ECE 5700 Final Project - Image Captioning

This Notebook will train and evaluate an instance of the GLobal Enhanced Transformer (Ji et al.). Please consult the repository's ReadMe for setup requirements and information on how to customize the run.

Environment Setup

First, we mount the Google Drive, as this is where we expect the image features and captions to be stored prior to running.

```python
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

Next, we clone the repository into the colab session so the project has access to the code files.

In [20]:
```python
import os

if os.path.isdir('/content/image_captioning'):
  %cd ~
  !rm -rf /content/image_captioning

!git clone https://github.com/colio22/image_captioning.git /content/image_captionin
```

```
/root
Cloning into '/content/image_captioning'...
remote: Enumerating objects: 716, done.
remote: Counting objects: 100% (716/716), done.
remote: Compressing objects: 100% (328/328), done.
remote: Total 716 (delta 388), reused 690 (delta 364), pack-reused 0 (from 0)
Receiving objects: 100% (716/716), 5.31 MiB | 5.65 MiB/s, done.
Resolving deltas: 100% (388/388), done.
```

Finally, we install needed dependencies.

In [21]:
```python
%cd '/content/image_captioning'

! sudo pip install -r requirements.txt
```

```
/content/image_captioning
Collecting cudf-cu12@ https://pypi.nvidia.com/cudf-cu12/cudf_cu12-24.10.1-cp310-cp31
0-manylinux_2_24_x86_64.manylinux_2_28_x86_64.whl (from -r requirements.txt (line 6
0))
  Downloading https://pypi.nvidia.com/cudf-cu12/cudf_cu12-24.10.1-cp310-cp310-manyli
nux_2_24_x86_64.manylinux_2_28_x86_64.whl (24.9 MB)
                               ━━━━━━━━━━━━━━━━━━━━ 24.9/24.9 MB 81.2 MB/s eta 0:00:00
Collecting en-core-web-sm@ https://github.com/explosion/spacy-models/releases/downlo
ad/en_core_web_sm-3.7.1/en_core_web_sm-3.7.1-py3-none-any.whl#sha256=86cc141f63942d4
b2c5fcee06630fd6f904788d2f0ab005cce45aadb8fb73889 (from -r requirements.txt (line 9
1))
  Downloading https://github.com/explosion/spacy-models/releases/download/en_core_we
b_sm-3.7.1/en_core_web_sm-3.7.1-py3-none-any.whl (12.8 MB)
                               ━━━━━━━━━━━━━━━━━━━━ 12.8/12.8 MB 8.1 MB/s eta 0:00:00
Collecting libcudf-cu12@ https://pypi.nvidia.com/libcudf-cu12/libcudf_cu12-24.10.1-p
y3-none-manylinux_2_28_x86_64.whl (from -r requirements.txt (line 244))
  Downloading https://pypi.nvidia.com/libcudf-cu12/libcudf_cu12-24.10.1-py3-none-man
ylinux_2_28_x86_64.whl (515.1 MB)
                               ━━━━━━━━━━━━━━━━━━━━ 515.1/515.1 MB 2.0 MB/s eta 0:00:00
Collecting nx-cugraph-cu12@ https://pypi.nvidia.com/nx-cugraph-cu12/nx_cugraph_cu12-
24.10.0-py3-none-any.whl (from -r requirements.txt (line 304))
  Downloading https://pypi.nvidia.com/nx-cugraph-cu12/nx_cugraph_cu12-24.10.0-py3-no
ne-any.whl (149 kB)
                               ━━━━━━━━━━━━━━━━━━━━ 149.4/149.4 kB 11.8 MB/s eta 0:00:00
Collecting pylibcudf-cu12@ https://pypi.nvidia.com/pylibcudf-cu12/pylibcudf_cu12-24.
10.1-cp310-cp310-manylinux_2_24_x86_64.manylinux_2_28_x86_64.whl (from -r requiremen
ts.txt (line 382))
  Downloading https://pypi.nvidia.com/pylibcudf-cu12/pylibcudf_cu12-24.10.1-cp310-cp
310-manylinux_2_24_x86_64.manylinux_2_28_x86_64.whl (20.5 MB)
                               ━━━━━━━━━━━━━━━━━━━━ 20.5/20.5 MB 95.4 MB/s eta 0:00:00
Collecting torch@ https://download.pytorch.org/whl/cu121_full/torch-2.5.0%2Bcu121-cp
310-cp310-linux_x86_64.whl (from -r requirements.txt (line 497))
  Downloading https://download.pytorch.org/whl/cu121_full/torch-2.5.0%2Bcu121-cp310-
cp310-linux_x86_64.whl (2370.5 MB)
                               ━━━━━━━━━━━━━━━━━━━━ 2.4/2.4 GB 952.4 kB/s eta 0:00:00
Collecting torchaudio@ https://download.pytorch.org/whl/cu121_full/torchaudio-2.5.0%
2Bcu121-cp310-cp310-linux_x86_64.whl (from -r requirements.txt (line 498))
  Downloading https://download.pytorch.org/whl/cu121_full/torchaudio-2.5.0%2Bcu121-c
p310-cp310-linux_x86_64.whl (3.4 MB)
                               ━━━━━━━━━━━━━━━━━━━━ 3.4/3.4 MB 14.2 MB/s eta 0:00:00
Collecting torchvision@ https://download.pytorch.org/whl/cu121_full/torchvision-0.2
0.0%2Bcu121-cp310-cp310-linux_x86_64.whl (from -r requirements.txt (line 500))
