Introduction to AI

All for One

Choi Minjoo

Choi Minjoo (Judy Choi)

- Careers
  - 2018 **Working Holiday** in France
  - 2020 ~ **M.S** in Kangwon Univ
    - Intelligence Software Lab
      - **NLP (Machine Translation)**
  - 2021 ~ 2022 **Bering Lab** (NLP Researcher & Engineer)
- SNS
  - https://www.facebook.com/minjoo.choi.562/
  - https://github.com/Judy-Choi
  - https://www.linkedin.com/in/judy-choi/

Before we start the class..

Let's have a discussion!

What is your goal?

- What do you want to get in our class?
- Why are you interested in A.I?
- What do you want to do?

- Please feel free to share what you think 🤗

Minjoo's Goal..

- In my case…
  - My dream is 'Overcome the language barrier' 
  - So I studied A.I
  - To develop a translator (ex: Google Translate)

- In our class…
  - Learn about A.I (* Deep dive into NLP)
  - Develop simple translator

Today’s Contents

- Abstract of A.I
- Natural Language Processing (NLP)
- Deep dive into NLP Model : Transformer

Abstract of A.I

A.I?

Artificial Intelligence

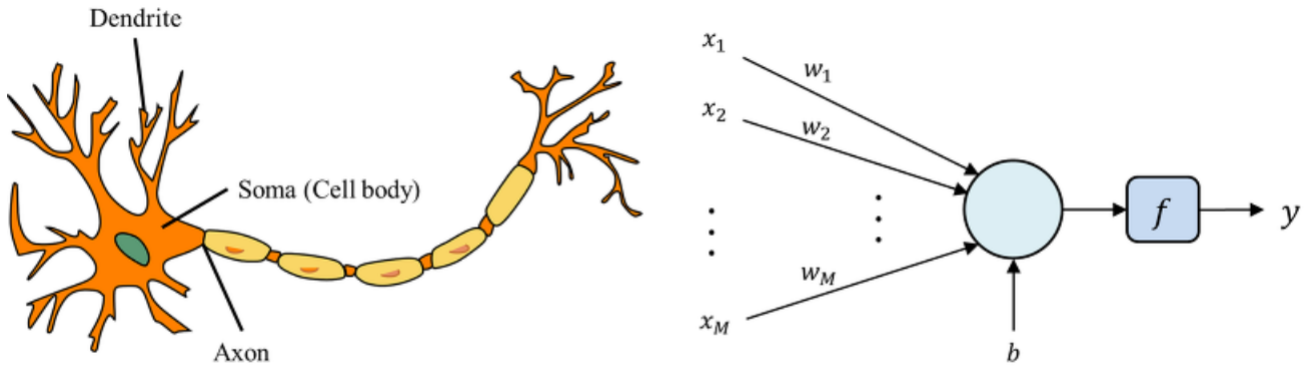
A.I (Artificial Intelligence)

- Intelligence made by human
- Similar to human brain

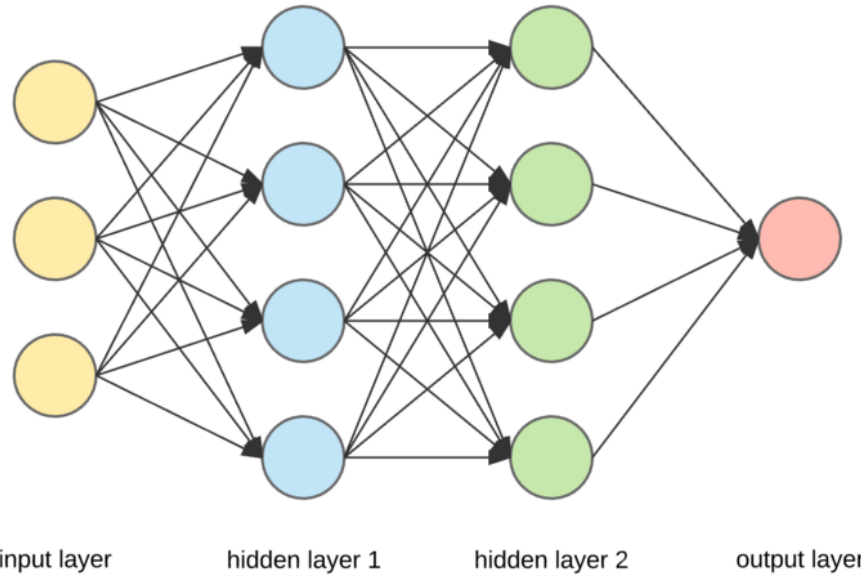
- So, how does it work? 🧐

Neural Network

- Artificial neural network mimicking neural networks in the human brain.
- Brain : Neuron = A.I : Perceptron



[그림 1] 생물체의 neuron (좌)과 artificial neuron (우)



https://smartstuartkim.wordpress.com/2019/01/27/history-of-neural-networks-1-perceptron/

https://gongster.medium.com/how-does-a-neural-network-work-intuitively-in-code-f51f7b2c1e3f

Deep Neural Network (DNN)

- A network of multiple layers of perceptron layers

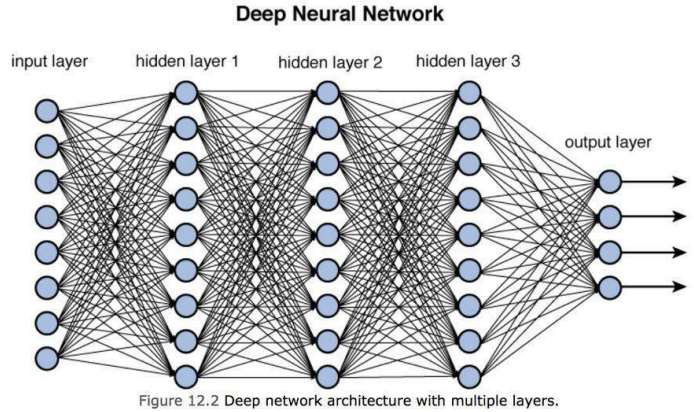
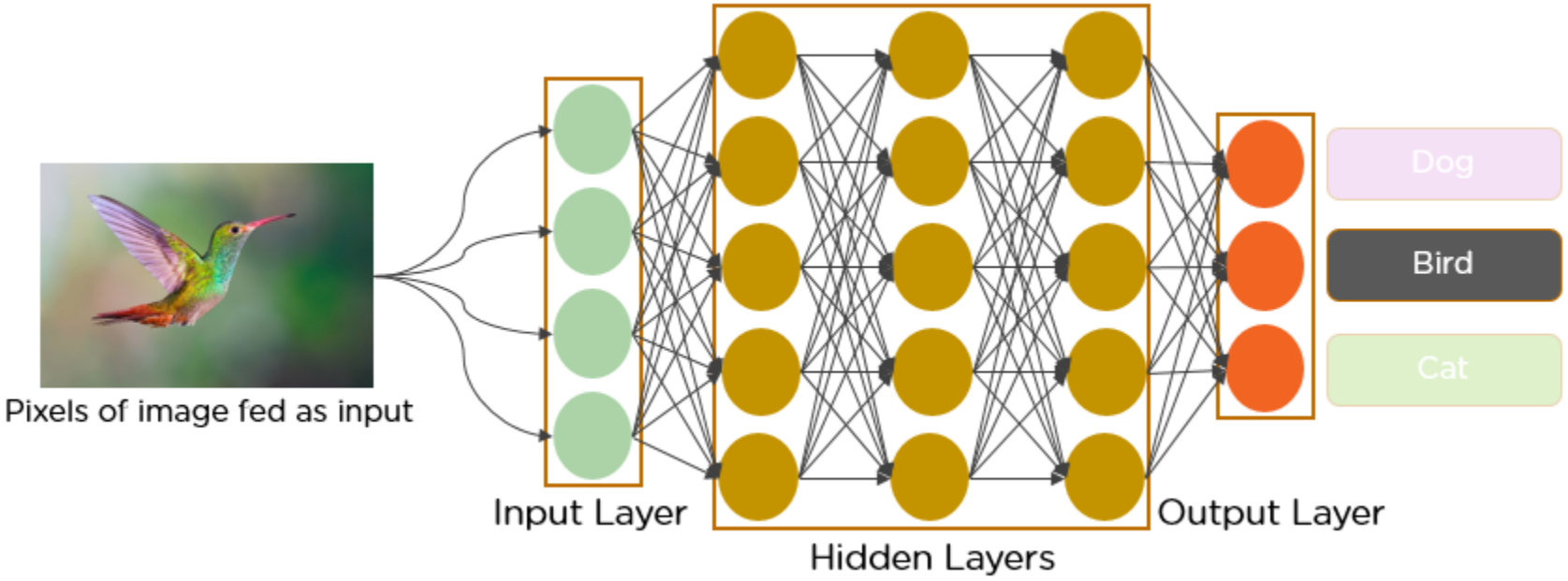


Figure 12.2 Deep network architecture with multiple layers.



https://towardsdatascience.com/training-deep-neural-networks-9fdb1964b964

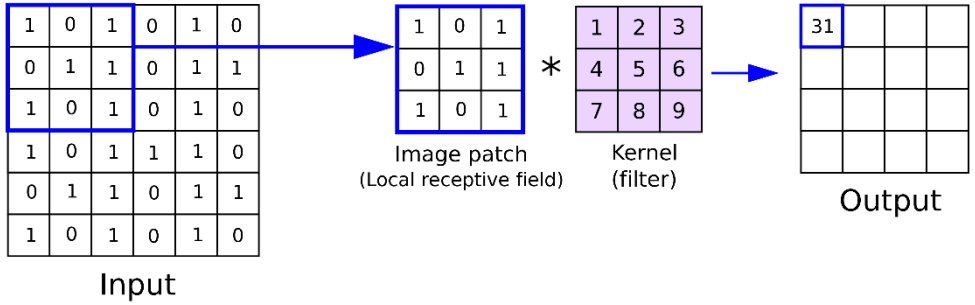
https://www.analyticsvidhya.com/blog/2021/05/convolutional-neural-networks-cnn/

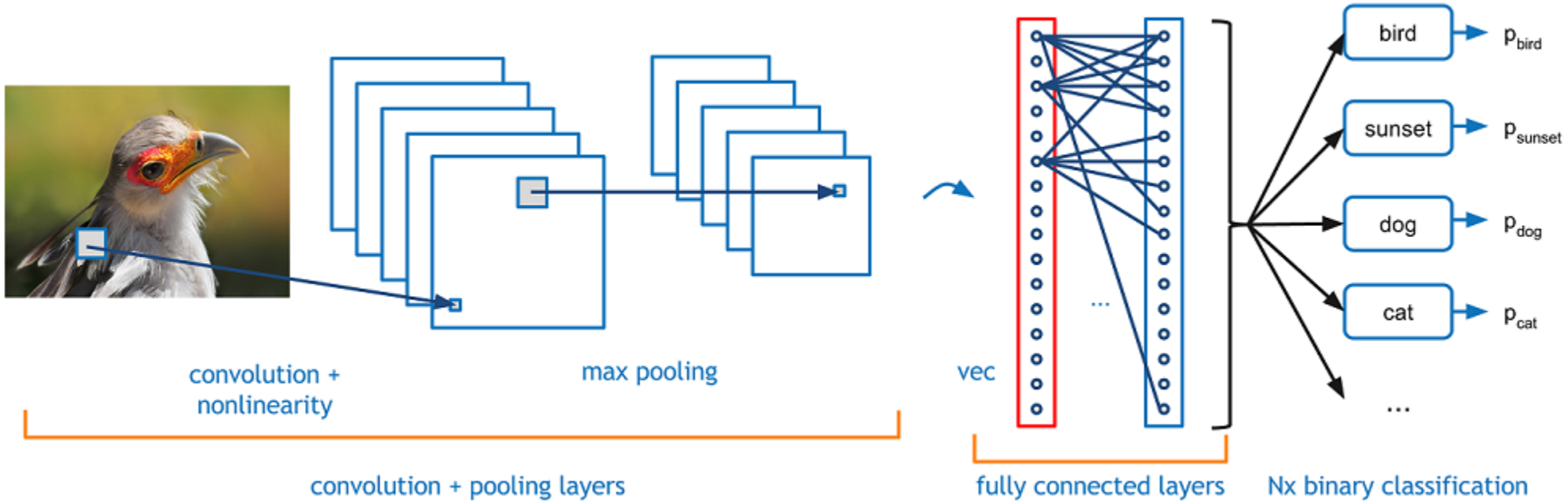
(Tip) 3 big category of AI

- 👀 CV (Computer Vision)
- 👄 NLP (Natural Language Processing)
- 🔢 DS (Data Science)

CV (Computer Vision)

- CNN (Convolution Neural Network)

