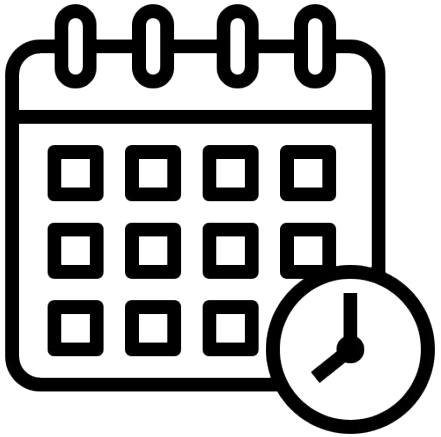
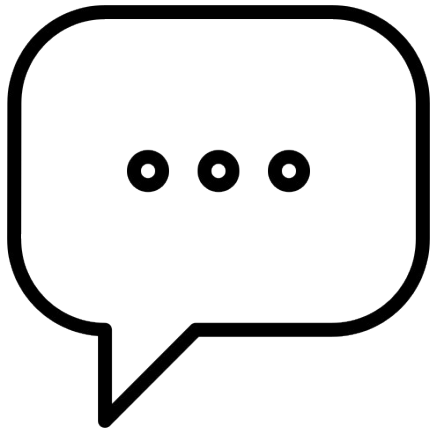
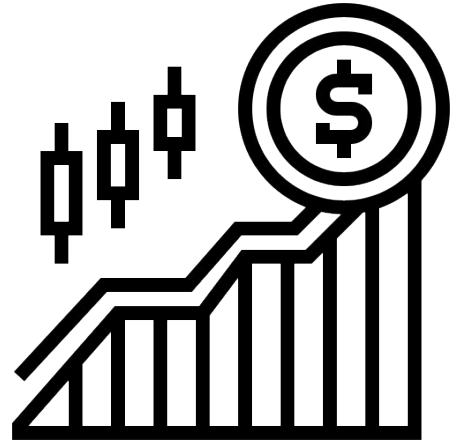
Hands-on Introduction to Deep Learning

Sequences

INSTITUT DU DÉVELOPPEMENT ET DES RESSOURCES EN INFORMATIQUE SCIENTIFIQUE

X_0 → X_1 → ... → X_t → ... → X_{n-1} → X_n

Sequential Data

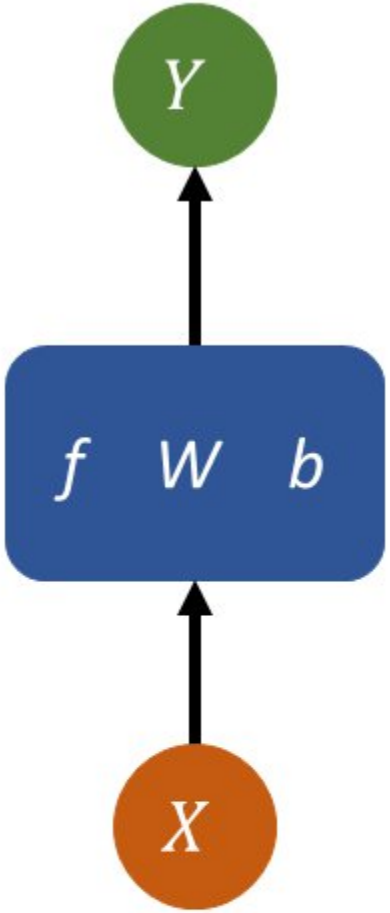
Stock market

	day 1	day 2	day 3
asset 1	9.77	79.94	64.13
asset 2	47.66	74.07	70.90
asset 3	94.25	76.34	99.95
asset 4	41.19	9.99	89.50
asset 5	65.44	63.79	67.14

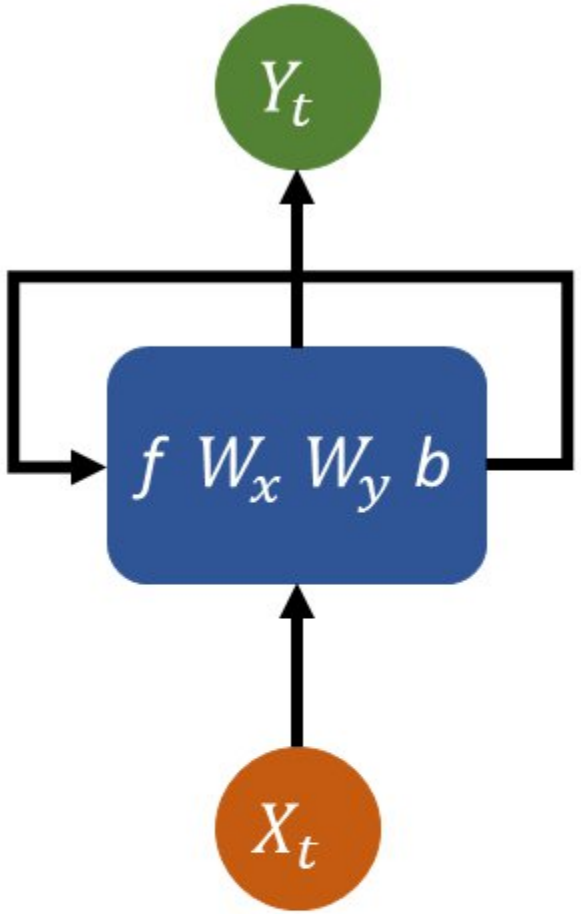
Text

I	am	learning	.
0,83	0,65	-0,90	-0,04
-0,53	0,81	-0,61	-0,12
0,24	-0,14	0,58	0,66
-0,31	0,32	0,37	-0,11
-0,53	0,50	-0,96	0,48
-0,34	-0,85	0,19	-0,78
-0,79	0,53	-0,31	-0,28
-0,23	-0,13	0,33	0,45
0,95	0,53	0,74	-0,24
-0,60	0,04	-0,96	-0,96