  Downloading https://download.pytorch.org/whl/cu121_full/torchvision-0.20.0%2Bcu121
-cp310-cp310-linux_x86_64.whl (7.3 MB)
                               ━━━━━━━━━━━━━━━━━━━━ 7.3/7.3 MB 101.3 MB/s eta 0:00:00
Requirement already satisfied: absl-py==1.4.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 1)) (1.4.0)
Requirement already satisfied: accelerate==0.34.2 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 2)) (0.34.2)
Requirement already satisfied: aiohappyeyeballs==2.4.3 in /usr/local/lib/python3.10/
dist-packages (from -r requirements.txt (line 3)) (2.4.3)
Requirement already satisfied: aiohttp==3.10.10 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 4)) (3.10.10)
Requirement already satisfied: aiosignal==1.3.1 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 5)) (1.3.1)
Requirement already satisfied: alabaster==0.7.16 in /usr/local/lib/python3.10/dist-p
```

ackages (from -r requirements.txt (line 6)) (0.7.16)
Requirement already satisfied: albucore==0.0.19 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 7)) (0.0.19)
Requirement already satisfied: albumentations==1.4.20 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 8)) (1.4.20)
Requirement already satisfied: altair==4.2.2 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 9)) (4.2.2)
Requirement already satisfied: annotated-types==0.7.0 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 10)) (0.7.0)
Requirement already satisfied: anyio==3.7.1 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 11)) (3.7.1)
Requirement already satisfied: argon2-cffi==23.1.0 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 12)) (23.1.0)
Requirement already satisfied: argon2-cffi-bindings==21.2.0 in /usr/local/lib/python
3.10/dist-packages (from -r requirements.txt (line 13)) (21.2.0)
Requirement already satisfied: array_record==0.5.1 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 14)) (0.5.1)
Requirement already satisfied: arviz==0.20.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 15)) (0.20.0)
Requirement already satisfied: astropy==6.1.4 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 16)) (6.1.4)
Requirement already satisfied: astropy-iers-data==0.2024.10.28.0.34.7 in /usr/local/
lib/python3.10/dist-packages (from -r requirements.txt (line 17)) (0.2024.10.28.0.3
4.7)
Requirement already satisfied: astunparse==1.6.3 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 18)) (1.6.3)
Requirement already satisfied: async-timeout==4.0.3 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 19)) (4.0.3)
Requirement already satisfied: atpublic==4.1.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 20)) (4.1.0)
Requirement already satisfied: attrs==24.2.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 21)) (24.2.0)
Requirement already satisfied: audioread==3.0.1 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 22)) (3.0.1)
Requirement already satisfied: autograd==1.7.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 23)) (1.7.0)
Requirement already satisfied: babel==2.16.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 24)) (2.16.0)
Requirement already satisfied: backcall==0.2.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 25)) (0.2.0)
Requirement already satisfied: beautifulsoup4==4.12.3 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 26)) (4.12.3)
Requirement already satisfied: bigframes==1.25.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 27)) (1.25.0)
Requirement already satisfied: bigquery-magics==0.4.0 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 28)) (0.4.0)
Requirement already satisfied: bleach==6.2.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 29)) (6.2.0)
Requirement already satisfied: blinker==1.4 in /usr/lib/python3/dist-packages (from
-r requirements.txt (line 30)) (1.4)
Requirement already satisfied: blis==0.7.11 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 31)) (0.7.11)
Requirement already satisfied: blosc2==2.0.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 32)) (2.0.0)
Requirement already satisfied: bokeh==3.4.3 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 33)) (3.4.3)