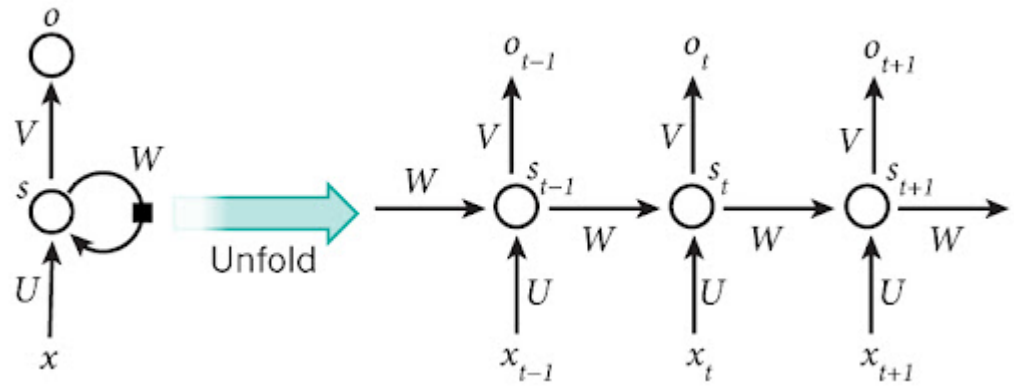




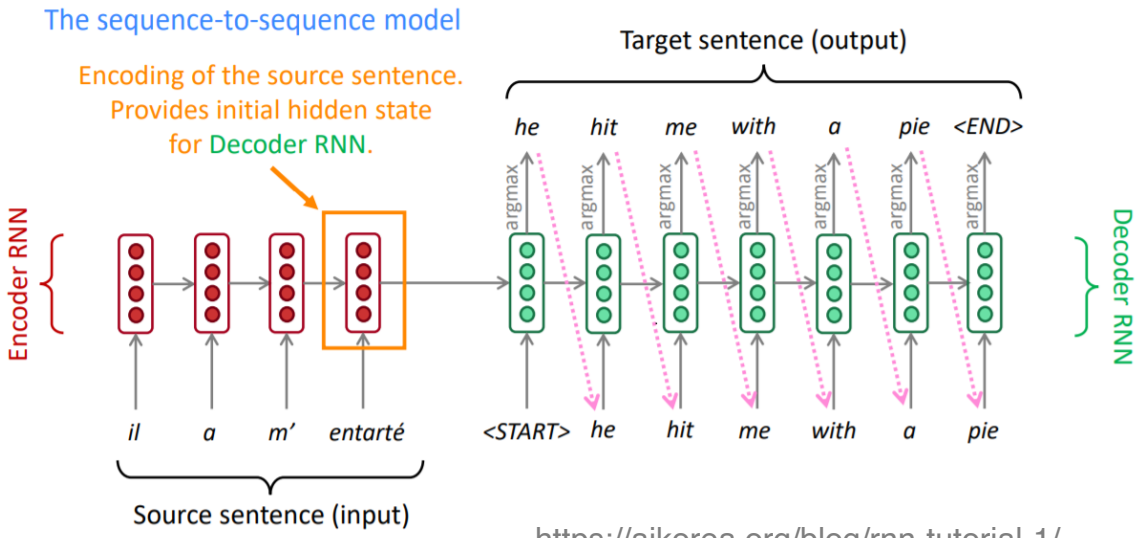
https://towardsdatascience.com/covolutional-neural-network-cb0883dd6529

NLP (Natural Language Processing)

- RNN (Recursive Neural Network)



- Seq2Seq (Sequence to Sequence)



https://aikorea.org/blog/rnn-tutorial-1/

https://medium.com/analytics-vidhya/neural-machine-translation-using-bahdanau-attention-mechanism-d496c9be30c3

Only A.I model is all we need? 🙋

We need more…

Process

1. Set your **goal**
2. Prepare **Dataset** for your goal
3. **Train** model using dataset
4. **Evaluate** the model performance

Example in my case

1. I want Korean-English Translator!
2. Get Korean-English dataset
3. Train NLP model for ‘Machine Translation’ using dataset
4. Evaluate my model performance

Natural Language Processing (NLP)

NLP?

- ‘Interactions between computers and human language’
- A subfield of linguistics, computer science, and artificial intelligence
- Programming computers to process and analyze large amounts of natural language data.
- The goal is a computer capable of "understanding" the contents of documents, including the contextual nuances of the language within them.

Field of application

- Chatbot
  - ChatGPT, Alexa, Siri, Bixby.
- Text Summarization
  - Google search
- Document Classification
  - Spam mail filtering
- Machine Translation
  - Google Translate

Uzbekistan

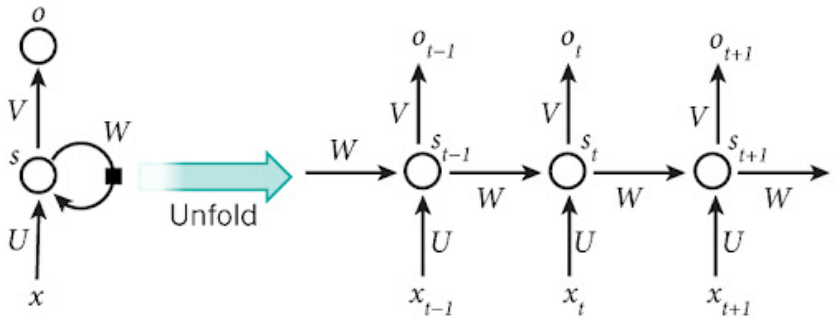
Country in Central Asia

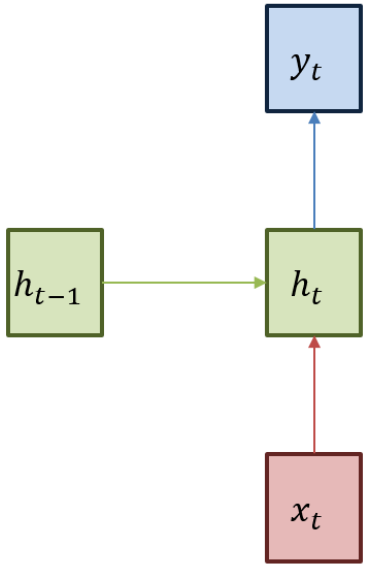
Uzbekistan is a Central Asian nation and former Soviet republic. It's known for its mosques, mausoleums and other sites linked to the Silk Road, the ancient trade route between China and the Mediterranean. Samarkand, a major city on the route, contains a landmark of Islamic architecture: the Registan, a plaza bordered by 3 ornate, mosaic-covered religious schools dating to the 15th and 17th centuries. — Google

https://www.mvtvwireless.com/why-are-my-emails-going-into-spam/

Google Translate

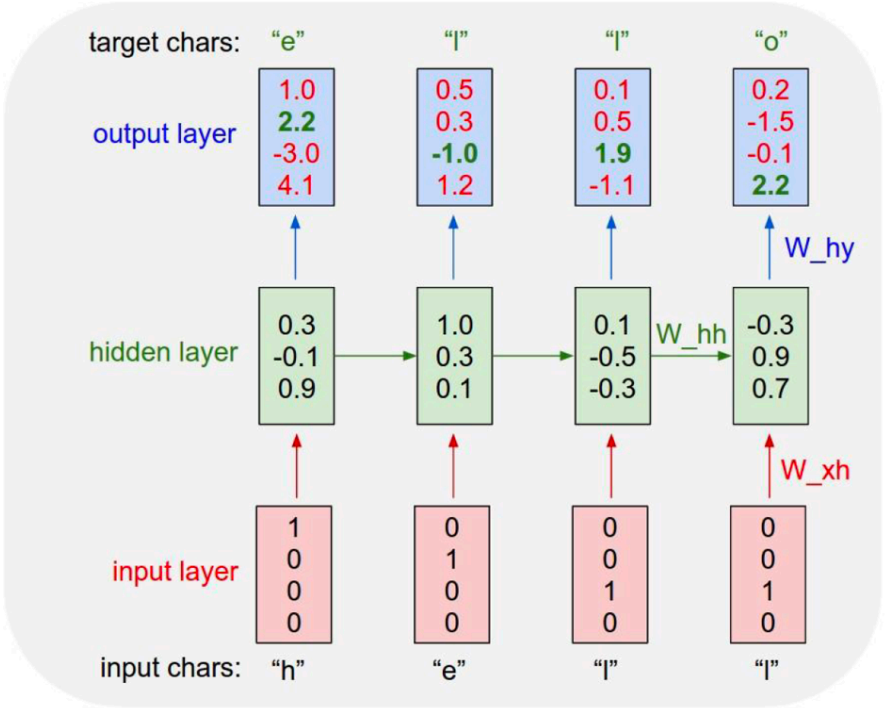
RNN (Recursive Neural Network)





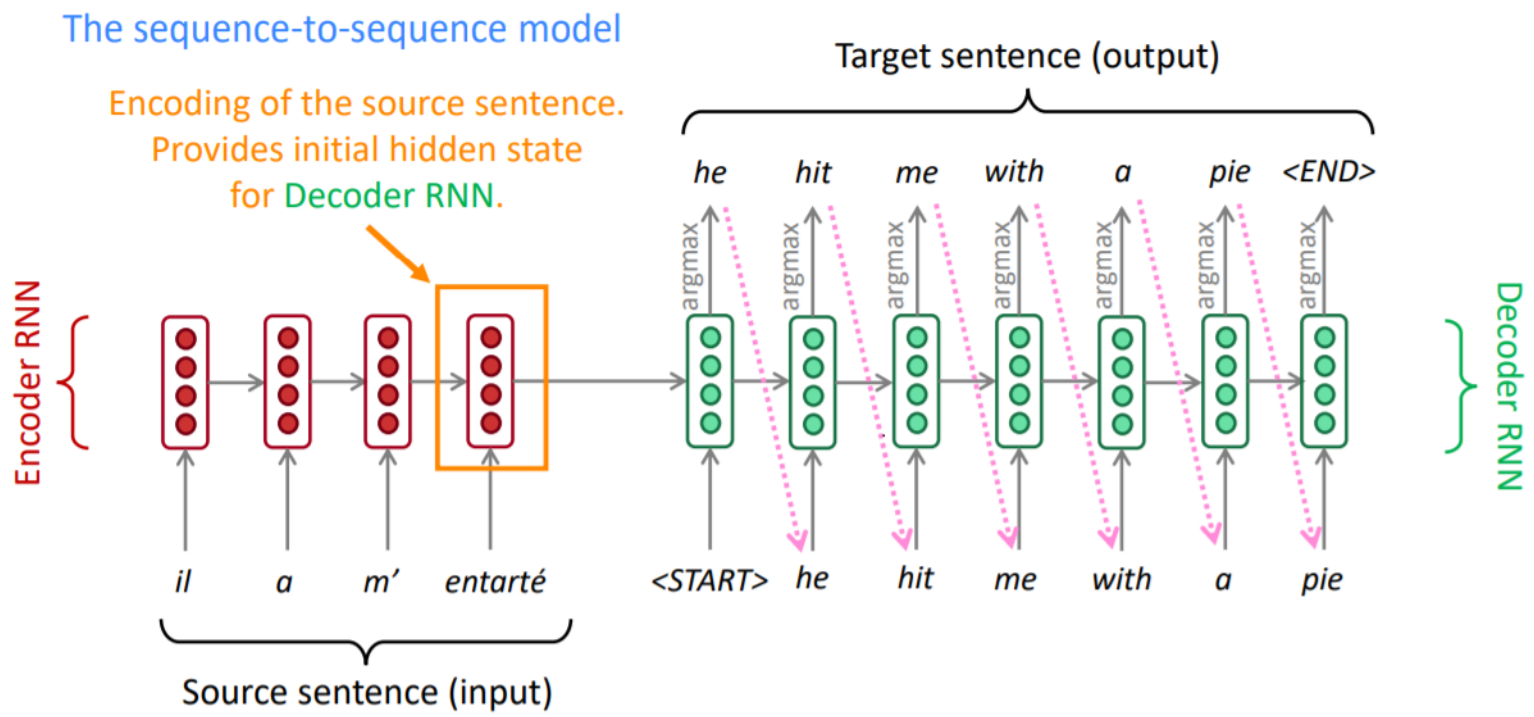
$$y_t = W_{hy} h_t + b_y$$

$$h_t = \tanh(W_{hh} h_{t-1} + W_{xh} x_t + b_h)$$



https://aikorea.org/blog/rnn-tutorial-1/
https://ratsgo.github.io/natural%20language%20processing/2017/03/09/rnnlstm/