Sequential Data - Examples

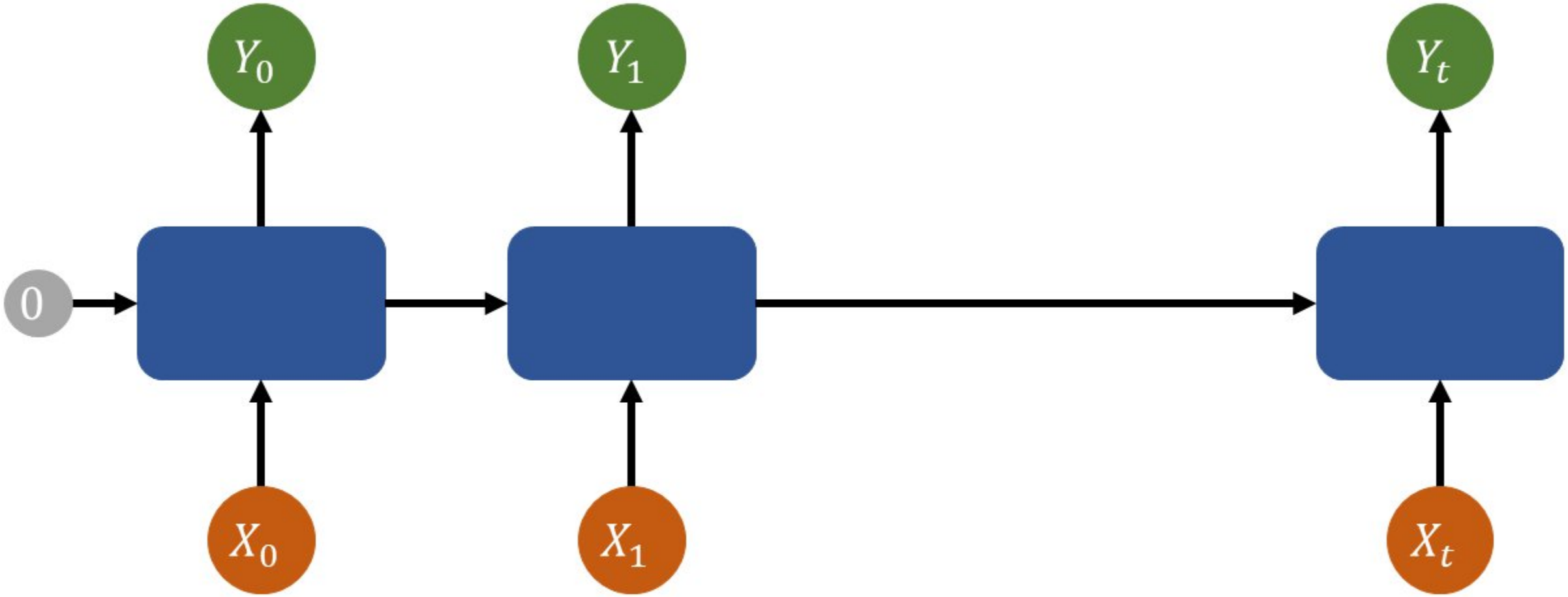


$$Y = f(W.X + b)$$

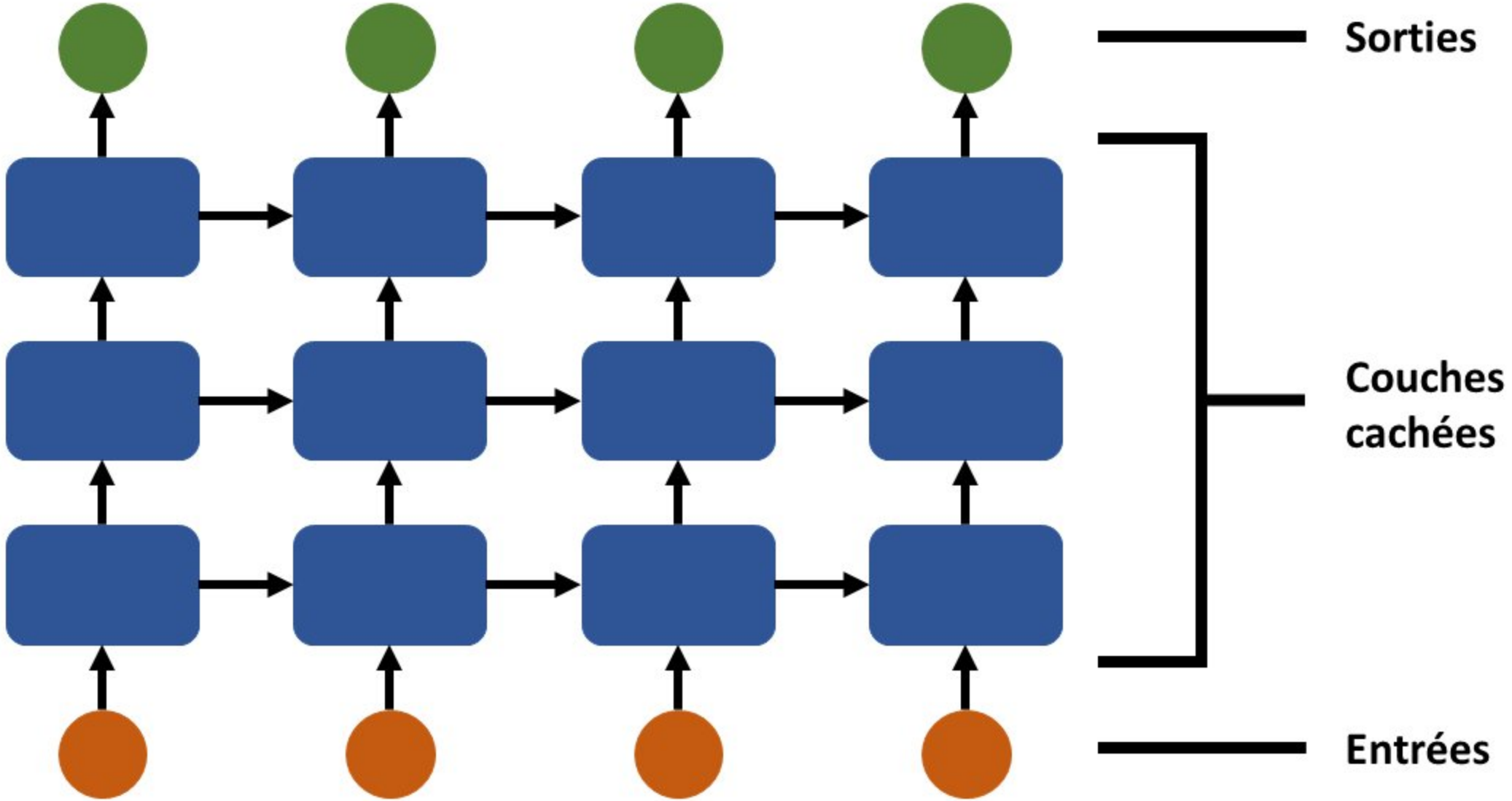


$$Y_t = f(W_x.X_t + W_y Y_{t-1} + b)$$

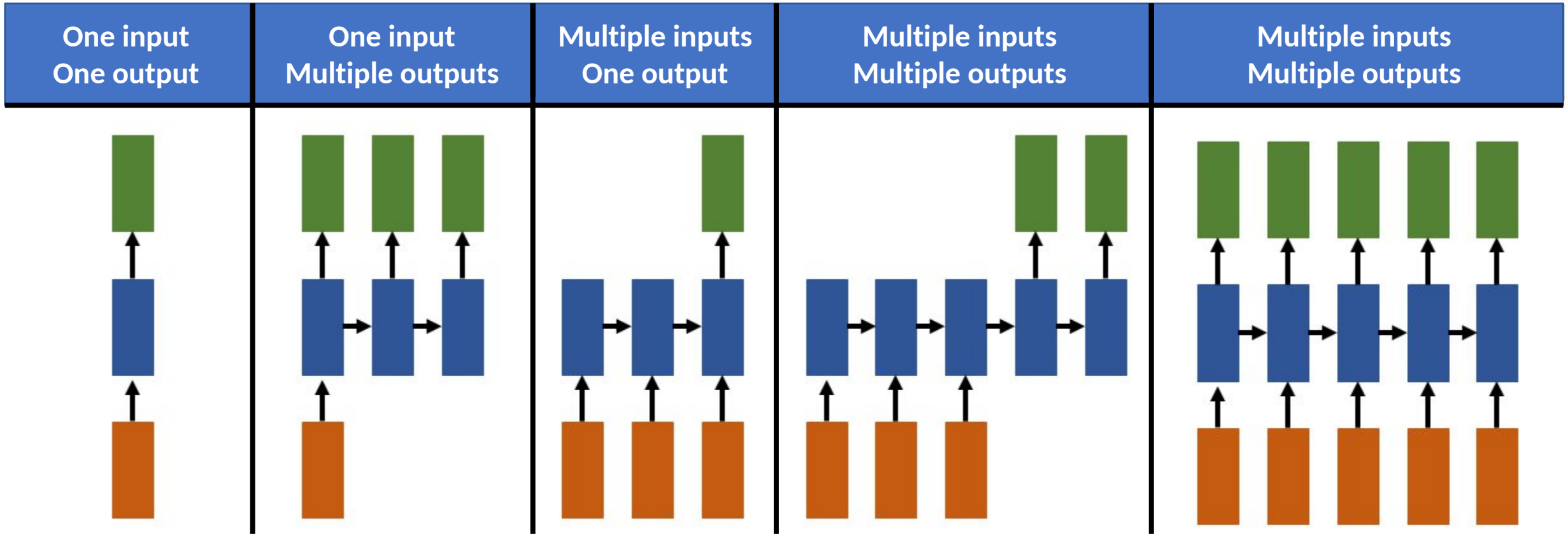
Simple recurrent neuron



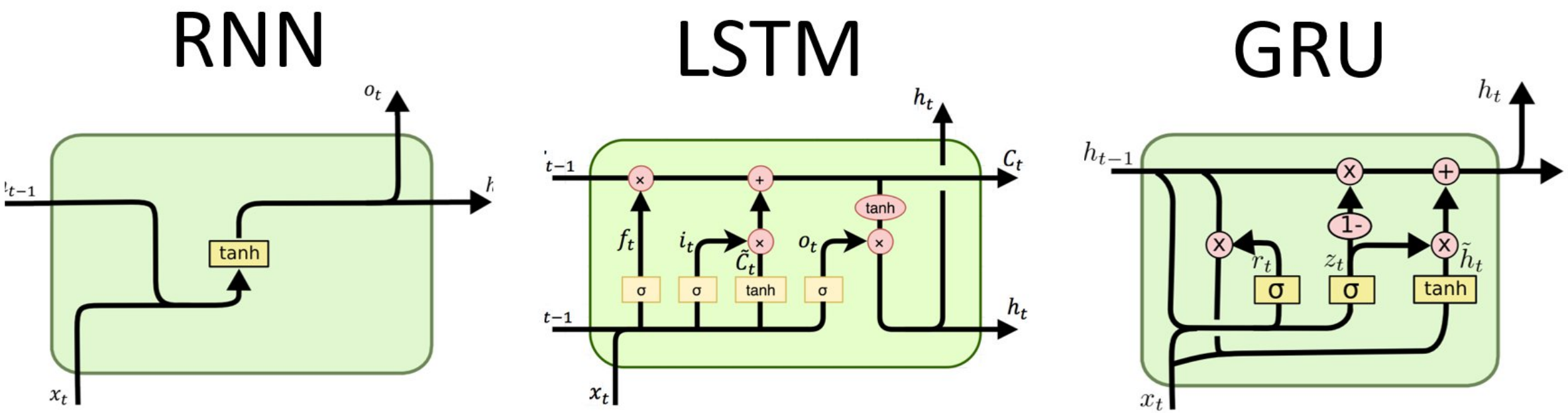
Recurrent neuron unfolded



Recurrent Neural Network

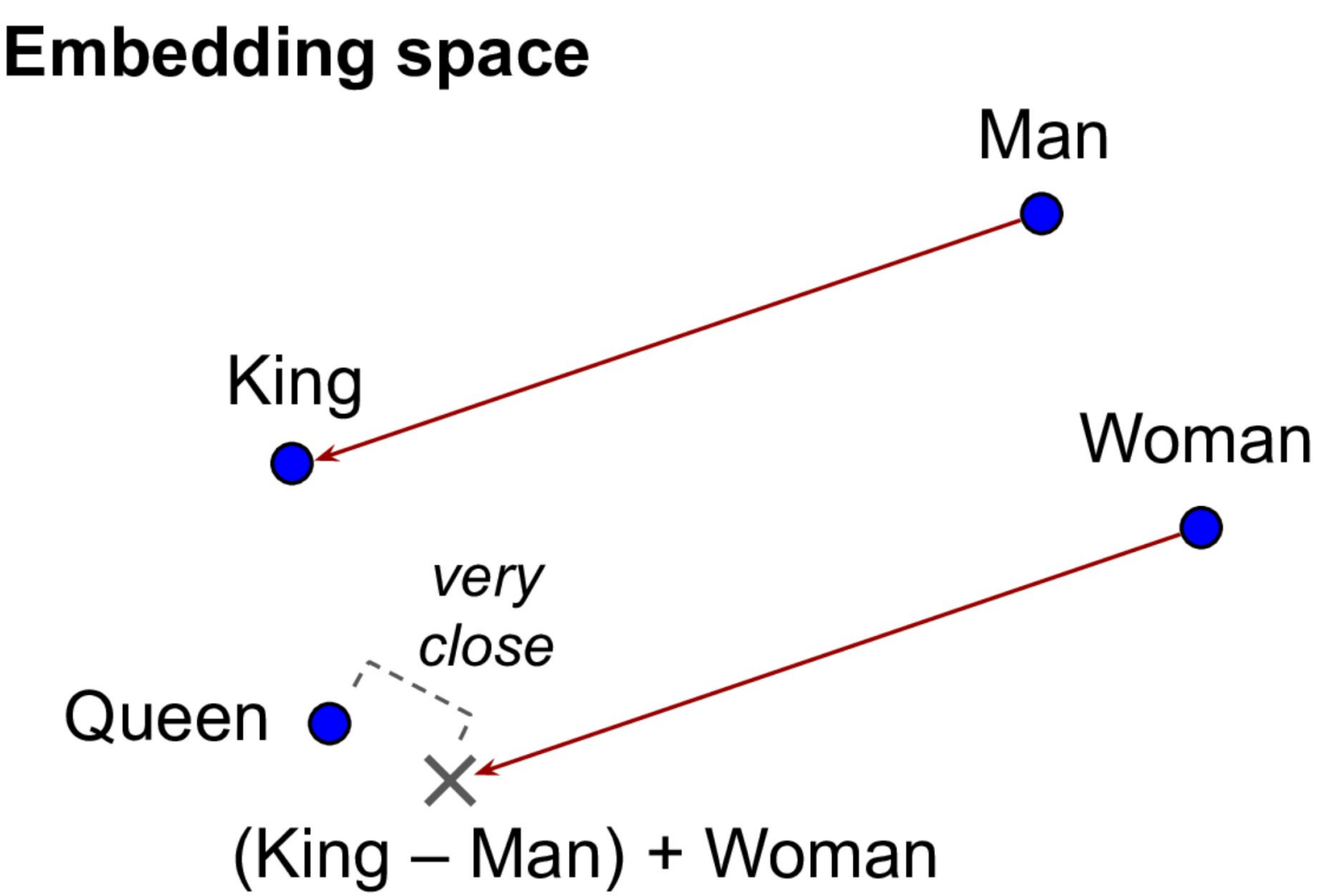


A flexible model type



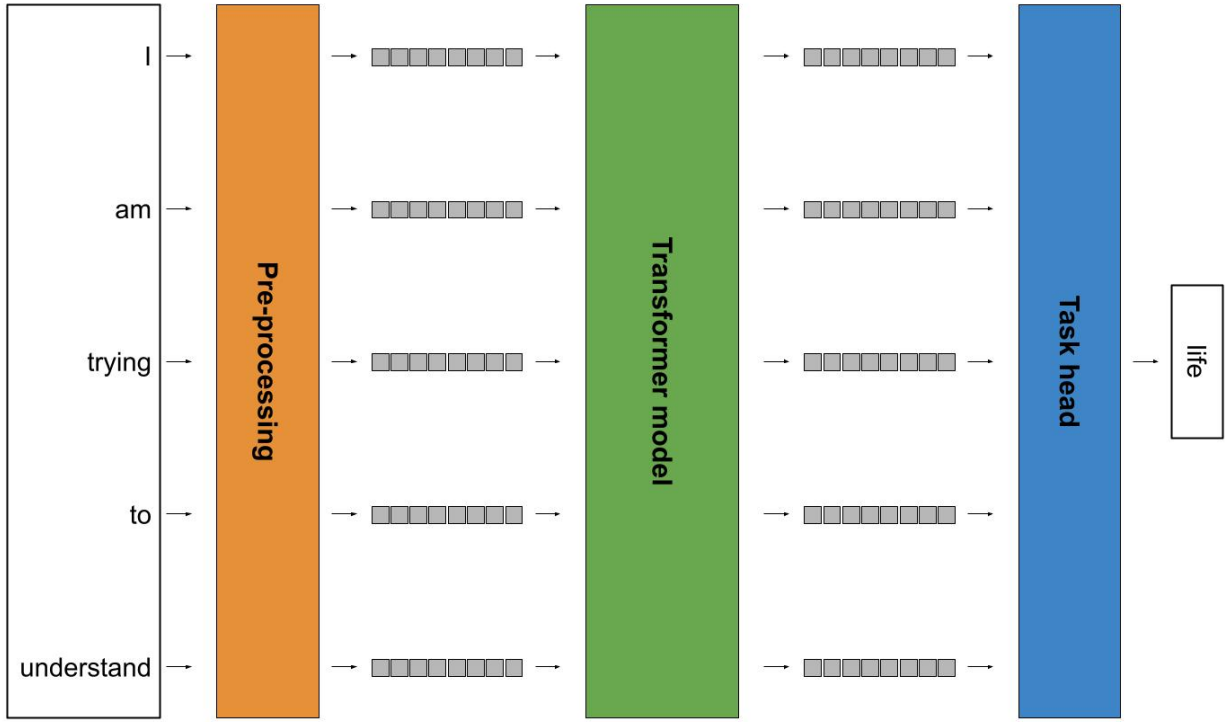
Tembhurne, Jitendra V., and Tausif Diwan. « Sentiment analysis in textual, visual and multimodal inputs using recurrent neural networks. » *Multimedia Tools and Applications* 80.5 (2021) : 6871-6910.

