Transformer Review

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Outline

- Introduction
- Model architecture
- Result
- Derived models
- Applications

Introduction

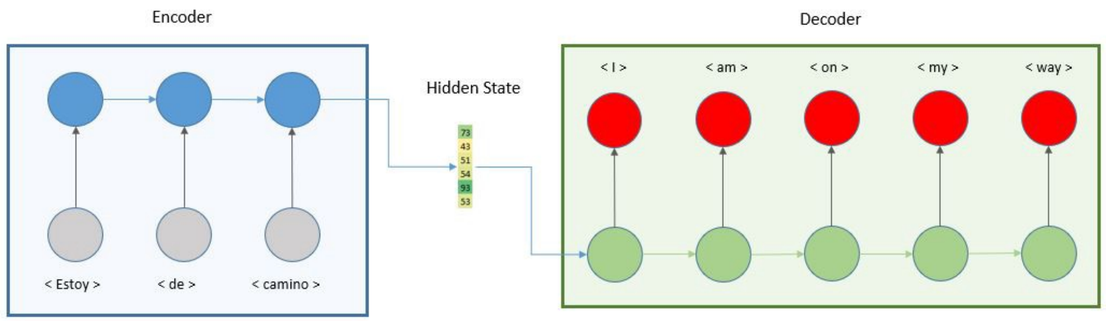
- From Sequence Modeling to Attention
  - RNN, LSTM, GRU
  - From recurrent language models to encoder-decoder model
    - H_{t-1} to h_t
    - Hard to parallelize
    - Long sequence memory lose, large H_t
  - Attention used from encoder to decoder

- Derivatives of Transformers
  - BERT (2018), GPT3 (2020)
  - ChatGPT(2022)

- From NLP to audio, video, etc.

Model Architecture

- Structure of encoder-decoder



- Transformer

Attention Is All You Need

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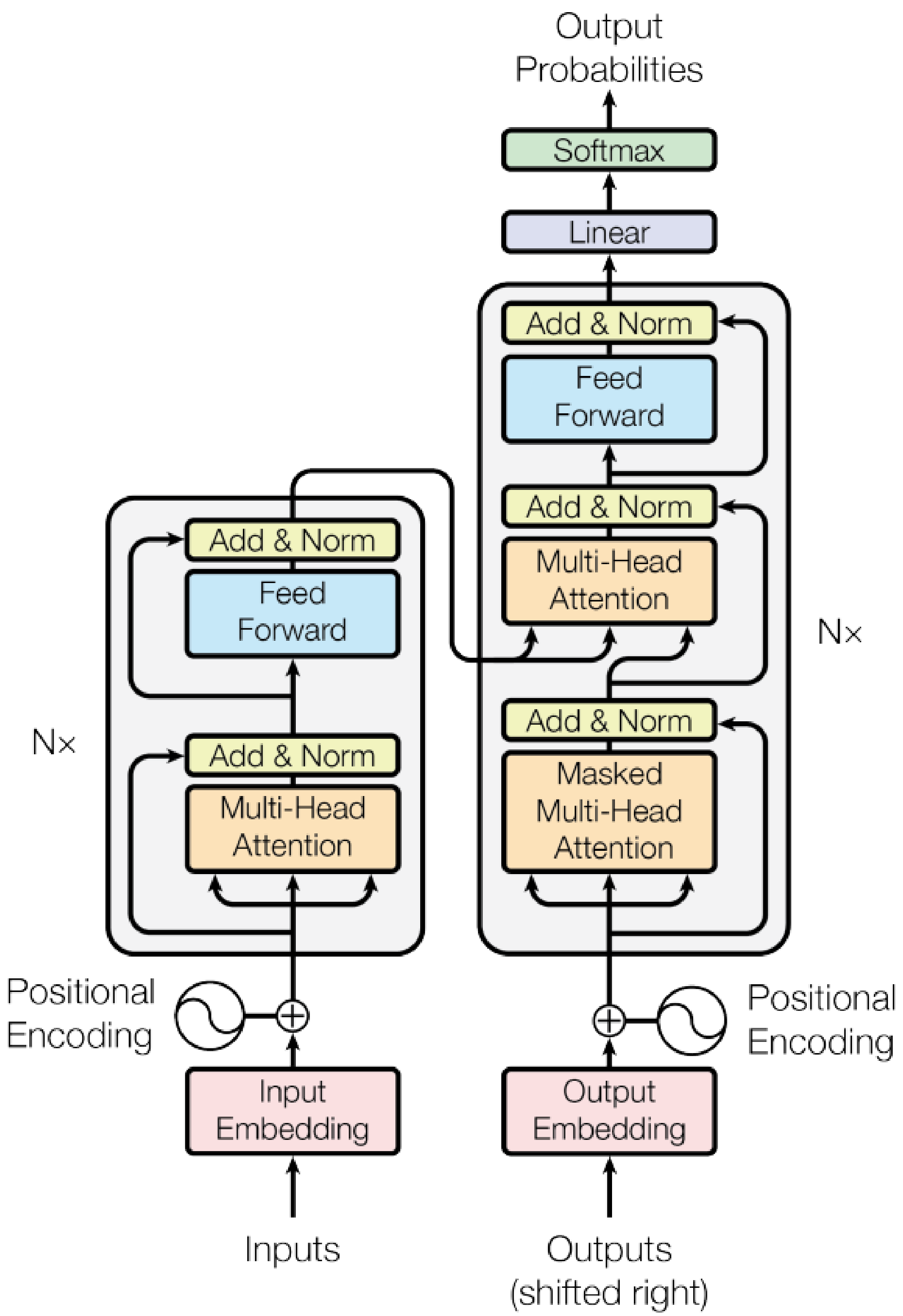
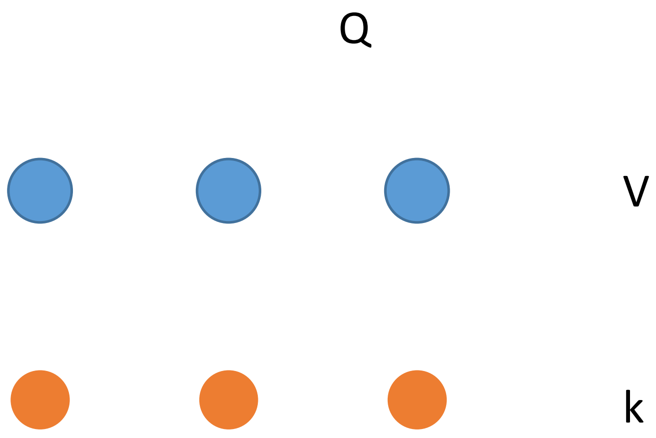
31st Conference on Neural Information Processing Systems (**NIPS 2017**), Long Beach, CA, USA.