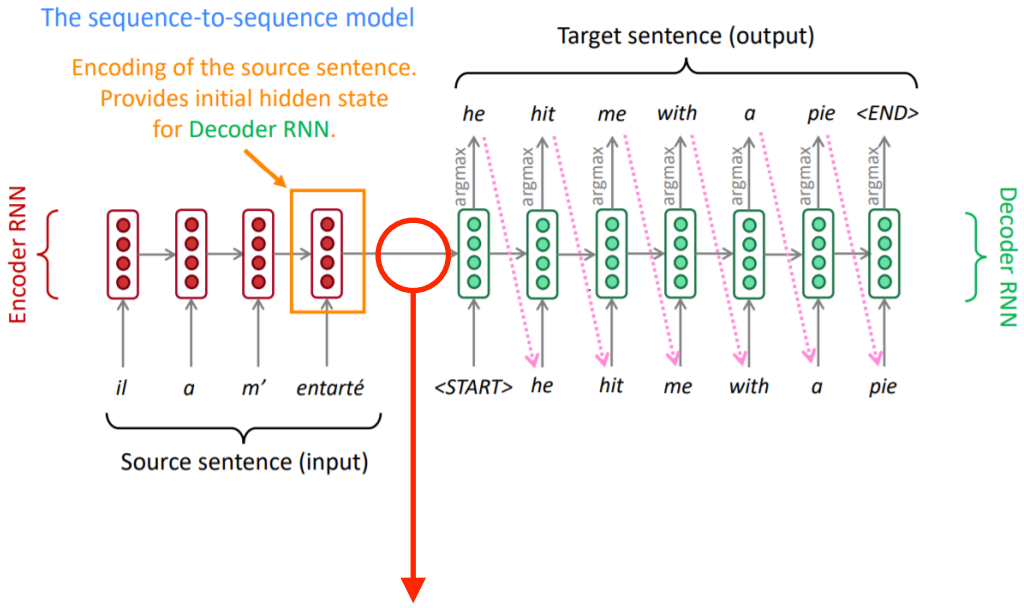
Seq2Seq



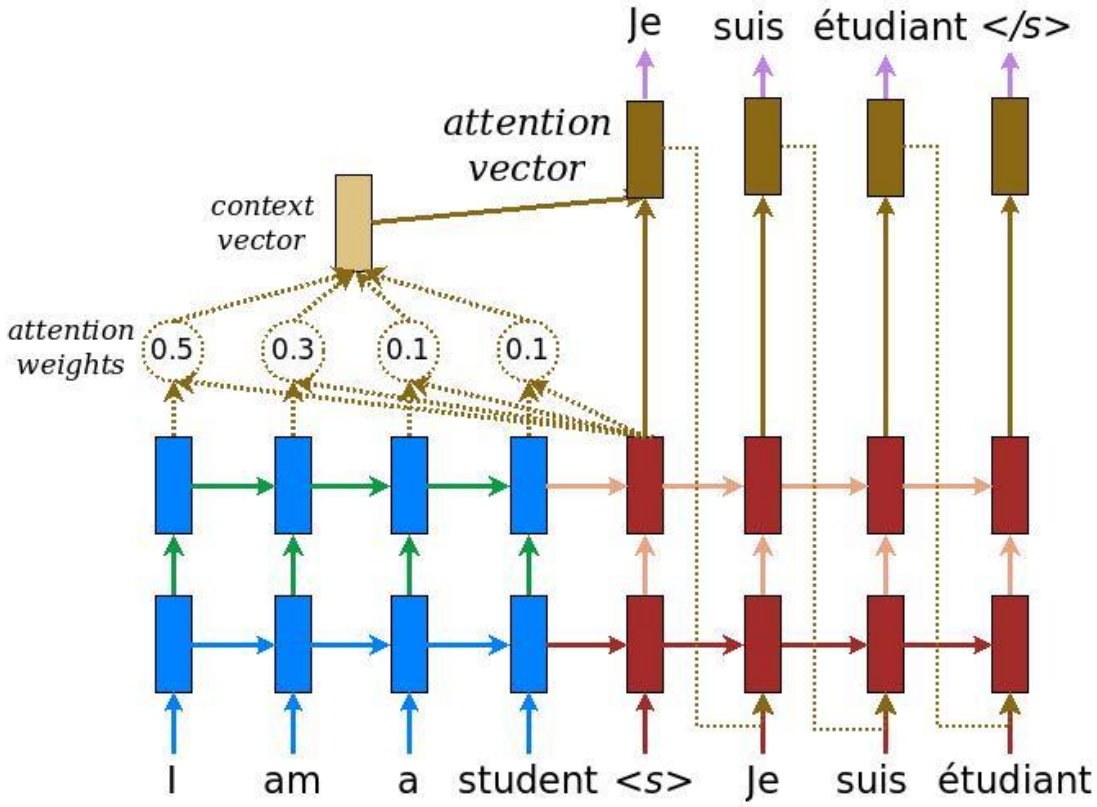
https://medium.com/analytics-vidhya/neural-machine-translation-using-bahdanau-attention-mechanism-d496c9be30c3

Seq2Seq + '**Attention**'

- Decoder learn to **focus** over a specific range of the input sequence



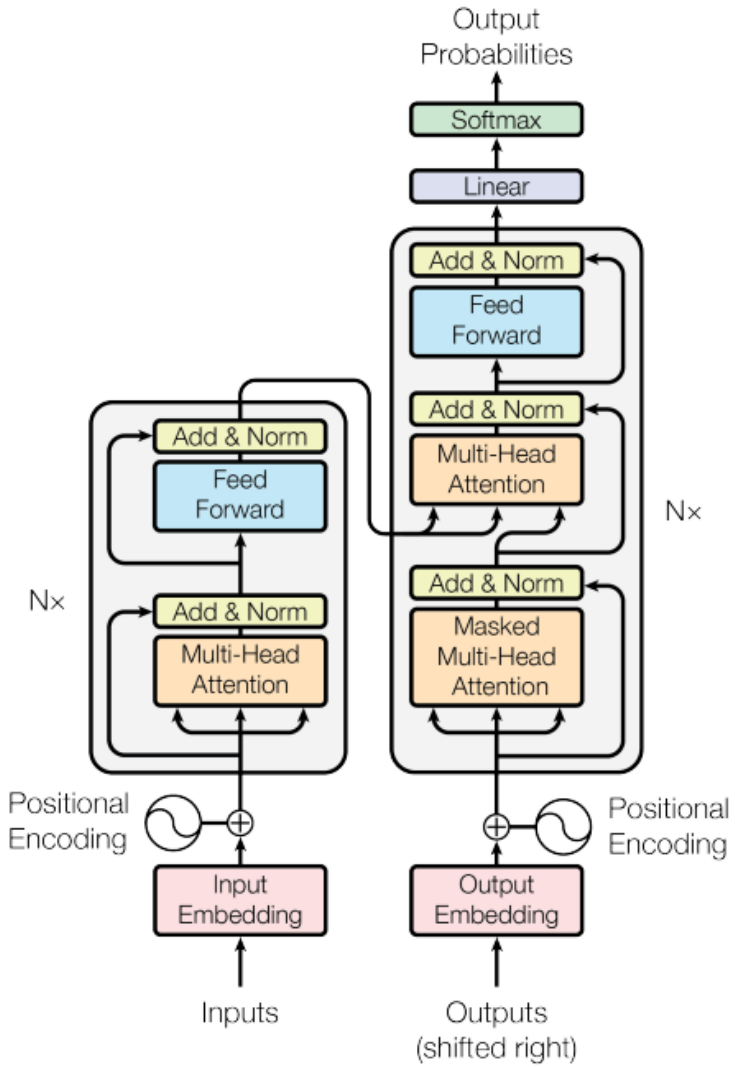
Bottleneck Problem!



https://www.tensorflow.org/text/tutorials/nmt_with_attention

Transformer

- ‘Attention is All you Need’

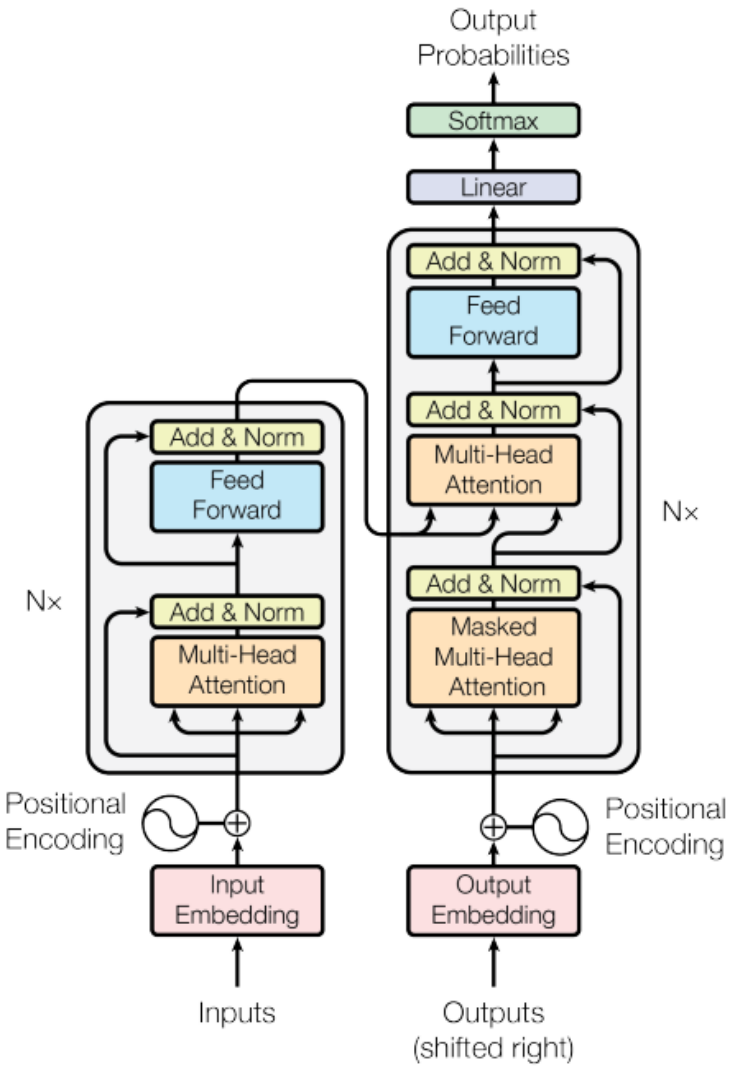


https://jalammar.github.io/illustrated-transformer/

Deep dive into NLP Model: Transformer

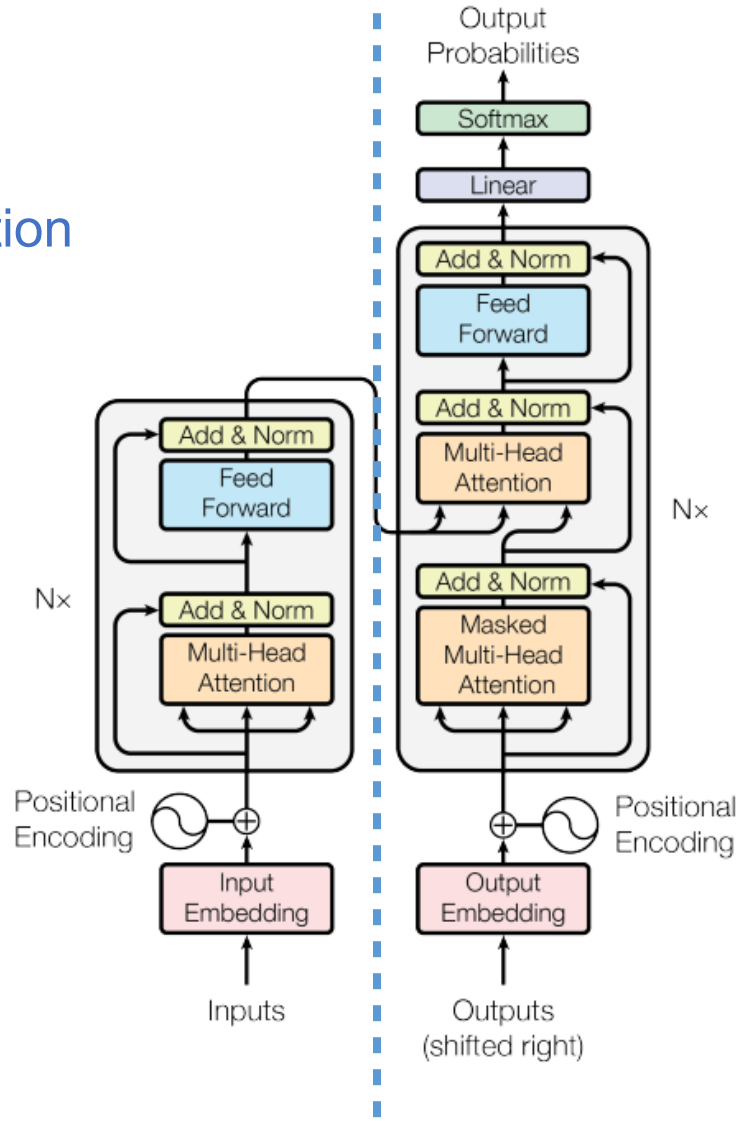
Why we deep dive into Transformer?

- Revolution in the NLP world!
- Root of BERT, GPT (ChatGPT)…



After Transformer..

Encoder
- Extracts contextual information
- Base of **BERT**

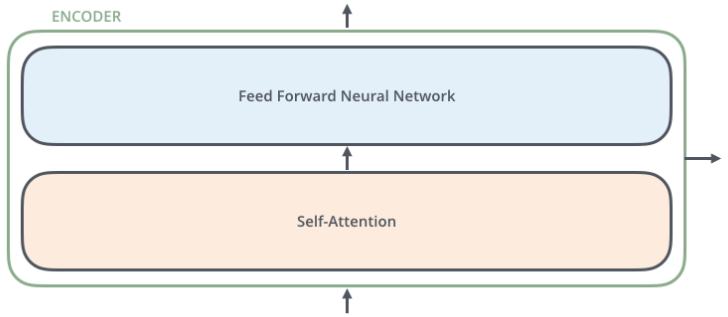


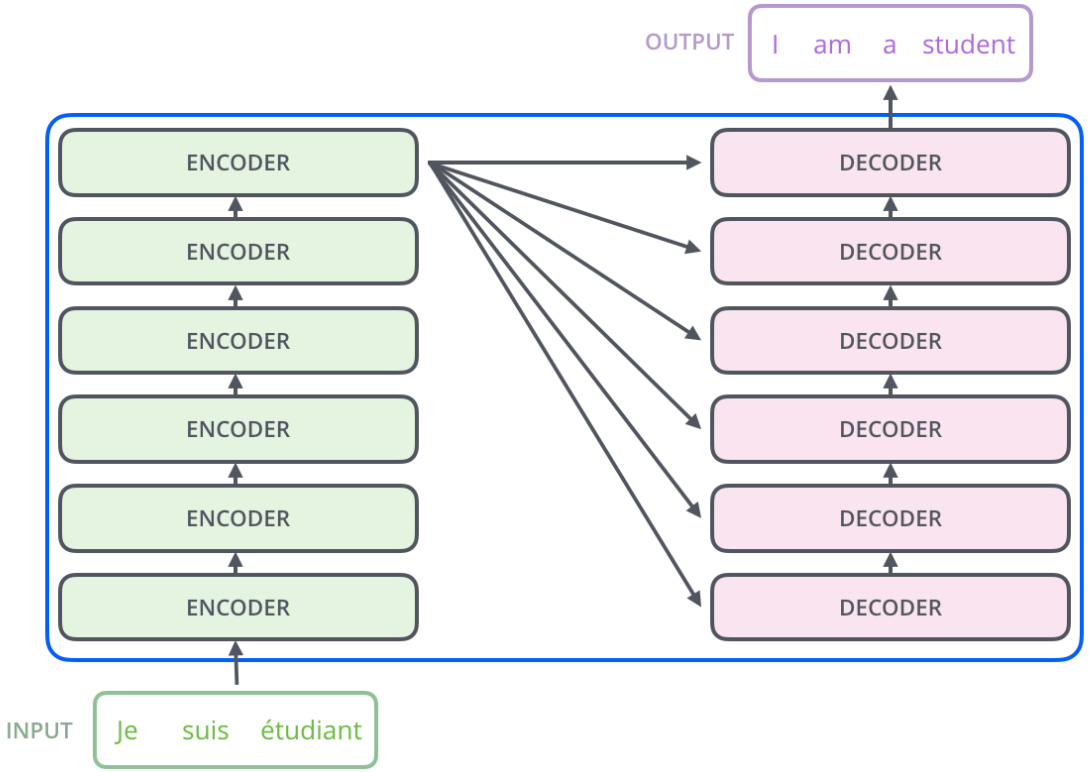
Decoder
- **Generates** the desired output
- Base of **GPT**