```
Requirement already satisfied: Bottleneck==1.4.2 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 34)) (1.4.2)
Requirement already satisfied: bqplot==0.12.43 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 35)) (0.12.43)
Requirement already satisfied: branca==0.8.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 36)) (0.8.0)
Requirement already satisfied: CacheControl==0.14.0 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 37)) (0.14.0)
Requirement already satisfied: cachetools==5.5.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 38)) (5.5.0)
Requirement already satisfied: catalogue==2.0.10 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 39)) (2.0.10)
Requirement already satisfied: certifi==2024.8.30 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 40)) (2024.8.30)
Requirement already satisfied: cffi==1.17.1 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 41)) (1.17.1)
Requirement already satisfied: chardet==5.2.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 42)) (5.2.0)
Requirement already satisfied: charset-normalizer==3.4.0 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 43)) (3.4.0)
Requirement already satisfied: chex==0.1.87 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 44)) (0.1.87)
Requirement already satisfied: clarabel==0.9.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 45)) (0.9.0)
Requirement already satisfied: click==8.1.7 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 46)) (8.1.7)
Requirement already satisfied: cloudpathlib==0.20.0 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 47)) (0.20.0)
Requirement already satisfied: cloudpickle==3.1.0 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 48)) (3.1.0)
Requirement already satisfied: cmake==3.30.5 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 49)) (3.30.5)
Requirement already satisfied: cmdstanpy==1.2.4 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 50)) (1.2.4)
Requirement already satisfied: colorcet==3.1.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 51)) (3.1.0)
Requirement already satisfied: colorlover==0.3.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 52)) (0.3.0)
Requirement already satisfied: colour==0.1.5 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 53)) (0.1.5)
Requirement already satisfied: community==1.0.0b1 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 54)) (1.0.0b1)
Requirement already satisfied: confection==0.1.5 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 55)) (0.1.5)
Requirement already satisfied: cons==0.4.6 in /usr/local/lib/python3.10/dist-package
s (from -r requirements.txt (line 56)) (0.4.6)
Requirement already satisfied: contourpy==1.3.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 57)) (1.3.0)
Requirement already satisfied: cryptography==43.0.3 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 58)) (43.0.3)
Requirement already satisfied: cuda-python==12.2.1 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 59)) (12.2.1)
Requirement already satisfied: cufflinks==0.17.3 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 61)) (0.17.3)
Requirement already satisfied: cupy-cuda12x==12.2.0 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 62)) (12.2.0)
```

