



National Technical
University of Ukraine
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Institute of
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Technology

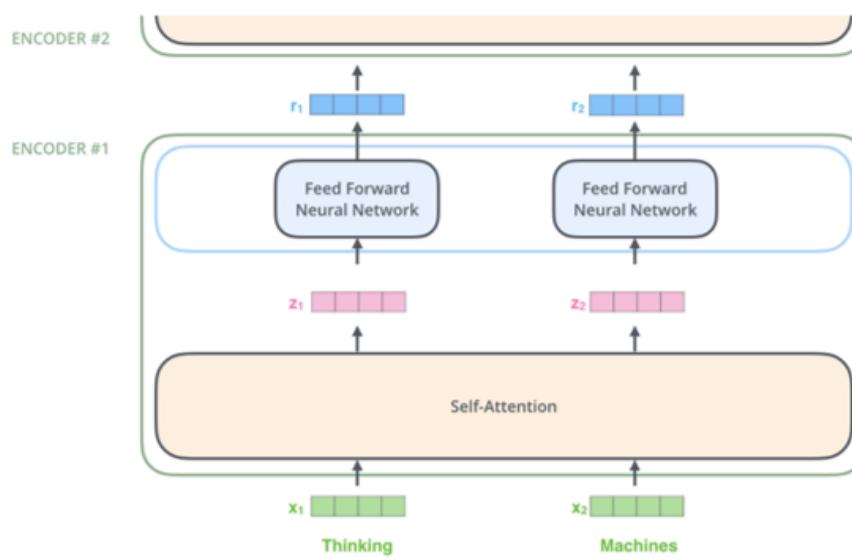
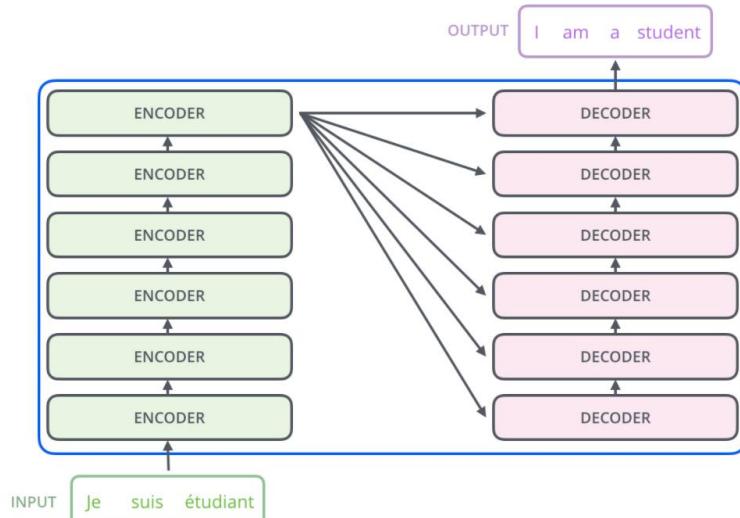
Intellectual Data Analysis

Practice 7: Transformers

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Please review Lecture 11 before this practical

Transformer



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Attention Is All You Need

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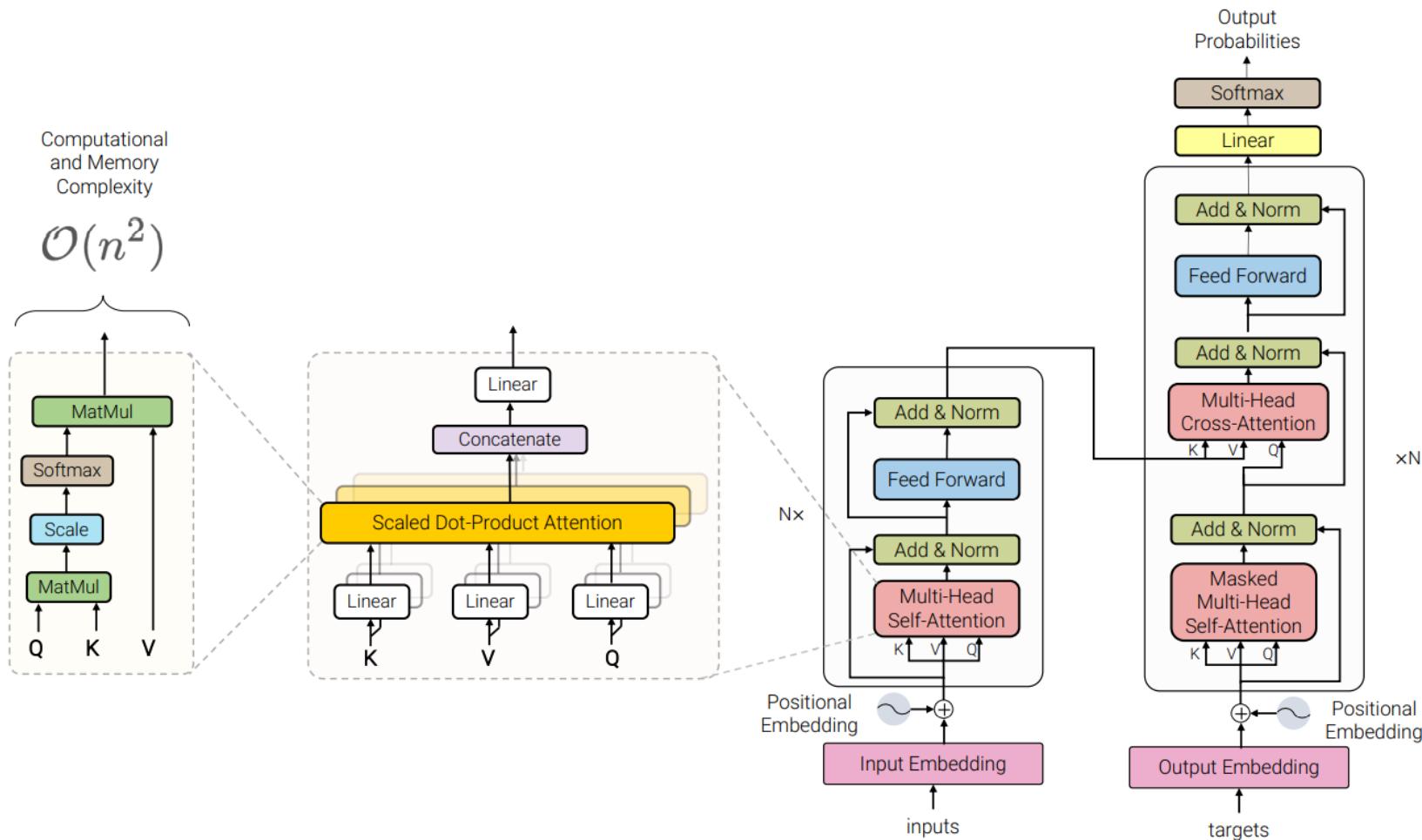
$$\text{softmax}\left(\frac{\text{Attention}(\text{Q}, \text{K}, \text{V})}{\sqrt{d_k}}\right) \text{ V}$$