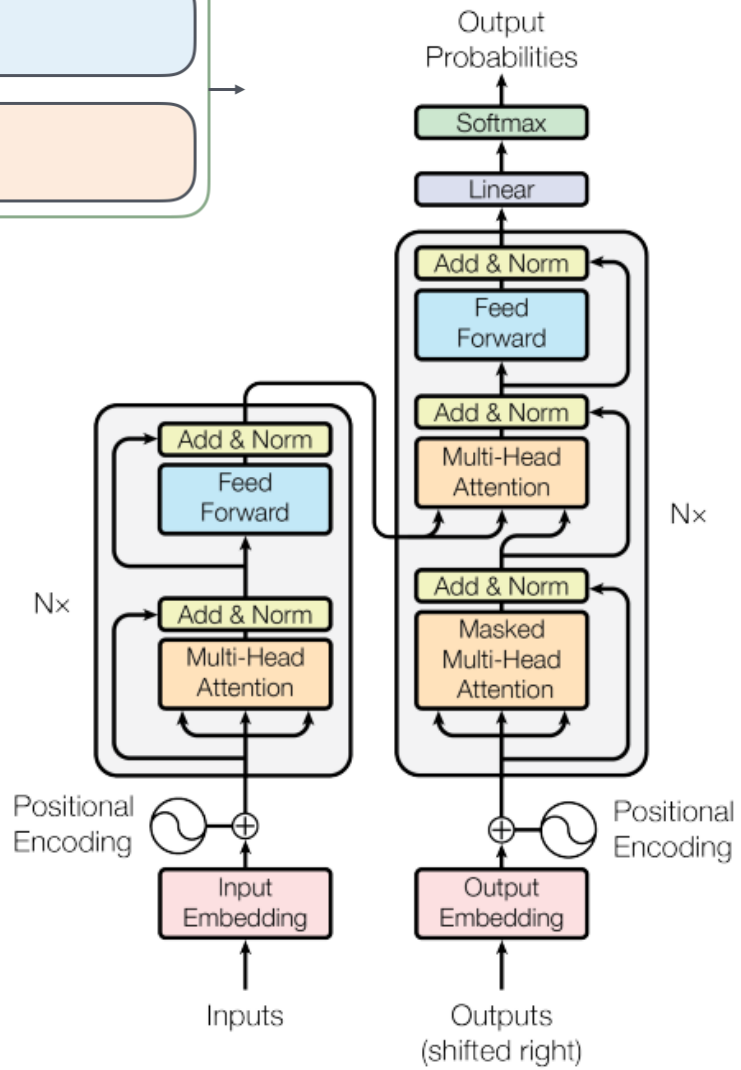
Let’s dive!

Transformer

- Encoder – Decoder (6-6)







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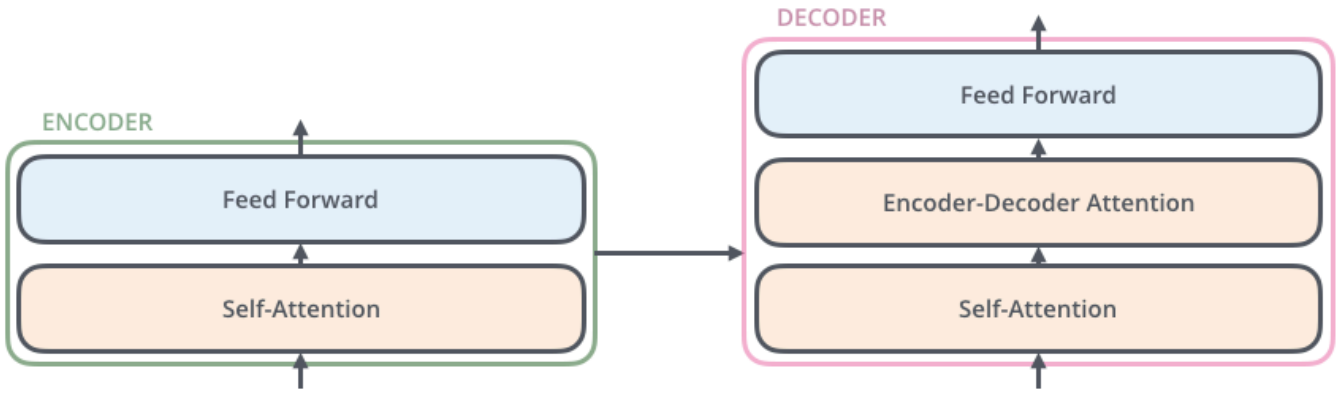
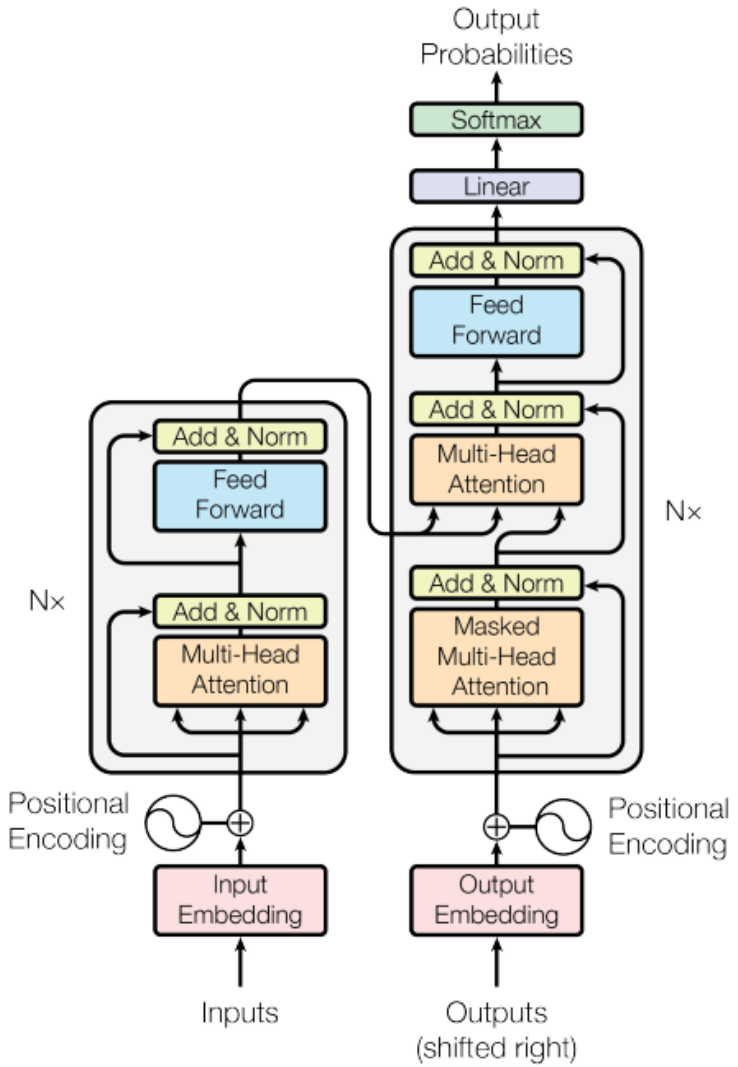
Transformer

- FFNN & Self-Attn in Encoder





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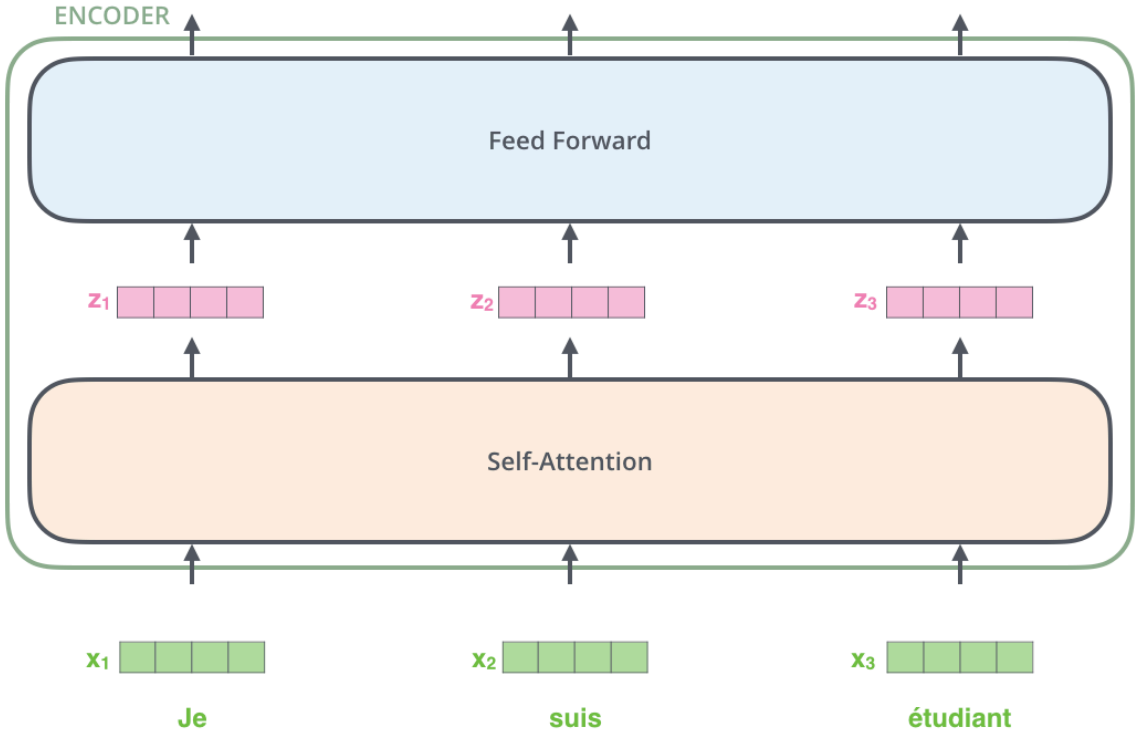
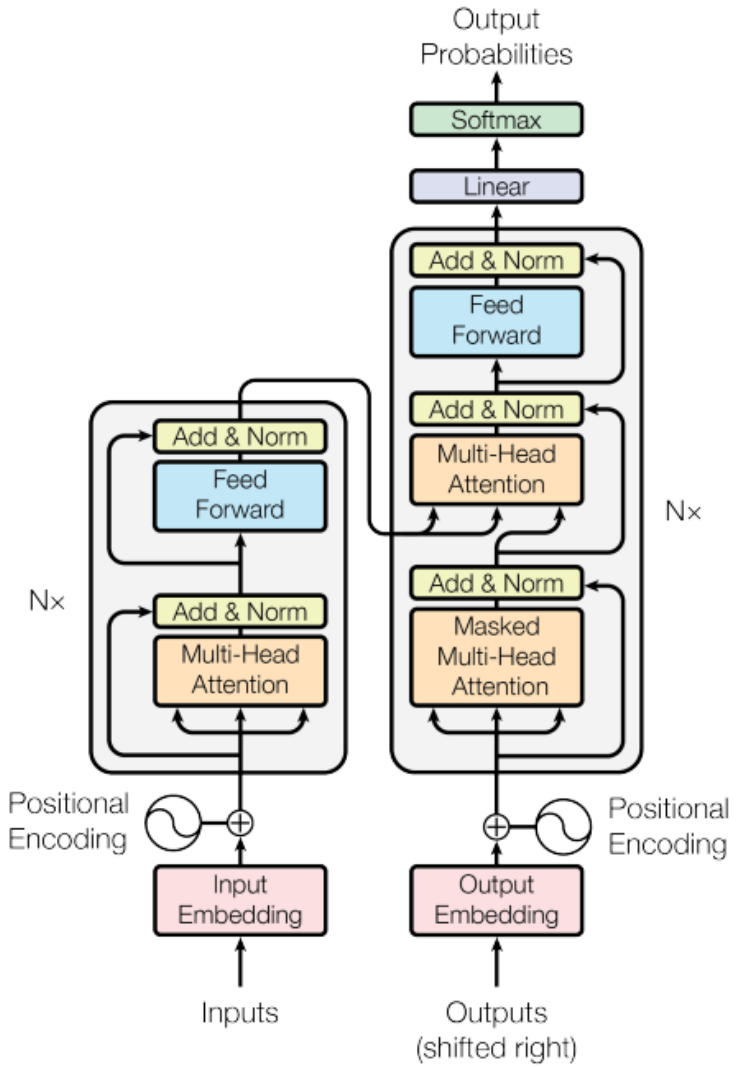
Transformer

