

Experiment No.4 Transformer-based Generative Models

Link : <https://colab.research.google.com/drive/1wJHzghsdGJurtGQ5WcybygMHIU1jENQa?usp=sharing>

1.Generate coherent and contextually relevant text using GPT models.

2.Create images based on text prompts using a text-to-image model to explore Transformer capabilities in multimodal tasks

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```
# Install libraries: transformers and torch
!pip install transformers torch
```

```
Requirement already satisfied: transformers in /usr/local/lib/python3.12/dist-packages (4.56.2)
Requirement already satisfied: torch in /usr/local/lib/python3.12/dist-packages (2.8.0+cu126)
Requirement already satisfied: filelock in /usr/local/lib/python3.12/dist-packages (from transformers) (3.19.1)
Requirement already satisfied: huggingface-hub<1.0,>=0.34.0 in /usr/local/lib/python3.12/dist-packages (from transformers) (0.34.0)
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Requirement already satisfied: tokenizers<=0.23.0,>=0.22.0 in /usr/local/lib/python3.12/dist-packages (from transformers) (0.22.0)
Requirement already satisfied: safetensors>=0.4.3 in /usr/local/lib/python3.12/dist-packages (from transformers) (0.6.2)
Requirement already satisfied: tqdm>=4.27 in /usr/local/lib/python3.12/dist-packages (from transformers) (4.67.1)
Requirement already satisfied: typing-extensions>=4.10.0 in /usr/local/lib/python3.12/dist-packages (from torch) (4.15.0)
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Requirement already satisfied: sympy>=1.13.3 in /usr/local/lib/python3.12/dist-packages (from torch) (1.13.3)
Requirement already satisfied: networkx in /usr/local/lib/python3.12/dist-packages (from torch) (3.5)
Requirement already satisfied: Jinja2 in /usr/local/lib/python3.12/dist-packages (from torch) (3.1.6)
Requirement already satisfied: fsspec in /usr/local/lib/python3.12/dist-packages (from torch) (2025.3.0)
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Requirement already satisfied: nvidia-cuda-runtime-cu12==12.6.77 in /usr/local/lib/python3.12/dist-packages (from torch) (12.6.77)
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Requirement already satisfied: nvidia-cudnn-cu12==9.10.2.21 in /usr/local/lib/python3.12/dist-packages (from torch) (9.10.2.21)
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Requirement already satisfied: nvidia-cufft-cu12==11.3.0.4 in /usr/local/lib/python3.12/dist-packages (from torch) (11.3.0.4)
Requirement already satisfied: nvidia-curand-cu12==10.3.7.77 in /usr/local/lib/python3.12/dist-packages (from torch) (10.3.7.77)
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Requirement already satisfied: hf-xet<2.0.0,>=1.1.3 in /usr/local/lib/python3.12/dist-packages (from huggingface-hub<1.0,>=0.34.0->transformers) (1.1.3)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in /usr/local/lib/python3.12/dist-packages (from sympy>=1.13.3->torch) (1.3.0)
Requirement already satisfied: MarkupSafe>=2.0 in /usr/local/lib/python3.12/dist-packages (from Jinja2->torch) (3.0.3)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.12/dist-packages (from requests->transformers) (3.4.0)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.12/dist-packages (from requests->transformers) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.12/dist-packages (from requests->transformers) (2.5.0)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.12/dist-packages (from requests->transformers) (2025.11.11)
```

```
from transformers import pipeline

generator = pipeline('text-generation', model='gpt2')

print("GPT-2 model loaded successfully!")
```

```
Device set to use cuda:0
GPT-2 model loaded successfully!
```

```
from transformers import AutoModelForCausalLM, AutoTokenizer

# Load GPT-2 model and tokenizer
tokenizer = AutoTokenizer.from_pretrained("gpt2")
model = AutoModelForCausalLM.from_pretrained("gpt2")

# Define your starting prompt
prompt = "The future of artificial intelligence explain in short."

# Tokenize input prompt
inputs = tokenizer(prompt, return_tensors="pt")

# Generate text
generated_ids = model.generate(
    inputs.input_ids,
    max_length=100,
```



```

num_return_sequences=1,
no_repeat_ngram_size=2,
do_sample=True,
temperature=0.7,
top_k=50
)

