```python
# Install required libraries
!pip install transformers  # Installs the transformers library for NLP
models
!pip install imageio       # Installs imageio to handle image files
(e.g., GIFs)
!pip install gtts          # Installs Google Text-to-Speech API for
text-to-speech
!pip install bert-score    # Installs the BERTScore metric library for
evaluation
!pip install nltk          # Installs the NLTK library for natural
language processing tasks
!pip install rouge-score   # Installs the Rouge score package for
evaluation metrics

import os
import json
import random
import requests
import imageio
from PIL import Image
from io import BytesIO
import torch
from transformers import (
    BlipProcessor,
    BlipForConditionalGeneration,
    T5Tokenizer,
    T5ForConditionalGeneration,
    AdamW
)
from torch.utils.data import Dataset, DataLoader, random_split
from tqdm import tqdm
import nltk
from nltk.translate.bleu_score import sentence_bleu, corpus_bleu
# from nltk.translate.meteor_score import meteor_score
from rouge_score import rouge_scorer
from bert_score import score as bert_score_fn
import numpy as np

# Download NLTK data
nltk.download('wordnet')
```

```
Requirement already satisfied: transformers in
/usr/local/lib/python3.10/dist-packages (4.44.2)
Requirement already satisfied: filelock in
/usr/local/lib/python3.10/dist-packages (from transformers) (3.16.1)
Requirement already satisfied: huggingface-hub<1.0,>=0.23.2 in
/usr/local/lib/python3.10/dist-packages (from transformers) (0.24.7)
Requirement already satisfied: numpy>=1.17 in
/usr/local/lib/python3.10/dist-packages (from transformers) (1.26.4)
Requirement already satisfied: packaging>=20.0 in
```

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/usr/local/lib/python3.10/dist-packages (from transformers) (24.1)
Requirement already satisfied: pyyaml>=5.1 in
/usr/local/lib/python3.10/dist-packages (from transformers) (6.0.2)
Requirement already satisfied: regex!=2019.12.17 in
/usr/local/lib/python3.10/dist-packages (from transformers)
(2024.9.11)
Requirement already satisfied: requests in
/usr/local/lib/python3.10/dist-packages (from transformers) (2.32.3)
Requirement already satisfied: safetensors>=0.4.1 in
/usr/local/lib/python3.10/dist-packages (from transformers) (0.4.5)
Requirement already satisfied: tokenizers<0.20,>=0.19 in
/usr/local/lib/python3.10/dist-packages (from transformers) (0.19.1)
Requirement already satisfied: tqdm>=4.27 in
/usr/local/lib/python3.10/dist-packages (from transformers) (4.66.6)
Requirement already satisfied: fsspec>=2023.5.0 in
/usr/local/lib/python3.10/dist-packages (from huggingface-
hub<1.0,>=0.23.2->transformers) (2024.10.0)
Requirement already satisfied: typing-extensions>=3.7.4.3 in
/usr/local/lib/python3.10/dist-packages (from huggingface-
hub<1.0,>=0.23.2->transformers) (4.12.2)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.10/dist-packages (from requests->transformers)
(3.4.0)
Requirement already satisfied: idna<4,>=2.5 in
/usr/local/lib/python3.10/dist-packages (from requests->transformers)
(3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in
/usr/local/lib/python3.10/dist-packages (from requests->transformers)
(2.2.3)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.10/dist-packages (from requests->transformers)
(2024.8.30)
Requirement already satisfied: imageio in
/usr/local/lib/python3.10/dist-packages (2.36.0)
Requirement already satisfied: numpy in
/usr/local/lib/python3.10/dist-packages (from imageio) (1.26.4)
Requirement already satisfied: pillow>=8.3.2 in
/usr/local/lib/python3.10/dist-packages (from imageio) (10.4.0)
Collecting gtts
  Downloading gTTS-2.5.3-py3-none-any.whl.metadata (4.1 kB)
Requirement already satisfied: requests<3,>=2.27 in
/usr/local/lib/python3.10/dist-packages (from gtts) (2.32.3)
Requirement already satisfied: click<8.2,>=7.1 in
/usr/local/lib/python3.10/dist-packages (from gtts) (8.1.7)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.10/dist-packages (from requests<3,>=2.27->gtts)
(3.4.0)
Requirement already satisfied: idna<4,>=2.5 in
/usr/local/lib/python3.10/dist-packages (from requests<3,>=2.27->gtts)
```

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(3.10)
Requirement already satisfied: urllib3<3,>=1.21.1 in
/usr/local/lib/python3.10/dist-packages (from requests<3,>=2.27->gtts)
(2.2.3)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.10/dist-packages (from requests<3,>=2.27->gtts)
(2024.8.30)
Downloading gTTS-2.5.3-py3-none-any.whl (29 kB)
Installing collected packages: gtts
Successfully installed gtts-2.5.3
Collecting bert-score
  Downloading bert_score-0.3.13-py3-none-any.whl.metadata (15 kB)
Requirement already satisfied: torch>=1.0.0 in
/usr/local/lib/python3.10/dist-packages (from bert-score)
(2.5.0+cu121)
Requirement already satisfied: pandas>=1.0.1 in
/usr/local/lib/python3.10/dist-packages (from bert-score) (2.2.2)
Requirement already satisfied: transformers>=3.0.0 in
/usr/local/lib/python3.10/dist-packages (from bert-score) (4.44.2)
Requirement already satisfied: numpy in
/usr/local/lib/python3.10/dist-packages (from bert-score) (1.26.4)
Requirement already satisfied: requests in
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Requirement already satisfied: tqdm>=4.31.1 in
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Requirement already satisfied: matplotlib in
/usr/local/lib/python3.10/dist-packages (from bert-score) (3.8.0)
Requirement already satisfied: packaging>=20.9 in
/usr/local/lib/python3.10/dist-packages (from bert-score) (24.1)
Requirement already satisfied: python-dateutil>=2.8.2 in
/usr/local/lib/python3.10/dist-packages (from pandas>=1.0.1->bert-
score) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in
/usr/local/lib/python3.10/dist-packages (from pandas>=1.0.1->bert-
score) (2024.2)
Requirement already satisfied: tzdata>=2022.7 in
/usr/local/lib/python3.10/dist-packages (from pandas>=1.0.1->bert-
score) (2024.2)
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/usr/local/lib/python3.10/dist-packages (from torch>=1.0.0->bert-
score) (3.16.1)
Requirement already satisfied: typing-extensions>=4.8.0 in
/usr/local/lib/python3.10/dist-packages (from torch>=1.0.0->bert-
score) (4.12.2)
Requirement already satisfied: networkx in
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score) (3.4.2)
Requirement already satisfied: jinja2 in
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score) (3.1.4)
Requirement already satisfied: fsspec in
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score) (2024.10.0)
Requirement already satisfied: sympy==1.13.1 in
/usr/local/lib/python3.10/dist-packages (from torch>=1.0.0->bert-
score) (1.13.1)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in
/usr/local/lib/python3.10/dist-packages (from sympy==1.13.1-
>torch>=1.0.0->bert-score) (1.3.0)
Requirement already satisfied: huggingface-hub<1.0,>=0.23.2 in
/usr/local/lib/python3.10/dist-packages (from transformers>=3.0.0-
>bert-score) (0.24.7)
Requirement already satisfied: pyyaml>=5.1 in
/usr/local/lib/python3.10/dist-packages (from transformers>=3.0.0-
>bert-score) (6.0.2)
Requirement already satisfied: regex!=2019.12.17 in
/usr/local/lib/python3.10/dist-packages (from transformers>=3.0.0-
>bert-score) (2024.9.11)
Requirement already satisfied: safetensors>=0.4.1 in
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>bert-score) (0.4.5)
Requirement already satisfied: tokenizers<0.20,>=0.19 in
/usr/local/lib/python3.10/dist-packages (from transformers>=3.0.0-
>bert-score) (0.19.1)
Requirement already satisfied: contourpy>=1.0.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->bert-score)
(1.3.0)
Requirement already satisfied: cycler>=0.10 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->bert-score)
(0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->bert-score)
(4.54.1)
Requirement already satisfied: kiwisolver>=1.0.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->bert-score)
(1.4.7)
Requirement already satisfied: pillow>=6.2.0 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->bert-score)
(10.4.0)
Requirement already satisfied: pyparsing>=2.3.1 in
/usr/local/lib/python3.10/dist-packages (from matplotlib->bert-score)
(3.2.0)
Requirement already satisfied: charset-normalizer<4,>=2 in
/usr/local/lib/python3.10/dist-packages (from requests->bert-score)
(3.4.0)
Requirement already satisfied: idna<4,>=2.5 in
/usr/local/lib/python3.10/dist-packages (from requests->bert-score)
(3.10)
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Requirement already satisfied: urllib3<3,>=1.21.1 in
/usr/local/lib/python3.10/dist-packages (from requests->bert-score)
(2.2.3)
Requirement already satisfied: certifi>=2017.4.17 in
/usr/local/lib/python3.10/dist-packages (from requests->bert-score)
(2024.8.30)
Requirement already satisfied: six>=1.5 in
/usr/local/lib/python3.10/dist-packages (from python-dateutil>=2.8.2-
>pandas>=1.0.1->bert-score) (1.16.0)
Requirement already satisfied: MarkupSafe>=2.0 in
/usr/local/lib/python3.10/dist-packages (from jinja2->torch>=1.0.0-
>bert-score) (3.0.2)
Downloading bert_score-0.3.13-py3-none-any.whl (61 kB)
━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 61.1/61.1 kB 4.4 MB/s eta
0:00:00
ent already satisfied: nltk in /usr/local/lib/python3.10/dist-packages
(3.8.1)
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/usr/local/lib/python3.10/dist-packages (from nltk) (8.1.7)
Requirement already satisfied: joblib in
/usr/local/lib/python3.10/dist-packages (from nltk) (1.4.2)
Requirement already satisfied: regex>=2021.8.3 in
/usr/local/lib/python3.10/dist-packages (from nltk) (2024.9.11)
Requirement already satisfied: tqdm in /usr/local/lib/python3.10/dist-
packages (from nltk) (4.66.6)
Collecting rouge-score
  Downloading rouge_score-0.1.2.tar.gz (17 kB)
  Preparing metadata (setup.py) ... ent already satisfied: absl-py
in /usr/local/lib/python3.10/dist-packages (from rouge-score) (1.4.0)
Requirement already satisfied: nltk in /usr/local/lib/python3.10/dist-
packages (from rouge-score) (3.8.1)
Requirement already satisfied: numpy in
/usr/local/lib/python3.10/dist-packages (from rouge-score) (1.26.4)
Requirement already satisfied: six>=1.14.0 in
/usr/local/lib/python3.10/dist-packages (from rouge-score) (1.16.0)
Requirement already satisfied: click in
/usr/local/lib/python3.10/dist-packages (from nltk->rouge-score)
(8.1.7)
Requirement already satisfied: joblib in
/usr/local/lib/python3.10/dist-packages (from nltk->rouge-score)
(1.4.2)
Requirement already satisfied: regex>=2021.8.3 in
/usr/local/lib/python3.10/dist-packages (from nltk->rouge-score)
(2024.9.11)
Requirement already satisfied: tqdm in /usr/local/lib/python3.10/dist-
packages (from nltk->rouge-score) (4.66.6)
Building wheels for collected packages: rouge-score
  Building wheel for rouge-score (setup.py) ... e=rouge_score-0.1.2-
py3-none-any.whl size=24935
```

```
sha256=b0abd92c27af592126f598e236c66c197e64b11b92ac2650105910a37fbda83
f
  Stored in directory:
/root/.cache/pip/wheels/5f/dd/89/461065a73be61a532ff8599a28e9beef17985
c9e9c31e541b4
Successfully built rouge-score
Installing collected packages: rouge-score
Successfully installed rouge-score-0.1.2
```

```
[nltk_data] Downloading package wordnet to /root/nltk_data...
```

```
True
```

```python
import os
import json
import random

# Define paths
metadata_file = 'datafile.json'  # Path to your metadata file that
contains GIF information
gifs_dir = 'gifs_temp'           # Directory to temporarily store GIFs

# Create temporary GIFs directory if it doesn't exist
os.makedirs(gifs_dir, exist_ok=True)

# Load metadata from the metadata file
with open(metadata_file, 'r') as f:
    metadata = json.load(f)

# Check if the dataset contains at least 100 GIFs, if not raise an
error
if len(metadata) < 1500:
    raise ValueError("The metadata file contains fewer than 100
GIFs.")

# Randomly select 1500 GIFs from the metadata for processing
selected_gifs = random.sample(metadata, 1500)

# Output the number of selected GIFs
print(f"Selected {len(selected_gifs)} random GIFs for processing.")

import time

# Enhanced download function with retries
def download_gif(url, save_path, max_retries=3, backoff_factor=2):
    for attempt in range(1, max_retries + 1):
        try:
            headers = {
                "User-Agent": "Mozilla/5.0 (Windows NT 10.0; Win64;
x64)"
            }
            response = requests.get(url, headers=headers, timeout=10)
            response.raise_for_status()
            with open(save_path, 'wb') as f:
                f.write(response.content)
            print(f"Downloaded: {save_path}")
            return True
        except requests.exceptions.HTTPError as http_err:
            print(f"HTTP error: {http_err} - Attempt {attempt}")
            if response.status_code == 404:
                break
        except requests.exceptions.RequestException as req_err:
            print(f"Request error: {req_err} - Attempt {attempt}")
        except Exception as e:
            print(f"Unexpected error: {e} - Attempt {attempt}")
        # Exponential backoff
        time.sleep(backoff_factor ** attempt)
    print(f"Failed to download {url}")
    return False

# Function to extract and preprocess frames from GIF
def extract_frames(gif_path, num_frames=10, frame_size=(256, 256)):
    try:
        gif = imageio.mimread(gif_path)
        total_frames = len(gif)

        if total_frames == 0:
            raise ValueError("No frames found in GIF.")

        interval = max(total_frames // num_frames, 1)
        selected_frames = [gif[i] for i in range(0, total_frames,
interval)][:num_frames]

        processed_frames = []
        for frame in selected_frames:
            img = Image.fromarray(frame)
            if img.mode != 'RGB':
                img = img.convert('RGB')
            img_resized = img.resize(frame_size)
            processed_frames.append(np.array(img_resized))

        # Pad with the last frame or zeros
        while len(processed_frames) < num_frames:
            processed_frames.append(processed_frames[-1] if
processed_frames else np.zeros((frame_size[0], frame_size[1], 3),
dtype=np.uint8))

        return processed_frames

    except Exception as e:
        print(f"Failed to extract frames from {gif_path}: {e}")
        return []

# Function to delete GIF after processing
def delete_gif(gif_path):
    try:
        os.remove(gif_path)
        print(f"Deleted: {gif_path}")
    except Exception as e:
        print(f"Failed to delete {gif_path}: {e}")

import torch
import numpy as np
from tqdm import tqdm
import os

# Initialize lists to store data
target_frames = []
target_texts = []

# Process each GIF
for gif in tqdm(selected_gifs, desc="Processing GIFs"):
    gif_id = gif.get('id')
    url = gif.get('url')
    reference_description = gif.get('description')

    # Validate GIF entry
    if not gif_id or not url or not reference_description:
        print(f"Invalid GIF entry: {gif}")
        continue

    # Define local path to save the GIF temporarily
    gif_filename = f"{gif_id}.gif"
    gif_path = os.path.join(gifs_dir, gif_filename)

    # Download the GIF
    success = download_gif(url, gif_path)
    if not success:
        print(f"Skipping GIF {gif_id} due to download failure.")
        continue

    # Extract frames
    selected_frames = extract_frames(gif_path, num_frames=5)

    # Validate frame extraction
    if not selected_frames:
        print(f"No frames extracted for {gif_id}. Skipping.")
        delete_gif(gif_path)
        continue

    # Append the extracted frames and corresponding text
    target_frames.append(selected_frames)
    target_texts.append(reference_description)

    # Delete the downloaded GIF
    delete_gif(gif_path)

import torch
import numpy as np

# Assume target_frames is the list of GIFs, where each GIF is a list
of frames (each frame is a numpy array)
processed_gifs = []

for gif in target_frames:
    # Convert list of frames (numpy arrays) into a single numpy array
    frames_array = np.array(gif)  # Convert to a single numpy array
    # Now convert the numpy array to a PyTorch tensor
    frames_tensor = torch.tensor(frames_array)  # Convert to a PyTorch
tensor

    # Append the processed tensor to the list
    processed_gifs.append(frames_tensor)

# Now processed_gifs is a list of tensors, where each tensor
represents a GIF
```

Saving the data

```
import torch

# Move all tensors in processed_gifs to CPU
processed_gifs_cpu = [gif.cpu() for gif in processed_gifs]

# Create a dictionary to hold both lists
data = {
    'processed_gifs': processed_gifs_cpu,
    'target_texts': target_texts
}

# Save the dictionary to a file
torch.save(data, 'data.pth')

print("Data has been saved successfully as 'data.pth'.")
