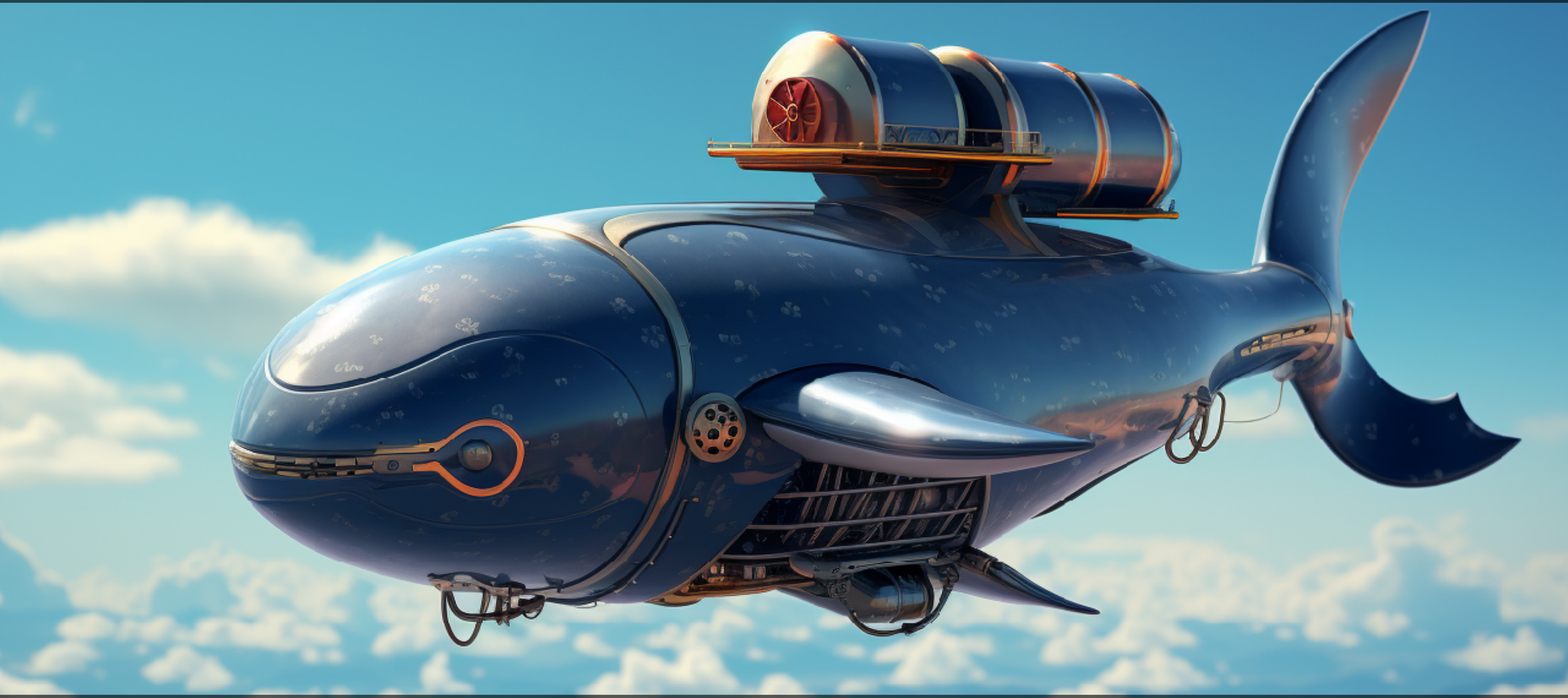
Transformerを詳しく学ぼう！



Section3


Section3の概要

講座の内容

Section1. Transformerの概要

Section2. Attentionの仕組み

Section3. Transformerにおける埋め込み

Section4. Transformerを組み立てる

今回の内容

1. Section3の概要
2. Token Embedding
3. Positional Encoding
4. Position-wise Feed-Forward Networks
5. Layer Normalization
6. 演習