- Input embedding





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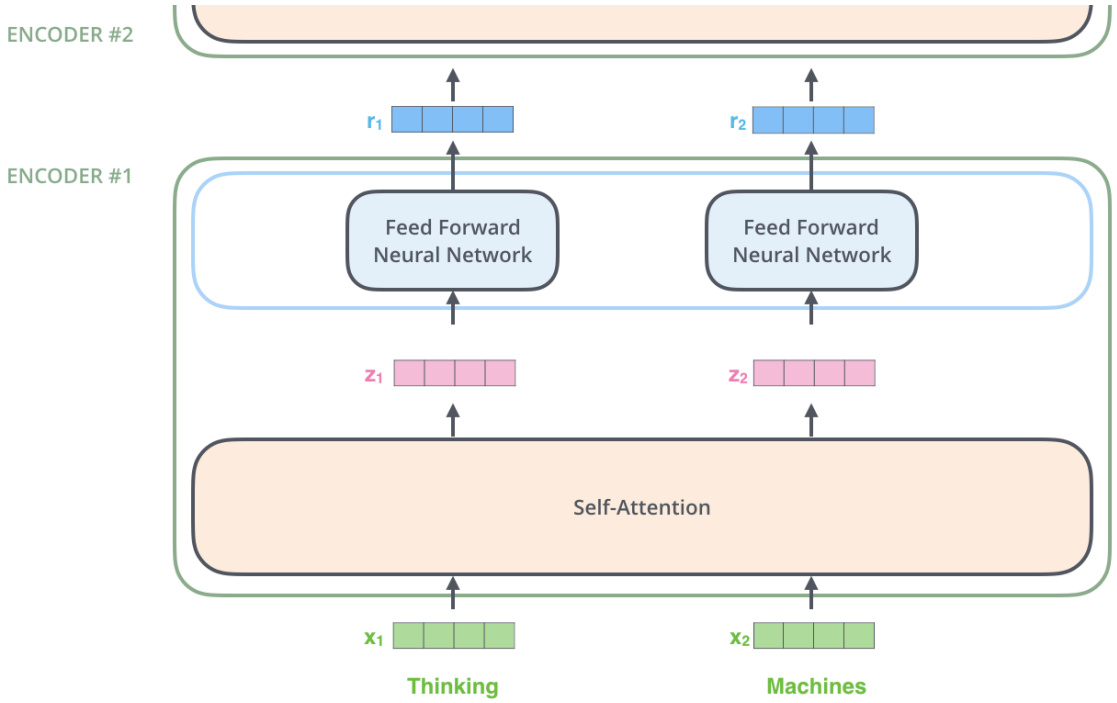
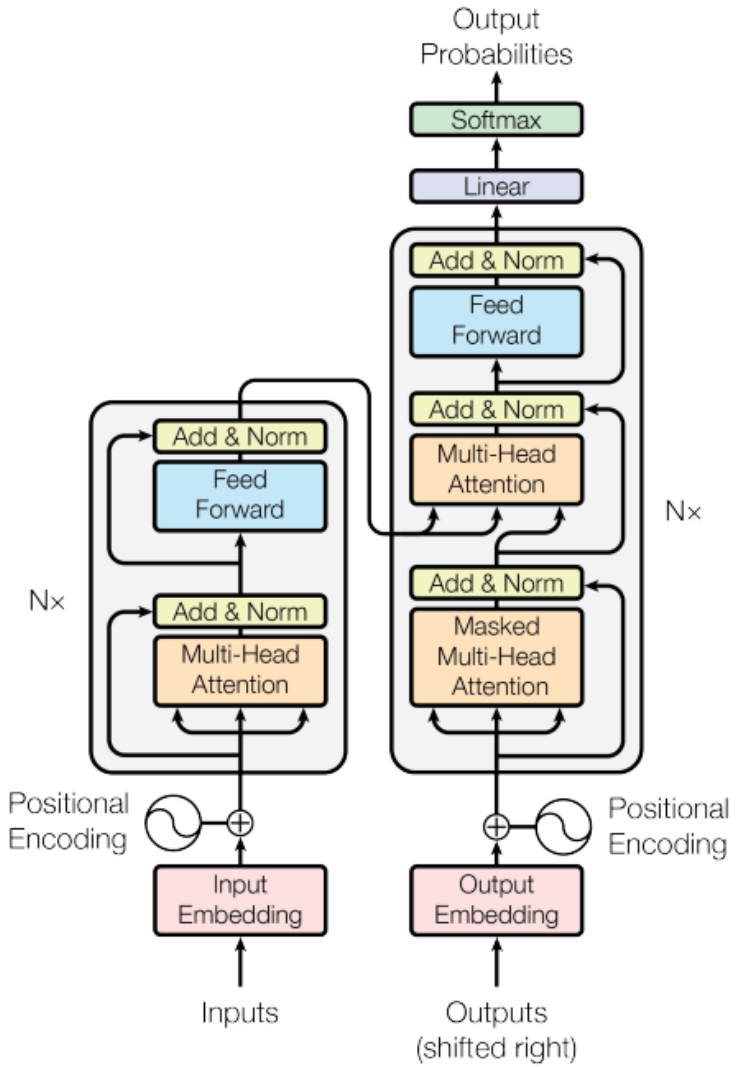
Transformer

- Encoding

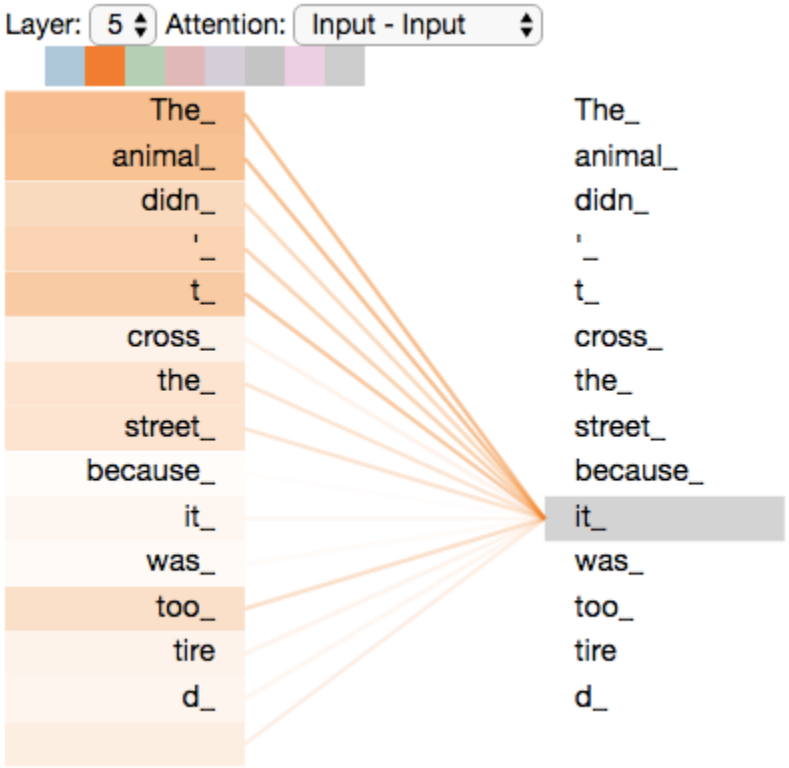


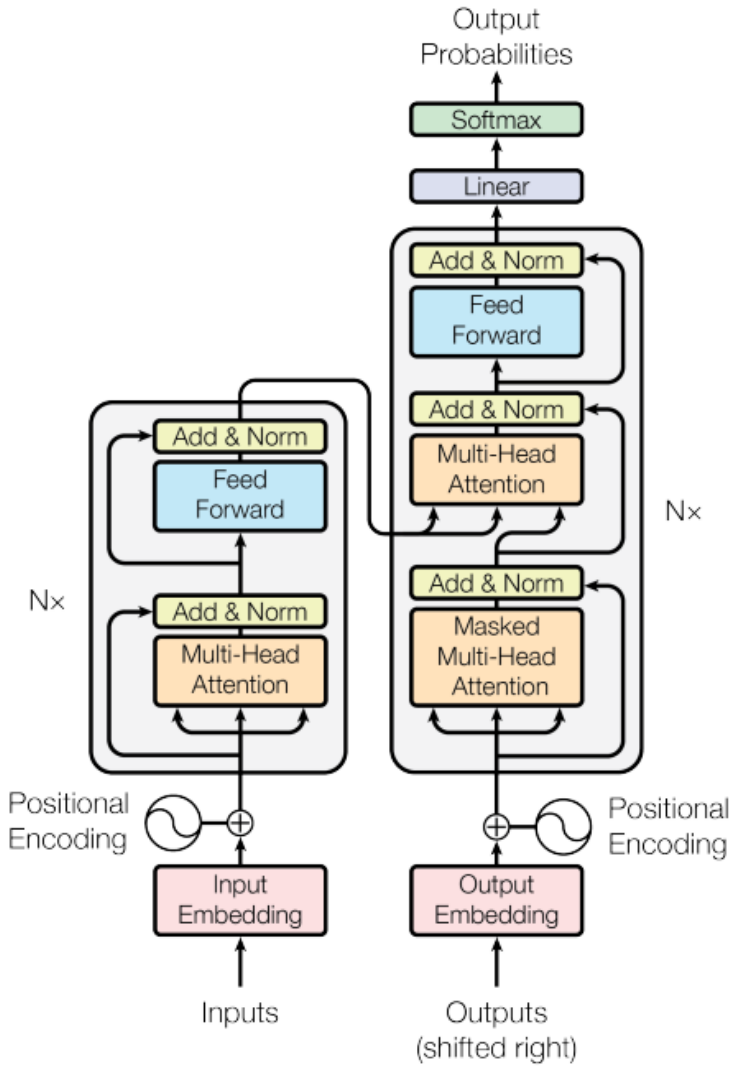


https://jalammar.github.io/illustrated-transformer/

Transformer

- Self-Attention





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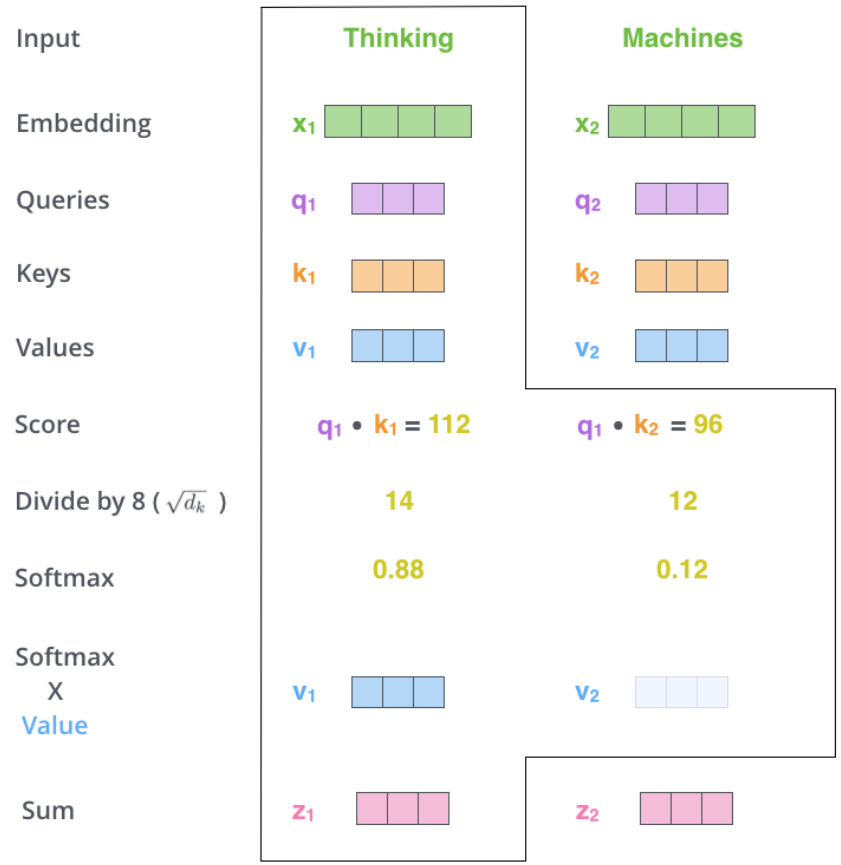
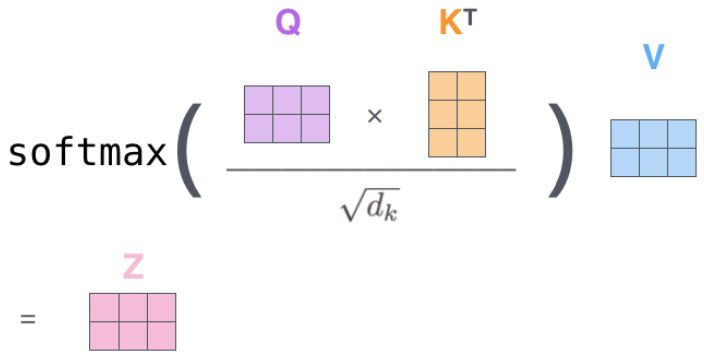
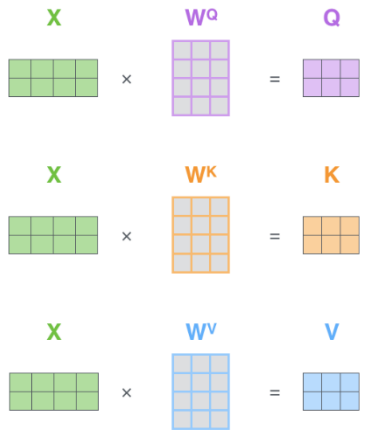
Transformer