```

Loading data when needed

```
import torch

# Load the saved data from the local file
data = torch.load('data.pth', map_location=torch.device('cpu'))  #
```

```
Change 'cpu' to 'cuda' if loading on GPU

processed_gifs = data['processed_gifs']
target_texts = data['target_texts']

print("Data has been loaded successfully from 'data.pth'.")
```

```
<ipython-input-10-1e2442dfdc7f>:4: FutureWarning: You are using
`torch.load` with `weights_only=False` (the current default value),
which uses the default pickle module implicitly. It is possible to
construct malicious pickle data which will execute arbitrary code
during unpickling (See
https://github.com/pytorch/pytorch/blob/main/SECURITY.md#untrusted-
models for more details). In a future release, the default value for
`weights_only` will be flipped to `True`. This limits the functions
that could be executed during unpickling. Arbitrary objects will no
longer be allowed to be loaded via this mode unless they are
explicitly allowlisted by the user via
`torch.serialization.add_safe_globals`. We recommend you start setting
`weights_only=True` for any use case where you don't have full control
of the loaded file. Please open an issue on GitHub for any issues
related to this experimental feature.
  data = torch.load('data.pth', map_location=torch.device('cpu'))  #
Change 'cpu' to 'cuda' if loading on GPU

Data has been loaded successfully from 'data.pth'.
```

```
# Initialize BLIP processor and model
blip_processor = BlipProcessor.from_pretrained("Salesforce/blip-image-
captioning-base")
blip_model =
BlipForConditionalGeneration.from_pretrained("Salesforce/blip-image-
captioning-base").to('cuda' if torch.cuda.is_available() else 'cpu')
```

```
/usr/local/lib/python3.10/dist-packages/huggingface_hub/utils/
_token.py:89: UserWarning:
The secret `HF_TOKEN` does not exist in your Colab secrets.
To authenticate with the Hugging Face Hub, create a token in your
settings tab (https://huggingface.co/settings/tokens), set it as
secret in your Google Colab and restart your session.
You will be able to reuse this secret in all of your notebooks.
Please note that authentication is recommended but still optional to
access public models or datasets.
  warnings.warn(
```

```
{"model_id":"5005aed05b1241de9b429f2252fb9ecf","version_major":2,"vers
ion_minor":0}

{"model_id":"aa6fdb1b783f4538a02ca3028c9fe2b9","version_major":2,"vers
ion_minor":0}
```

```
{"model_id":"dec6d4407789424cbc5b9211dc7596fb","version_major":2,"vers
ion_minor":0}
```

```
{"model_id":"2bf67e30d8cc497b86005c0297381e7a","version_major":2,"vers
ion_minor":0}
```

```
{"model_id":"42c3b9c7261640bcbb3b209e004e277a","version_major":2,"vers
ion_minor":0}
```

```
/usr/local/lib/python3.10/dist-packages/transformers/
tokenization_utils_base.py:1601: FutureWarning:
`clean_up_tokenization_spaces` was not set. It will be set to `True`
by default. This behavior will be depracted in transformers v4.45, and
will be then set to `False` by default. For more details check this
issue: https://github.com/huggingface/transformers/issues/31884
  warnings.warn(
```

```
{"model_id":"f1b2a252c43e45e1b1fdfba1c7cf1e22","version_major":2,"vers
ion_minor":0}
```

```
{"model_id":"ad664e9e0de64a95a9badaa7aaa00e43","version_major":2,"vers
ion_minor":0}
```

```python
layers = ["layer.10", "layer.11", "layers.10", "layers.11"]
for name, param in blip_model.named_parameters():
  param.requires_grad = False
  for layer in layers:
    if layer in name:
      param.requires_grad = True
      break

for name, param in blip_model.named_parameters():
    status = "Trainable" if param.requires_grad else "Frozen"
    print(f"Layer: {name}, Status: {status}")
```

```
Layer: vision_model.embeddings.class_embedding, Status: Frozen
Layer: vision_model.embeddings.position_embedding, Status: Frozen
Layer: vision_model.embeddings.patch_embedding.weight, Status: Frozen
Layer: vision_model.embeddings.patch_embedding.bias, Status: Frozen
Layer: vision_model.encoder.layers.0.self_attn.qkv.weight, Status:
Frozen
Layer: vision_model.encoder.layers.0.self_attn.qkv.bias, Status:
Frozen
Layer: vision_model.encoder.layers.0.self_attn.projection.weight,
Status: Frozen
Layer: vision_model.encoder.layers.0.self_attn.projection.bias,
Status: Frozen
Layer: vision_model.encoder.layers.0.layer_norm1.weight, Status:
Frozen
Layer: vision_model.encoder.layers.0.layer_norm1.bias, Status: Frozen
Layer: vision_model.encoder.layers.0.mlp.fc1.weight, Status: Frozen
```

```
Layer: vision_model.encoder.layers.0.mlp.fc1.bias, Status: Frozen
Layer: vision_model.encoder.layers.0.mlp.fc2.weight, Status: Frozen
Layer: vision_model.encoder.layers.0.mlp.fc2.bias, Status: Frozen
Layer: vision_model.encoder.layers.0.layer_norm2.weight, Status:
Frozen
Layer: vision_model.encoder.layers.0.layer_norm2.bias, Status: Frozen
Layer: vision_model.encoder.layers.1.self_attn.qkv.weight, Status:
Frozen
Layer: vision_model.encoder.layers.1.self_attn.qkv.bias, Status:
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Layer: vision_model.encoder.layers.1.self_attn.projection.weight,
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Layer: vision_model.encoder.layers.1.self_attn.projection.bias,
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Layer: vision_model.encoder.layers.1.layer_norm1.weight, Status:
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Layer: vision_model.encoder.layers.1.layer_norm1.bias, Status: Frozen
Layer: vision_model.encoder.layers.1.mlp.fc1.weight, Status: Frozen
Layer: vision_model.encoder.layers.1.mlp.fc1.bias, Status: Frozen
Layer: vision_model.encoder.layers.1.mlp.fc2.weight, Status: Frozen
Layer: vision_model.encoder.layers.1.mlp.fc2.bias, Status: Frozen
Layer: vision_model.encoder.layers.1.layer_norm2.weight, Status:
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Layer: vision_model.encoder.layers.1.layer_norm2.bias, Status: Frozen
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Layer: vision_model.encoder.layers.2.layer_norm2.weight, Status:
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Layer: vision_model.encoder.layers.3.self_attn.qkv.weight, Status:
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Layer: vision_model.encoder.layers.3.self_attn.qkv.bias, Status:
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Layer: vision_model.encoder.layers.3.self_attn.projection.weight,
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Layer: vision_model.encoder.layers.5.mlp.fc2.weight, Status: Frozen
Layer: vision_model.encoder.layers.5.mlp.fc2.bias, Status: Frozen
Layer: vision_model.encoder.layers.5.layer_norm2.weight, Status:
Frozen
Layer: vision_model.encoder.layers.5.layer_norm2.bias, Status: Frozen
Layer: vision_model.encoder.layers.6.self_attn.qkv.weight, Status:
Frozen
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Status: Frozen
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Layer: vision_model.encoder.layers.6.mlp.fc2.bias, Status: Frozen
Layer: vision_model.encoder.layers.6.layer_norm2.weight, Status:
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Layer: vision_model.encoder.layers.7.mlp.fc2.bias, Status: Frozen
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Layer: vision_model.encoder.layers.7.layer_norm2.bias, Status: Frozen
Layer: vision_model.encoder.layers.8.self_attn.qkv.weight, Status:
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Layer: vision_model.encoder.layers.8.self_attn.qkv.bias, Status:
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Layer: vision_model.encoder.layers.8.self_attn.projection.weight,
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Layer: vision_model.encoder.layers.8.self_attn.projection.bias,
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Layer: vision_model.encoder.layers.8.layer_norm1.bias, Status: Frozen
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Layer: vision_model.encoder.layers.8.mlp.fc2.weight, Status: Frozen
Layer: vision_model.encoder.layers.8.mlp.fc2.bias, Status: Frozen
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Layer: vision_model.encoder.layers.9.mlp.fc2.weight, Status: Frozen
Layer: vision_model.encoder.layers.9.mlp.fc2.bias, Status: Frozen
Layer: vision_model.encoder.layers.9.layer_norm2.weight, Status:
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Status: Trainable
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Layer: vision_model.encoder.layers.10.layer_norm1.bias, Status:
Trainable
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Trainable
Layer: vision_model.encoder.layers.10.mlp.fc1.bias, Status: Trainable
Layer: vision_model.encoder.layers.10.mlp.fc2.weight, Status:
Trainable
Layer: vision_model.encoder.layers.10.mlp.fc2.bias, Status: Trainable
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Trainable
Layer: vision_model.encoder.layers.10.layer_norm2.bias, Status:
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Trainable
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Trainable
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Status: Trainable
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Layer: vision_model.encoder.layers.11.self_attn.projection.bias,
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text_decoder.bert.encoder.layer.0.crossattention.output.LayerNorm.weig
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Layer:
text_decoder.bert.encoder.layer.0.crossattention.output.LayerNorm.bias
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Layer: text_decoder.bert.encoder.layer.1.attention.self.key.bias,
Status: Frozen
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Layer: text_decoder.bert.encoder.layer.3.output.dense.bias, Status:
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Status: Frozen
Layer: text_decoder.bert.encoder.layer.4.attention.self.value.bias,
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Layer:
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Status: Frozen
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text_decoder.bert.encoder.layer.4.crossattention.self.value.bias,
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ht, Status: Frozen
Layer:
text_decoder.bert.encoder.layer.4.crossattention.output.LayerNorm.bias
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Layer: text_decoder.bert.encoder.layer.4.intermediate.dense.weight,
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Status: Frozen
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Status: Frozen
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Status: Frozen
Layer: text_decoder.bert.encoder.layer.5.attention.self.value.bias,
Status: Frozen
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text_decoder.bert.encoder.layer.5.attention.output.dense.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.5.attention.output.dense.bias,
Status: Frozen
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text_decoder.bert.encoder.layer.5.attention.output.LayerNorm.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.5.attention.output.LayerNorm.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.5.crossattention.self.query.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.5.crossattention.self.query.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.5.crossattention.self.key.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.5.crossattention.self.key.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.5.crossattention.self.value.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.5.crossattention.self.value.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.5.crossattention.output.dense.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.5.crossattention.output.dense.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.5.crossattention.output.LayerNorm.weig
ht, Status: Frozen
```

```
Layer:
text_decoder.bert.encoder.layer.5.crossattention.output.LayerNorm.bias
, Status: Frozen
Layer: text_decoder.bert.encoder.layer.5.intermediate.dense.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.5.intermediate.dense.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.5.output.dense.weight, Status:
Frozen
Layer: text_decoder.bert.encoder.layer.5.output.dense.bias, Status:
Frozen
Layer: text_decoder.bert.encoder.layer.5.output.LayerNorm.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.5.output.LayerNorm.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.6.attention.self.query.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.6.attention.self.query.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.6.attention.self.key.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.6.attention.self.key.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.6.attention.self.value.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.6.attention.self.value.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.6.attention.output.dense.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.6.attention.output.dense.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.6.attention.output.LayerNorm.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.6.attention.output.LayerNorm.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.6.crossattention.self.query.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.6.crossattention.self.query.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.6.crossattention.self.key.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.6.crossattention.self.key.bias,
Status: Frozen
```

```
Layer:
text_decoder.bert.encoder.layer.6.crossattention.self.value.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.6.crossattention.self.value.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.6.crossattention.output.dense.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.6.crossattention.output.dense.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.6.crossattention.output.LayerNorm.weig
ht, Status: Frozen
Layer:
text_decoder.bert.encoder.layer.6.crossattention.output.LayerNorm.bias
, Status: Frozen
Layer: text_decoder.bert.encoder.layer.6.intermediate.dense.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.6.intermediate.dense.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.6.output.dense.weight, Status:
Frozen
Layer: text_decoder.bert.encoder.layer.6.output.dense.bias, Status:
Frozen
Layer: text_decoder.bert.encoder.layer.6.output.LayerNorm.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.6.output.LayerNorm.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.7.attention.self.query.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.7.attention.self.query.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.7.attention.self.key.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.7.attention.self.key.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.7.attention.self.value.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.7.attention.self.value.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.7.attention.output.dense.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.7.attention.output.dense.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.7.attention.output.LayerNorm.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.7.attention.output.LayerNorm.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.7.crossattention.self.query.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.7.crossattention.self.query.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.7.crossattention.self.key.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.7.crossattention.self.key.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.7.crossattention.self.value.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.7.crossattention.self.value.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.7.crossattention.output.dense.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.7.crossattention.output.dense.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.7.crossattention.output.LayerNorm.weig
ht, Status: Frozen
Layer:
text_decoder.bert.encoder.layer.7.crossattention.output.LayerNorm.bias
, Status: Frozen
Layer: text_decoder.bert.encoder.layer.7.intermediate.dense.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.7.intermediate.dense.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.7.output.dense.weight, Status:
Frozen
Layer: text_decoder.bert.encoder.layer.7.output.dense.bias, Status:
Frozen
Layer: text_decoder.bert.encoder.layer.7.output.LayerNorm.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.7.output.LayerNorm.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.8.attention.self.query.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.8.attention.self.query.bias,
Status: Frozen
```

```