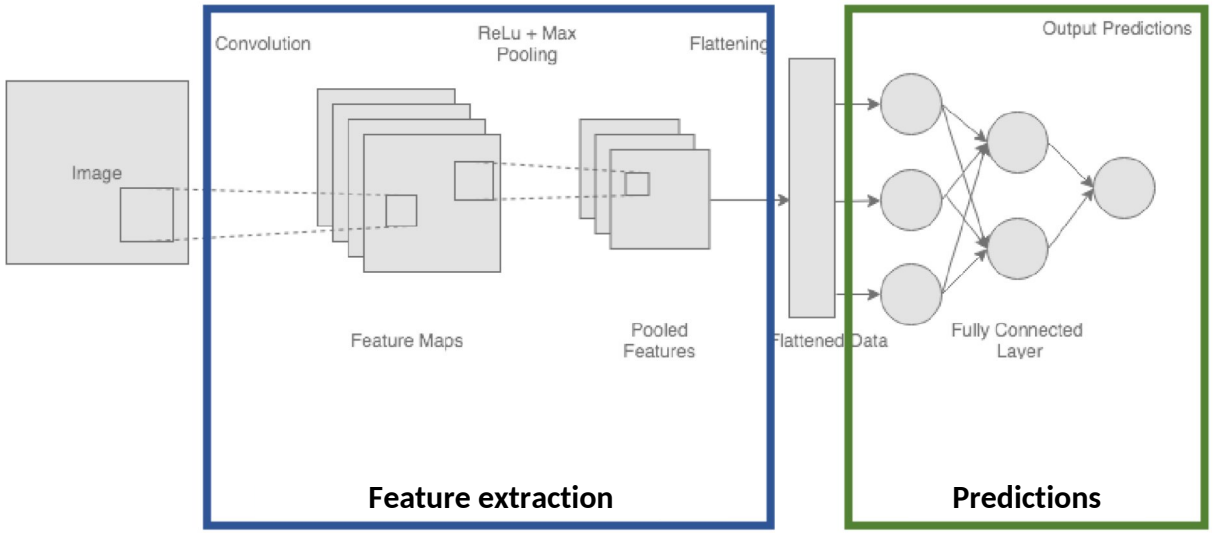
Simple RNN vs LSTM vs GRU



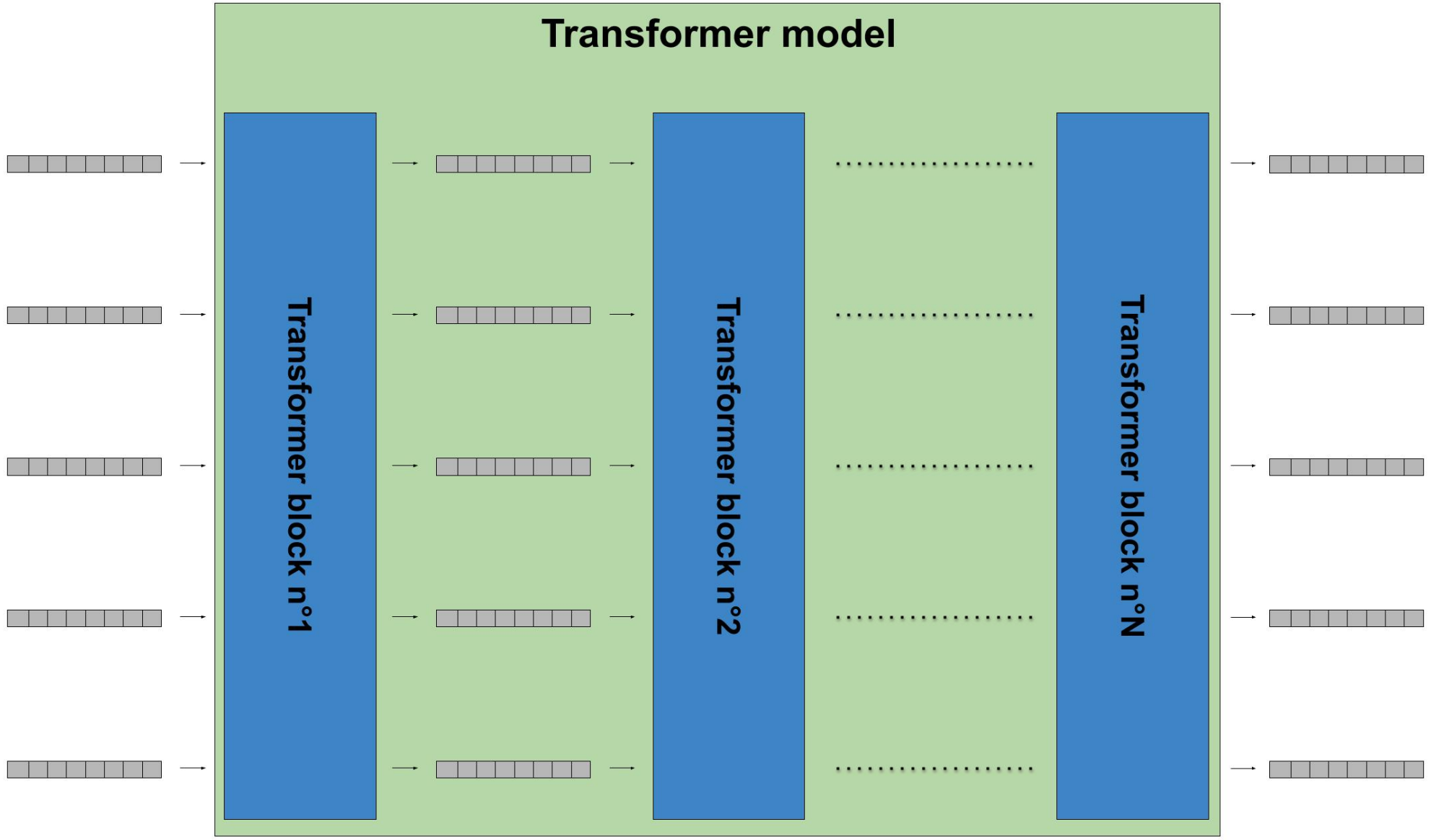
Géron, Aurélien. Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems. " O'Reilly Media, Inc.", 2019.