教材の紹介

- **Pythonの基礎:**

  python_basic

- **Section3の教材**

  01_token_embedding.ipynb

  02_positional_encoding.ipynb

  03_positionwise_feed_forward.ipynb

  04_layer_norm.ipynb

  05_exercise.ipynb

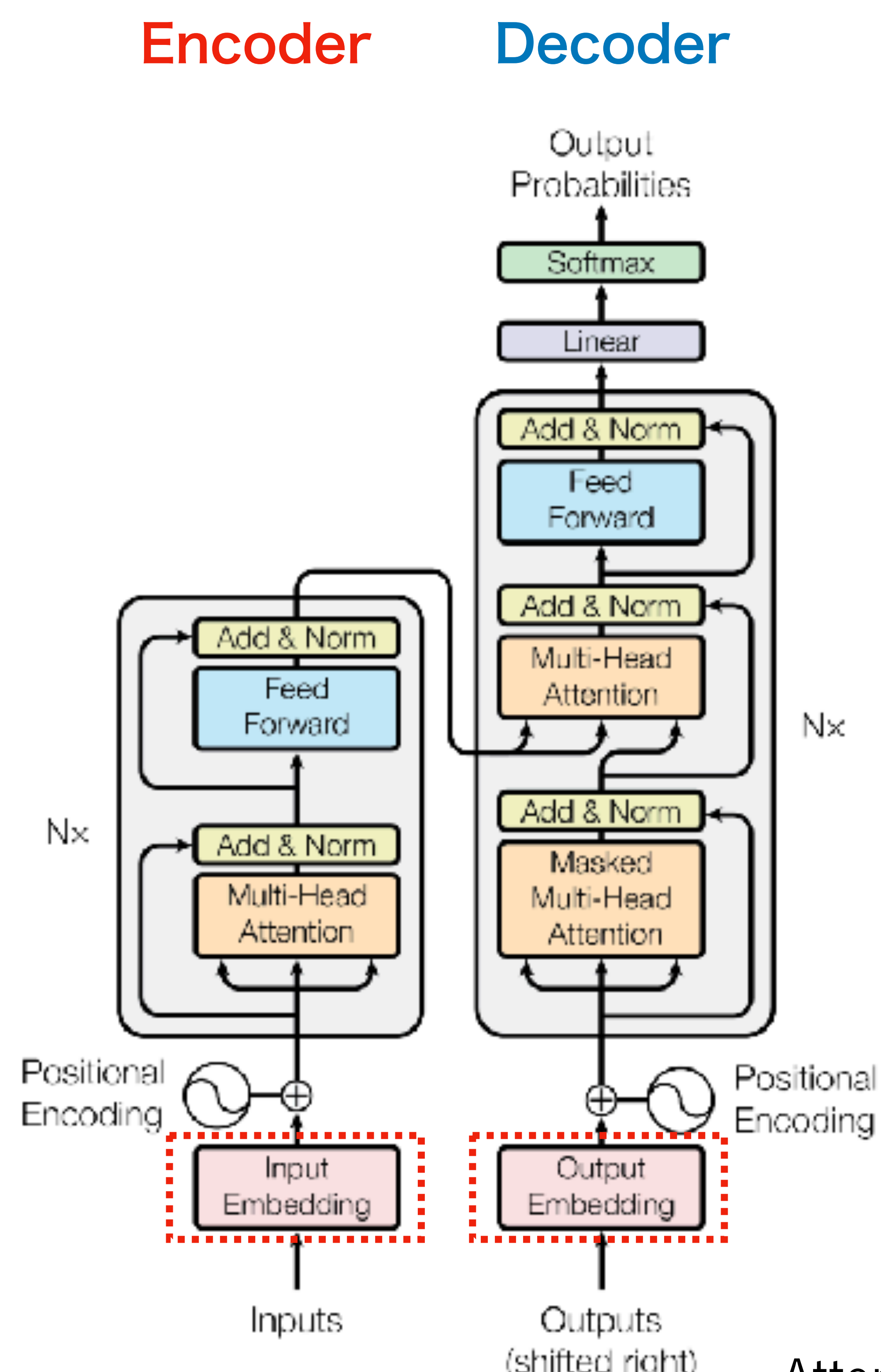
https://github.com/yukinaga/learning_transformer/

Section2演習の解答例

- 03_exercise.ipynb


Token Embedding

Token Embedding



Attention Is All You Need, Ashish, V. et al. (2017) より引用

nn.Embedding()