Layer: text_decoder.bert.encoder.layer.8.attention.self.key.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.8.attention.self.key.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.8.attention.self.value.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.8.attention.self.value.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.8.attention.output.dense.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.8.attention.output.dense.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.8.attention.output.LayerNorm.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.8.attention.output.LayerNorm.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.8.crossattention.self.query.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.8.crossattention.self.query.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.8.crossattention.self.key.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.8.crossattention.self.key.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.8.crossattention.self.value.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.8.crossattention.self.value.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.8.crossattention.output.dense.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.8.crossattention.output.dense.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.8.crossattention.output.LayerNorm.weig
ht, Status: Frozen
Layer:
text_decoder.bert.encoder.layer.8.crossattention.output.LayerNorm.bias
, Status: Frozen
Layer: text_decoder.bert.encoder.layer.8.intermediate.dense.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.8.intermediate.dense.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.8.output.dense.weight, Status:
Frozen
Layer: text_decoder.bert.encoder.layer.8.output.dense.bias, Status:
Frozen
Layer: text_decoder.bert.encoder.layer.8.output.LayerNorm.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.8.output.LayerNorm.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.9.attention.self.query.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.9.attention.self.query.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.9.attention.self.key.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.9.attention.self.key.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.9.attention.self.value.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.9.attention.self.value.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.9.attention.output.dense.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.9.attention.output.dense.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.9.attention.output.LayerNorm.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.9.attention.output.LayerNorm.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.9.crossattention.self.query.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.9.crossattention.self.query.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.9.crossattention.self.key.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.9.crossattention.self.key.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.9.crossattention.self.value.weight,
Status: Frozen
Layer:
```

```
text_decoder.bert.encoder.layer.9.crossattention.self.value.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.9.crossattention.output.dense.weight,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.9.crossattention.output.dense.bias,
Status: Frozen
Layer:
text_decoder.bert.encoder.layer.9.crossattention.output.LayerNorm.weig
ht, Status: Frozen
Layer:
text_decoder.bert.encoder.layer.9.crossattention.output.LayerNorm.bias
, Status: Frozen
Layer: text_decoder.bert.encoder.layer.9.intermediate.dense.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.9.intermediate.dense.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.9.output.dense.weight, Status:
Frozen
Layer: text_decoder.bert.encoder.layer.9.output.dense.bias, Status:
Frozen
Layer: text_decoder.bert.encoder.layer.9.output.LayerNorm.weight,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.9.output.LayerNorm.bias,
Status: Frozen
Layer: text_decoder.bert.encoder.layer.10.attention.self.query.weight,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.10.attention.self.query.bias,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.10.attention.self.key.weight,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.10.attention.self.key.bias,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.10.attention.self.value.weight,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.10.attention.self.value.bias,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.10.attention.output.dense.weight,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.10.attention.output.dense.bias,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.10.attention.output.LayerNorm.weight,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.10.attention.output.LayerNorm.bias,
Status: Trainable
```

```
Layer:
text_decoder.bert.encoder.layer.10.crossattention.self.query.weight,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.10.crossattention.self.query.bias,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.10.crossattention.self.key.weight,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.10.crossattention.self.key.bias,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.10.crossattention.self.value.weight,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.10.crossattention.self.value.bias,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.10.crossattention.output.dense.weight,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.10.crossattention.output.dense.bias,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.10.crossattention.output.LayerNorm.wei
ght, Status: Trainable
Layer:
text_decoder.bert.encoder.layer.10.crossattention.output.LayerNorm.bia
s, Status: Trainable
Layer: text_decoder.bert.encoder.layer.10.intermediate.dense.weight,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.10.intermediate.dense.bias,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.10.output.dense.weight, Status:
Trainable
Layer: text_decoder.bert.encoder.layer.10.output.dense.bias, Status:
Trainable
Layer: text_decoder.bert.encoder.layer.10.output.LayerNorm.weight,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.10.output.LayerNorm.bias,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.11.attention.self.query.weight,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.11.attention.self.query.bias,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.11.attention.self.key.weight,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.11.attention.self.key.bias,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.11.attention.self.value.weight,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.11.attention.self.value.bias,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.11.attention.output.dense.weight,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.11.attention.output.dense.bias,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.11.attention.output.LayerNorm.weight,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.11.attention.output.LayerNorm.bias,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.11.crossattention.self.query.weight,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.11.crossattention.self.query.bias,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.11.crossattention.self.key.weight,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.11.crossattention.self.key.bias,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.11.crossattention.self.value.weight,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.11.crossattention.self.value.bias,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.11.crossattention.output.dense.weight,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.11.crossattention.output.dense.bias,
Status: Trainable
Layer:
text_decoder.bert.encoder.layer.11.crossattention.output.LayerNorm.wei
ght, Status: Trainable
Layer:
text_decoder.bert.encoder.layer.11.crossattention.output.LayerNorm.bia
s, Status: Trainable
Layer: text_decoder.bert.encoder.layer.11.intermediate.dense.weight,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.11.intermediate.dense.bias,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.11.output.dense.weight, Status:
Trainable
Layer: text_decoder.bert.encoder.layer.11.output.dense.bias, Status:
Trainable
Layer: text_decoder.bert.encoder.layer.11.output.LayerNorm.weight,
Status: Trainable
Layer: text_decoder.bert.encoder.layer.11.output.LayerNorm.bias,
Status: Trainable
Layer: text_decoder.cls.predictions.bias, Status: Frozen
Layer: text_decoder.cls.predictions.transform.dense.weight, Status:
Frozen
Layer: text_decoder.cls.predictions.transform.dense.bias, Status:
Frozen
Layer: text_decoder.cls.predictions.transform.LayerNorm.weight,
Status: Frozen
Layer: text_decoder.cls.predictions.transform.LayerNorm.bias, Status:
Frozen
Layer: text_decoder.cls.predictions.decoder.weight, Status: Frozen
```

```python
# Initialize T5 tokenizer and model
t5_tokenizer = T5Tokenizer.from_pretrained('t5-base')
t5_model = T5ForConditionalGeneration.from_pretrained('t5-base').to('cuda' if torch.cuda.is_available() else 'cpu')
```

{"model_id":"61cf278f5bff4f4f92dd2b5ffdf50d86","version_major":2,"version_minor":0}

{"model_id":"ccfe5991560f41d38e6f58774ff7d6b7","version_major":2,"version_minor":0}

{"model_id":"0e0539b3572b4ded9335203cc5345dd6","version_major":2,"version_minor":0}

```
You are using the default legacy behaviour of the <class
'transformers.models.t5.tokenization_t5.T5Tokenizer'>. This is
expected, and simply means that the `legacy` (previous) behavior will
be used so nothing changes for you. If you want to use the new
behaviour, set `legacy=False`. This should only be set if you
understand what it means, and thoroughly read the reason why this was
added as explained in
https://github.com/huggingface/transformers/pull/24565
```

{"model_id":"864e60a6b94d455fb1e2f933bc8a5480","version_major":2,"version_minor":0}

{"model_id":"e744fb4be660406a9a9afef3ebf14261","version_major":2,"version_minor":0}

```python
for name, parameter in t5_model.named_parameters():
  if "encoder.block" in name:
    index = name.split(".")[2]
    if int(index) < 10:
      parameter.requires_grad = False
    else:
      parameter.requires_grad = True


for name, parameter in t5_model.named_parameters():
  if "decoder.block" in name:
    index = name.split(".")[2]
    if int(index) < 9:
      parameter.requires_grad = False
    else:
      parameter.requires_grad = True

for name, parameter in t5_model.named_parameters():
  status = "Trainable" if parameter.requires_grad else "Frozen"
  print(f"Layer: {name}, Status: {status}")
```

```
Layer: shared.weight, Status: Trainable
Layer: encoder.block.0.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: encoder.block.0.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: encoder.block.0.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: encoder.block.0.layer.0.SelfAttention.o.weight, Status: Frozen
Layer:
encoder.block.0.layer.0.SelfAttention.relative_attention_bias.weight,
Status: Frozen
Layer: encoder.block.0.layer.0.layer_norm.weight, Status: Frozen
Layer: encoder.block.0.layer.1.DenseReluDense.wi.weight, Status:
Frozen
Layer: encoder.block.0.layer.1.DenseReluDense.wo.weight, Status:
Frozen
Layer: encoder.block.0.layer.1.layer_norm.weight, Status: Frozen
Layer: encoder.block.1.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: encoder.block.1.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: encoder.block.1.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: encoder.block.1.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: encoder.block.1.layer.0.layer_norm.weight, Status: Frozen
Layer: encoder.block.1.layer.1.DenseReluDense.wi.weight, Status:
Frozen
Layer: encoder.block.1.layer.1.DenseReluDense.wo.weight, Status:
Frozen
Layer: encoder.block.1.layer.1.layer_norm.weight, Status: Frozen
Layer: encoder.block.2.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: encoder.block.2.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: encoder.block.2.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: encoder.block.2.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: encoder.block.2.layer.0.layer_norm.weight, Status: Frozen
Layer: encoder.block.2.layer.1.DenseReluDense.wi.weight, Status:
Frozen
```

```
Layer: encoder.block.2.layer.1.DenseReluDense.wo.weight, Status:
Frozen
Layer: encoder.block.2.layer.1.layer_norm.weight, Status: Frozen
Layer: encoder.block.3.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: encoder.block.3.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: encoder.block.3.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: encoder.block.3.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: encoder.block.3.layer.0.layer_norm.weight, Status: Frozen
Layer: encoder.block.3.layer.1.DenseReluDense.wi.weight, Status:
Frozen
Layer: encoder.block.3.layer.1.DenseReluDense.wo.weight, Status:
Frozen
Layer: encoder.block.3.layer.1.layer_norm.weight, Status: Frozen
Layer: encoder.block.4.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: encoder.block.4.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: encoder.block.4.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: encoder.block.4.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: encoder.block.4.layer.0.layer_norm.weight, Status: Frozen
Layer: encoder.block.4.layer.1.DenseReluDense.wi.weight, Status:
Frozen
Layer: encoder.block.4.layer.1.DenseReluDense.wo.weight, Status:
Frozen
Layer: encoder.block.4.layer.1.layer_norm.weight, Status: Frozen
Layer: encoder.block.5.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: encoder.block.5.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: encoder.block.5.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: encoder.block.5.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: encoder.block.5.layer.0.layer_norm.weight, Status: Frozen
Layer: encoder.block.5.layer.1.DenseReluDense.wi.weight, Status:
Frozen
Layer: encoder.block.5.layer.1.DenseReluDense.wo.weight, Status:
Frozen
Layer: encoder.block.5.layer.1.layer_norm.weight, Status: Frozen
Layer: encoder.block.6.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: encoder.block.6.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: encoder.block.6.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: encoder.block.6.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: encoder.block.6.layer.0.layer_norm.weight, Status: Frozen
Layer: encoder.block.6.layer.1.DenseReluDense.wi.weight, Status:
Frozen
Layer: encoder.block.6.layer.1.DenseReluDense.wo.weight, Status:
Frozen
Layer: encoder.block.6.layer.1.layer_norm.weight, Status: Frozen
Layer: encoder.block.7.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: encoder.block.7.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: encoder.block.7.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: encoder.block.7.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: encoder.block.7.layer.0.layer_norm.weight, Status: Frozen
Layer: encoder.block.7.layer.1.DenseReluDense.wi.weight, Status:
```

```
Frozen
Layer: encoder.block.7.layer.1.DenseReluDense.wo.weight, Status:
Frozen
Layer: encoder.block.7.layer.1.layer_norm.weight, Status: Frozen
Layer: encoder.block.8.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: encoder.block.8.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: encoder.block.8.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: encoder.block.8.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: encoder.block.8.layer.0.layer_norm.weight, Status: Frozen
Layer: encoder.block.8.layer.1.DenseReluDense.wi.weight, Status:
Frozen
Layer: encoder.block.8.layer.1.DenseReluDense.wo.weight, Status:
Frozen
Layer: encoder.block.8.layer.1.layer_norm.weight, Status: Frozen
Layer: encoder.block.9.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: encoder.block.9.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: encoder.block.9.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: encoder.block.9.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: encoder.block.9.layer.0.layer_norm.weight, Status: Frozen
Layer: encoder.block.9.layer.1.DenseReluDense.wi.weight, Status:
Frozen
Layer: encoder.block.9.layer.1.DenseReluDense.wo.weight, Status:
Frozen
Layer: encoder.block.9.layer.1.layer_norm.weight, Status: Frozen
Layer: encoder.block.10.layer.0.SelfAttention.q.weight, Status:
Trainable
Layer: encoder.block.10.layer.0.SelfAttention.k.weight, Status:
Trainable
Layer: encoder.block.10.layer.0.SelfAttention.v.weight, Status:
Trainable
Layer: encoder.block.10.layer.0.SelfAttention.o.weight, Status:
Trainable
Layer: encoder.block.10.layer.0.layer_norm.weight, Status: Trainable
Layer: encoder.block.10.layer.1.DenseReluDense.wi.weight, Status:
Trainable
Layer: encoder.block.10.layer.1.DenseReluDense.wo.weight, Status:
Trainable
Layer: encoder.block.10.layer.1.layer_norm.weight, Status: Trainable
Layer: encoder.block.11.layer.0.SelfAttention.q.weight, Status:
Trainable
Layer: encoder.block.11.layer.0.SelfAttention.k.weight, Status:
Trainable
Layer: encoder.block.11.layer.0.SelfAttention.v.weight, Status:
Trainable
Layer: encoder.block.11.layer.0.SelfAttention.o.weight, Status:
Trainable
Layer: encoder.block.11.layer.0.layer_norm.weight, Status: Trainable
Layer: encoder.block.11.layer.1.DenseReluDense.wi.weight, Status:
Trainable
```

```
Layer: encoder.block.11.layer.1.DenseReluDense.wo.weight, Status:
Trainable
Layer: encoder.block.11.layer.1.layer_norm.weight, Status: Trainable
Layer: encoder.final_layer_norm.weight, Status: Trainable
Layer: decoder.block.0.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: decoder.block.0.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: decoder.block.0.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: decoder.block.0.layer.0.SelfAttention.o.weight, Status: Frozen
Layer:
decoder.block.0.layer.0.SelfAttention.relative_attention_bias.weight,
Status: Frozen
Layer: decoder.block.0.layer.0.layer_norm.weight, Status: Frozen
Layer: decoder.block.0.layer.1.EncDecAttention.q.weight, Status:
Frozen
Layer: decoder.block.0.layer.1.EncDecAttention.k.weight, Status:
Frozen
Layer: decoder.block.0.layer.1.EncDecAttention.v.weight, Status:
Frozen
Layer: decoder.block.0.layer.1.EncDecAttention.o.weight, Status:
Frozen
Layer: decoder.block.0.layer.1.layer_norm.weight, Status: Frozen
Layer: decoder.block.0.layer.2.DenseReluDense.wi.weight, Status:
Frozen
Layer: decoder.block.0.layer.2.DenseReluDense.wo.weight, Status:
Frozen
Layer: decoder.block.0.layer.2.layer_norm.weight, Status: Frozen
Layer: decoder.block.1.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: decoder.block.1.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: decoder.block.1.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: decoder.block.1.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: decoder.block.1.layer.0.layer_norm.weight, Status: Frozen
Layer: decoder.block.1.layer.1.EncDecAttention.q.weight, Status:
Frozen
Layer: decoder.block.1.layer.1.EncDecAttention.k.weight, Status:
Frozen
Layer: decoder.block.1.layer.1.EncDecAttention.v.weight, Status:
Frozen
Layer: decoder.block.1.layer.1.EncDecAttention.o.weight, Status:
Frozen
Layer: decoder.block.1.layer.1.layer_norm.weight, Status: Frozen
Layer: decoder.block.1.layer.2.DenseReluDense.wi.weight, Status:
Frozen
Layer: decoder.block.1.layer.2.DenseReluDense.wo.weight, Status:
Frozen
Layer: decoder.block.1.layer.2.layer_norm.weight, Status: Frozen
Layer: decoder.block.2.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: decoder.block.2.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: decoder.block.2.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: decoder.block.2.layer.0.SelfAttention.o.weight, Status: Frozen
```

```
Layer: decoder.block.2.layer.0.layer_norm.weight, Status: Frozen
Layer: decoder.block.2.layer.1.EncDecAttention.q.weight, Status:
Frozen
Layer: decoder.block.2.layer.1.EncDecAttention.k.weight, Status:
Frozen
Layer: decoder.block.2.layer.1.EncDecAttention.v.weight, Status:
Frozen
Layer: decoder.block.2.layer.1.EncDecAttention.o.weight, Status:
Frozen
Layer: decoder.block.2.layer.1.layer_norm.weight, Status: Frozen
Layer: decoder.block.2.layer.2.DenseReluDense.wi.weight, Status:
Frozen
Layer: decoder.block.2.layer.2.DenseReluDense.wo.weight, Status:
Frozen
Layer: decoder.block.2.layer.2.layer_norm.weight, Status: Frozen
Layer: decoder.block.3.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: decoder.block.3.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: decoder.block.3.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: decoder.block.3.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: decoder.block.3.layer.0.layer_norm.weight, Status: Frozen
Layer: decoder.block.3.layer.1.EncDecAttention.q.weight, Status:
Frozen
Layer: decoder.block.3.layer.1.EncDecAttention.k.weight, Status:
Frozen
Layer: decoder.block.3.layer.1.EncDecAttention.v.weight, Status:
Frozen
Layer: decoder.block.3.layer.1.EncDecAttention.o.weight, Status:
Frozen
Layer: decoder.block.3.layer.1.layer_norm.weight, Status: Frozen
Layer: decoder.block.3.layer.2.DenseReluDense.wi.weight, Status:
Frozen
Layer: decoder.block.3.layer.2.DenseReluDense.wo.weight, Status:
Frozen
Layer: decoder.block.3.layer.2.layer_norm.weight, Status: Frozen
Layer: decoder.block.4.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: decoder.block.4.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: decoder.block.4.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: decoder.block.4.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: decoder.block.4.layer.0.layer_norm.weight, Status: Frozen
Layer: decoder.block.4.layer.1.EncDecAttention.q.weight, Status:
Frozen
Layer: decoder.block.4.layer.1.EncDecAttention.k.weight, Status:
Frozen
Layer: decoder.block.4.layer.1.EncDecAttention.v.weight, Status:
Frozen
Layer: decoder.block.4.layer.1.EncDecAttention.o.weight, Status:
Frozen
Layer: decoder.block.4.layer.1.layer_norm.weight, Status: Frozen
Layer: decoder.block.4.layer.2.DenseReluDense.wi.weight, Status:
```

```
Frozen
Layer: decoder.block.4.layer.2.DenseReluDense.wo.weight, Status:
Frozen
Layer: decoder.block.4.layer.2.layer_norm.weight, Status: Frozen
Layer: decoder.block.5.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: decoder.block.5.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: decoder.block.5.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: decoder.block.5.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: decoder.block.5.layer.0.layer_norm.weight, Status: Frozen
Layer: decoder.block.5.layer.1.EncDecAttention.q.weight, Status:
Frozen
Layer: decoder.block.5.layer.1.EncDecAttention.k.weight, Status:
Frozen
Layer: decoder.block.5.layer.1.EncDecAttention.v.weight, Status:
Frozen
Layer: decoder.block.5.layer.1.EncDecAttention.o.weight, Status:
Frozen
Layer: decoder.block.5.layer.1.layer_norm.weight, Status: Frozen
Layer: decoder.block.5.layer.2.DenseReluDense.wi.weight, Status:
Frozen
Layer: decoder.block.5.layer.2.DenseReluDense.wo.weight, Status:
Frozen
Layer: decoder.block.5.layer.2.layer_norm.weight, Status: Frozen
Layer: decoder.block.6.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: decoder.block.6.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: decoder.block.6.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: decoder.block.6.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: decoder.block.6.layer.0.layer_norm.weight, Status: Frozen
Layer: decoder.block.6.layer.1.EncDecAttention.q.weight, Status:
Frozen
Layer: decoder.block.6.layer.1.EncDecAttention.k.weight, Status:
Frozen
Layer: decoder.block.6.layer.1.EncDecAttention.v.weight, Status:
Frozen
Layer: decoder.block.6.layer.1.EncDecAttention.o.weight, Status:
Frozen
Layer: decoder.block.6.layer.1.layer_norm.weight, Status: Frozen
Layer: decoder.block.6.layer.2.DenseReluDense.wi.weight, Status:
Frozen
Layer: decoder.block.6.layer.2.DenseReluDense.wo.weight, Status:
Frozen
Layer: decoder.block.6.layer.2.layer_norm.weight, Status: Frozen
Layer: decoder.block.7.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: decoder.block.7.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: decoder.block.7.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: decoder.block.7.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: decoder.block.7.layer.0.layer_norm.weight, Status: Frozen
Layer: decoder.block.7.layer.1.EncDecAttention.q.weight, Status:
Frozen
```

```
Layer: decoder.block.7.layer.1.EncDecAttention.k.weight, Status:
Frozen
Layer: decoder.block.7.layer.1.EncDecAttention.v.weight, Status:
Frozen
Layer: decoder.block.7.layer.1.EncDecAttention.o.weight, Status:
Frozen
Layer: decoder.block.7.layer.1.layer_norm.weight, Status: Frozen
Layer: decoder.block.7.layer.2.DenseReluDense.wi.weight, Status:
Frozen
Layer: decoder.block.7.layer.2.DenseReluDense.wo.weight, Status:
Frozen
Layer: decoder.block.7.layer.2.layer_norm.weight, Status: Frozen
Layer: decoder.block.8.layer.0.SelfAttention.q.weight, Status: Frozen
Layer: decoder.block.8.layer.0.SelfAttention.k.weight, Status: Frozen
Layer: decoder.block.8.layer.0.SelfAttention.v.weight, Status: Frozen
Layer: decoder.block.8.layer.0.SelfAttention.o.weight, Status: Frozen
Layer: decoder.block.8.layer.0.layer_norm.weight, Status: Frozen
Layer: decoder.block.8.layer.1.EncDecAttention.q.weight, Status:
Frozen
Layer: decoder.block.8.layer.1.EncDecAttention.k.weight, Status:
Frozen
Layer: decoder.block.8.layer.1.EncDecAttention.v.weight, Status:
Frozen
Layer: decoder.block.8.layer.1.EncDecAttention.o.weight, Status:
Frozen
Layer: decoder.block.8.layer.1.layer_norm.weight, Status: Frozen
Layer: decoder.block.8.layer.2.DenseReluDense.wi.weight, Status:
Frozen
Layer: decoder.block.8.layer.2.DenseReluDense.wo.weight, Status:
Frozen
Layer: decoder.block.8.layer.2.layer_norm.weight, Status: Frozen
Layer: decoder.block.9.layer.0.SelfAttention.q.weight, Status:
Trainable
Layer: decoder.block.9.layer.0.SelfAttention.k.weight, Status:
Trainable
Layer: decoder.block.9.layer.0.SelfAttention.v.weight, Status:
Trainable
Layer: decoder.block.9.layer.0.SelfAttention.o.weight, Status:
Trainable
Layer: decoder.block.9.layer.0.layer_norm.weight, Status: Trainable
Layer: decoder.block.9.layer.1.EncDecAttention.q.weight, Status:
Trainable
Layer: decoder.block.9.layer.1.EncDecAttention.k.weight, Status:
Trainable
Layer: decoder.block.9.layer.1.EncDecAttention.v.weight, Status:
Trainable
Layer: decoder.block.9.layer.1.EncDecAttention.o.weight, Status:
Trainable
Layer: decoder.block.9.layer.1.layer_norm.weight, Status: Trainable
```

```
Layer: decoder.block.9.layer.2.DenseReluDense.wi.weight, Status:
Trainable
Layer: decoder.block.9.layer.2.DenseReluDense.wo.weight, Status:
Trainable
Layer: decoder.block.9.layer.2.layer_norm.weight, Status: Trainable
Layer: decoder.block.10.layer.0.SelfAttention.q.weight, Status:
Trainable
Layer: decoder.block.10.layer.0.SelfAttention.k.weight, Status:
Trainable
Layer: decoder.block.10.layer.0.SelfAttention.v.weight, Status:
Trainable
Layer: decoder.block.10.layer.0.SelfAttention.o.weight, Status:
Trainable
Layer: decoder.block.10.layer.0.layer_norm.weight, Status: Trainable
Layer: decoder.block.10.layer.1.EncDecAttention.q.weight, Status:
Trainable
Layer: decoder.block.10.layer.1.EncDecAttention.k.weight, Status:
Trainable
Layer: decoder.block.10.layer.1.EncDecAttention.v.weight, Status:
Trainable
Layer: decoder.block.10.layer.1.EncDecAttention.o.weight, Status:
Trainable
Layer: decoder.block.10.layer.1.layer_norm.weight, Status: Trainable
Layer: decoder.block.10.layer.2.DenseReluDense.wi.weight, Status:
Trainable
Layer: decoder.block.10.layer.2.DenseReluDense.wo.weight, Status:
Trainable
Layer: decoder.block.10.layer.2.layer_norm.weight, Status: Trainable
Layer: decoder.block.11.layer.0.SelfAttention.q.weight, Status:
Trainable
Layer: decoder.block.11.layer.0.SelfAttention.k.weight, Status:
Trainable
Layer: decoder.block.11.layer.0.SelfAttention.v.weight, Status:
Trainable
Layer: decoder.block.11.layer.0.SelfAttention.o.weight, Status:
Trainable
Layer: decoder.block.11.layer.0.layer_norm.weight, Status: Trainable
Layer: decoder.block.11.layer.1.EncDecAttention.q.weight, Status:
Trainable
Layer: decoder.block.11.layer.1.EncDecAttention.k.weight, Status:
Trainable
Layer: decoder.block.11.layer.1.EncDecAttention.v.weight, Status:
Trainable
Layer: decoder.block.11.layer.1.EncDecAttention.o.weight, Status:
Trainable
Layer: decoder.block.11.layer.1.layer_norm.weight, Status: Trainable
Layer: decoder.block.11.layer.2.DenseReluDense.wi.weight, Status:
Trainable
Layer: decoder.block.11.layer.2.DenseReluDense.wo.weight, Status:
Trainable
```

```
Layer: decoder.block.11.layer.2.layer_norm.weight, Status: Trainable
Layer: decoder.final_layer_norm.weight, Status: Trainable

import torch
import numpy as np
from torch.utils.data import Dataset

class GifAggregationDataset(Dataset):
    def __init__(self, frames_list, targets, tokenizer,
max_target_length=150):
        """
        frames_list: A list of lists containing frames (as tensors or
numpy arrays) for each GIF.
        targets: The ground truth captions for each GIF.
        tokenizer: Tokenizer for T5 to encode the target captions.
        max_target_length: Maximum length for the target text
sequences.
        """
        self.frames_list = frames_list  # List of frame sequences
(e.g., list of tensors for each GIF)
        self.targets = targets  # Ground truth captions for each GIF
        self.tokenizer = tokenizer
        self.max_target_length = max_target_length

    def __len__(self):
        return len(self.frames_list)

    def __getitem__(self, idx):
        # Get frames and target for the given index
        frames = self.frames_list[idx]  # List or tensor of frames for
a single GIF
        target_text = self.targets[idx]

        # Ensure frames are in the correct shape (num_frames, height,
width, channels)
        if isinstance(frames, list):
            # Convert list of numpy arrays to a single numpy array, if
necessary
            frames = np.array(frames)

        # If frames are numpy arrays, convert to torch tensor and make
sure dimensions are correct
        if isinstance(frames, np.ndarray):
            frames = torch.tensor(frames, dtype=torch.float32)  #
Convert to float32 tensor for PyTorch

        # Reshape or permute frames to ensure the shape is
(num_frames, height, width, channels)
        if frames.ndim == 4 and frames.shape[-1] == 3:
            # Shape is (num_frames, height, width, channels), which is
```

```
correct for PIL conversion
            pass
        elif frames.ndim == 4 and frames.shape[1] == 3:
            # If frames have shape (num_frames, channels, height,
width), change to (num_frames, height, width, channels)
            frames = frames.permute(0, 2, 3, 1)  # (N, C, H, W) -> (N,
H, W, C)

        # Tokenize the target caption (ground-truth description)
        target_encoding = self.tokenizer(
            target_text,
            padding='max_length',
            truncation=True,
            max_length=self.max_target_length,
            return_tensors="pt"
        )

        # Replace padding token ID's of the labels by -100 to ignore
them in the loss
        labels = target_encoding.input_ids.squeeze()
        labels[labels == self.tokenizer.pad_token_id] = -100

        return {
            'frames': frames,  # Provide frames directly in tensor
format (num_frames, height, width, channels)
            'labels': labels,  # Provide tokenized ground truth
captions for T5
            'reference_description': target_text
        }

import torch
import torch.nn as nn
import torch.optim as optim
from transformers import T5Tokenizer
from torch.utils.data import DataLoader, random_split

# Setup the models in training mode
blip_model.train()  # BLIP is now being trained, so it's in training
mode
t5_model.train()    # T5 is also being trained

# Define optimizers for BLIP and T5
blip_params = filter(lambda p: p.requires_grad,
blip_model.parameters())
t5_params = filter(lambda p: p.requires_grad, t5_model.parameters())

blip_optimizer = optim.AdamW(blip_params, lr=0.00005)  # Lower
learning rate since we're training both
t5_optimizer = optim.AdamW(t5_params, lr=0.00005)
```

```
# Define the loss function for T5
criterion = nn.CrossEntropyLoss(ignore_index=-100)

# Prepare DataLoader (frames and target descriptions)

aggregation_dataset = GifAggregationDataset(
    frames_list=processed_gifs,   # This should be the frames for each
GIF (as a list of tensors)
    targets=target_texts,      # The ground truth aggregated captions
    tokenizer=t5_tokenizer,    # Tokenizer for processing the target
texts
    max_target_length=150      # Max length for target captions
)

# Split dataset into training and validation sets (80-20 split)
train_size = int(0.8 * len(aggregation_dataset))
val_size = len(aggregation_dataset) - train_size
train_dataset, val_dataset = random_split(aggregation_dataset,
[train_size, val_size])

# Create DataLoaders
train_dataloader = DataLoader(
    train_dataset,
    batch_size=16,  # Define the batch size that fits your GPU memory
    shuffle=True,
    num_workers=0,
    pin_memory=True
)

val_dataloader = DataLoader(
    val_dataset,
    batch_size=16,  # Define the batch size for validation
    shuffle=False,
    num_workers=0,
    pin_memory=True
)
```

Function to evaluate the model in the training phase

```
import torch
from tqdm import tqdm
from rouge_score import rouge_scorer
from nltk.translate.bleu_score import corpus_bleu
from nltk.translate.meteor_score import meteor_score
import bert_score
from PIL import Image

def evaluate_model_training(blip_model, t5_model, blip_processor,
tokenizer, dataloader, device='cuda' if torch.cuda.is_available() else
'cpu'):
    blip_model.eval()  # Set BLIP to evaluation mode
    t5_model.eval()    # Set T5 to evaluation mode

    # Metrics containers