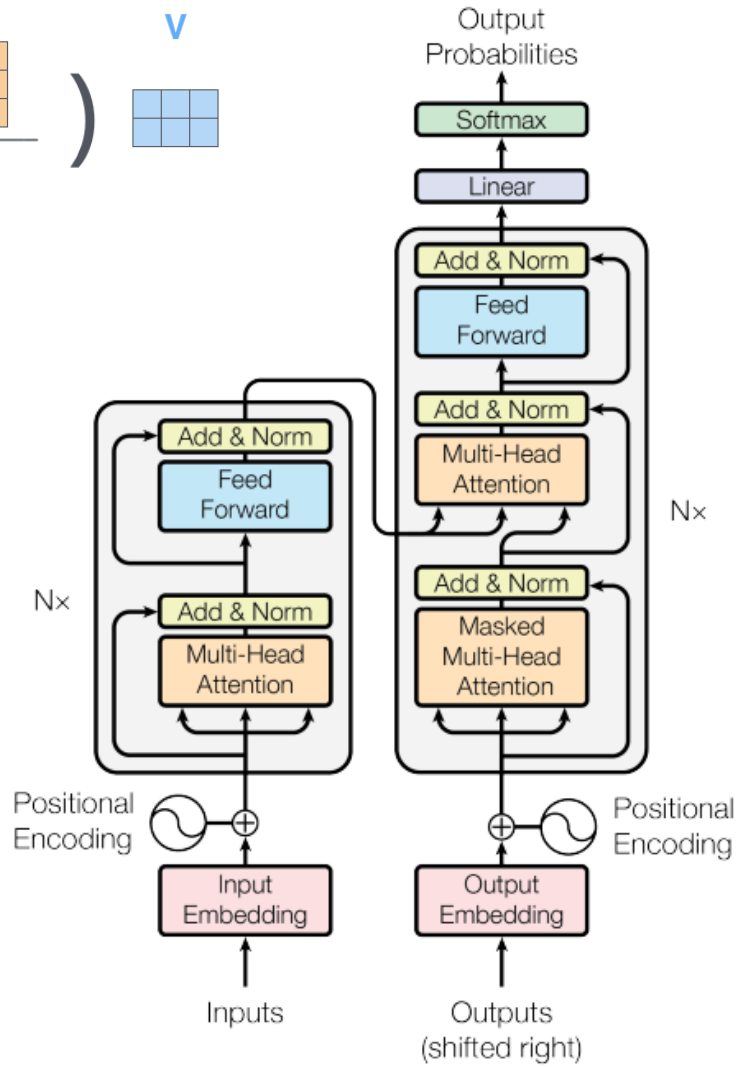
- Self-Attention





Matrix Calculation of Self-Attention

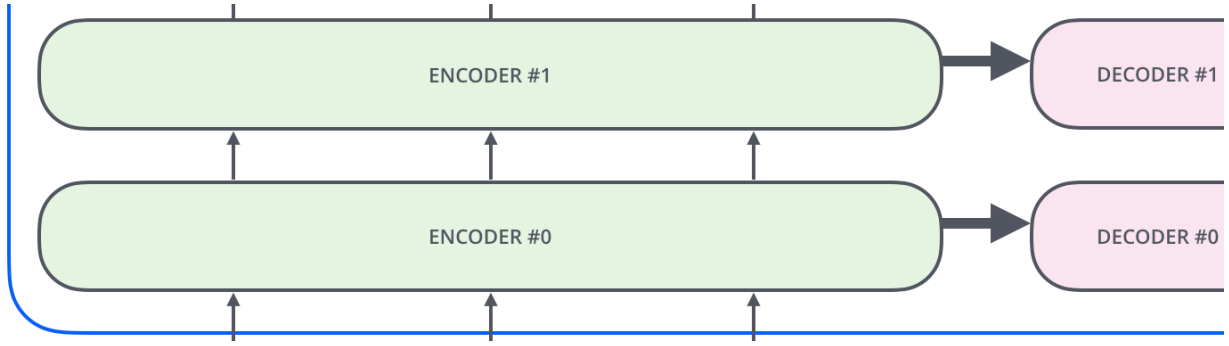


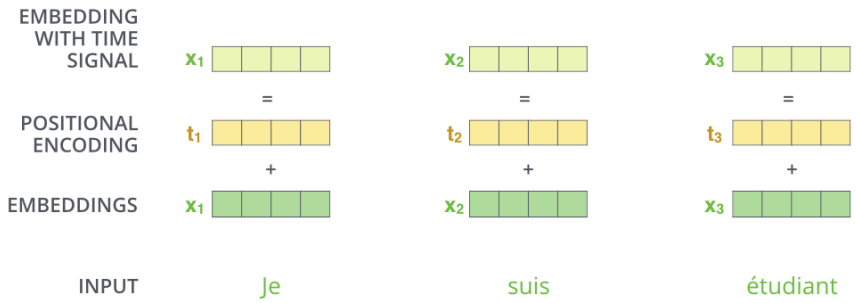


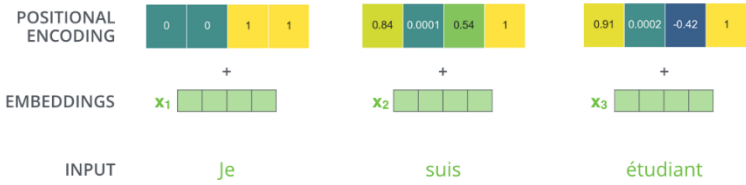
https://jalammar.github.io/illustrated-transformer/