Sequences in NLP

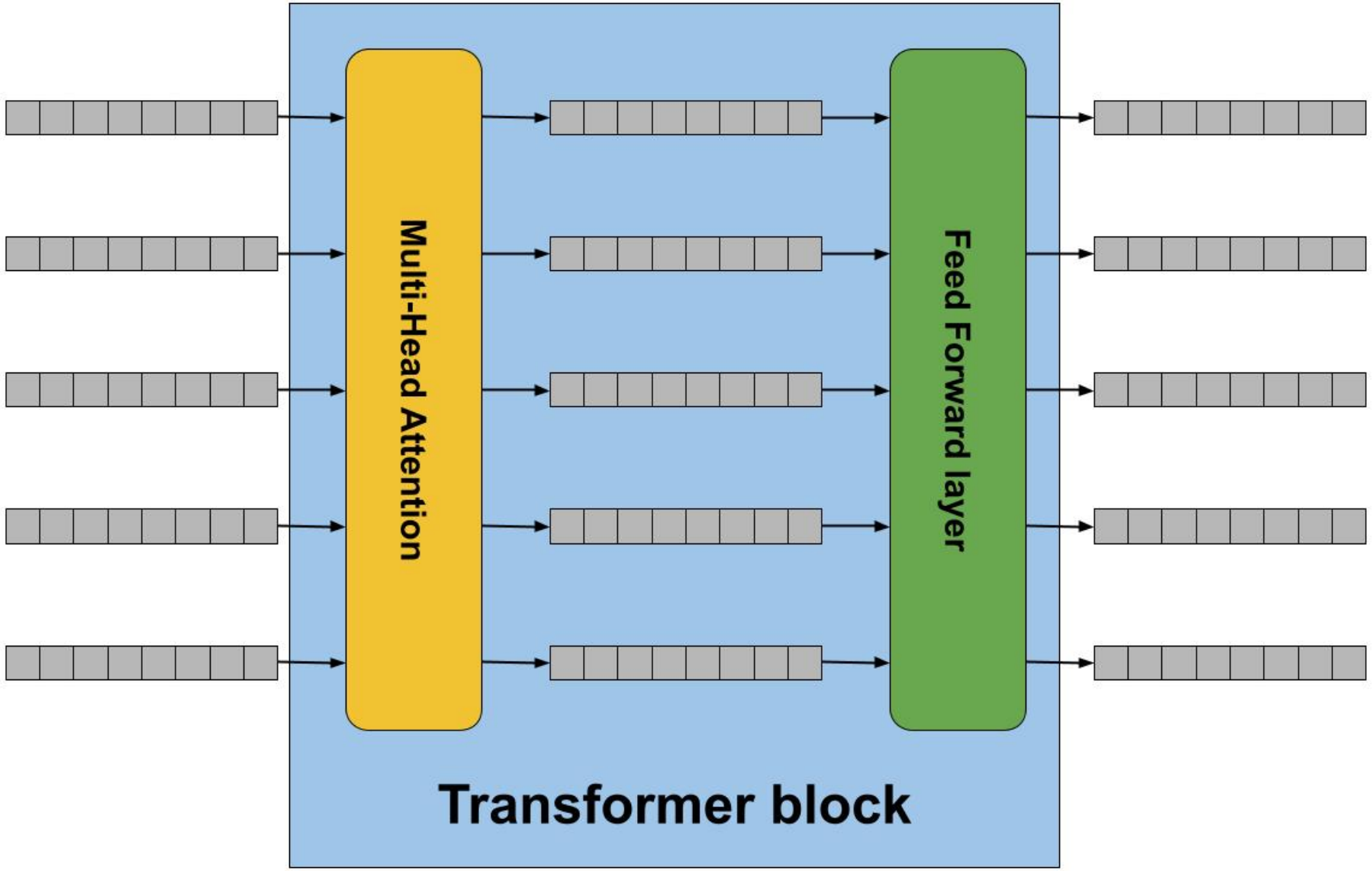




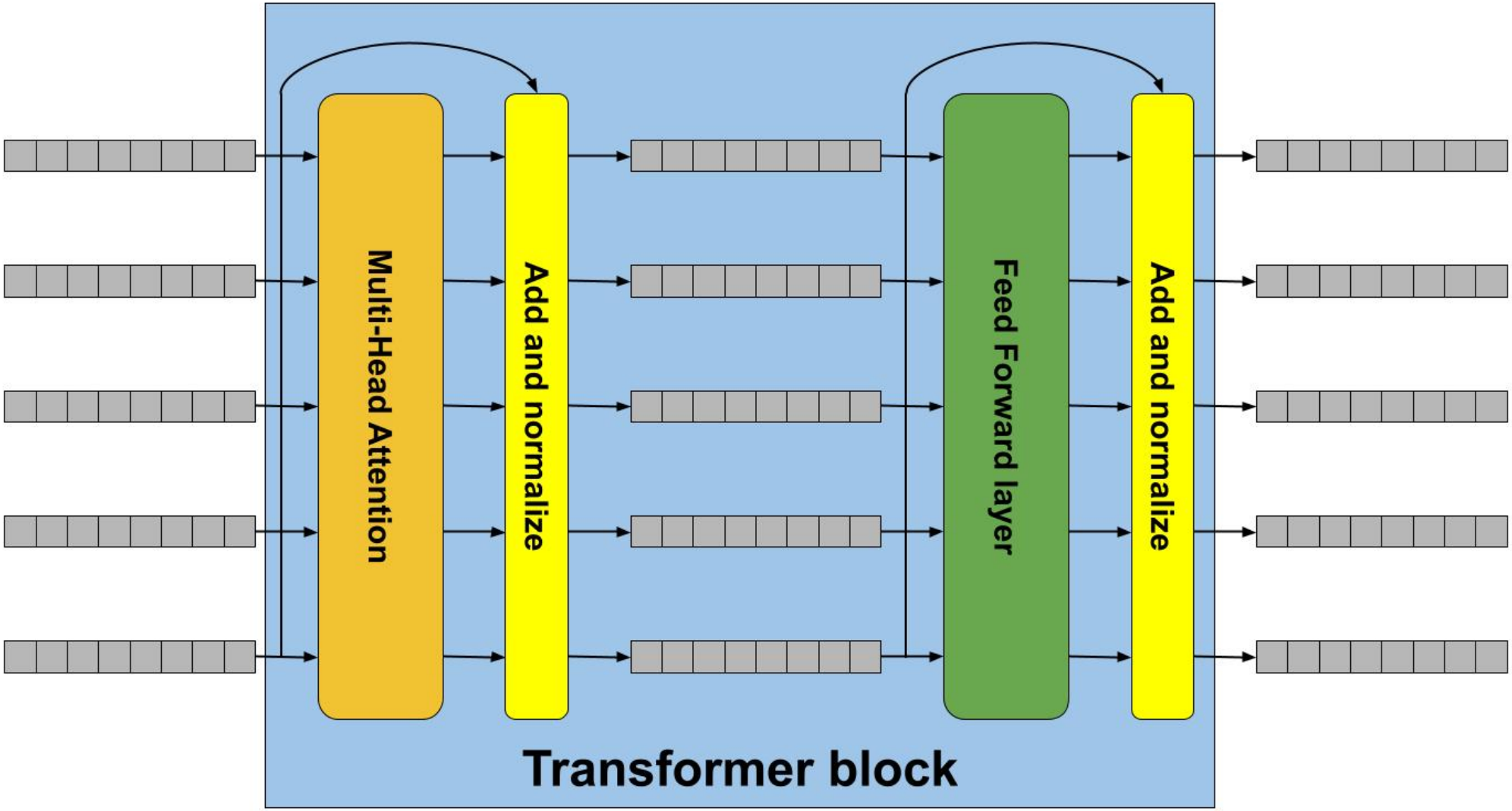
Transformer in a system



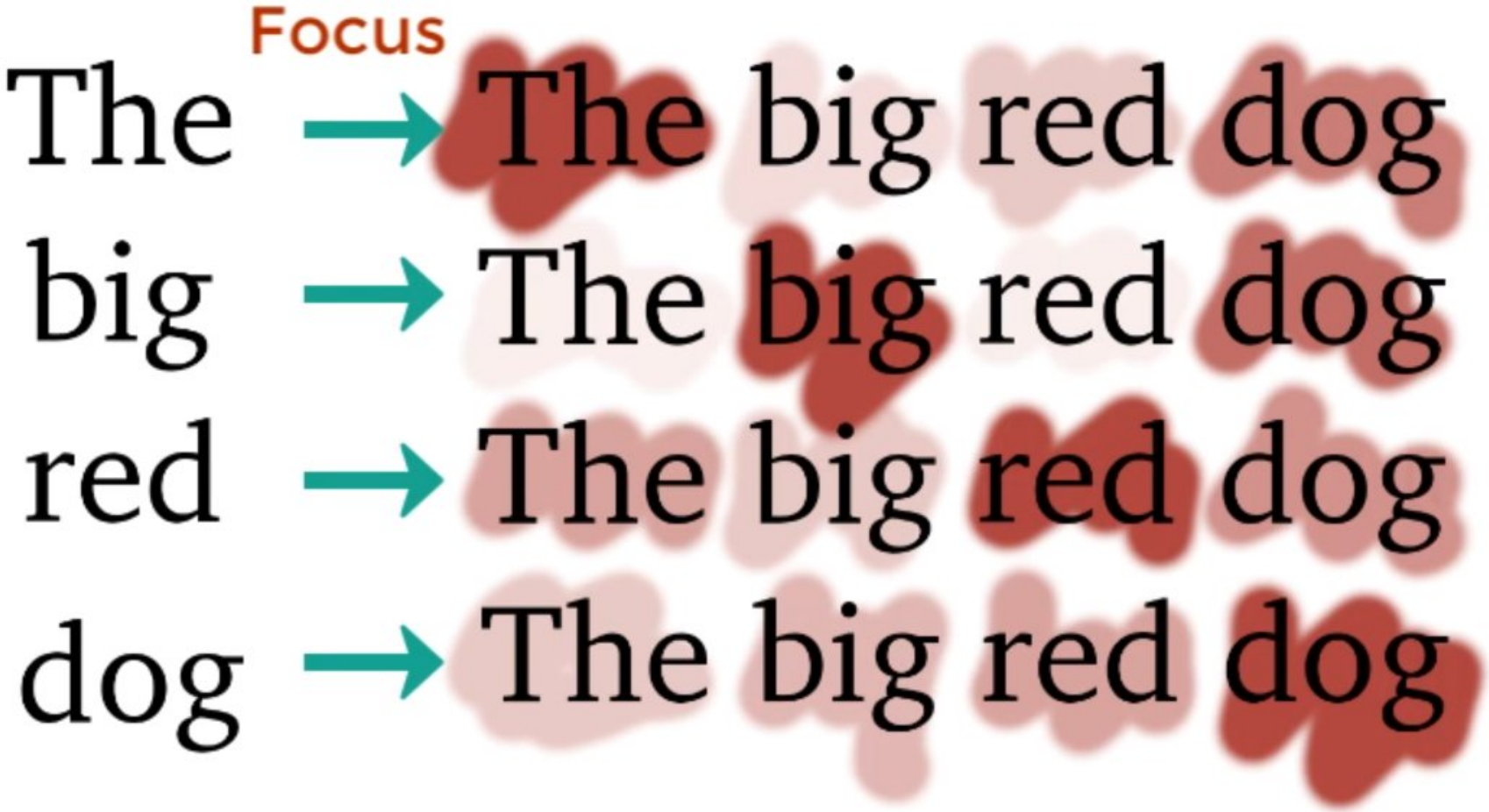
Transformer architecture (1)



Transformer architecture (2)

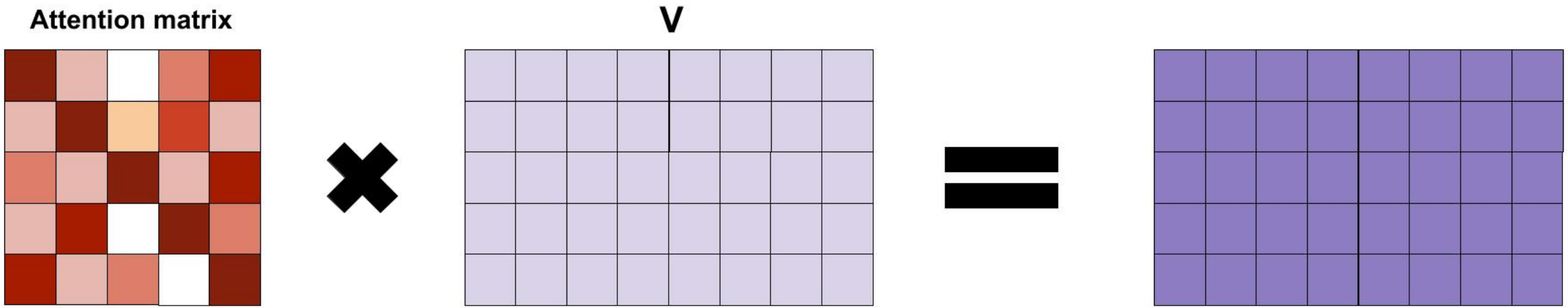


Transformer architecture (3)

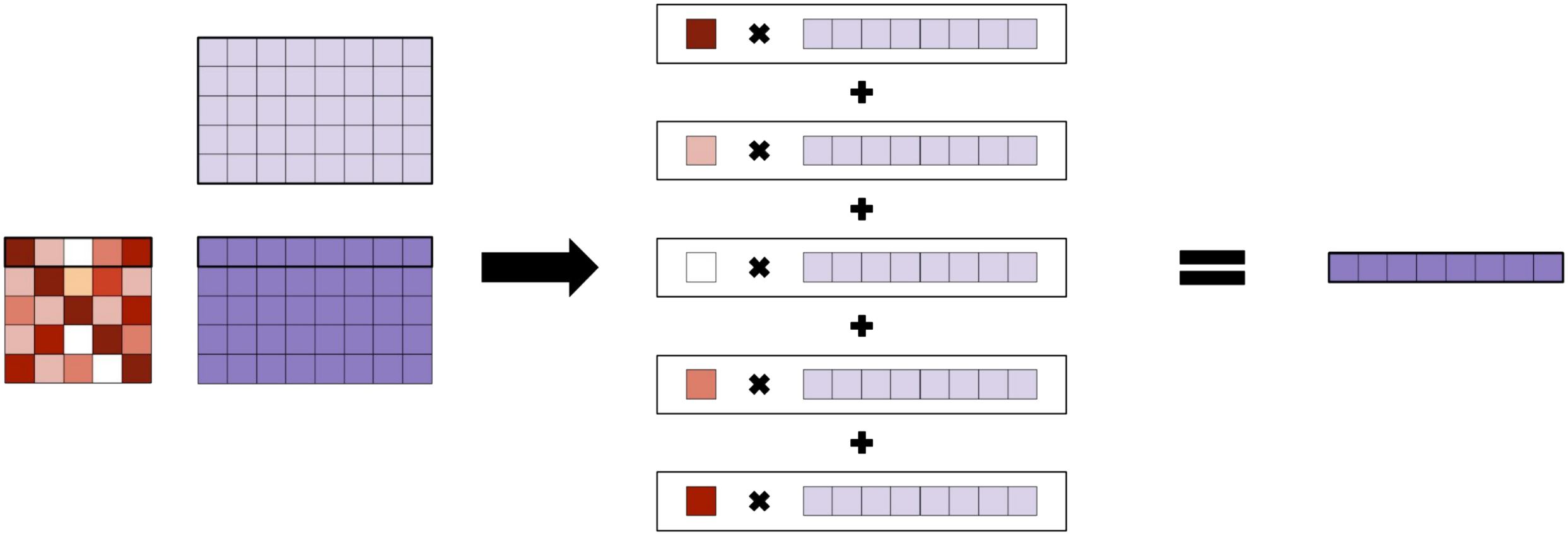


Transformer Neural Networks - EXPLAINED! (Attention is all you need) : https://www.youtube.com/watch?v=TQQlZhbC5ps