    all_references = []
    all_candidates = []
    rougeL_scores = []


    # ROUGE scorer initialization
    scorer = rouge_scorer.RougeScorer(['rougeL'], use_stemmer=True)


    with torch.no_grad():
        for batch in tqdm(dataloader, desc="Evaluating"):
            # Step 1: Prepare frames for BLIP
            frames = batch['frames']  # Assuming shape [batch_size, num_frames, C, H, W] or [batch_size, num_frames, H, W, C]
            reference_descriptions = batch['reference_description']  # List of reference captions

            batch_size, num_frames = frames.shape[0], frames.shape[1]

            frame_captions = []

            for i in range(batch_size):
                single_captions = []
                for j in range(num_frames):
                    frame = frames[i, j]  # Shape depends on data format

                    # Determine frame shape and permute if necessary
                    if frame.ndim == 3:
                        # Possible shapes:
                        # [C, H, W] or [H, W, C]
                        if frame.shape[0] == 3:
                            # [C, H, W] -> [H, W, C]
                            frame = frame.permute(1, 2, 0)
                        # Else assume [H, W, C], no change needed
                    else:
                        raise ValueError(f"Unexpected frame shape: {frame.shape}")

                    # Convert to CPU and numpy
                    frame_np = frame.cpu().numpy().astype('uint8')  # Ensure dtype is uint8

                    # Convert to PIL Image
                    try:
                        img = Image.fromarray(frame_np).convert('RGB')
                    except Exception as e:
                        print(f"Error converting frame to image: {e}")
                        continue  # Skip this frame

                    # Generate caption using BLIP
                    inputs = blip_processor(img, 
return_tensors="pt").to(device)
                    outputs = blip_model.generate(**inputs, 
max_length=150)  # Limit caption length
                    caption = blip_processor.decode(outputs[0], 
skip_special_tokens=True)
                    single_captions.append(caption)

                # Concatenate captions for the current example
                concatenated_caption = " ".join(single_captions)
                frame_captions.append(concatenated_caption)

            # Step 2: Tokenize the concatenated captions as a batch
            max_length = 128  # Adjust based on GPU capacity and 
desired sequence length
            t5_inputs = tokenizer(
                frame_captions,  # List of concatenated captions, one 
per example in the batch
                max_length=max_length,
                padding='max_length',
                truncation=True,
                return_tensors="pt"
            ).to(device)

            # Step 3: Generate predictions using T5
            outputs = t5_model.generate(
                input_ids=t5_inputs.input_ids,
                attention_mask=t5_inputs.attention_mask,
                max_length=150,
                num_beams=4,
                early_stopping=True
            )

            # Step 4: Decode predictions
            predictions = tokenizer.batch_decode(outputs, 
skip_special_tokens=True)

            # Step 5: Evaluate the predictions
            for ref, pred in zip(reference_descriptions, predictions):
                ref_tokens = ref.split()
                pred_tokens = pred.split()

                # Append references and predictions for BLEU
                all_references.append([ref_tokens])
                all_candidates.append(pred_tokens)
                # ROUGE scores calculation
                scores = scorer.score(ref, pred)
                rougeL_scores.append(scores['rougeL'].fmeasure)

    # Calculate average ROUGE scores
    avg_rougeL = sum(rougeL_scores) / len(rougeL_scores) if
rougeL_scores else 0


    # Compile metrics
    metrics = {
        'ROUGE-L': avg_rougeL,
    }

    return metrics
```

Function to evaluate the models when they finished training phase

```
import torch
from tqdm import tqdm
from rouge_score import rouge_scorer
from nltk.translate.bleu_score import corpus_bleu
from nltk.translate.meteor_score import meteor_score
import bert_score
from PIL import Image

def evaluate_model(blip_model, t5_model, blip_processor, tokenizer,
dataloader, device='cuda' if torch.cuda.is_available() else 'cpu'):
    blip_model.eval()  # Set BLIP to evaluation mode
    t5_model.eval()    # Set T5 to evaluation mode

    # Metrics containers
    all_references = []
    all_candidates = []
    rouge1_scores = []
    rouge2_scores = []
    rougeL_scores = []
    # meteor_scores_list = []

    # ROUGE scorer initialization
    scorer = rouge_scorer.RougeScorer(['rouge1', 'rouge2', 'rougeL'],
use_stemmer=True)

    # BERTScore
    bert_score_fn = bert_score.score

    with torch.no_grad():
        for batch in tqdm(dataloader, desc="Evaluating"):
            # Step 1: Prepare frames for BLIP
            frames = batch['frames']  # Assuming shape [batch_size,
num_frames, C, H, W] or [batch_size, num_frames, H, W, C]
            reference_descriptions = batch['reference_description']  #
List of reference captions

            batch_size, num_frames = frames.shape[0], frames.shape[1]

            frame_captions = []

            for i in range(batch_size):
                single_captions = []
                for j in range(num_frames):
                    frame = frames[i, j]  # Shape depends on data
format

                    # Determine frame shape and permute if necessary
                    if frame.ndim == 3:
                        # Possible shapes:
                        # [C, H, W] or [H, W, C]
                        if frame.shape[0] == 3:
                            # [C, H, W] -> [H, W, C]
                            frame = frame.permute(1, 2, 0)
                        # Else assume [H, W, C], no change needed
                    else:
                        raise ValueError(f"Unexpected frame shape:
{frame.shape}")

                    # Convert to CPU and numpy
                    frame_np = frame.cpu().numpy().astype('uint8')  #
Ensure dtype is uint8

                    # Convert to PIL Image
                    try:
                        img = Image.fromarray(frame_np).convert('RGB')
                    except Exception as e:
                        print(f"Error converting frame to image: {e}")
                        continue  # Skip this frame

                    # Generate caption using BLIP
                    inputs = blip_processor(img,
return_tensors="pt").to(device)
                    outputs = blip_model.generate(**inputs,
max_length=50)  # Limit caption length
                    caption = blip_processor.decode(outputs[0],
skip_special_tokens=True)
                    single_captions.append(caption)

                # Concatenate captions for the current example
                concatenated_caption = " ".join(single_captions)
                frame_captions.append(concatenated_caption)
            # Step 2: Tokenize the concatenated captions as a batch
            max_length = 128  # Adjust based on GPU capacity and
desired sequence length
            t5_inputs = tokenizer(
                frame_captions,  # List of concatenated captions, one
per example in the batch
                max_length=max_length,
                padding='max_length',
                truncation=True,
                return_tensors="pt"
            ).to(device)

            # Step 3: Generate predictions using T5
            outputs = t5_model.generate(
                input_ids=t5_inputs.input_ids,
                attention_mask=t5_inputs.attention_mask,
                max_length=150,
                num_beams=4,
                early_stopping=True
            )

            # Step 4: Decode predictions
            predictions = tokenizer.batch_decode(outputs,
skip_special_tokens=True)

            # Step 5: Evaluate the predictions
            for ref, pred in zip(reference_descriptions, predictions):
                ref_tokens = ref.split()
                pred_tokens = pred.split()

                # Append references and predictions for BLEU
                all_references.append([ref_tokens])
                all_candidates.append(pred_tokens)

                # ROUGE scores calculation
                scores = scorer.score(ref, pred)
                rouge1_scores.append(scores['rouge1'].fmeasure)
                rouge2_scores.append(scores['rouge2'].fmeasure)
                rougeL_scores.append(scores['rougeL'].fmeasure)

                # METEOR score calculation
                # meteor = meteor_score([ref_tokens], pred_tokens)
                # meteor_scores_list.append(meteor)

    # Calculate BLEU score
    bleu = corpus_bleu(all_references, all_candidates)

    # Calculate average ROUGE scores
    avg_rouge1 = sum(rouge1_scores) / len(rouge1_scores) if
```

```
rouge1_scores else 0
    avg_rouge2 = sum(rouge2_scores) / len(rouge2_scores) if
rouge2_scores else 0
    avg_rougeL = sum(rougeL_scores) / len(rougeL_scores) if
rougeL_scores else 0

    # Calculate average METEOR score
    # avg_meteor = sum(meteor_scores_list) / len(meteor_scores_list)
if meteor_scores_list else 0

    # Calculate BERT Score
    P, R, F1 = bert_score_fn(
        [' '.join(cand) for cand in all_candidates],
        [' '.join(ref[0]) for ref in all_references],
        lang='en',
        verbose=True)
    avg_bert_f1 = F1.mean().item()

    # Compile metrics
    metrics = {
        'BLEU': bleu,
        'ROUGE-1': avg_rouge1,
        'ROUGE-2': avg_rouge2,
        'ROUGE-L': avg_rougeL,
        # 'METEOR': avg_meteor,
        'BERT_F1': avg_bert_f1
    }

    return metrics

import torch
from torch.optim import AdamW
from PIL import Image
from transformers import T5Tokenizer
import torch.nn.functional as F

# Set the models to training mode
t5_model.train()
blip_model.train()

# Filter parameters that require gradients for BLIP and T5 models
blip_params = filter(lambda p: p.requires_grad,
blip_model.parameters())
t5_params = filter(lambda p: p.requires_grad, t5_model.parameters())

# Define the optimizer using AdamW with appropriate learning rates
blip_optimizer = AdamW(blip_params, lr=1e-4)
t5_optimizer = AdamW(t5_params, lr=1e-4)

# Training Loop
```

```
epochs = 7
device = 'cuda' if torch.cuda.is_available() else 'cpu'
blip_model.to(device)
t5_model.to(device)

# Lists to store metrics over epochs
training_losses = []
#bleu_scores = []
#rouge1_scores = []
#rouge2_scores = []
rougeL_scores = []
# meteor_scores = []
#bert_f1_scores = []

# Training both BLIP and T5 using the DataLoader
for epoch in range(epochs):
    t5_model.train()
    blip_model.train()

    # Initialize average loss for tracking epoch training loss
    epoch_loss = 0.0
    num_batches = 0

    for batch in train_dataloader:
        # Step 1: Prepare data for BLIP
        frames = batch['frames']  # Get frames for the current batch
        # Assuming frames is a list of shape [batch_size, num_frames,
height, width, channels]
        batch_size = frames.size(0)
        frames = frames.to(device)  # Move frames to GPU if available

        # Zero gradients for both optimizers
        blip_optimizer.zero_grad()
        t5_optimizer.zero_grad()

        # Step 2: Generate frame-level captions with BLIP
        frame_captions = []
        for i in range(batch_size):
            single_captions = []
            for single_frame in frames[i]:
                # Convert frame to a PIL image and generate caption
using BLIP model
                img =
Image.fromarray(single_frame.cpu().numpy().astype('uint8'), 'RGB')
                inputs = blip_processor(img,
return_tensors="pt").to(device)

                # Set max_length explicitly for BLIP generation to
avoid inconsistent lengths
                outputs = blip_model.generate(**inputs,
max_length=200)  # Limit caption length to 150 tokens
                caption = blip_processor.decode(outputs[0],
skip_special_tokens=True)
                single_captions.append(caption)
            # Concatenate captions for the current example
            concatenated_caption = " ".join(single_captions)
            frame_captions.append(concatenated_caption)

        # Step 3: Tokenize the concatenated captions as a batch
        max_length = 200  # Adjust as needed based on your GPU
capacity
        t5_inputs = t5_tokenizer(
            frame_captions,  # List of concatenated captions, one per
example in the batch
            max_length=max_length,
            padding='max_length',
            truncation=True,
            return_tensors="pt"
        ).to(device)

        # Prepare labels
        labels = batch['labels'].to(device)
        labels = labels[:, :t5_inputs.input_ids.shape[-1]]  # Truncate
labels if necessary

        # Pad labels to match input length using -100 to ignore during
loss calculation
        labels = F.pad(
            labels,
            (0, max(0, t5_inputs.input_ids.shape[-1] - labels.shape[-
1])),
            value=-100
        )

        # Ensure the attention mask is consistent
        t5_attention_mask = t5_inputs.attention_mask

        # Step 5: Forward pass through T5 model
        outputs = t5_model(
            input_ids=t5_inputs.input_ids,
            attention_mask=t5_attention_mask,
            labels=labels
        )
        loss = outputs.loss

        # Step 6: Backpropagation and optimizer step
        loss.backward()  # Compute gradients for both models (BLIP and
T5)
        blip_optimizer.step()
        t5_optimizer.step()
```

```python
        # Accumulate the loss for averaging
        epoch_loss += loss.item()
        num_batches += 1

        # Step 7: Print the training loss for the current iteration
        print(f"Epoch [{epoch + 1}/{epochs}], Batch Loss:
{loss.item()}")

    # Calculate the average training loss for the epoch
    average_epoch_loss = epoch_loss / num_batches
    training_losses.append(average_epoch_loss)
    print(f"Epoch [{epoch + 1}/{epochs}], Average Training Loss:
{average_epoch_loss}")

    # Evaluate after each epoch
    metrics = evaluate_model_training(blip_model, t5_model,
blip_processor, t5_tokenizer, val_dataloader, device)
    #bleu_scores.append(metrics['BLEU'])
    #rouge1_scores.append(metrics['ROUGE-1'])
    #rouge2_scores.append(metrics['ROUGE-2'])
    rougeL_scores.append(metrics['ROUGE-L'])
    # meteor_scores.append(metrics['METEOR'])
    # bert_f1_scores.append(metrics['BERT_F1'])

    # Print evaluation metrics for each epoch
    print(f"Validation Metrics after Epoch {epoch+1}: {metrics}")

    # Clear GPU cache after each epoch to free up memory
    torch.cuda.empty_cache()
```

```
Epoch [1/7], Batch Loss: 2.792562484741211
Epoch [1/7], Batch Loss: 3.05653715133667
Epoch [1/7], Batch Loss: 2.8849689960479736
Epoch [1/7], Batch Loss: 2.9645094871520996
Epoch [1/7], Batch Loss: 2.6882576942443848
Epoch [1/7], Batch Loss: 2.5022499561309814
Epoch [1/7], Batch Loss: 2.851562261581421
Epoch [1/7], Batch Loss: 2.91620135307312
Epoch [1/7], Batch Loss: 3.1907904148101807
Epoch [1/7], Batch Loss: 2.9111499786376953
Epoch [1/7], Batch Loss: 3.0466115474700928
Epoch [1/7], Batch Loss: 2.8951869010925293
Epoch [1/7], Batch Loss: 2.815492868423462
Epoch [1/7], Batch Loss: 2.6365480422973633
Epoch [1/7], Batch Loss: 2.799355983734131
Epoch [1/7], Batch Loss: 2.536698579788208
Epoch [1/7], Batch Loss: 2.613626003265381
Epoch [1/7], Batch Loss: 2.661198377609253
Epoch [1/7], Batch Loss: 2.7486190795898438
Epoch [1/7], Batch Loss: 2.721141815185547
Epoch [1/7], Batch Loss: 2.695596933364868
Epoch [1/7], Batch Loss: 2.6508281230926514
Epoch [1/7], Batch Loss: 2.557412624359131
Epoch [1/7], Batch Loss: 3.0691192150115967
Epoch [1/7], Batch Loss: 2.6178832054138184
Epoch [1/7], Batch Loss: 2.716886520385742
Epoch [1/7], Batch Loss: 2.892625331878662
Epoch [1/7], Batch Loss: 2.5394060611724854
Epoch [1/7], Batch Loss: 2.2684273719787598
Epoch [1/7], Batch Loss: 2.6580679416656494
Epoch [1/7], Batch Loss: 2.595590591430664
Epoch [1/7], Batch Loss: 2.724113941192627
Epoch [1/7], Batch Loss: 2.3373875617980957
Epoch [1/7], Batch Loss: 2.622941017150879
Epoch [1/7], Batch Loss: 2.670625925064087
Epoch [1/7], Batch Loss: 2.3872199058532715
Epoch [1/7], Batch Loss: 2.351562023162842
Epoch [1/7], Batch Loss: 2.644439935684204
Epoch [1/7], Batch Loss: 2.3942604064941406
Epoch [1/7], Batch Loss: 2.319535493850708
Epoch [1/7], Batch Loss: 2.723679780960083
Epoch [1/7], Batch Loss: 2.794512987136841
Epoch [1/7], Batch Loss: 2.486840009689331
Epoch [1/7], Batch Loss: 2.5631191730499268
Epoch [1/7], Batch Loss: 2.565117597579956
Epoch [1/7], Batch Loss: 2.6146843433380127
Epoch [1/7], Batch Loss: 2.479147434234619
Epoch [1/7], Batch Loss: 2.392965078353882
Epoch [1/7], Batch Loss: 2.6993730068206787