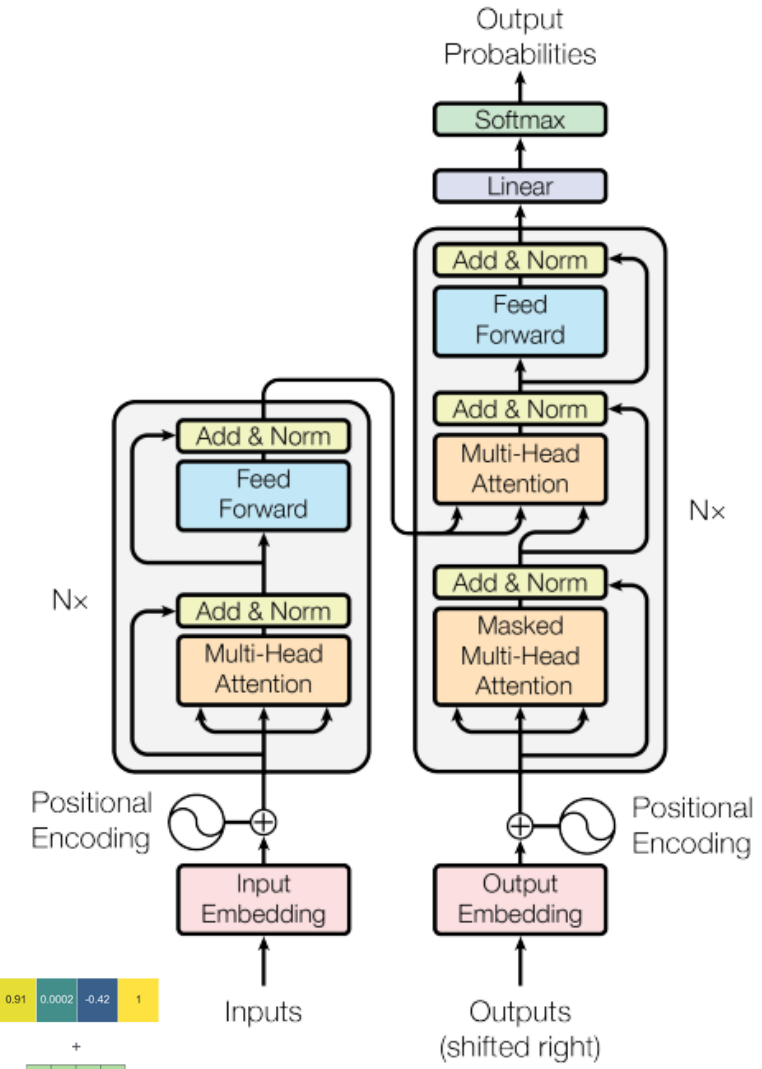
Transformer

- Positional Encoding





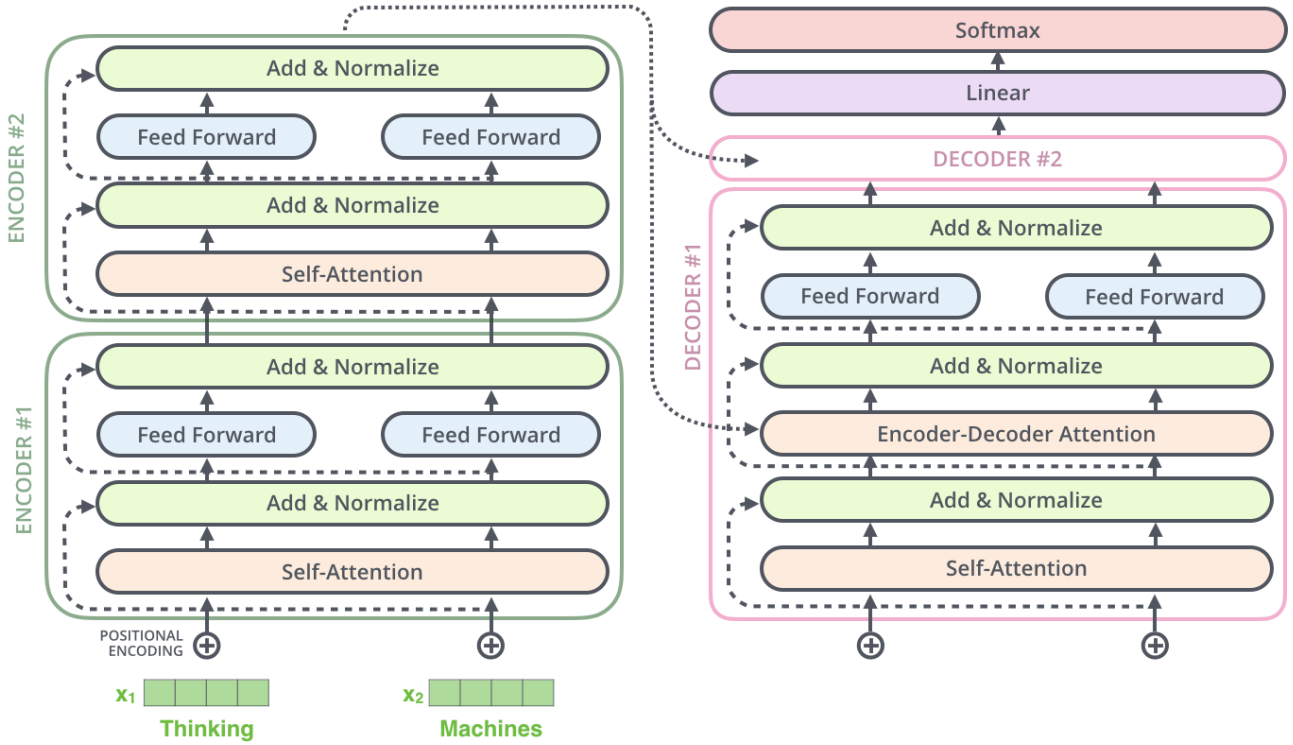


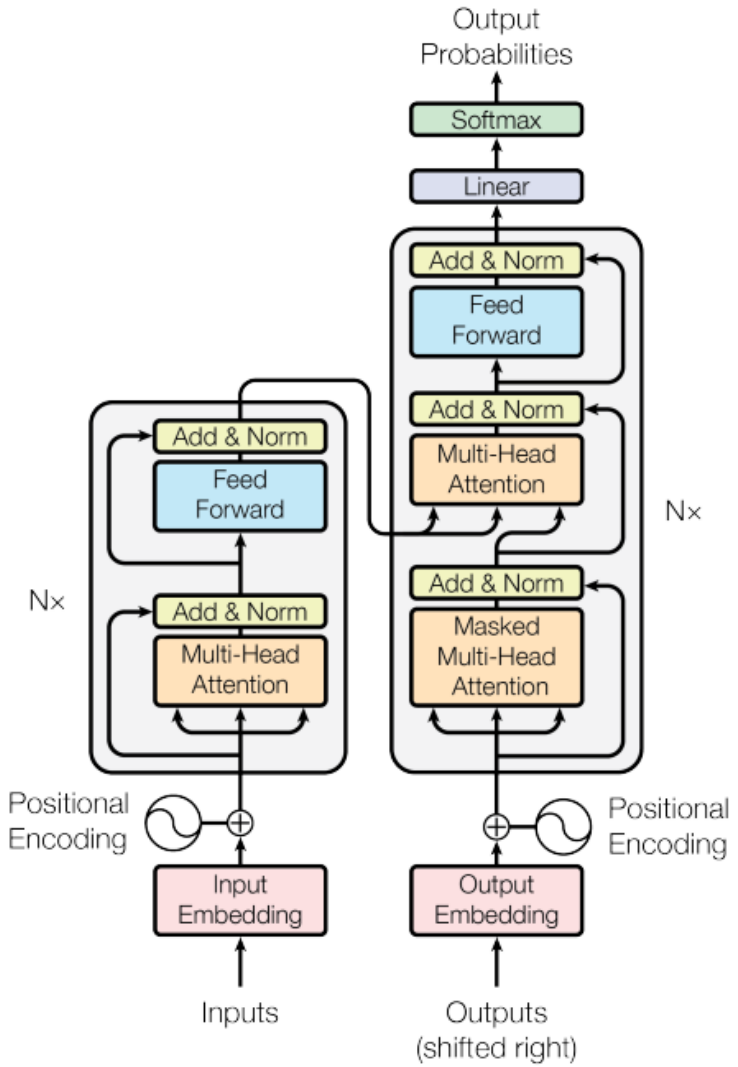


https://jalammar.github.io/illustrated-transformer/

Transformer

- Detail process in encoder & decoder

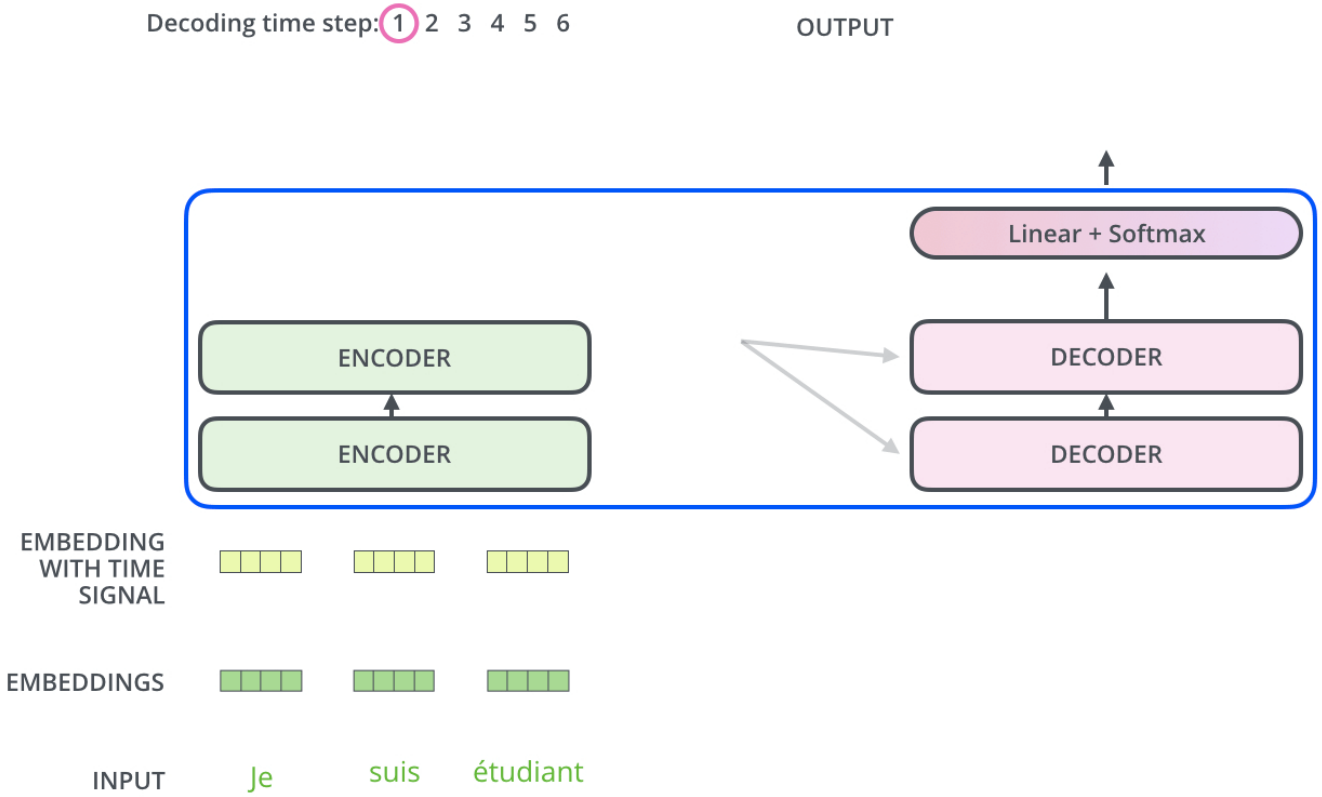


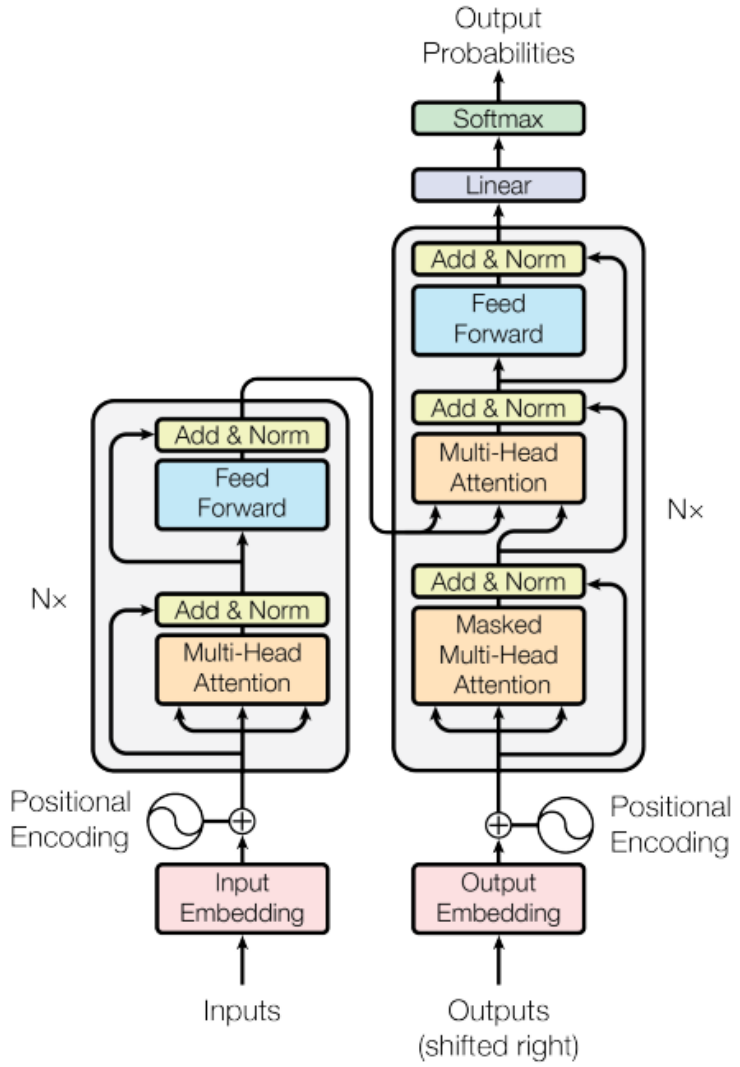


https://jalammar.github.io/illustrated-transformer/

Transformer

- Decoder





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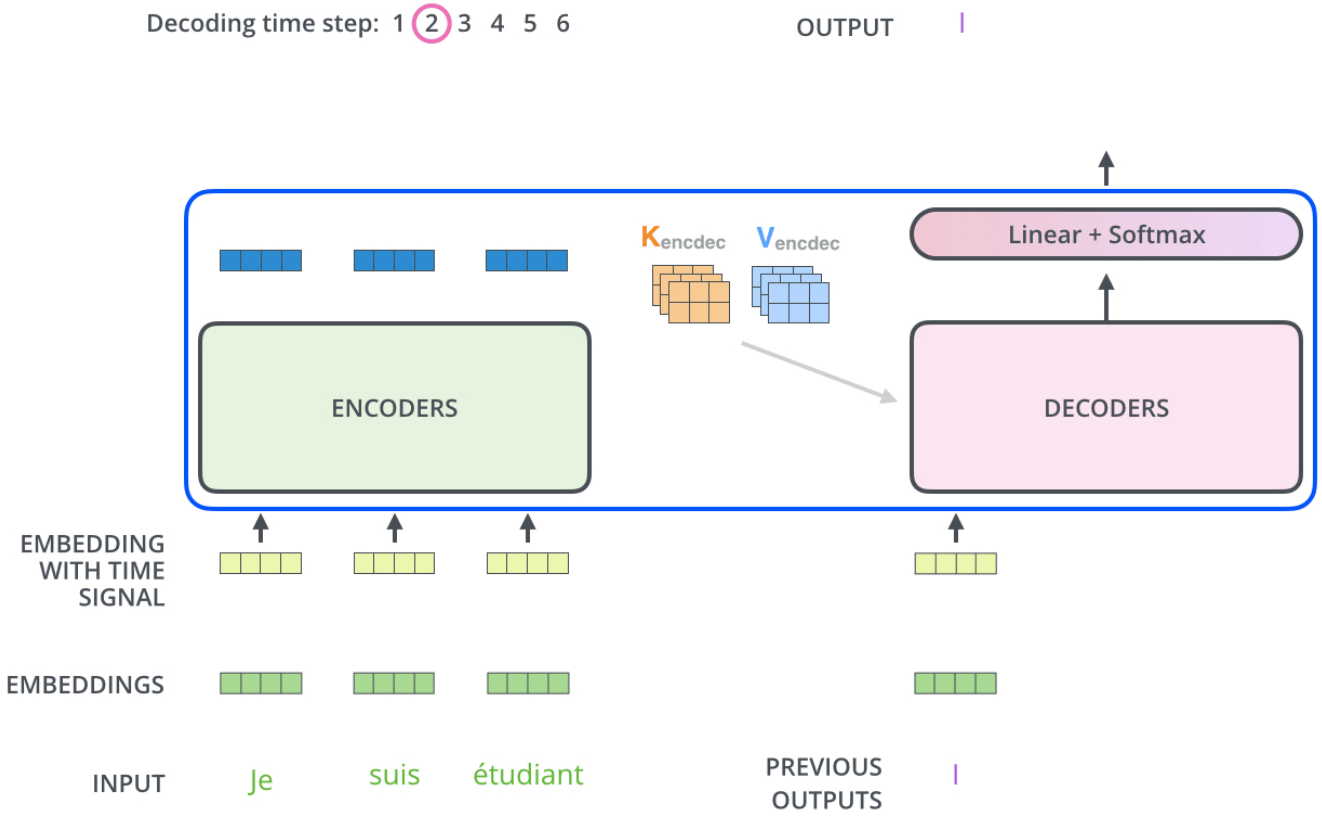
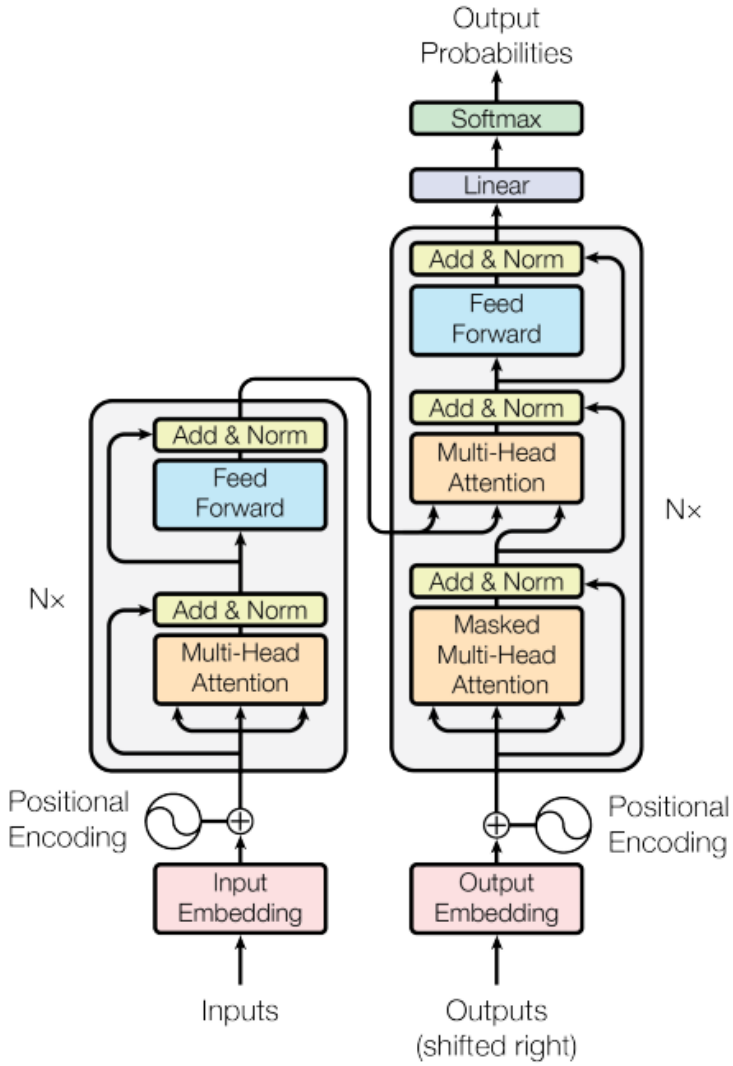
Transformer

- Decoder





https://jalammar.github.io/illustrated-transformer/

Summary of Transformer

- Encoder - Decoder Model
  - Encoder extracts contextual information
  - Decoder generates the desired output