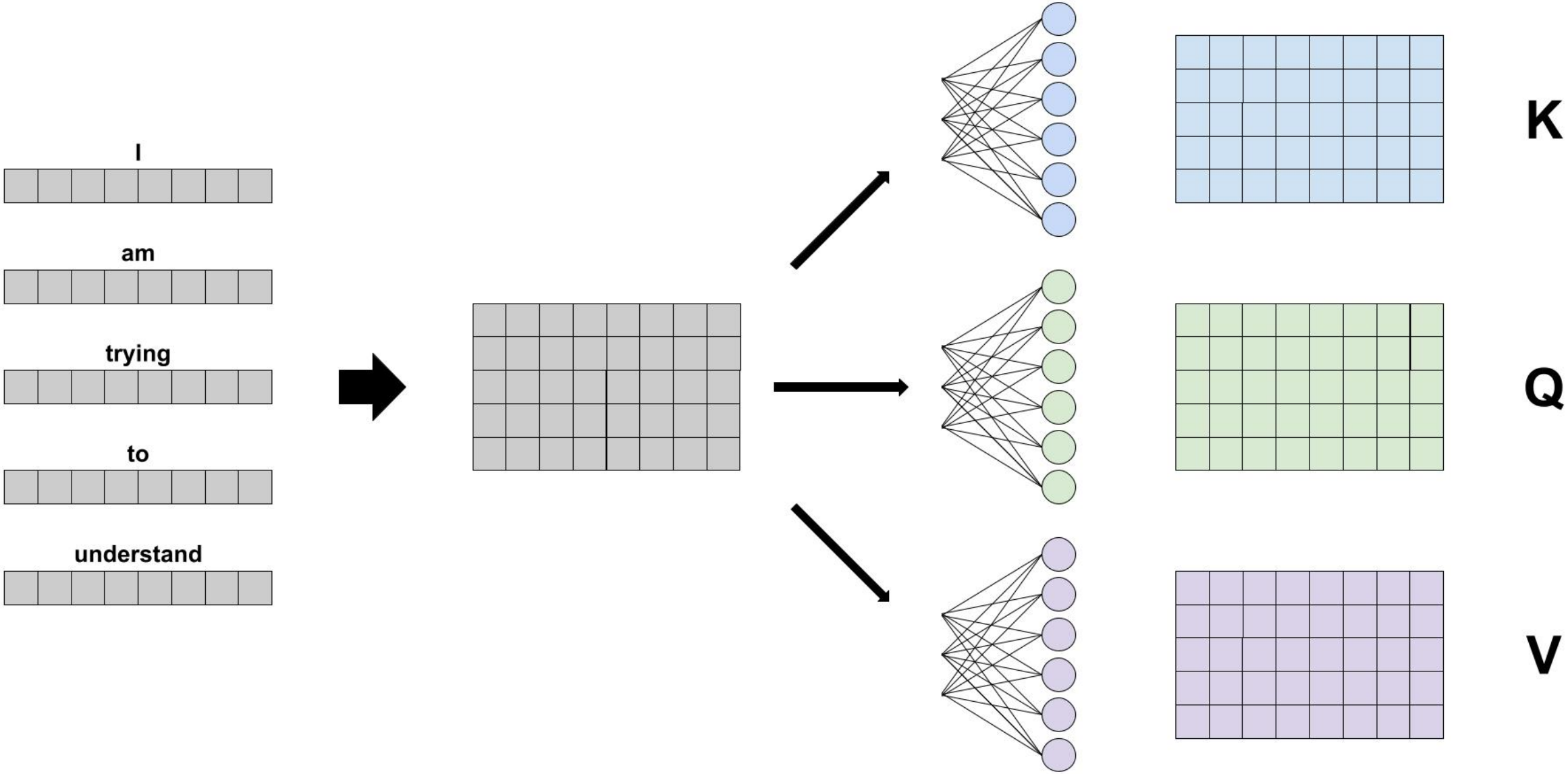
Intuition behind the Attention mechanism (1)



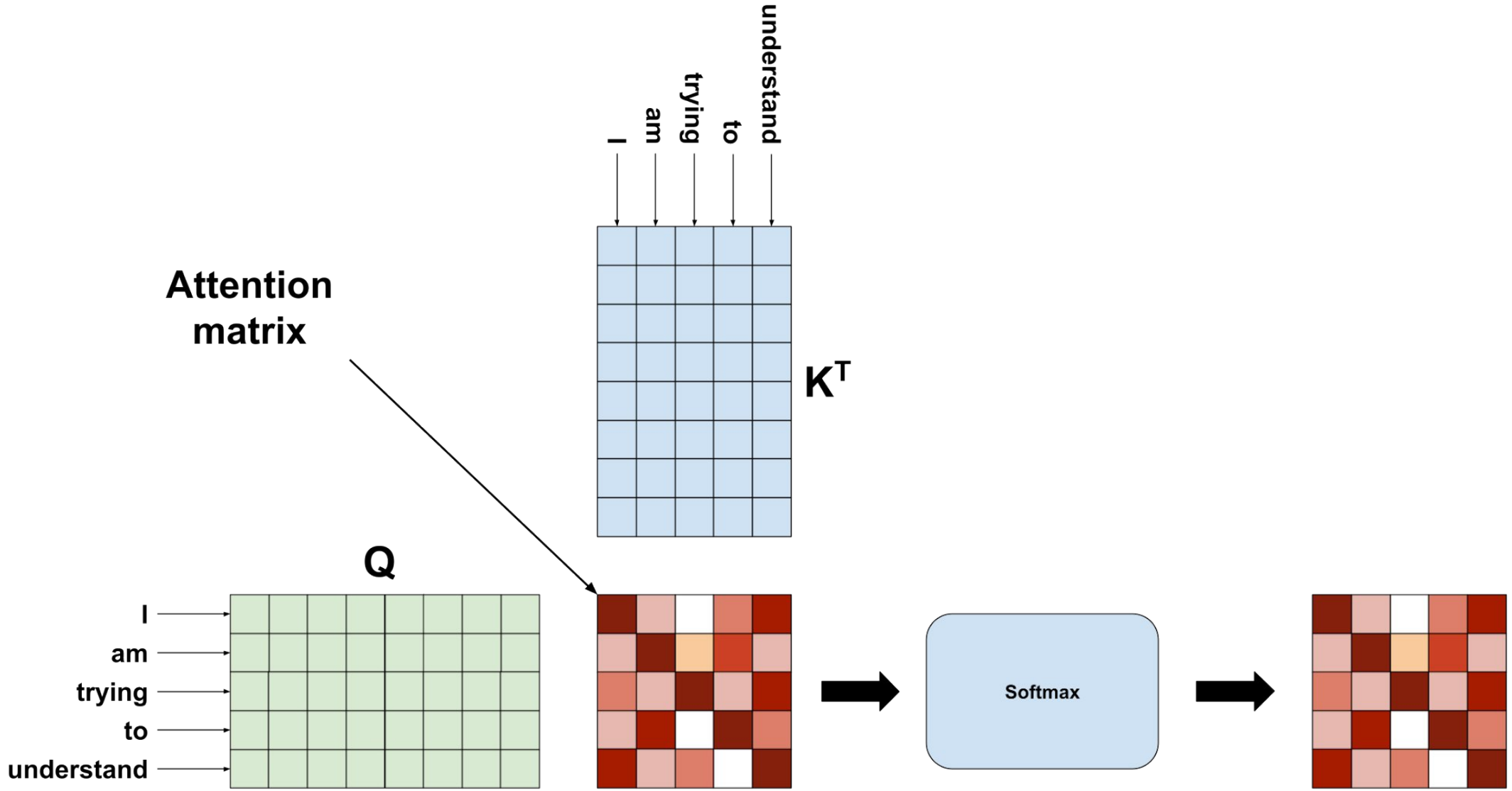
Intuition behind the Attention mechanism (2)



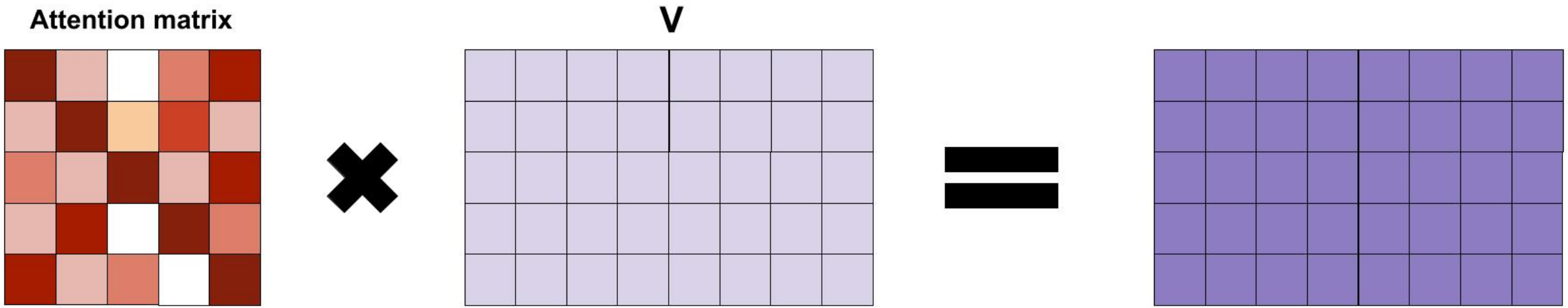
Intuition behind the Attention mechanism (3)



Attention mechanism (1)

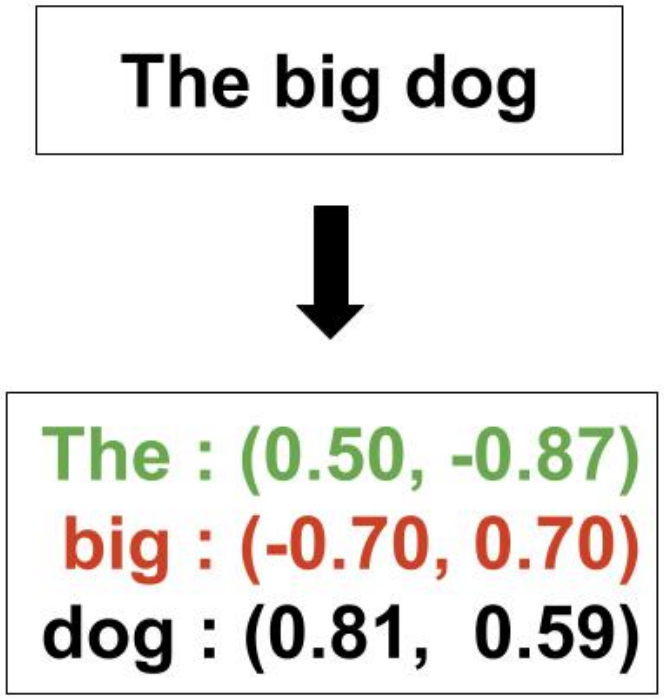


Attention mechanism (2)