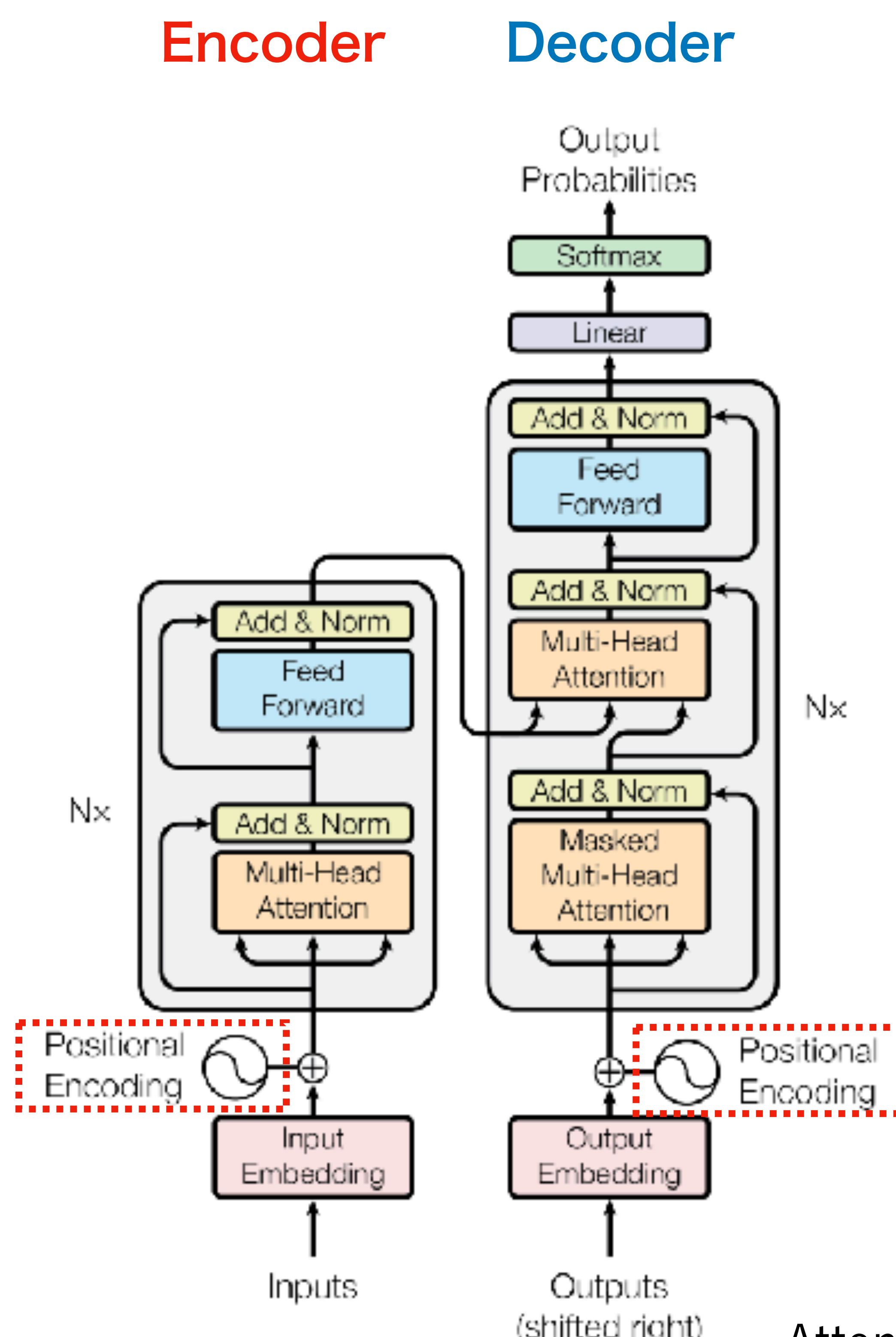
- https://pytorch.org/docs/stable/generated/torch.nn.Embedding