- Self-Attention
  - using Query, Key, Value

After Transformer…

Quiz time : BERT 

BERT

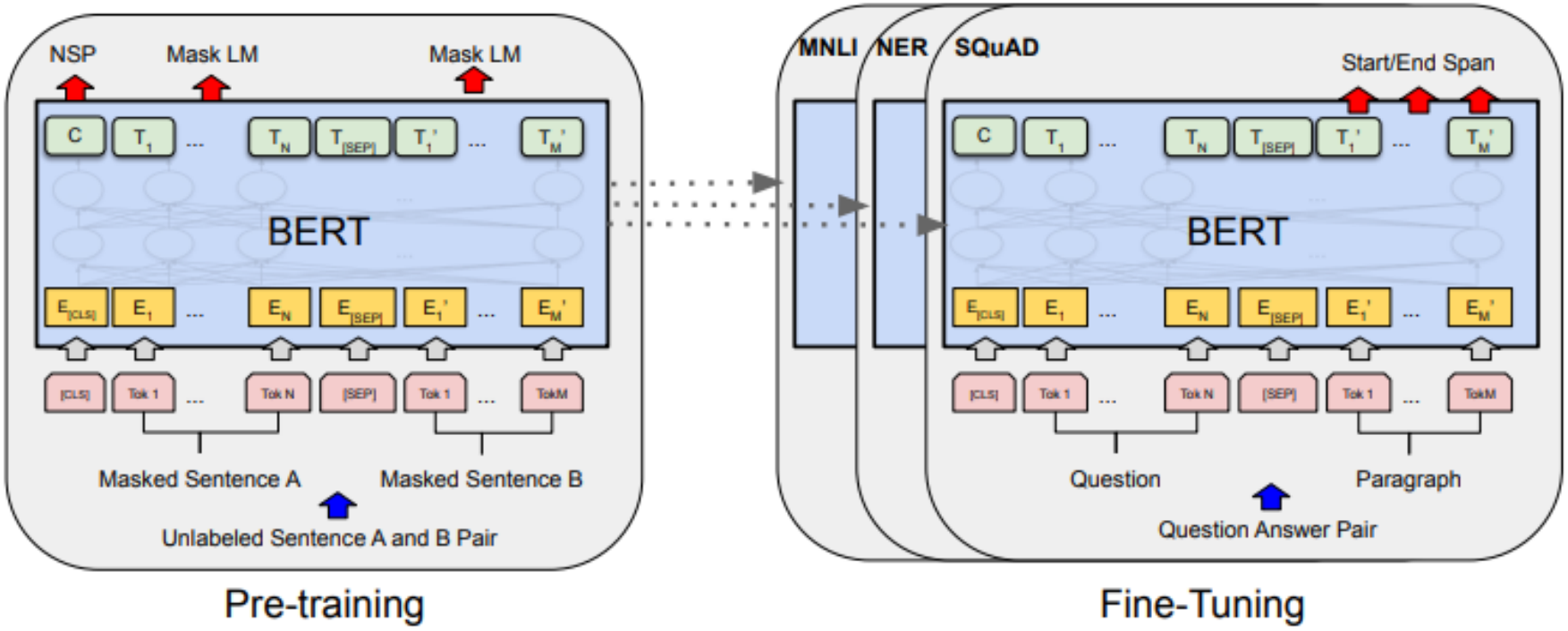
- **Quiz**
  - Minjoo _____ kimchi
    - ① run
    - ② read
    - ③ eat

BERT

- **Quiz**
  - Minjoo _____ kimchi
    - ① run
    - ② read
    - ③ **eat**

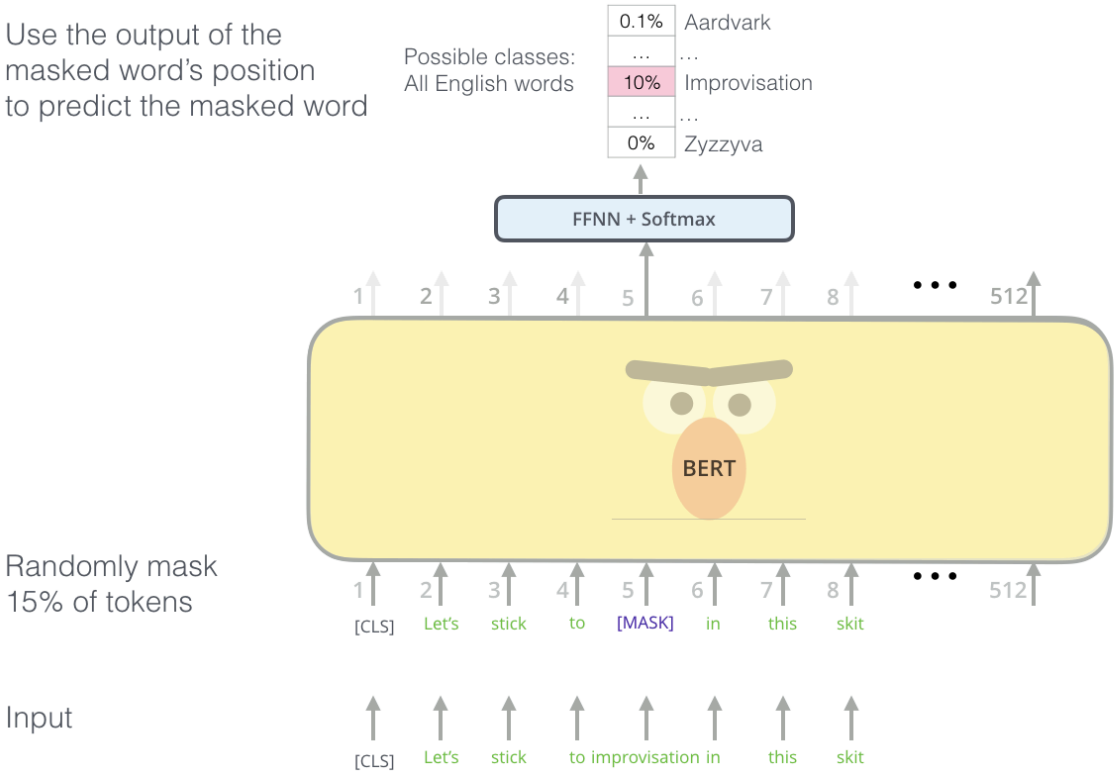
BERT

- **B**idirectional **E**ncoder **R**epresentations from **T**ransformers



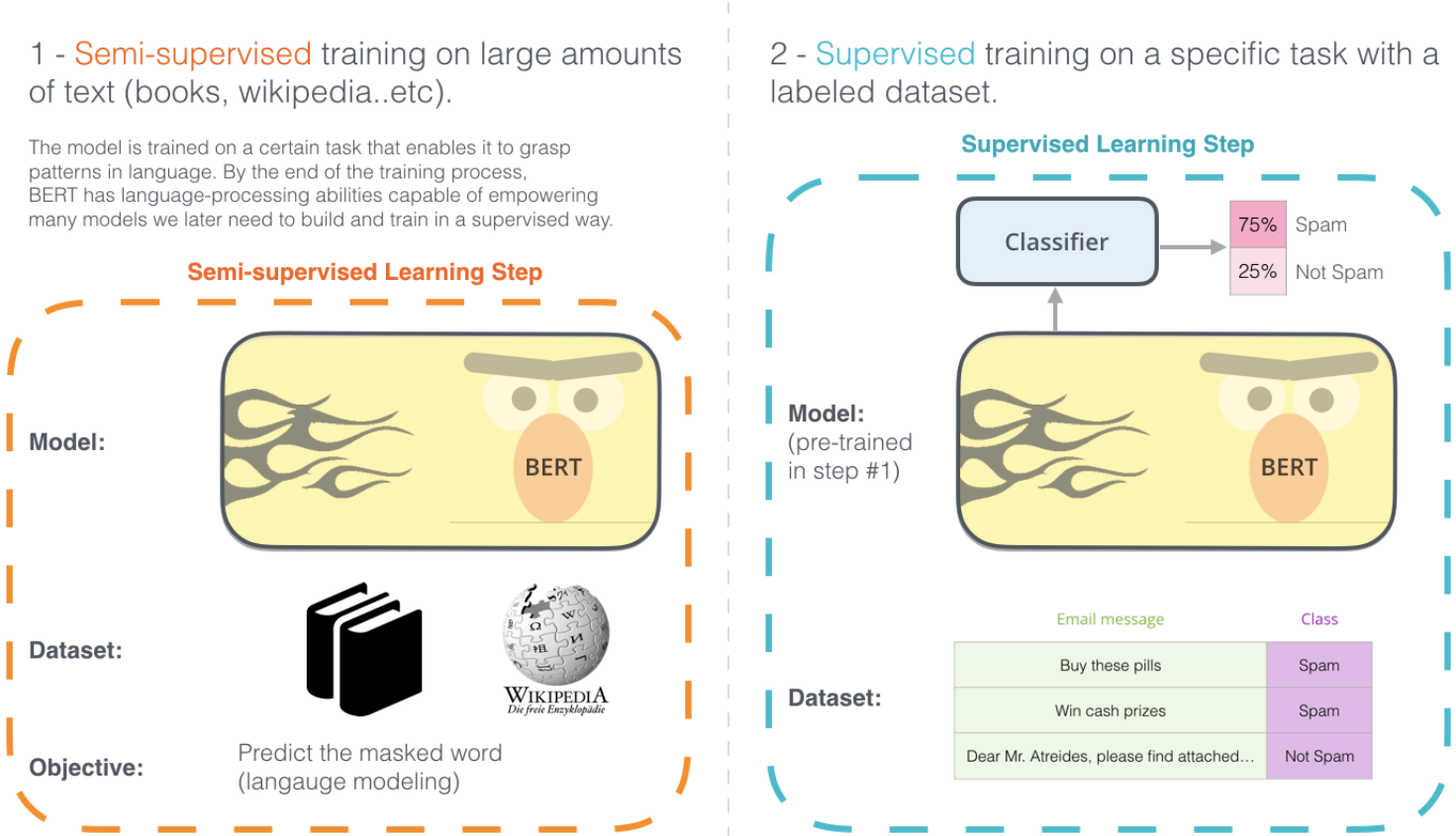
BERT

- Masked Language Model

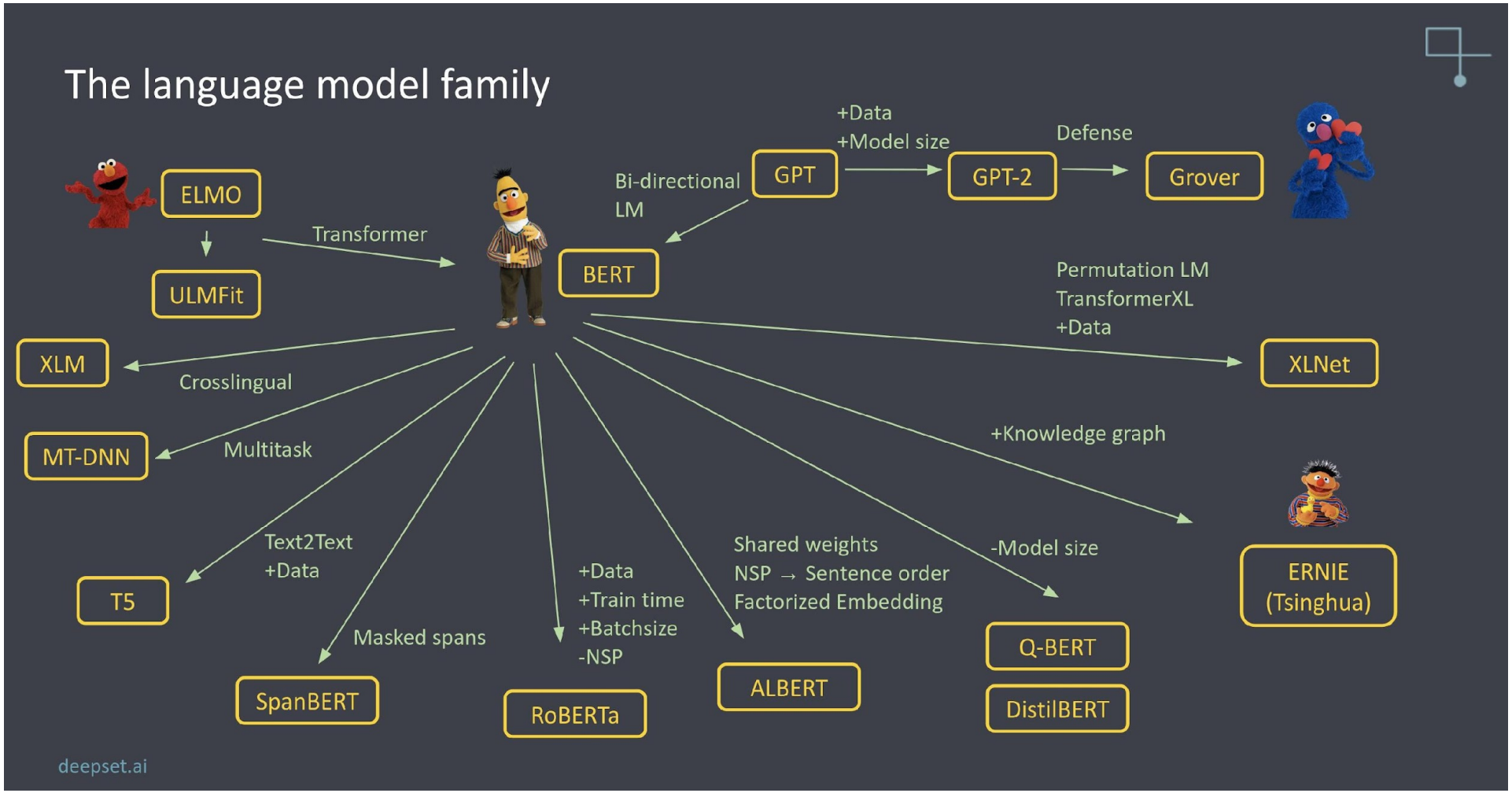


BERT

- Pre-trained model



Family of BERT



Summary

Today’s summary

- A.I
    - Neural Network
    - Deep Neural Network
    - CV, NLP, DS
    - Process to train A.I

- NLP
    - RNN → Seq2Seq → Transformer
    - Transformer (deep)
    - BERT

Let’s take some rest 🤯

and think about something…

You can have some questions, maybe…

- We learned A.I
  - So show us an practice of using AI

- We learned how NLP model (Transformer) works
  - So what can we do using this model?

- As a developer, how can we develop AI service?

So next class :

- How to make Machine Translation?
  - Concept of Machine Translation
  - Practice using Transformer & OpenNMT Framework

- How to develop Translator service?
  - Back-end development using python (FastAPI)
  - Model serving

Q&A

- Teams Q&A
- Google Sheet

https://docs.google.com/spreadsheets/d/1VeDMsarHZV2mPx5muKAtl4P6JRlW6dxEeEblMrZ1MMA/edit#gid=0

https://www.facebook.com/minjoo.choi.562/

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