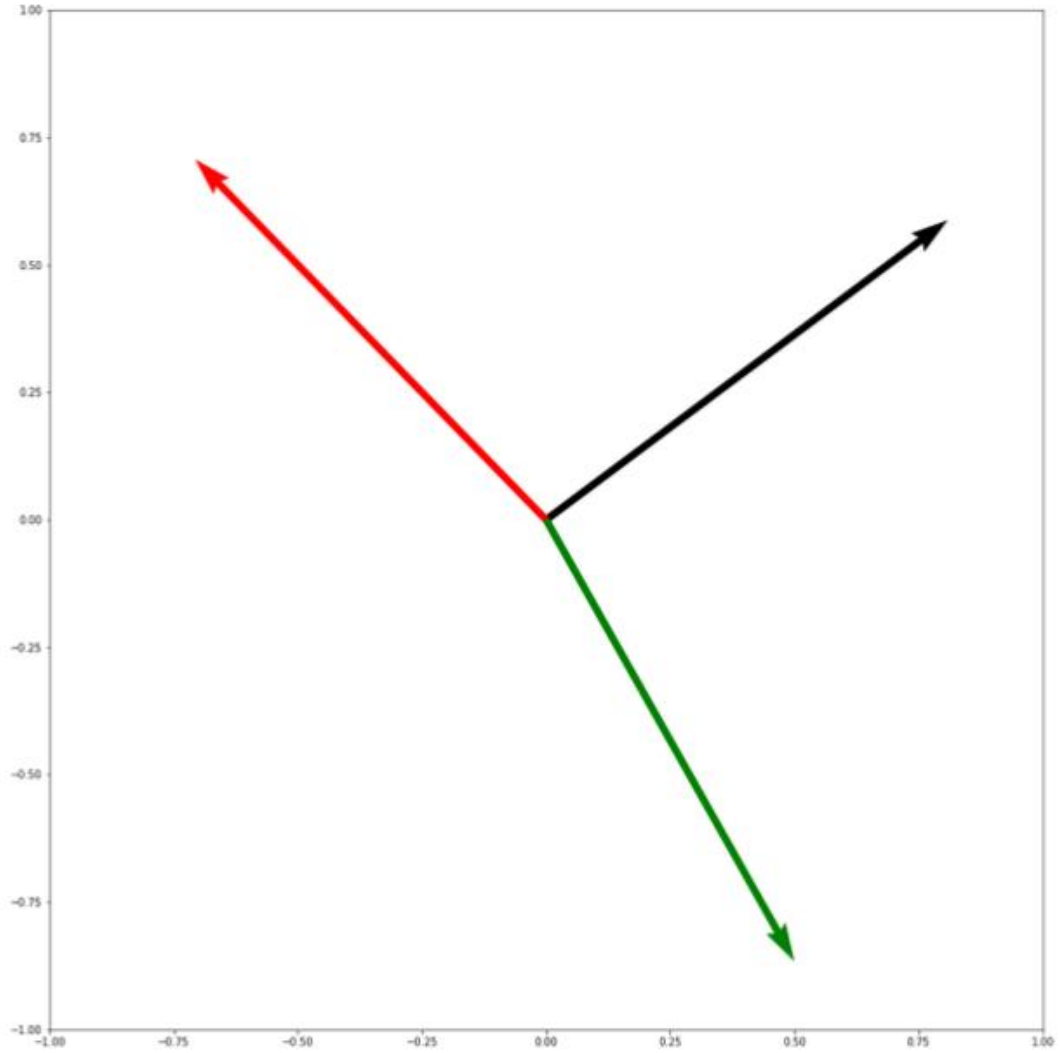


Attention mechanism (3)

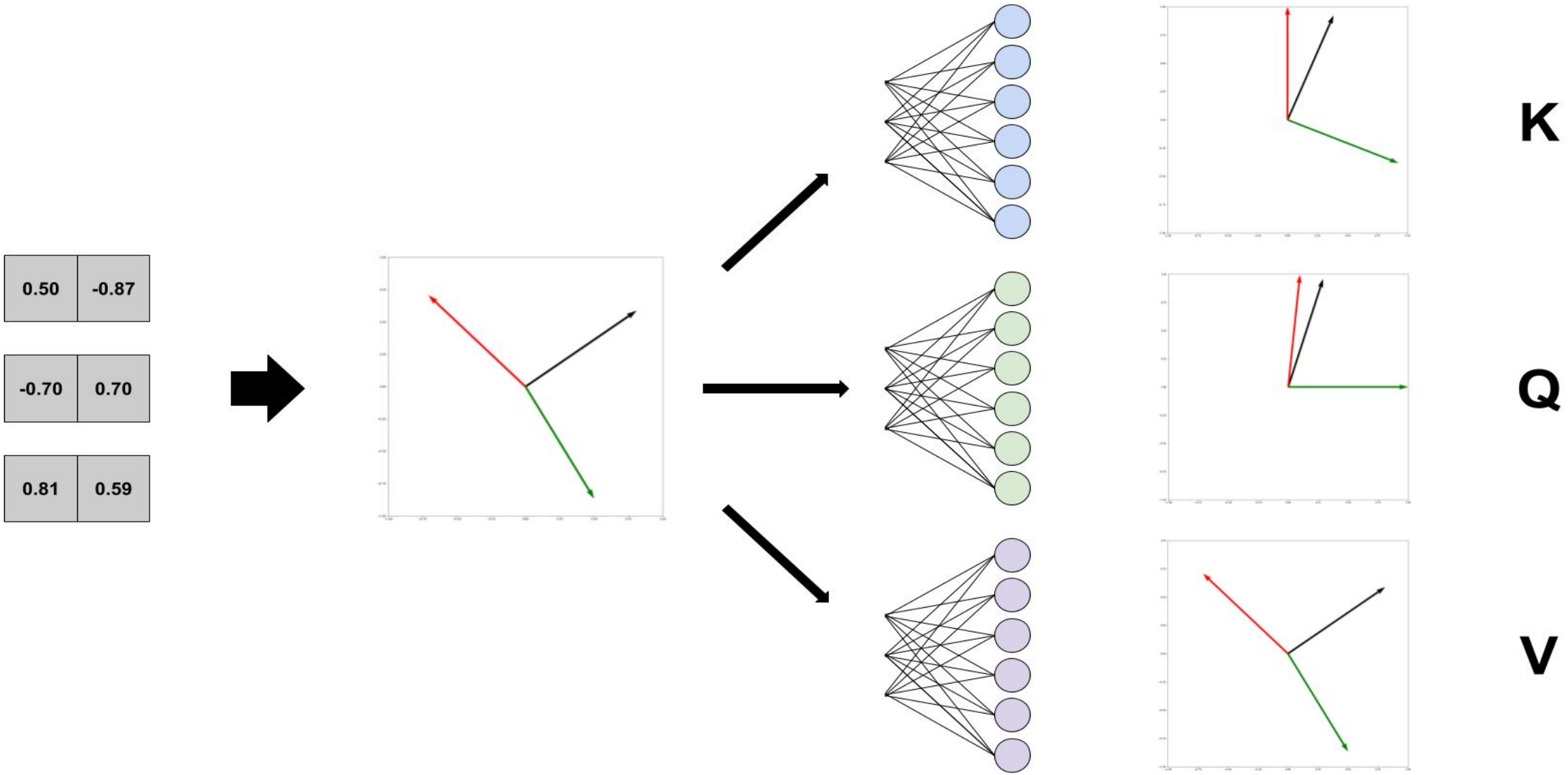
The big dog



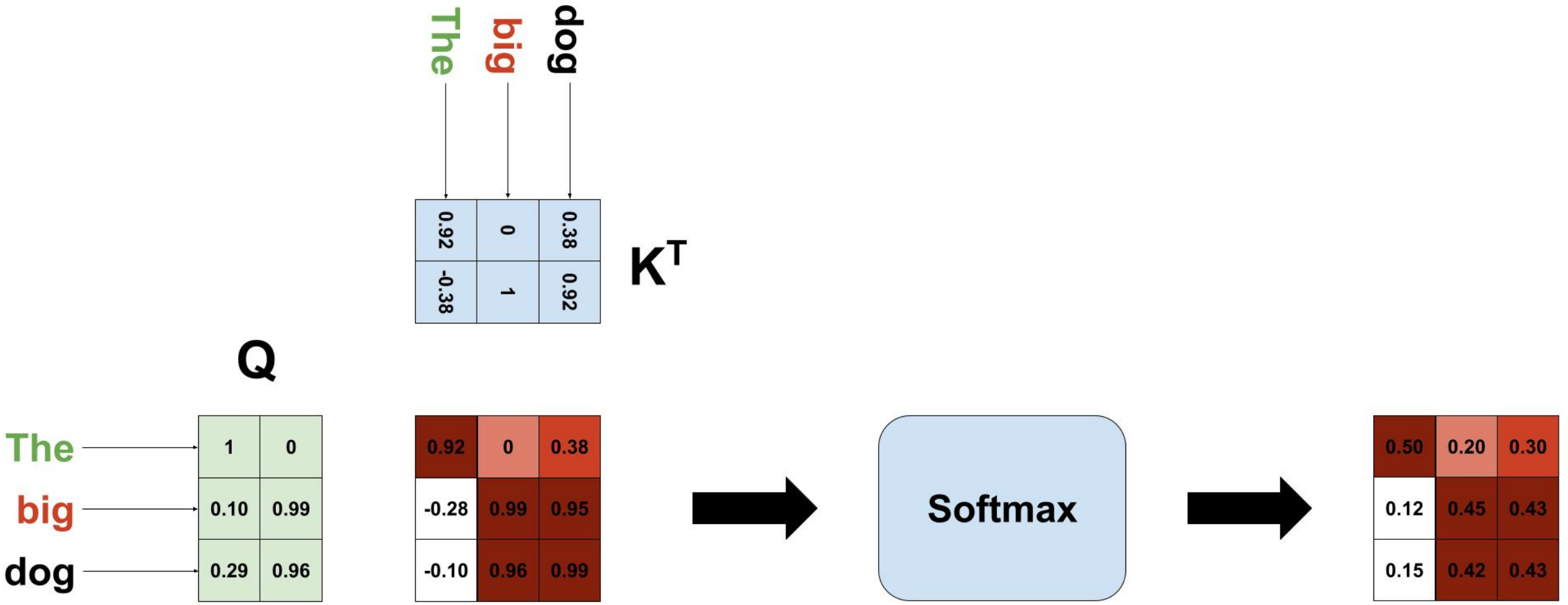
The : (0.50, -0.87)
big : (-0.70, 0.70)
dog : (0.81, 0.59)



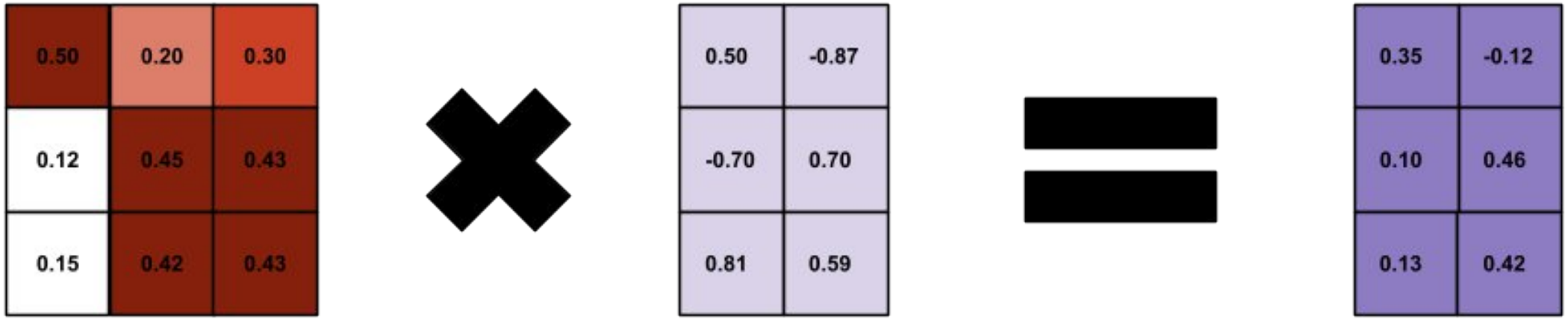
Attention mechanism - Example (1)