```
Requirement already satisfied: cvxopt==1.3.2 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 63)) (1.3.2)
Requirement already satisfied: cvxpy==1.5.3 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 64)) (1.5.3)
Requirement already satisfied: cycler==0.12.1 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 65)) (0.12.1)
Requirement already satisfied: cymem==2.0.8 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 66)) (2.0.8)
Requirement already satisfied: Cython==3.0.11 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 67)) (3.0.11)
Requirement already satisfied: dask==2024.10.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 68)) (2024.10.0)
Requirement already satisfied: datascience==0.17.6 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 69)) (0.17.6)
Requirement already satisfied: db-dtypes==1.3.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 70)) (1.3.0)
Requirement already satisfied: dbus-python==1.2.18 in /usr/lib/python3/dist-packages
(from -r requirements.txt (line 71)) (1.2.18)
Requirement already satisfied: debugpy==1.6.6 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 72)) (1.6.6)
Requirement already satisfied: decorator==4.4.2 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 73)) (4.4.2)
Requirement already satisfied: defusedxml==0.7.1 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 74)) (0.7.1)
Requirement already satisfied: Deprecated==1.2.14 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 75)) (1.2.14)
Requirement already satisfied: diffusers==0.30.3 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 76)) (0.30.3)
Requirement already satisfied: distro==1.9.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 77)) (1.9.0)
Requirement already satisfied: dlib==19.24.2 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 78)) (19.24.2)
Requirement already satisfied: dm-tree==0.1.8 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 79)) (0.1.8)
Requirement already satisfied: docker-pycreds==0.4.0 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 80)) (0.4.0)
Requirement already satisfied: docstring_parser==0.16 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 81)) (0.16)
Requirement already satisfied: docutils==0.18.1 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 82)) (0.18.1)
Requirement already satisfied: dopamine_rl==4.0.9 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 83)) (4.0.9)
Requirement already satisfied: duckdb==1.1.2 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 84)) (1.1.2)
Requirement already satisfied: earthengine-api==1.2.0 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 85)) (1.2.0)
Requirement already satisfied: easydict==1.13 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 86)) (1.13)
Requirement already satisfied: ecos==2.0.14 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 87)) (2.0.14)
Requirement already satisfied: editdistance==0.8.1 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 88)) (0.8.1)
Requirement already satisfied: eerepr==0.0.4 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 89)) (0.0.4)
Requirement already satisfied: einops==0.8.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 90)) (0.8.0)
```