Model Architecture

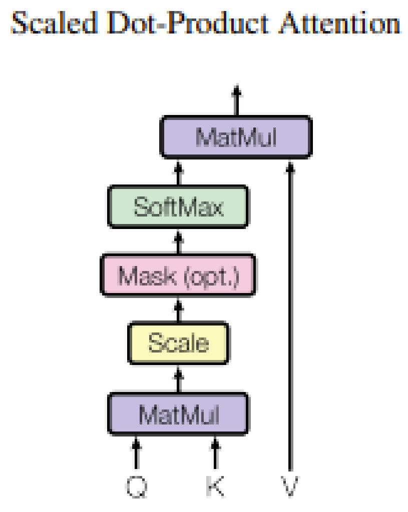
- Attention layer: mapping a query and a set of key-value pairs to an output in vector form.

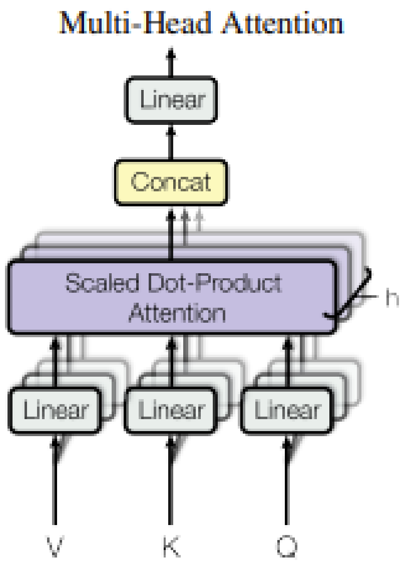


Model Architecture

- Scaled dot-product attention

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





Model Architecture

- Position-wise Feed-Forward Networks

$$\mathrm{FFN}(x) = \max(0, xW_1 + b_1)W_2 + b_2$$

- Positional Encoding
  - Ensure sequence of tokens