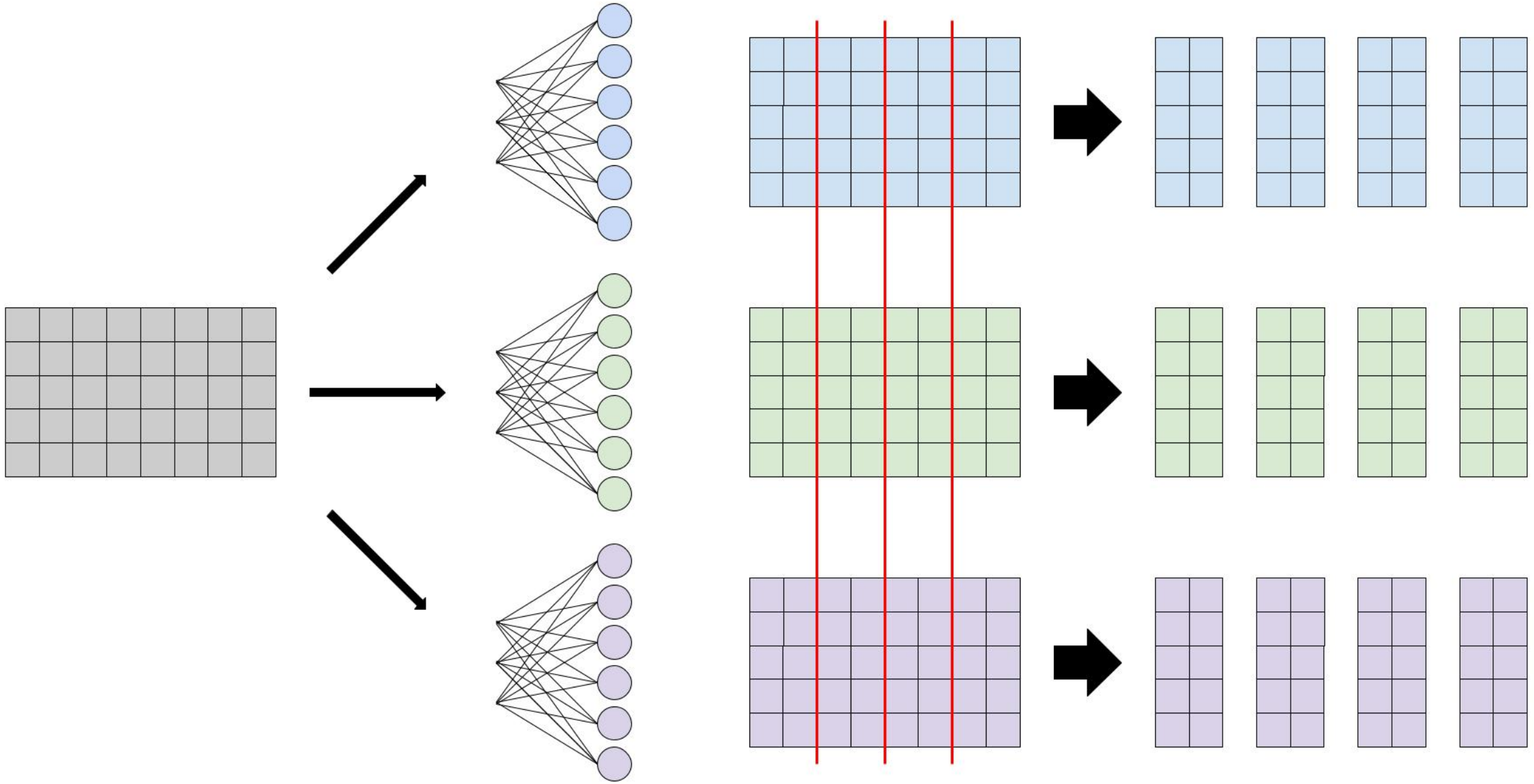
Attention mechanism - Example (2)



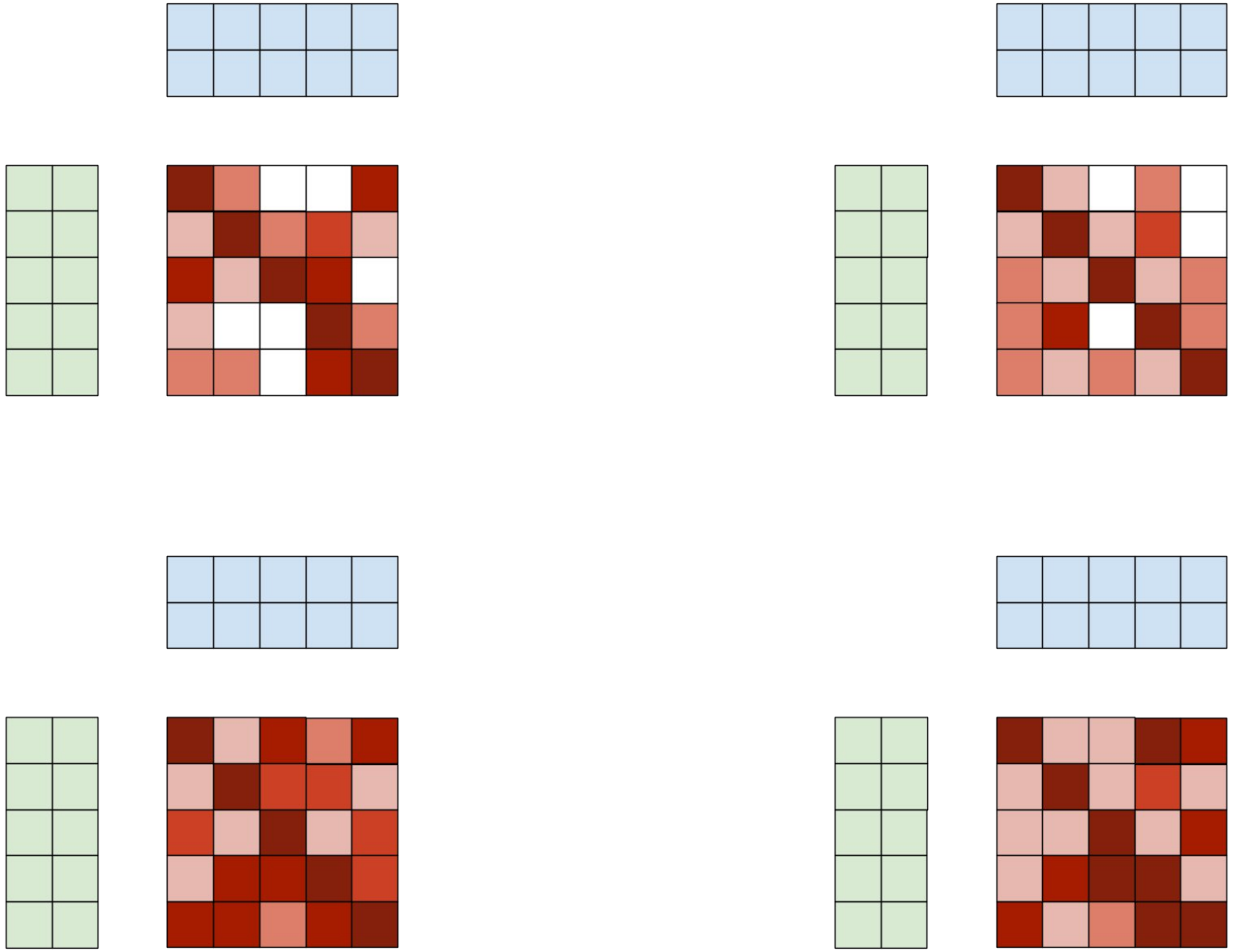
Attention mechanism - Example (3)



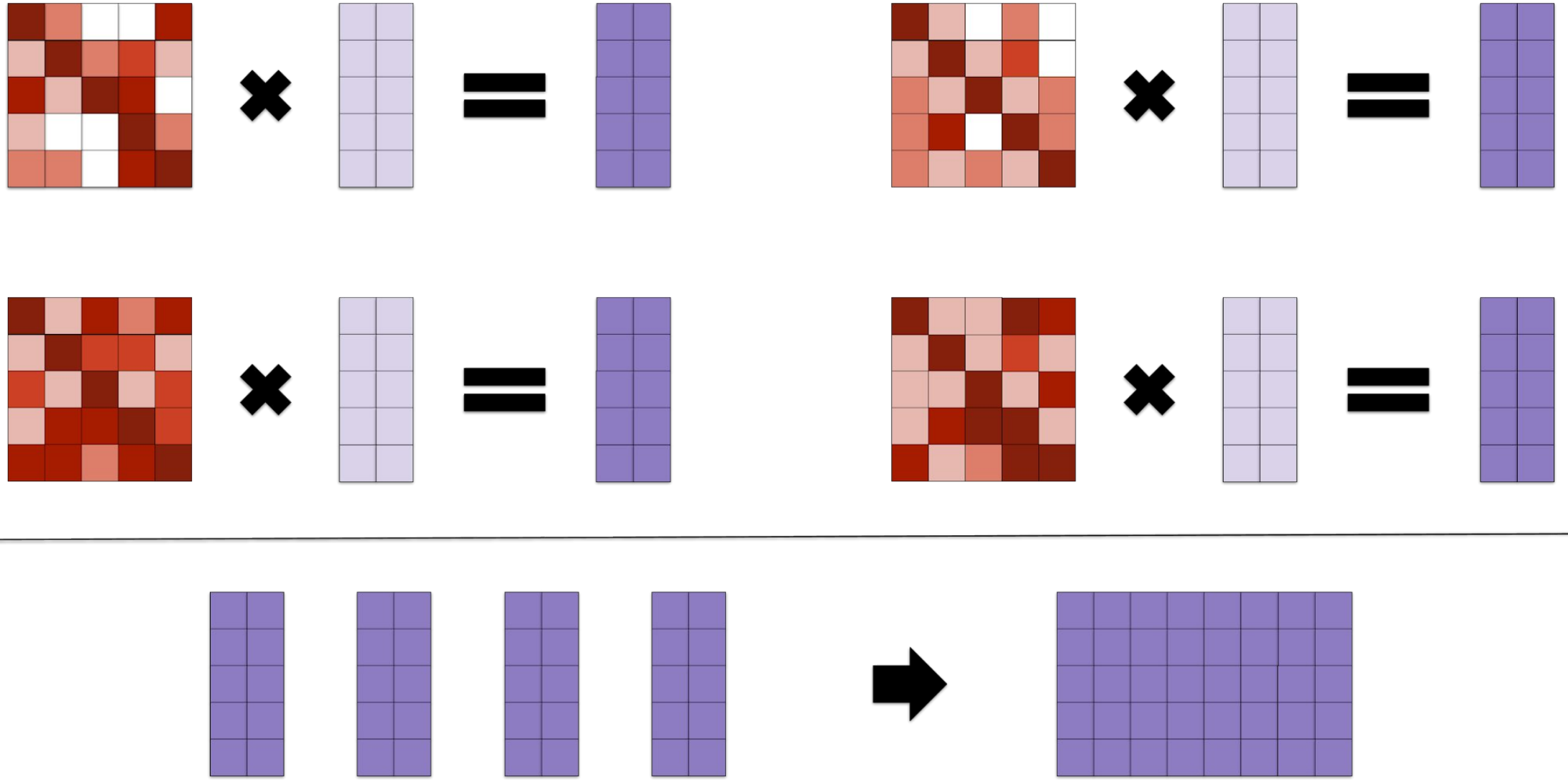
Attention mechanism - Example (4)



Multi-Head Attention (1)