Epoch [1/7], Batch Loss: 2.6262025833129883
Epoch [1/7], Batch Loss: 2.429753303527832
Epoch [1/7], Batch Loss: 2.519545316696167
Epoch [1/7], Batch Loss: 2.65714168548584
Epoch [1/7], Batch Loss: 2.45499587059021
Epoch [1/7], Batch Loss: 2.672262191772461
Epoch [1/7], Batch Loss: 2.419902801513672
Epoch [1/7], Batch Loss: 2.4081788063049316
Epoch [1/7], Batch Loss: 2.5227558612823486
Epoch [1/7], Batch Loss: 2.254258632659912
Epoch [1/7], Batch Loss: 2.55667781829834
Epoch [1/7], Batch Loss: 2.4328277111053467
Epoch [1/7], Batch Loss: 2.791801691055298
Epoch [1/7], Batch Loss: 2.7886228561401367
Epoch [1/7], Batch Loss: 2.450453281402588
Epoch [1/7], Batch Loss: 2.238307476043701
Epoch [1/7], Batch Loss: 2.8428313732147217
Epoch [1/7], Batch Loss: 2.7892682552337646
Epoch [1/7], Batch Loss: 2.473942279815674
Epoch [1/7], Batch Loss: 2.133924722671509
Epoch [1/7], Batch Loss: 2.0994653701782227
Epoch [1/7], Batch Loss: 2.2195956707000732
Epoch [1/7], Batch Loss: 2.6091225147247314
Epoch [1/7], Batch Loss: 2.849940299987793
Epoch [1/7], Batch Loss: 2.6282076835632324
Epoch [1/7], Batch Loss: 2.5078916549682617
Epoch [1/7], Average Training Loss: 2.621926883061727

Evaluating: 100%|██████████| 19/19 [05:37<00:00, 17.78s/it]

Validation Metrics after Epoch 1: {'ROUGE-L': 0.3243333918983624}
Epoch [2/7], Batch Loss: 2.473907947540283
Epoch [2/7], Batch Loss: 2.302682638168335
Epoch [2/7], Batch Loss: 2.329249858856201
Epoch [2/7], Batch Loss: 2.5172479152679443
Epoch [2/7], Batch Loss: 2.761099100112915
Epoch [2/7], Batch Loss: 2.3488035202026367
Epoch [2/7], Batch Loss: 2.4597198963165283
Epoch [2/7], Batch Loss: 2.6647422313690186
Epoch [2/7], Batch Loss: 2.5523948669433594
Epoch [2/7], Batch Loss: 2.1182148456573486
Epoch [2/7], Batch Loss: 2.4329872131347656
Epoch [2/7], Batch Loss: 2.316796064376831
Epoch [2/7], Batch Loss: 2.259514808654785
Epoch [2/7], Batch Loss: 2.6163504123687744
Epoch [2/7], Batch Loss: 2.3733248710632324
Epoch [2/7], Batch Loss: 2.4834394454956055
Epoch [2/7], Batch Loss: 2.3729352951049805
Epoch [2/7], Batch Loss: 2.58955717086792
Epoch [2/7], Batch Loss: 2.56703782081604
Epoch [2/7], Batch Loss: 2.5039615631103516
Epoch [2/7], Batch Loss: 2.472188949584961
Epoch [2/7], Batch Loss: 2.455782413482666
Epoch [2/7], Batch Loss: 2.459120273590088
Epoch [2/7], Batch Loss: 2.235743284225464
Epoch [2/7], Batch Loss: 2.5564215183258057
Epoch [2/7], Batch Loss: 2.3535382747650146
Epoch [2/7], Batch Loss: 2.568927526473999
Epoch [2/7], Batch Loss: 2.387378454208374
Epoch [2/7], Batch Loss: 2.713947057723999
Epoch [2/7], Batch Loss: 2.4272289276123047
Epoch [2/7], Batch Loss: 2.3013620376586914
Epoch [2/7], Batch Loss: 2.389380931854248
Epoch [2/7], Batch Loss: 2.330120086669922
Epoch [2/7], Batch Loss: 2.503119707107544
Epoch [2/7], Batch Loss: 2.4521543979644775
Epoch [2/7], Batch Loss: 2.468416213989258
Epoch [2/7], Batch Loss: 2.0798542499542236
Epoch [2/7], Batch Loss: 2.617144823074341
Epoch [2/7], Batch Loss: 2.2453935146331787
Epoch [2/7], Batch Loss: 2.52299165725708
Epoch [2/7], Batch Loss: 2.45682954788208
Epoch [2/7], Batch Loss: 2.378944158554077
Epoch [2/7], Batch Loss: 2.700363874435425
Epoch [2/7], Batch Loss: 2.080040454864502
Epoch [2/7], Batch Loss: 2.543712615966797
Epoch [2/7], Batch Loss: 2.2072529792785645
Epoch [2/7], Batch Loss: 2.27642822265625
Epoch [2/7], Batch Loss: 2.521725654602051
Epoch [2/7], Batch Loss: 2.4891200065612793
Epoch [2/7], Batch Loss: 2.2736752033233643
Epoch [2/7], Batch Loss: 2.6230950355529785
Epoch [2/7], Batch Loss: 2.5693767070770264
Epoch [2/7], Batch Loss: 2.3844621181488037
Epoch [2/7], Batch Loss: 2.45255970954895
Epoch [2/7], Batch Loss: 2.205230712890625
Epoch [2/7], Batch Loss: 2.4437568187713623
Epoch [2/7], Batch Loss: 2.4140477180480957
Epoch [2/7], Batch Loss: 2.439300060272217
Epoch [2/7], Batch Loss: 2.313997268676758
Epoch [2/7], Batch Loss: 2.554961919784546
Epoch [2/7], Batch Loss: 2.4694268703460693
Epoch [2/7], Batch Loss: 2.4955074787139893
Epoch [2/7], Batch Loss: 2.322580099105835
Epoch [2/7], Batch Loss: 2.6096081733703613
Epoch [2/7], Batch Loss: 2.311009645462036
Epoch [2/7], Batch Loss: 2.4948084354400635
Epoch [2/7], Batch Loss: 2.212188243865967
Epoch [2/7], Batch Loss: 2.2408926486968994
Epoch [2/7], Batch Loss: 2.22233510017395
Epoch [2/7], Batch Loss: 2.5274388790130615
Epoch [2/7], Batch Loss: 2.517465591430664
Epoch [2/7], Batch Loss: 2.412813186645508
Epoch [2/7], Batch Loss: 2.2280445098876953
Epoch [2/7], Batch Loss: 2.306326389312744
Epoch [2/7], Batch Loss: 2.5579192638397217
Epoch [2/7], Average Training Loss: 2.4245523611704507

Evaluating: 100%|██████████| 19/19 [05:40<00:00, 17.94s/it]

Validation Metrics after Epoch 2: {'ROUGE-L': 0.344430507047284}
Epoch [3/7], Batch Loss: 2.1594936847686768
Epoch [3/7], Batch Loss: 2.2254562377929688
Epoch [3/7], Batch Loss: 2.238584041595459
Epoch [3/7], Batch Loss: 2.3106191158294678
Epoch [3/7], Batch Loss: 2.3417437076568604
Epoch [3/7], Batch Loss: 2.27418851852417
Epoch [3/7], Batch Loss: 2.168013572692871
Epoch [3/7], Batch Loss: 2.4113423824310303
Epoch [3/7], Batch Loss: 2.413123607635498
Epoch [3/7], Batch Loss: 2.1674985885620117
Epoch [3/7], Batch Loss: 2.2781403064727783
Epoch [3/7], Batch Loss: 2.450666666030884
Epoch [3/7], Batch Loss: 2.333395004272461
Epoch [3/7], Batch Loss: 2.5388786792755127
Epoch [3/7], Batch Loss: 2.3976004123687744
Epoch [3/7], Batch Loss: 2.227501392364502
Epoch [3/7], Batch Loss: 2.392740249633789
Epoch [3/7], Batch Loss: 2.5090410709381104
Epoch [3/7], Batch Loss: 2.302180051803589
Epoch [3/7], Batch Loss: 2.5127153396606445
Epoch [3/7], Batch Loss: 2.105900526046753
Epoch [3/7], Batch Loss: 2.37640380859375
Epoch [3/7], Batch Loss: 2.359524965286255
Epoch [3/7], Batch Loss: 2.455698013305664
Epoch [3/7], Batch Loss: 2.440885305404663
Epoch [3/7], Batch Loss: 2.180384874343872
Epoch [3/7], Batch Loss: 2.5481936931610107
Epoch [3/7], Batch Loss: 2.4100120067596436
Epoch [3/7], Batch Loss: 2.3338232040405273
Epoch [3/7], Batch Loss: 2.1490001678466797
Epoch [3/7], Batch Loss: 2.313507556915283
Epoch [3/7], Batch Loss: 2.412898063659668
Epoch [3/7], Batch Loss: 2.318373680114746
Epoch [3/7], Batch Loss: 2.3067574501037598
Epoch [3/7], Batch Loss: 2.3636155128479004
Epoch [3/7], Batch Loss: 2.3872010707855225
Epoch [3/7], Batch Loss: 2.4502766132354736
Epoch [3/7], Batch Loss: 2.4639973640441895
Epoch [3/7], Batch Loss: 2.333822727203369
Epoch [3/7], Batch Loss: 2.081879138946533
Epoch [3/7], Batch Loss: 2.237070322036743
Epoch [3/7], Batch Loss: 2.232893228530884
Epoch [3/7], Batch Loss: 2.285958766937256
Epoch [3/7], Batch Loss: 2.4619176387786865
Epoch [3/7], Batch Loss: 2.2604429721832275
Epoch [3/7], Batch Loss: 2.2655153274536133
Epoch [3/7], Batch Loss: 2.482696771621704
Epoch [3/7], Batch Loss: 2.1740479469299316
Epoch [3/7], Batch Loss: 2.2022299766540527
Epoch [3/7], Batch Loss: 2.5882089138031006
Epoch [3/7], Batch Loss: 2.41127872467041
Epoch [3/7], Batch Loss: 2.2348477840423584
Epoch [3/7], Batch Loss: 2.2224011421203613
Epoch [3/7], Batch Loss: 2.337162971496582
Epoch [3/7], Batch Loss: 2.255171537399292
Epoch [3/7], Batch Loss: 2.2868802547454834
Epoch [3/7], Batch Loss: 2.2586216926574707
Epoch [3/7], Batch Loss: 2.3802683353424072
Epoch [3/7], Batch Loss: 2.3150317668914795
Epoch [3/7], Batch Loss: 2.4159576892852783
Epoch [3/7], Batch Loss: 2.4201531410217285
Epoch [3/7], Batch Loss: 2.0149495601654053
Epoch [3/7], Batch Loss: 2.3650448322296143
Epoch [3/7], Batch Loss: 2.2265522480010986
Epoch [3/7], Batch Loss: 2.4751734733581543
Epoch [3/7], Batch Loss: 2.3235912322998047
Epoch [3/7], Batch Loss: 2.230715751647949
Epoch [3/7], Batch Loss: 2.383399248123169
Epoch [3/7], Batch Loss: 2.320690393447876
Epoch [3/7], Batch Loss: 2.3636586666107178
Epoch [3/7], Batch Loss: 2.1514906883239746
Epoch [3/7], Batch Loss: 2.358126401901245
Epoch [3/7], Batch Loss: 2.4013311862945557
Epoch [3/7], Batch Loss: 2.4799017906188965
Epoch [3/7], Batch Loss: 2.445903778076172
Epoch [3/7], Average Training Loss: 2.32952486038208

Evaluating: 100%|██████████| 19/19 [05:39<00:00, 17.85s/it]

Validation Metrics after Epoch 3: {'ROUGE-L': 0.345049722565402}
Epoch [4/7], Batch Loss: 2.332324504852295
Epoch [4/7], Batch Loss: 1.9613622426986694
Epoch [4/7], Batch Loss: 2.4344804286956787
Epoch [4/7], Batch Loss: 2.2704036235809326
Epoch [4/7], Batch Loss: 2.047391653060913
Epoch [4/7], Batch Loss: 2.4810235500335693
Epoch [4/7], Batch Loss: 2.0178885459899902
Epoch [4/7], Batch Loss: 2.5367531776428223
Epoch [4/7], Batch Loss: 2.224294424057007
Epoch [4/7], Batch Loss: 2.3060758113861084
Epoch [4/7], Batch Loss: 1.9798797369003296
Epoch [4/7], Batch Loss: 2.010374069213867
Epoch [4/7], Batch Loss: 2.366204023361206
Epoch [4/7], Batch Loss: 2.5163962841033936
Epoch [4/7], Batch Loss: 2.3553290367126465
Epoch [4/7], Batch Loss: 2.0656449794769287
Epoch [4/7], Batch Loss: 2.4845731258392334
Epoch [4/7], Batch Loss: 2.170170783996582
Epoch [4/7], Batch Loss: 2.3512303829193115
Epoch [4/7], Batch Loss: 2.300783395767212
Epoch [4/7], Batch Loss: 2.099226951599121
Epoch [4/7], Batch Loss: 2.3625922203063965
Epoch [4/7], Batch Loss: 2.441337823867798
Epoch [4/7], Batch Loss: 2.4301116466522217
Epoch [4/7], Batch Loss: 2.3263907432556152
Epoch [4/7], Batch Loss: 1.983954906463623
Epoch [4/7], Batch Loss: 2.226391315460205
Epoch [4/7], Batch Loss: 2.379263162612915
Epoch [4/7], Batch Loss: 2.207843542098999
Epoch [4/7], Batch Loss: 2.398375988006592
Epoch [4/7], Batch Loss: 2.414604663848877
Epoch [4/7], Batch Loss: 2.309366226196289
Epoch [4/7], Batch Loss: 2.2828786373138428
Epoch [4/7], Batch Loss: 2.3672001361846924
Epoch [4/7], Batch Loss: 2.266467571258545
Epoch [4/7], Batch Loss: 2.1704819202423096
Epoch [4/7], Batch Loss: 2.212552070617676
Epoch [4/7], Batch Loss: 2.526765823364258
Epoch [4/7], Batch Loss: 2.1123907566070557
Epoch [4/7], Batch Loss: 2.200368642807007
Epoch [4/7], Batch Loss: 2.364555597305298
Epoch [4/7], Batch Loss: 2.289813756942749
Epoch [4/7], Batch Loss: 2.570289134979248
Epoch [4/7], Batch Loss: 2.158773899078369
Epoch [4/7], Batch Loss: 2.2397894859313965
Epoch [4/7], Batch Loss: 2.5088140964508057
Epoch [4/7], Batch Loss: 1.9906984567642212
Epoch [4/7], Batch Loss: 2.2286391258239746
Epoch [4/7], Batch Loss: 2.2493960857391357
Epoch [4/7], Batch Loss: 2.199307918548584
Epoch [4/7], Batch Loss: 2.018333673477173
Epoch [4/7], Batch Loss: 2.325873851776123
Epoch [4/7], Batch Loss: 2.3053174018859863
Epoch [4/7], Batch Loss: 1.8854585886001587
Epoch [4/7], Batch Loss: 2.4385743141174316
Epoch [4/7], Batch Loss: 2.4265918731689453
Epoch [4/7], Batch Loss: 2.214899778366089
Epoch [4/7], Batch Loss: 2.3062381744384766
Epoch [4/7], Batch Loss: 1.9436981678009033
Epoch [4/7], Batch Loss: 2.579129695892334
Epoch [4/7], Batch Loss: 2.1832504272460938
Epoch [4/7], Batch Loss: 2.3401811122894287
Epoch [4/7], Batch Loss: 2.2009291648864746
Epoch [4/7], Batch Loss: 2.140896797180176
Epoch [4/7], Batch Loss: 2.1954007148742676
Epoch [4/7], Batch Loss: 2.220191240310669
Epoch [4/7], Batch Loss: 2.014578104019165
Epoch [4/7], Batch Loss: 2.191800355911255
Epoch [4/7], Batch Loss: 2.5481059551239014
Epoch [4/7], Batch Loss: 1.6948726177215576
Epoch [4/7], Batch Loss: 2.4542059898376465
Epoch [4/7], Batch Loss: 2.120124340057373
Epoch [4/7], Batch Loss: 2.225001335144043
Epoch [4/7], Batch Loss: 2.4827544689178467
Epoch [4/7], Batch Loss: 2.350822687149048
Epoch [4/7], Average Training Loss: 2.260512758890788
```

```
Evaluating: 100%|██████████| 19/19 [05:44<00:00, 18.13s/it]

Validation Metrics after Epoch 4: {'ROUGE-L': 0.3317802685420676}
Epoch [5/7], Batch Loss: 2.312358856201172
Epoch [5/7], Batch Loss: 2.3025755882263184
Epoch [5/7], Batch Loss: 1.948441982269287
Epoch [5/7], Batch Loss: 2.246487617492676
Epoch [5/7], Batch Loss: 2.4745826721191406
Epoch [5/7], Batch Loss: 2.2634265422821045
Epoch [5/7], Batch Loss: 2.0459282398223877
Epoch [5/7], Batch Loss: 2.197880983352661
Epoch [5/7], Batch Loss: 2.2163000106811523
Epoch [5/7], Batch Loss: 2.130763292312622
Epoch [5/7], Batch Loss: 2.293497085571289
Epoch [5/7], Batch Loss: 2.124683380126953
Epoch [5/7], Batch Loss: 2.2604856491088867
Epoch [5/7], Batch Loss: 2.1804897785186768
Epoch [5/7], Batch Loss: 2.147610664367676
Epoch [5/7], Batch Loss: 2.0365312099456787
Epoch [5/7], Batch Loss: 2.1277987957000732
Epoch [5/7], Batch Loss: 2.0480313301086426
Epoch [5/7], Batch Loss: 1.9922146797180176
Epoch [5/7], Batch Loss: 2.1892406940460205
Epoch [5/7], Batch Loss: 2.080991744995117
Epoch [5/7], Batch Loss: 2.123445987701416
Epoch [5/7], Batch Loss: 2.134263038635254
Epoch [5/7], Batch Loss: 2.121415138244629
Epoch [5/7], Batch Loss: 2.3681704998016357
Epoch [5/7], Batch Loss: 2.2607390880584717
Epoch [5/7], Batch Loss: 2.414848804473877
Epoch [5/7], Batch Loss: 1.9840725660324097
Epoch [5/7], Batch Loss: 2.1422922611236572
Epoch [5/7], Batch Loss: 2.1246800422668457
Epoch [5/7], Batch Loss: 2.103226661682129
Epoch [5/7], Batch Loss: 2.186436176300049
Epoch [5/7], Batch Loss: 2.37707257270813
Epoch [5/7], Batch Loss: 2.3411197662353516
Epoch [5/7], Batch Loss: 2.238363027572632
Epoch [5/7], Batch Loss: 2.4496703147888184
Epoch [5/7], Batch Loss: 1.985742211341858
Epoch [5/7], Batch Loss: 2.178551197052002
Epoch [5/7], Batch Loss: 2.3275115489959717
Epoch [5/7], Batch Loss: 2.1327927112579346
Epoch [5/7], Batch Loss: 2.1745541095733643
Epoch [5/7], Batch Loss: 1.800525188446045
Epoch [5/7], Batch Loss: 2.2693941593170166
Epoch [5/7], Batch Loss: 2.0052340030670166
Epoch [5/7], Batch Loss: 2.260847330093384
Epoch [5/7], Batch Loss: 2.301740884780884
Epoch [5/7], Batch Loss: 2.212573289871216
Epoch [5/7], Batch Loss: 2.1069445610046387
Epoch [5/7], Batch Loss: 2.1007611751556396
Epoch [5/7], Batch Loss: 1.626859188079834
Epoch [5/7], Batch Loss: 2.037775754928589
Epoch [5/7], Batch Loss: 2.160681962966919
Epoch [5/7], Batch Loss: 2.0486199855804443
Epoch [5/7], Batch Loss: 2.2519936561584473
Epoch [5/7], Batch Loss: 2.2492048740386963
Epoch [5/7], Batch Loss: 2.3523669242858887
Epoch [5/7], Batch Loss: 2.0610201358795166
Epoch [5/7], Batch Loss: 2.2708969116210938
Epoch [5/7], Batch Loss: 2.157914638519287
Epoch [5/7], Batch Loss: 2.434263229370117
Epoch [5/7], Batch Loss: 2.2026724815368652
Epoch [5/7], Batch Loss: 2.544494867324829
Epoch [5/7], Batch Loss: 2.1853957176208496
Epoch [5/7], Batch Loss: 2.1029481887817383
Epoch [5/7], Batch Loss: 2.3391783237457275
Epoch [5/7], Batch Loss: 2.367377281188965
Epoch [5/7], Batch Loss: 2.312711238861084
Epoch [5/7], Batch Loss: 2.532625675201416
Epoch [5/7], Batch Loss: 2.1843369007110596
Epoch [5/7], Batch Loss: 2.0345985889434814
Epoch [5/7], Batch Loss: 2.6099116802215576
Epoch [5/7], Batch Loss: 2.1024951934814453
Epoch [5/7], Batch Loss: 2.210735559463501
Epoch [5/7], Batch Loss: 1.9930121898651123
Epoch [5/7], Batch Loss: 2.1938745975494385
Epoch [5/7], Average Training Loss: 2.192203664779663

Evaluating: 100%|██████████| 19/19 [05:38<00:00, 17.80s/it]

Validation Metrics after Epoch 5: {'ROUGE-L': 0.33798108652954467}
Epoch [6/7], Batch Loss: 2.0221457481384277
Epoch [6/7], Batch Loss: 1.918637752532959
Epoch [6/7], Batch Loss: 2.465228319168091

----------------------------------------------------------------------
-----
KeyboardInterrupt                         Traceback (most recent call
last)
<ipython-input-19-200128bbeb7c> in <cell line: 35>()
     62 
     63                 # Set max_length explicitly for BLIP
generation to avoid inconsistent lengths
---> 64                 outputs = blip_model.generate(**inputs,
max_length=200)  # Limit caption length to 150 tokens
     65                 caption = blip_processor.decode(outputs[0],
skip_special_tokens=True)
     66                 single_captions.append(caption)
```

```
/usr/local/lib/python3.10/dist-packages/torch/utils/_contextlib.py in
decorate_context(*args, **kwargs)
    114     def decorate_context(*args, **kwargs):
    115         with ctx_factory():
--> 116             return func(*args, **kwargs)
    117 
    118     return decorate_context

/usr/local/lib/python3.10/dist-packages/transformers/models/blip/model
ing_blip.py in generate(self, pixel_values, input_ids, attention_mask,
interpolate_pos_encoding, **generate_kwargs)
   1185         attention_mask = attention_mask[:, :-1] if
attention_mask is not None else None
   1186 
-> 1187         outputs = self.text_decoder.generate(
   1188             input_ids=input_ids[:, :-1],
   1189             eos_token_id=self.config.text_config.sep_token_id,

/usr/local/lib/python3.10/dist-packages/torch/utils/_contextlib.py in
decorate_context(*args, **kwargs)
    114     def decorate_context(*args, **kwargs):
    115         with ctx_factory():
--> 116             return func(*args, **kwargs)
    117 
    118     return decorate_context

/usr/local/lib/python3.10/dist-packages/transformers/generation/utils.