Token Embedding

- 01_token_embedding.ipynb


Positional Encoding

Positional Encoding



Attention Is All You Need, Ashish, V. et al. (2017) より引用

Positional Encoding

- **Positional Encoding**
  → 「単語の位置」の情報を加える

$$PE_{(pos,2i)} = sin(pos/10000^{2i/d_{\text{model}}})$$
$$PE_{(pos,2i+1)} = cos(pos/10000^{2i/d_{\text{model}}})$$

pos: 単語の位置　2i, 2i+1: Embedding の何番目の次元か　d_{model}: 次元数

Attention Is All You Need, Ashish, V. et al. (2017) より引用

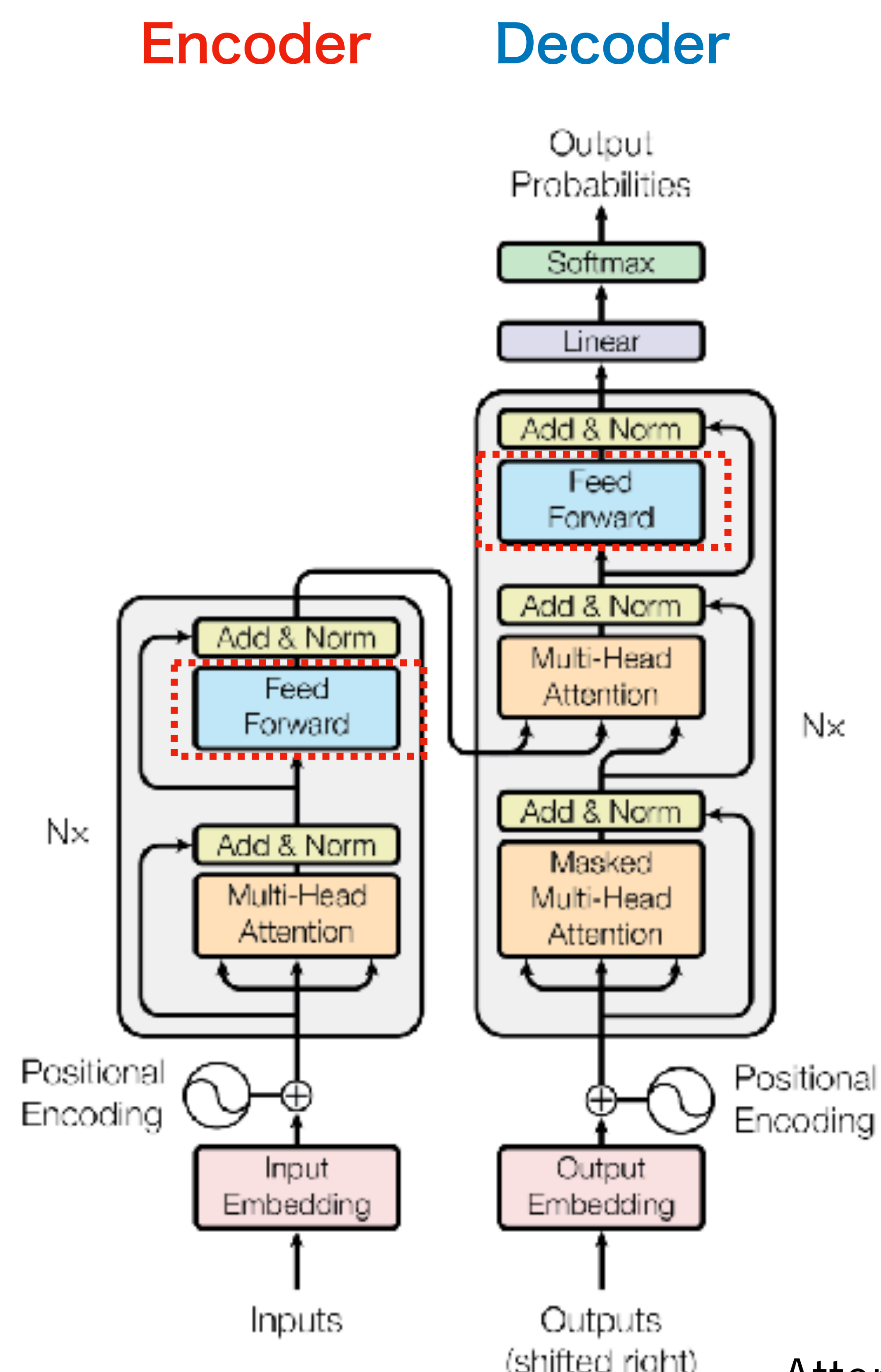
Positional Encoding

- 02_positional_encoding.ipynb


休憩…

Position-wise Feed-Forward Networks