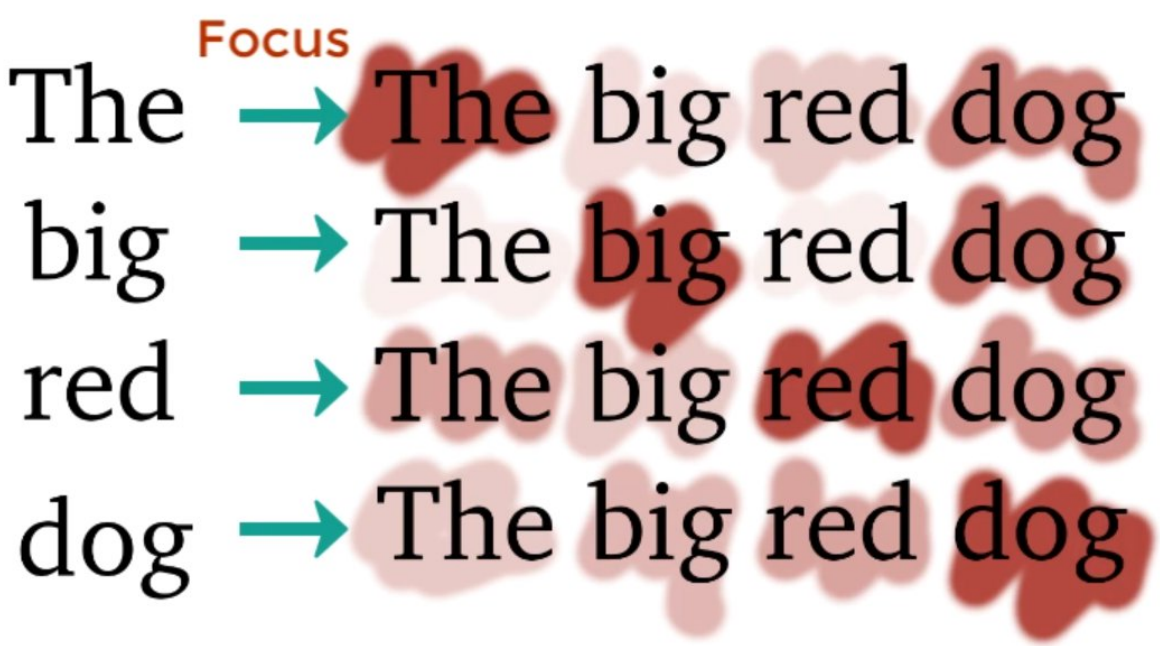


Multi-Head Attention (2)



Multi-Head Attention (3)

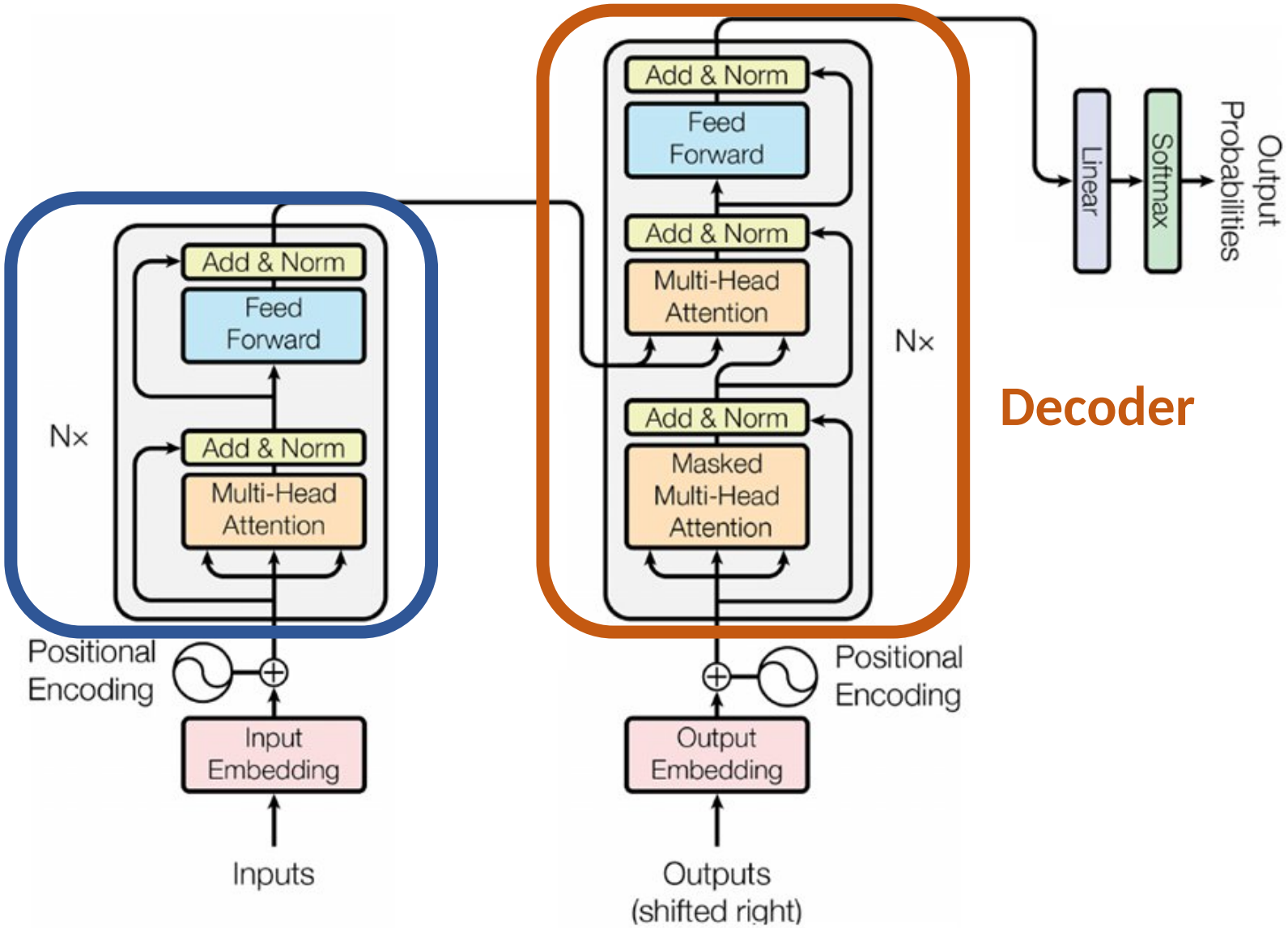
Bidirectional attention (BERT - Encoder - Auto-encoding)



Unidirectional attention (GPT - Decoder - Auto-regressive)

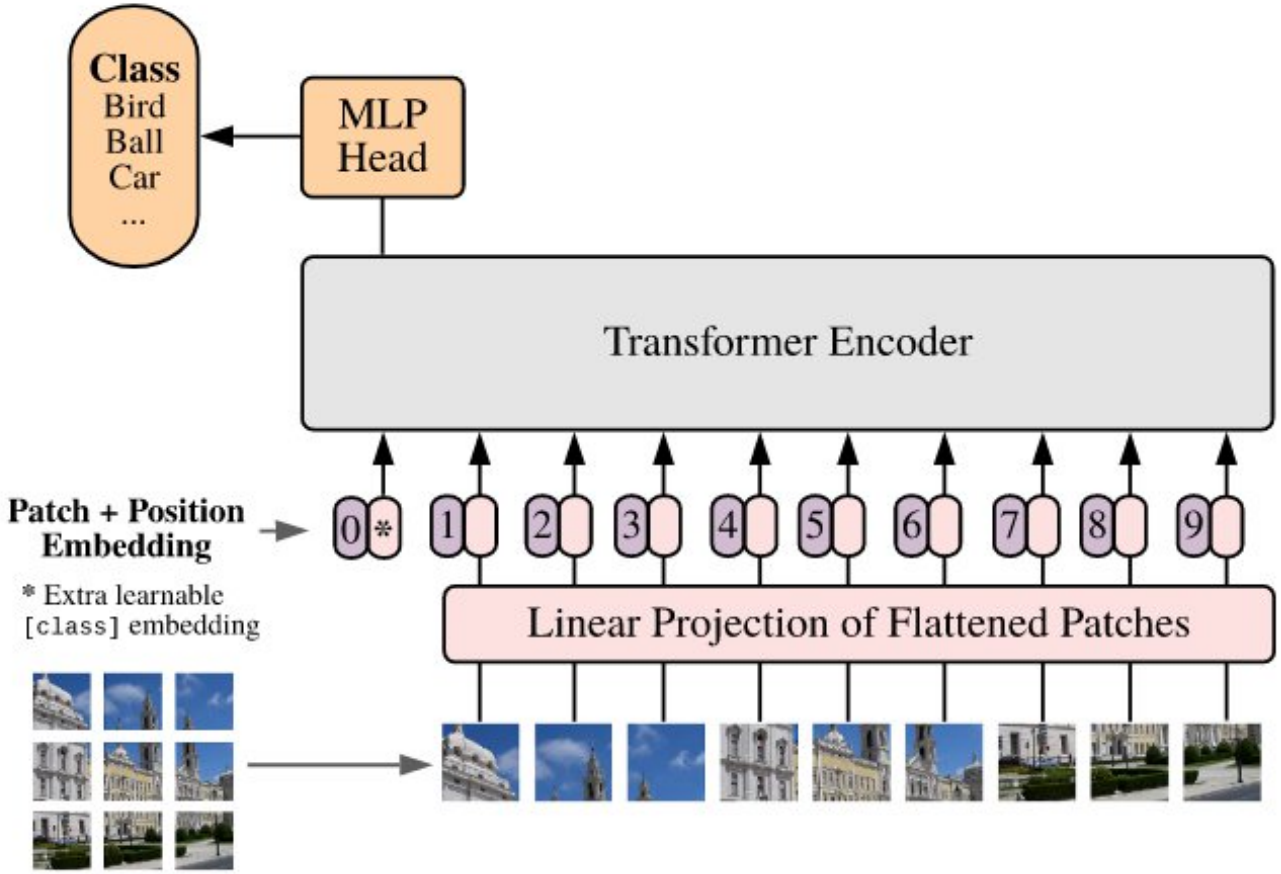
Transformer Neural Networks - EXPLAINED! (Attention is all you need) : https://www.youtube.com/watch?v=TQQlZhbC5ps

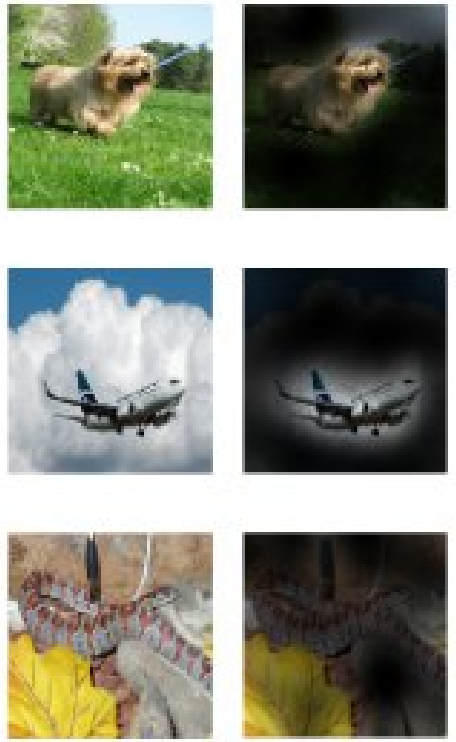
Transformer types (1)



Vaswani, Ashish, et al. "Attention is all you need." Advances in neural information processing systems 30 (2017).

Transformer types (2)





Dosovitskiy, Alexey, et al. "An image is worth 16x16 words: Transformers for image recognition at scale." arXiv preprint arXiv:2010.11929 (2020).

Vision Transformers