Q K^T V

$=$

$$\text{Attention}(\text{Q}, \text{K}, \text{V})$$

Transformer



Positional Encoding

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

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

Hugging Face

What is Hugging Face?

- A leading open-source ecosystem for modern AI and NLP.
- Provides thousands of **pretrained models** (Transformers, Diffusion, Speech, Vision).
- Offers large **public datasets** and tools for easy data loading.
- Includes powerful libraries: **Transformers, Datasets, Tokenizers, Accelerate**.
- Supports **fine-tuning**, evaluation, and deployment of AI models.
- Hosts **Hugging Face Hub** — a collaborative platform for sharing models, datasets, and demos.
- Enables easy experimentation via **pipelines**, Spaces, and inference widgets.
- A community-driven platform fostering **open, transparent, and reproducible AI**.

<https://huggingface.co/blog/proflead/hugging-face-tutorial>

<https://huggingface.co/learn/llm-course/en/>

Hugging Face

The screenshot shows the left sidebar of the Hugging Face LLM Course documentation. At the top, there's a navigation bar with a graduation cap icon, a search bar labeled "Search documentation" with a "Ctrl+K" keyboard shortcut, language selection "EN", and a user count "3,523". The sidebar has a vertical scroll bar. It contains three main sections: "0. SETUP", "1. TRANSFORMER MODELS", and "2. USING 😊 TRANSFORMERS". Under "1. TRANSFORMER MODELS", the "Transformers, what can they do?" section is currently active, indicated by a dark background. Other items in this section include "How do Transformers work?", "How 😊 Transformers solve tasks", "Transformer Architectures", "Quick quiz", "Inference with LLMs", "Bias and limitations", "Summary", and "Certification exam". Below these are sections for "2. USING 😊 TRANSFORMERS" and "3. FINE-TUNING A PRETRAINED MODEL". At the bottom of the sidebar, there's a link to "HUGGINGFACE.DOCSPROJECTS.COM".

The most basic object in the 😊 Transformers library is the `pipeline()` function. It connects a model with its necessary preprocessing and postprocessing steps, allowing us to directly input any text and get an intelligible answer:

```
from transformers import pipeline

classifier = pipeline("sentiment-analysis")
classifier("I've been waiting for a HuggingFace course my whole life.")

[{'label': 'POSITIVE', 'score': 0.9598047137260437}]
```

We can even pass several sentences!

```
classifier(
    ["I've been waiting for a HuggingFace course my whole life.", "I hate this so much!"]
)

[{'label': 'POSITIVE', 'score': 0.9598047137260437},
 {'label': 'NEGATIVE', 'score': 0.9994558095932007}]
```

By default, this pipeline selects a particular pretrained model that has been fine-tuned for sentiment analysis in English. The model is downloaded and cached when you create the `classifier` object. If you rerun the command, the cached model will be used instead and there is no need to download the model again.

https://huggingface.co/docs/transformers/main_classes/pipelines

<https://huggingface.co/learn/llm-course/en/chapter1/3>

Hugging Face Tasks page: huggingface.co/tasks

Model Hub (filter by Task): huggingface.co/models