py in generate(self, inputs, generation_config, logits_processor,
stopping_criteria, prefix_allowed_tokens_fn, synced_gpus,
assistant_model, streamer, negative_prompt_ids,
negative_prompt_attention_mask, **kwargs)
   2022 
   2023             # 13. run sample (it degenerates to greedy search
when `generation_config.do_sample=False`)
-> 2024             result = self._sample(
   2025                 input_ids,
   2026                 logits_processor=prepared_logits_processor,

/usr/local/lib/python3.10/dist-packages/transformers/generation/utils.
py in _sample(self, input_ids, logits_processor, stopping_criteria,
generation_config, synced_gpus, streamer, logits_warper,
**model_kwargs)
   2980 
   2981             # forward pass to get next token
-> 2982             outputs = self(**model_inputs, return_dict=True)
   2983 
   2984             if synced_gpus and this_peer_finished:

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_wrapped_call_impl(self, *args, **kwargs)
   1734             return self._compiled_call_impl(*args, **kwargs)
# type: ignore[misc]
   1735         else:
-> 1736             return self._call_impl(*args, **kwargs)
   1737 
   1738     # torchrec tests the code consistency with the following
code

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_call_impl(self, *args, **kwargs)
   1745                 or _global_backward_pre_hooks or
_global_backward_hooks
   1746                 or _global_forward_hooks or
_global_forward_pre_hooks):
-> 1747             return forward_call(*args, **kwargs)
   1748 
   1749         result = None

/usr/local/lib/python3.10/dist-packages/transformers/models/blip/model
ing_blip_text.py in forward(self, input_ids, attention_mask,
position_ids, head_mask, inputs_embeds, encoder_hidden_states,
encoder_attention_mask, labels, past_key_values, use_cache,
output_attentions, output_hidden_states, return_dict, return_logits,
is_decoder, reduction)
    869             use_cache = False
    870 
--> 871         outputs = self.bert(
    872             input_ids,
    873             attention_mask=attention_mask,

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_wrapped_call_impl(self, *args, **kwargs)
   1734             return self._compiled_call_impl(*args, **kwargs)
# type: ignore[misc]
   1735         else:
-> 1736             return self._call_impl(*args, **kwargs)
   1737 
   1738     # torchrec tests the code consistency with the following
code

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_call_impl(self, *args, **kwargs)
   1745                 or _global_backward_pre_hooks or
_global_backward_hooks
   1746                 or _global_forward_hooks or
_global_forward_pre_hooks):
-> 1747             return forward_call(*args, **kwargs)
   1748 
   1749         result = None
```

```
/usr/local/lib/python3.10/dist-packages/transformers/models/blip/model
ing_blip_text.py in forward(self, input_ids, attention_mask,
position_ids, head_mask, inputs_embeds, encoder_embeds,
encoder_hidden_states, encoder_attention_mask, past_key_values,
use_cache, output_attentions, output_hidden_states, return_dict,
is_decoder)
    780             embedding_output = encoder_embeds
    781 
--> 782         encoder_outputs = self.encoder(
    783             embedding_output,
    784             attention_mask=extended_attention_mask,

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_wrapped_call_impl(self, *args, **kwargs)
   1734             return self._compiled_call_impl(*args, **kwargs)
# type: ignore[misc]
   1735         else:
-> 1736             return self._call_impl(*args, **kwargs)
   1737 
   1738     # torchrec tests the code consistency with the following
code

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_call_impl(self, *args, **kwargs)
   1745                 or _global_backward_pre_hooks or
_global_backward_hooks
   1746                 or _global_forward_hooks or
_global_forward_pre_hooks):
-> 1747             return forward_call(*args, **kwargs)
   1748 
   1749         result = None

/usr/local/lib/python3.10/dist-packages/transformers/models/blip/model
ing_blip_text.py in forward(self, hidden_states, attention_mask,
head_mask, encoder_hidden_states, encoder_attention_mask,
past_key_values, use_cache, output_attentions, output_hidden_states,
return_dict)
    434                 )
    435             else:
--> 436                 layer_outputs = layer_module(
    437                     hidden_states,
    438                     attention_mask,

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_wrapped_call_impl(self, *args, **kwargs)
   1734             return self._compiled_call_impl(*args, **kwargs)
# type: ignore[misc]
   1735         else:
-> 1736             return self._call_impl(*args, **kwargs)
```

```
   1737
   1738     # torchrec tests the code consistency with the following
code

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_call_impl(self, *args, **kwargs)
   1745                 or _global_backward_pre_hooks or
_global_backward_hooks
   1746                 or _global_forward_hooks or
_global_forward_pre_hooks):
-> 1747             return forward_call(*args, **kwargs)
   1748
   1749         result = None

/usr/local/lib/python3.10/dist-packages/transformers/models/blip/model
ing_blip_text.py in forward(self, hidden_states, attention_mask,
head_mask, encoder_hidden_states, encoder_attention_mask,
past_key_value, output_attentions)
    356
    357         if encoder_hidden_states is not None:
--> 358             cross_attention_outputs = self.crossattention(
    359                 attention_output,
    360                 attention_mask,

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_wrapped_call_impl(self, *args, **kwargs)
   1734             return self._compiled_call_impl(*args, **kwargs)
# type: ignore[misc]
   1735         else:
-> 1736             return self._call_impl(*args, **kwargs)
   1737
   1738     # torchrec tests the code consistency with the following
code

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_call_impl(self, *args, **kwargs)
   1745                 or _global_backward_pre_hooks or
_global_backward_hooks
   1746                 or _global_forward_hooks or
_global_forward_pre_hooks):
-> 1747             return forward_call(*args, **kwargs)
   1748
   1749         result = None

/usr/local/lib/python3.10/dist-packages/transformers/models/blip/model
ing_blip_text.py in forward(self, hidden_states, attention_mask,
head_mask, encoder_hidden_states, encoder_attention_mask,
past_key_value, output_attentions)
    273         output_attentions: Optional[bool] = False,
    274     ) -> Tuple[torch.Tensor]:
```

```
--> 275         self_outputs = self.self(
    276             hidden_states,
    277             attention_mask,

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_wrapped_call_impl(self, *args, **kwargs)
   1734             return self._compiled_call_impl(*args, **kwargs)
# type: ignore[misc]
   1735         else:
-> 1736             return self._call_impl(*args, **kwargs)
   1737 
   1738     # torchrec tests the code consistency with the following
code

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_call_impl(self, *args, **kwargs)
   1745                 or _global_backward_pre_hooks or
_global_backward_hooks
   1746                 or _global_forward_hooks or
_global_forward_pre_hooks):
-> 1747             return forward_call(*args, **kwargs)
   1748 
   1749         result = None

/usr/local/lib/python3.10/dist-packages/transformers/models/blip/model
ing_blip_text.py in forward(self, hidden_states, attention_mask,
head_mask, encoder_hidden_states, encoder_attention_mask,
past_key_value, output_attentions)
    160         if is_cross_attention:
    161             key_layer =
self.transpose_for_scores(self.key(encoder_hidden_states))
--> 162             value_layer =
self.transpose_for_scores(self.value(encoder_hidden_states))
    163             attention_mask = encoder_attention_mask
    164         elif past_key_value is not None:

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_wrapped_call_impl(self, *args, **kwargs)
   1734             return self._compiled_call_impl(*args, **kwargs)
# type: ignore[misc]
   1735         else:
-> 1736             return self._call_impl(*args, **kwargs)
   1737 
   1738     # torchrec tests the code consistency with the following
code

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py in
_call_impl(self, *args, **kwargs)
   1745                 or _global_backward_pre_hooks or
_global_backward_hooks
```

```
   1746                 or _global_forward_hooks or
_global_forward_pre_hooks):
-> 1747             return forward_call(*args, **kwargs)
   1748
   1749         result = None

/usr/local/lib/python3.10/dist-packages/torch/nn/modules/linear.py in
forward(self, input)
    123
    124     def forward(self, input: Tensor) -> Tensor:
--> 125         return F.linear(input, self.weight, self.bias)
    126
    127     def extra_repr(self) -> str:

KeyboardInterrupt:
```

```python
rougeL_scores = [0.3243333918983624, 0.344430507047284,
0.345049722565402, 0.3317802685420676, 0.33798108652954467]
training_losses = [2.621926883061727, 2.4245523611704507,
2.32952486038208, 2.260512758890788, 2.192203664779663 ]
```

```python
import torch

# Define local save paths
blip_save_path = 'blip_model.pth'
t5_save_path = 't5_model.pth'

# Save the state_dict of each model
torch.save(blip_model.state_dict(), blip_save_path)
torch.save(t5_model.state_dict(), t5_save_path)

print("Models have been saved locally.")
```

```
Models have been saved locally.
