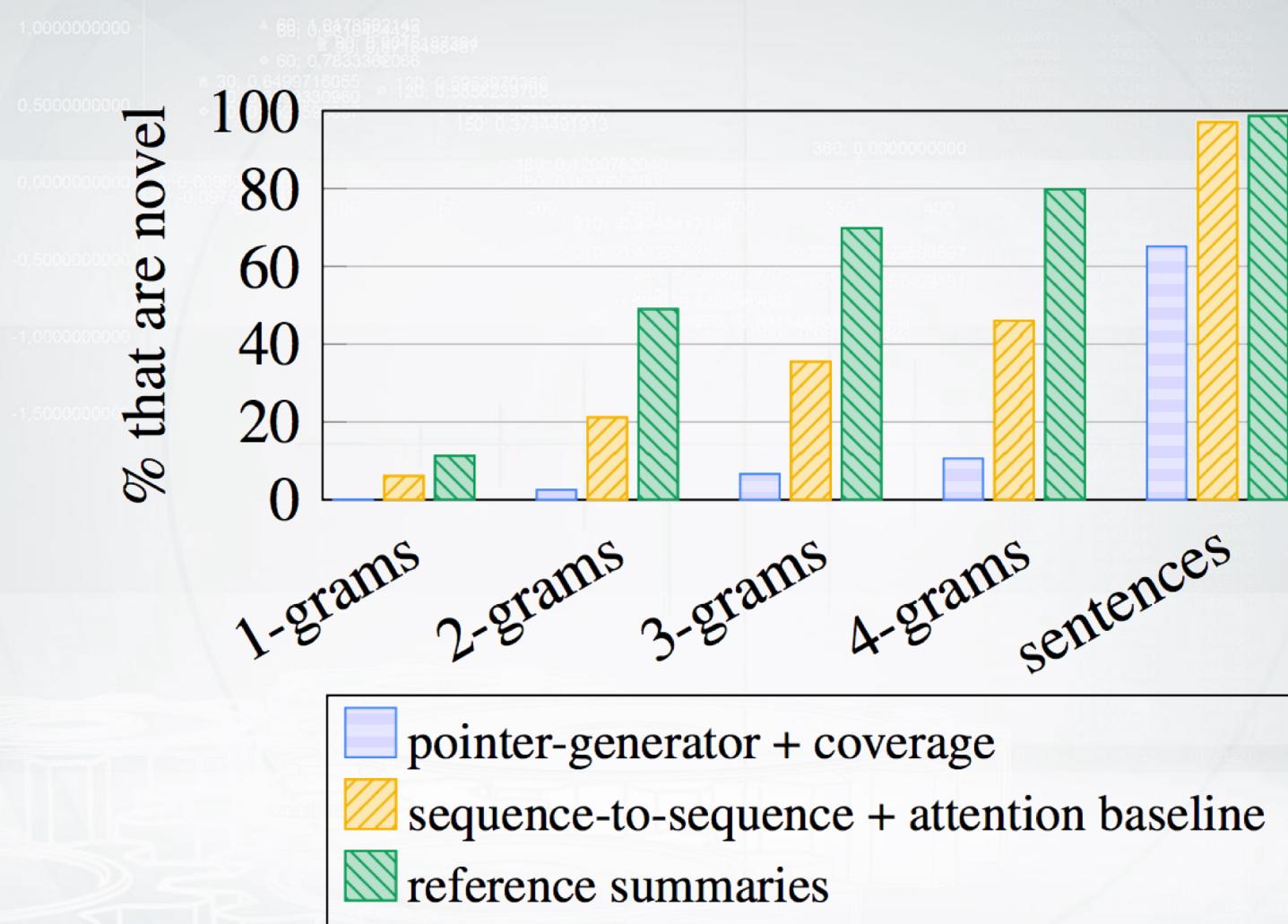
Coverage loss:

$$\text{covloss}_j = \sum_i \min(p_i^j, c_i^j)$$

Model avoids repetitions



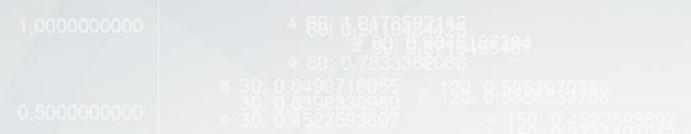
But becomes too extractive



Pointer-Gen + Coverage: *muhammadu buhari* says he plans to aggressively fight corruption that has long plagued nigeria. he says his administration is confident it will be able to thwart criminals. the win comes after a long history of military rule, coups and botched attempts at democracy in africa's most populous nation.

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Comparison of the models



	ROUGE score		
	1	2	L
abstractive model (Nallapati et al., 2016)	35.46	13.30	32.65
extractive model (Nallapati et al., 2017)	39.6	16.2	35.3
lead-3 baseline	40.34	17.70	36.57
seq2seq + attention	31.33	11.81	28.83
pointer-generator	36.44	15.66	33.42
pointer-generator + coverage	39.53	17.28	36.38