# Decode the generated tokens to text
generated_text = tokenizer.decode(generated_ids[0], skip_special_tokens=True)

# Print the results
print("\n--- Input Prompt ---")
print(prompt)
print("\n--- Generated Text ---")
print(generated_text)

```

The attention mask and the pad token id were not set. As a consequence, you may observe unexpected behavior. Please pass your input to the model with the keyword arguments `attn_mask` and `pad_token_id` to `eos_token_id`:50256 for open-end generation.

--- Input Prompt ---

The future of artificial intelligence explain in short.

--- Generated Text ---

The future of artificial intelligence explain in short. Artificial intelligences have yet to have a single goal. It only happens when they are given a goal.

I'm not sure if this is a new one but I believe it is the most well known. The idea is that we are getting closer than ever before to creating a machine that can think for itself.

libraries

Install the required libraries for text-to-image generation.

```
!pip install diffusers transformers accelerate safetensors scipy
```

```

Requirement already satisfied: diffusers in /usr/local/lib/python3.12/dist-packages (0.35.1)
Requirement already satisfied: transformers in /usr/local/lib/python3.12/dist-packages (4.56.1)
Requirement already satisfied: accelerate in /usr/local/lib/python3.12/dist-packages (1.10.1)
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Requirement already satisfied: zipp>=3.20 in /usr/local/lib/python3.12/dist-packages (from importlib_metadata->diffusers) (3.23.0)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.12/dist-packages (from requests->diffusers) (3.4.0)
Requirement already satisfied: idna<4,>=2.5 in /usr/local/lib/python3.12/dist-packages (from requests->diffusers) (3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.12/dist-packages (from requests->diffusers) (2.5.0)
Requirement already satisfied: certifi>=2017.4.17 in /usr/local/lib/python3.12/dist-packages (from requests->diffusers) (2025.8.3)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in /usr/local/lib/python3.12/dist-packages (from sympy=>1.13.3->torch>=2.0.0->accelerate) (1.3.0)
Requirement already satisfied: MarkupSafe==2.0 in /usr/local/lib/python3.12/dist-packages (from Jinja2->torch>=2.0.0->accelerate) (2.0.1)

```

Load the text-to-image model

```
from diffusers import DiffusionPipeline
import torch

pipeline = DiffusionPipeline.from_pretrained("runwayml/stable-diffusion-v1-5")
pipeline.to("cuda")
```

Loading pipeline components...: 100% 7/7 [00:00<00:00, 10.56it/s]

```
StableDiffusionPipeline {
  "_class_name": "StableDiffusionPipeline",
  "_diffusers_version": "0.35.1",
  "_name_or_path": "runwayml/stable-diffusion-v1-5",
  "feature_extractor": [
    "transformers",
    "CLIPImageProcessor"
  ],
  "image_encoder": [
    null,
    null
  ],
  "requires_safety_checker": true,
  "safety_checker": [
    "stable_diffusion",
    "StableDiffusionSafetyChecker"
  ],
  "scheduler": [
    "diffusers",
    "PNDMScheduler"
  ],
  "text_encoder": [
    "transformers",
    "CLIPTextModel"
  ],
  "tokenizer": [
    "transformers",
    "CLIPTokenizer"
  ],
  "unet": [
    "diffusers",
    "UNet2DConditionModel"
  ],
  "vae": [
    "diffusers",
    "AutoencoderKL"
  ]
}
```

```
# Define text prompts for image generation
prompts = [
    "A majestic lion in the savanna, digital art"
]
```

Generate Images

```
# Generate images based on the prompts
generated_images = []
for prompt in prompts:
    image = pipeline(prompt).images[0]
    generated_images.append(image)
```

100% 50/50 [00:24<00:00, 2.17it/s]

```
import matplotlib.pyplot as plt

# Display the generated images
for i, image in enumerate(generated_images):
    plt.imshow(image)
    plt.axis('off')
    plt.title(f"Generated Image {i+1}")
    plt.show()
```

Generated Image 1