```

```python
# Evaluate after each epoch
metrics = evaluate_model_training(blip_model, t5_model,
blip_processor, t5_tokenizer, train_dataloader, device)

# Print evaluation metrics for each epoch
print(f"Training Metric after Epoch {epoch+1}: {metrics}")
```

```
Evaluating:  93%|█████████▎| 70/75 [21:35<01:34, 18.85s/it]
```

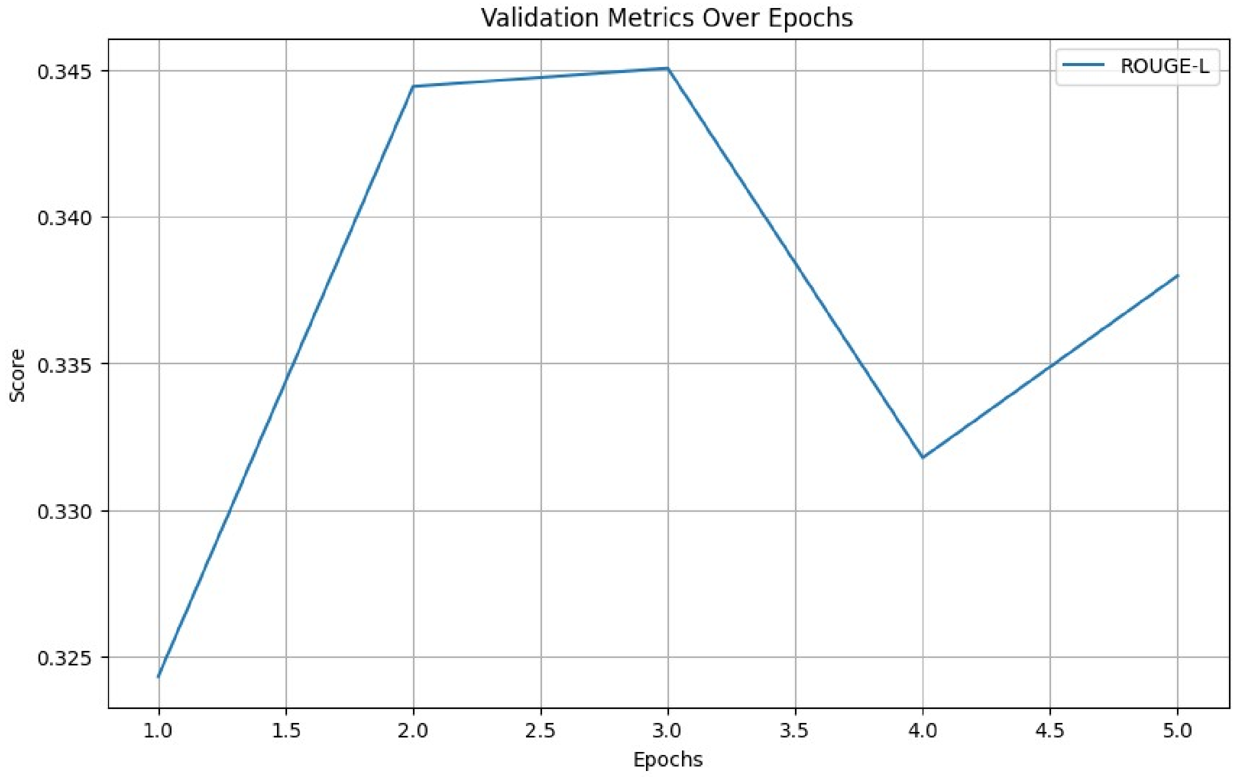
```python
# After training each epoch, evaluate the model on the validation set
metrics = evaluate_model(blip_model, t5_model, blip_processor,
t5_tokenizer, val_dataloader, device)
print(f"Validation Metrics after Epoch {epoch+1}: {metrics}")
```

```
Evaluating: 100%|██████████| 19/19 [05:36<00:00, 17.72s/it]
```

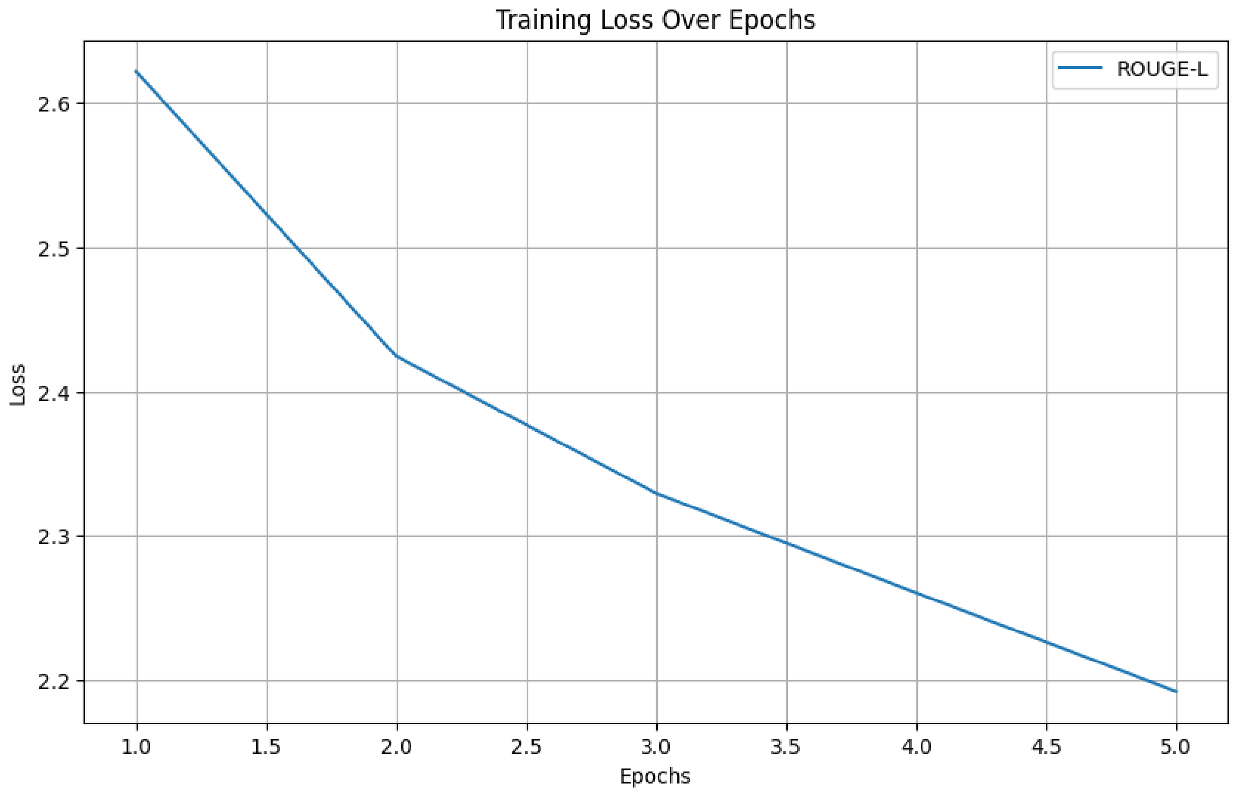
```
{"model_id":"f75d3086443c4945ad9ec5528628aee9","version_major":2,"vers
ion_minor":0}

{"model_id":"f0da07ee1eb74b68bc1d52ec89386d3d","version_major":2,"vers
ion_minor":0}

{"model_id":"d0d8485d09bb475981e2631b4c757bf0","version_major":2,"vers
ion_minor":0}

{"model_id":"ae383ae5940d4482b3a3426e9c580d5d","version_major":2,"vers
ion_minor":0}

{"model_id":"625558015b684bf4a6423bb03fe819a4","version_major":2,"vers
ion_minor":0}

/usr/local/lib/python3.10/dist-packages/transformers/
tokenization_utils_base.py:1601: FutureWarning:
`clean_up_tokenization_spaces` was not set. It will be set to `True`
by default. This behavior will be depracted in transformers v4.45, and
will be then set to `False` by default. For more details check this
issue: https://github.com/huggingface/transformers/issues/31884
  warnings.warn(

{"model_id":"3c8fb8f034ad4bd5ab246b33f215ffaa","version_major":2,"vers
ion_minor":0}

Some weights of RobertaModel were not initialized from the model
checkpoint at roberta-large and are newly initialized:
['roberta.pooler.dense.bias', 'roberta.pooler.dense.weight']
You should probably TRAIN this model on a down-stream task to be able
to use it for predictions and inference.

calculating scores...
computing bert embedding.

{"model_id":"97634b1077a243b78141b9454cca0ecb","version_major":2,"vers
ion_minor":0}

computing greedy matching.

{"model_id":"6d294038200c4e2baf391a53851c104d","version_major":2,"vers
ion_minor":0}

done in 1.98 seconds, 151.82 sentences/sec
Validation Metrics after Epoch 6: {'BLEU': 0.06442781788659759,
'ROUGE-1': 0.3742467614881393, 'ROUGE-2': 0.1251457245015394, 'ROUGE-
L': 0.3411455272680421, 'BERT_F1': 0.9064300656318665}
```

```python
import matplotlib.pyplot as plt

# Plot training loss over epochs
```

```
plt.figure(figsize=(10, 6))
#plt.plot(range(1, epochs + 1), bleu_scores, label='BLEU')
#plt.plot(range(1, epochs + 1), rouge1_scores, label='ROUGE-1')
#plt.plot(range(1, epochs + 1), rouge2_scores, label='ROUGE-2')
plt.plot(range(1, 6), rougeL_scores, label='ROUGE-L')
#plt.plot(range(1, epochs + 1), meteor_scores, label='METEOR')
#plt.plot(range(1, epochs + 1), bert_f1_scores, label='BERT F1')
plt.xlabel('Epochs')
plt.ylabel('Score')
plt.title('Validation Metrics Over Epochs')
plt.legend()
plt.grid()
plt.show()
```



```
import matplotlib.pyplot as plt

# Plot training loss over epochs

plt.figure(figsize=(10, 6))
plt.plot(range(1, 6), training_losses, label='ROUGE-L')
plt.xlabel('Epochs')
plt.ylabel('Loss')
plt.title('Training Loss Over Epochs')
plt.legend()
plt.grid()
plt.show()
```



```
import requests
import imageio
from PIL import Image
from io import BytesIO
import torch
from nltk.translate.bleu_score import corpus_bleu
from rouge_score import rouge_scorer
from bert_score import score as bert_score_fn
import torch.nn.functional as F

def process_and_evaluate_gif(
    gif_url,
    actual_description,
    blip_processor,
    blip_model,
    t5_tokenizer,
    t5_model,
    device='cuda' if torch.cuda.is_available() else 'cpu',
    num_frames=5,
    frame_size=(256, 256),
    max_length=128,
    max_target_length=150,
    num_beams=4
):
    """
    Processes an unseen GIF to generate a description and evaluates it
against the actual description.

    Args:
        gif_url (str): URL of the GIF to process.
        actual_description (str): The ground truth description of the
GIF.
        blip_processor: BLIP processor instance.
        blip_model: Trained BLIP model instance.
        t5_tokenizer: T5 tokenizer instance.
        t5_model: Trained T5 model instance.
        device (str): Device to run the models on ('cuda' or 'cpu').
        num_frames (int): Number of frames to extract from the GIF.
        frame_size (tuple): Desired frame size (width, height).
        max_length (int): Maximum token length for T5 input.
        max_target_length (int): Maximum token length for T5 output.
        num_beams (int): Number of beams for beam search in T5
generation.

    Returns:
        dict: Evaluation metrics including BLEU, ROUGE-1, ROUGE-2,
ROUGE-L, and BERT_F1.
    """
    # Step 1: Download the GIF
    try:
        response = requests.get(gif_url, timeout=10)
        response.raise_for_status()
        gif_bytes = BytesIO(response.content)
        print(f"Successfully downloaded GIF from {gif_url}")
    except requests.exceptions.RequestException as e:
        print(f"Failed to download GIF from {gif_url}: {e}")
        return None

    # Step 2: Extract frames from the GIF
    try:
        gif = imageio.mimread(gif_bytes, memtest=False)
        total_frames = len(gif)
        if total_frames == 0:
            print("No frames found in the GIF.")
            return None
        interval = max(total_frames // num_frames, 1)
        selected_frames = [gif[i] for i in range(0, total_frames,
interval)][:num_frames]
        print(f"Extracted {len(selected_frames)} frames from the
GIF.")
    except Exception as e:
        print(f"Error extracting frames from GIF: {e}")
        return None

    # Step 3: Ensure each GIF has exactly num_frames by padding if
necessary
    while len(selected_frames) < num_frames:
        if selected_frames:
            selected_frames.append(selected_frames[-1])
        else:
            # Append a blank frame if no frames are extracted
            selected_frames.append(np.zeros((frame_size[1],
frame_size[0], 3), dtype=np.uint8))
    selected_frames = selected_frames[:num_frames]  # Ensure no more
than num_frames
    print(f"Total frames after padding: {len(selected_frames)}")

    # Step 4: Convert frames to PIL Images, resize, and generate
captions using BLIP
    captions = []
    for idx, frame in enumerate(selected_frames):
        try:
            img = Image.fromarray(frame).convert('RGB')
            img_resized = img.resize(frame_size)
            inputs = blip_processor(img_resized,
return_tensors="pt").to(device)
            with torch.no_grad():
                outputs = blip_model.generate(**inputs, max_length=50)
            caption = blip_processor.decode(outputs[0],
skip_special_tokens=True)
            captions.append(caption)
            print(f"Frame {idx+1}: {caption}")
        except Exception as e:
            print(f"Failed to generate caption for frame {idx+1}:
{e}")
            captions.append("")  # Append empty string for failed
captions

    # Step 5: Concatenate captions to form T5 input
    concatenated_captions = " ".join(captions)
    print(f"Concatenated Captions: {concatenated_captions}")

    # Step 6: Tokenize the concatenated captions for T5
    try:
        encoding = t5_tokenizer.encode_plus(
            concatenated_captions,
            add_special_tokens=True,
            max_length=max_length,
            padding='max_length',
            truncation=True,
            return_attention_mask=True,
            return_tensors='pt',
        )
        input_ids = encoding['input_ids'].to(device)
        attention_mask = encoding['attention_mask'].to(device)
    except Exception as e:
        print(f"Error during tokenization: {e}")
        return None

    # Step 7: Generate description using T5
    try:
        t5_model.eval()
        with torch.no_grad():
            outputs = t5_model.generate(
                input_ids=input_ids,
                attention_mask=attention_mask,
                max_length=max_target_length,
                num_beams=num_beams,
                early_stopping=True
            )
        generated_description = t5_tokenizer.decode(outputs[0],
skip_special_tokens=True)
        print(f"Generated Description: {generated_description}")
    except Exception as e:
        print(f"Error during T5 generation: {e}")
        return None

    # Step 8: Evaluate the generated description against the actual
description
    scorer = rouge_scorer.RougeScorer(['rouge1', 'rouge2', 'rougeL'],
use_stemmer=True)

    # Prepare tokenized inputs
    ref_tokens = actual_description.split()
    hyp_tokens = generated_description.split()

    # Calculate BLEU
    bleu = corpus_bleu([[ref_tokens]], [hyp_tokens])

    # Calculate ROUGE
    scores = scorer.score(actual_description, generated_description)
    rouge1 = scores['rouge1'].fmeasure
    rouge2 = scores['rouge2'].fmeasure
    rougeL = scores['rougeL'].fmeasure

    # Calculate BERT Score
    P, R, F1 = bert_score_fn(
        [' '.join(hyp_tokens)],
        [' '.join(ref_tokens)],
        lang='en',
        verbose=False
    )
    bert_f1 = F1.mean().item()

    # Compile metrics
    metrics = {
        'BLEU': bleu,
        'ROUGE-1': rouge1,
        'ROUGE-2': rouge2,
        'ROUGE-L': rougeL,
        'BERT_F1': bert_f1
    }

    # Display Metrics
    print("\nEvaluation Metrics:")
    for metric, value in metrics.items():
        print(f"{metric}: {value:.4f}")

    return {
        'generated_description': generated_description,
        'actual_description': actual_description,
        'metrics': metrics
    }

# Example unseen GIF
unseen_gif = {
    'url':
'https://38.media.tumblr.com/f754d72da3c6a58211c760d39dff5be3/tumblr_n
8vbphDLEh1qdzzbko1_250.gif',
    'actual_description': 'a man in a tuxedo stares as smoke rises
next to him'
}

# Process and evaluate the unseen GIF
result = process_and_evaluate_gif(
    gif_url=unseen_gif['url'],
    actual_description=unseen_gif['actual_description'],
    blip_processor=blip_processor,
    blip_model=blip_model,
    t5_tokenizer=t5_tokenizer,
    t5_model=t5_model,
    device=device,
    num_frames=5,
    frame_size=(256, 256),
    max_length=128,
    max_target_length=150,
    num_beams=4
)

# Check the result
if result:
    print("\nFinal Results:")
    print(f"Generated Description: {result['generated_description']}")
    print(f"Actual Description: {result['actual_description']}")
    print("Evaluation Metrics:")
    for metric, score in result['metrics'].items():
        print(f"  {metric}: {score:.4f}")
else:
    print("Processing and evaluation failed.")
```

```
Successfully downloaded GIF from
https://38.media.tumblr.com/f754d72da3c6a58211c760d39dff5be3/tumblr_n8
vbphDLEh1qdzzbko1_250.gif
Extracted 5 frames from the GIF.
Total frames after padding: 5
Frame 1: a man in a tuxed suit and bow tie
Frame 2: a man in a tuxed suit and bow tie
Frame 3: a man in a tuxed suit and bow tie
Frame 4: a man in a tuxed suit and bow tie
Frame 5: a man in a tuxed suit and bow tie
Concatenated Captions: a man in a tuxed suit and bow tie a man in a
tuxed suit and bow tie a man in a tuxed suit and bow tie a man in a
tuxed suit and bow tie a man in a tuxed suit and bow tie
Generated Description: a man in a tuxedo wears a tuxedo with a hooded
shirt.

Some weights of RobertaModel were not initialized from the model
checkpoint at roberta-large and are newly initialized:
['roberta.pooler.dense.bias', 'roberta.pooler.dense.weight']
You should probably TRAIN this model on a down-stream task to be able
to use it for predictions and inference.


Evaluation Metrics:
BLEU: 0.3170
ROUGE-1: 0.4167
ROUGE-2: 0.3636
ROUGE-L: 0.4167
BERT_F1: 0.9107

Final Results:
Generated Description: a man in a tuxedo wears a tuxedo with a hooded
shirt.
Actual Description: a man in a tuxedo stares as smoke rises next to
him
Evaluation Metrics:
  BLEU: 0.3170
  ROUGE-1: 0.4167
  ROUGE-2: 0.3636
  ROUGE-L: 0.4167
  BERT_F1: 0.9107
```