Position-wise Feed-Forward Networks



Attention Is All You Need, Ashish, V. et al. (2017) より引用

Position-wise Feed-Forward Networks

- **Positionwise fully connected feed-forward network**

  → 2 層の全結合ニューラルネットワーク

  → 単語の位置ごとに個別の順伝播ネットワーク

  → 他単語との影響関係を排除

  → パラメータは全てのネットワークで共通

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

Attention Is All You Need, Ashish, V. et al. (2017) より引用

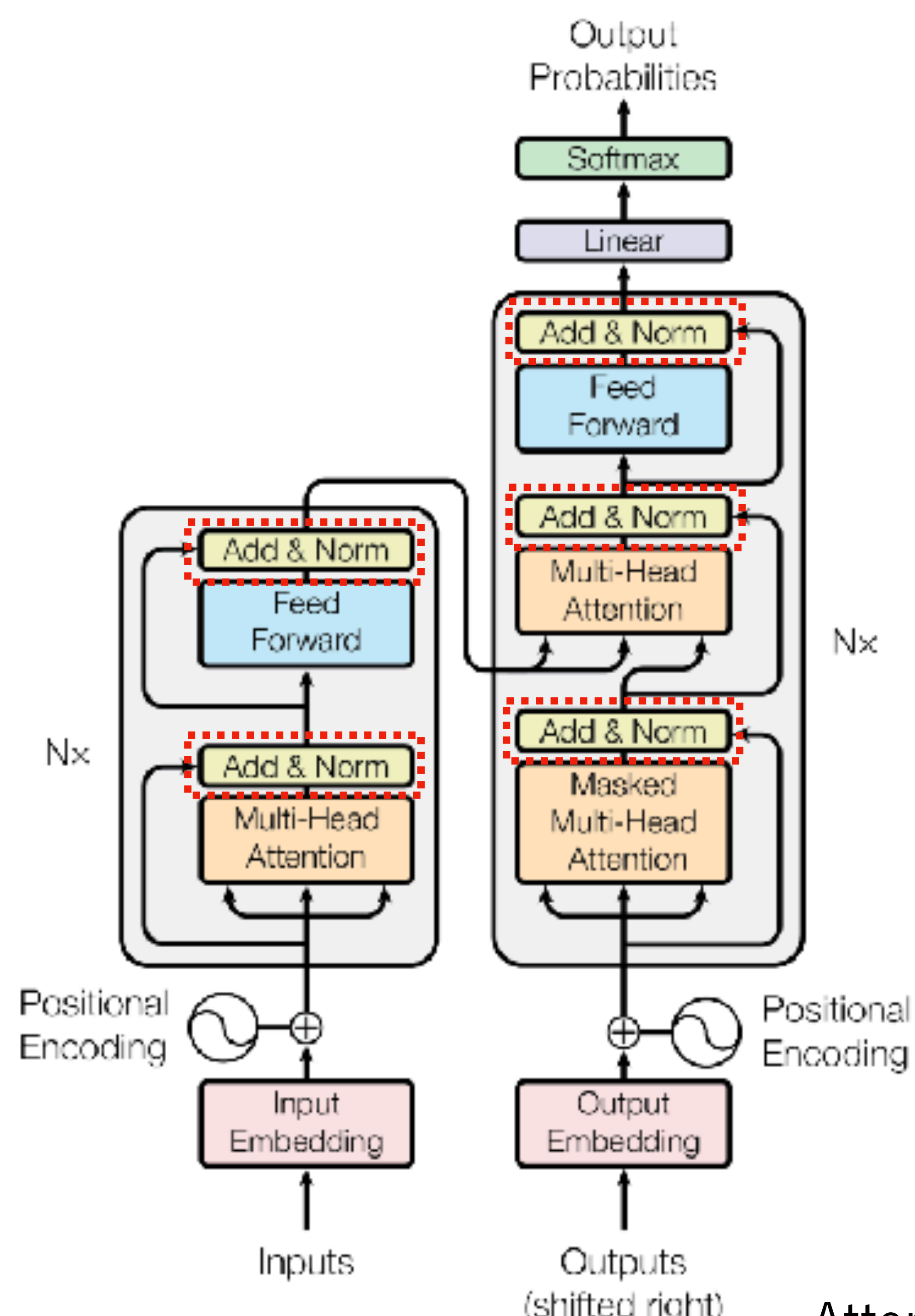
Position-wise Feed-Forward Networks

- 03_positionwise_feed_forward.ipynb


Layer Normalization

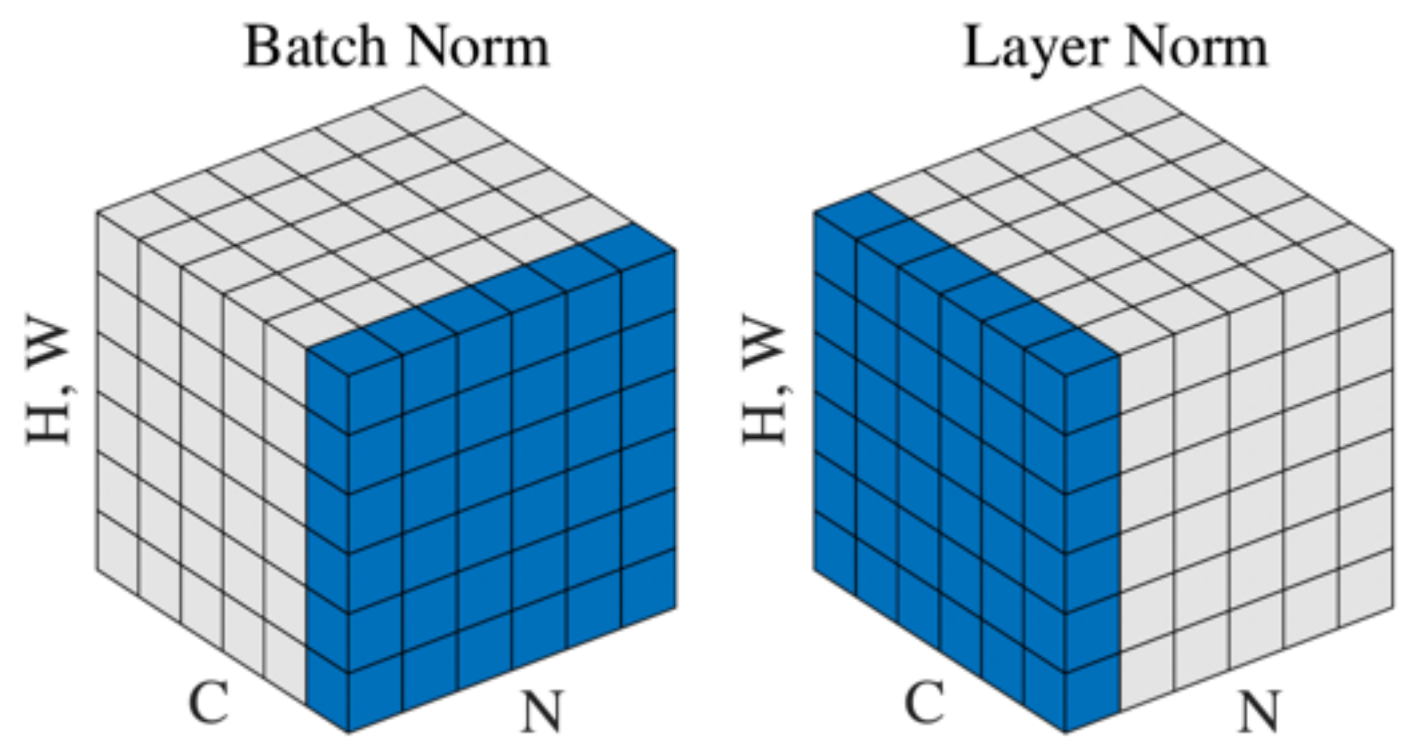
Layer Normalization

Encoder　　Decoder



Attention Is All You Need, Ashish, V. et al. (2017) より引用

Layer Normalization



Group Normalization, Yuxin Wu, et al. (2018) より引用

$$\mu^l = \frac{1}{H}\sum_{i=1}^{H} a_i^l \qquad \sigma^l = \sqrt{\frac{1}{H}\sum_{i=1}^{H}\left(a_i^l - \mu^l\right)^2}$$

Layer Normalization, Jimmy Lei Ba, et al. (2016) より引用

Layer Normalization

- 04_layer_norm.ipynb


演習

演習

- 05_exercise.ipynb

次回の内容

Section1. Transformerの概要

Section2. Attentionの仕組み

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Section4. Transformerを組み立てる