```
Requirement already satisfied: entrypoints==0.4 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 92)) (0.4)
Requirement already satisfied: et_xmlfile==2.0.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 93)) (2.0.0)
Requirement already satisfied: etils==1.10.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 94)) (1.10.0)
Requirement already satisfied: etuples==0.3.9 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 95)) (0.3.9)
Requirement already satisfied: eval_type_backport==0.2.0 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 96)) (0.2.0)
Requirement already satisfied: exceptiongroup==1.2.2 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 97)) (1.2.2)
Requirement already satisfied: fastai==2.7.18 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 98)) (2.7.18)
Requirement already satisfied: fastcore==1.7.19 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 99)) (1.7.19)
Requirement already satisfied: fastdownload==0.0.7 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 100)) (0.0.7)
Requirement already satisfied: fastjsonschema==2.20.0 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 101)) (2.20.0)
Requirement already satisfied: fastprogress==1.0.3 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 102)) (1.0.3)
Requirement already satisfied: fastrlock==0.8.2 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 103)) (0.8.2)
Requirement already satisfied: filelock==3.16.1 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 104)) (3.16.1)
Requirement already satisfied: firebase-admin==6.5.0 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 105)) (6.5.0)
Requirement already satisfied: Flask==2.2.5 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 106)) (2.2.5)
Requirement already satisfied: flatbuffers==24.3.25 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 107)) (24.3.25)
Requirement already satisfied: flax==0.8.5 in /usr/local/lib/python3.10/dist-package
s (from -r requirements.txt (line 108)) (0.8.5)
Requirement already satisfied: folium==0.18.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 109)) (0.18.0)
Requirement already satisfied: fonttools==4.54.1 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 110)) (4.54.1)
Requirement already satisfied: frozendict==2.4.6 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 111)) (2.4.6)
Requirement already satisfied: frozenlist==1.5.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 112)) (1.5.0)
Requirement already satisfied: fsspec==2024.10.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 113)) (2024.10.0)
Requirement already satisfied: future==1.0.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 114)) (1.0.0)
Requirement already satisfied: gast==0.6.0 in /usr/local/lib/python3.10/dist-package
s (from -r requirements.txt (line 115)) (0.6.0)
Requirement already satisfied: gcsfs==2024.10.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 116)) (2024.10.0)
Requirement already satisfied: GDAL==3.6.4 in /usr/local/lib/python3.10/dist-package
s (from -r requirements.txt (line 117)) (3.6.4)
Requirement already satisfied: gdown==5.2.0 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 118)) (5.2.0)
Requirement already satisfied: geemap==0.35.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 119)) (0.35.0)
```

Requirement already satisfied: gensim==4.3.3 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 120)) (4.3.3)
Requirement already satisfied: geocoder==1.38.1 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 121)) (1.38.1)
Requirement already satisfied: geographiclib==2.0 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 122)) (2.0)
Requirement already satisfied: geopandas==1.0.1 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 123)) (1.0.1)
Requirement already satisfied: geopy==2.4.1 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 124)) (2.4.1)
Requirement already satisfied: gin-config==0.5.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 125)) (0.5.0)
Requirement already satisfied: gitdb==4.0.11 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 126)) (4.0.11)
Requirement already satisfied: GitPython==3.1.43 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 127)) (3.1.43)
Requirement already satisfied: glob2==0.7 in /usr/local/lib/python3.10/dist-packages
(from -r requirements.txt (line 128)) (0.7)
Requirement already satisfied: google==2.0.3 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 129)) (2.0.3)
Requirement already satisfied: google-ai-generativelanguage==0.6.10 in /usr/local/li
b/python3.10/dist-packages (from -r requirements.txt (line 130)) (0.6.10)
Requirement already satisfied: google-api-core==2.19.2 in /usr/local/lib/python3.10/
dist-packages (from -r requirements.txt (line 131)) (2.19.2)
Requirement already satisfied: google-api-python-client==2.137.0 in /usr/local/lib/p
ython3.10/dist-packages (from -r requirements.txt (line 132)) (2.137.0)
Requirement already satisfied: google-auth==2.27.0 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 133)) (2.27.0)
Requirement already satisfied: google-auth-httplib2==0.2.0 in /usr/local/lib/python
3.10/dist-packages (from -r requirements.txt (line 134)) (0.2.0)
Requirement already satisfied: google-auth-oauthlib==1.2.1 in /usr/local/lib/python
3.10/dist-packages (from -r requirements.txt (line 135)) (1.2.1)
Requirement already satisfied: google-cloud-aiplatform==1.70.0 in /usr/local/lib/pyt
hon3.10/dist-packages (from -r requirements.txt (line 136)) (1.70.0)
Requirement already satisfied: google-cloud-bigquery==3.25.0 in /usr/local/lib/pytho
n3.10/dist-packages (from -r requirements.txt (line 137)) (3.25.0)
Requirement already satisfied: google-cloud-bigquery-connection==1.15.5 in /usr/loca
l/lib/python3.10/dist-packages (from -r requirements.txt (line 138)) (1.15.5)
Requirement already satisfied: google-cloud-bigquery-storage==2.27.0 in /usr/local/l
ib/python3.10/dist-packages (from -r requirements.txt (line 139)) (2.27.0)
Requirement already satisfied: google-cloud-bigtable==2.26.0 in /usr/local/lib/pytho
n3.10/dist-packages (from -r requirements.txt (line 140)) (2.26.0)
Requirement already satisfied: google-cloud-core==2.4.1 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 141)) (2.4.1)
Requirement already satisfied: google-cloud-datastore==2.19.0 in /usr/local/lib/pyth
on3.10/dist-packages (from -r requirements.txt (line 142)) (2.19.0)
Requirement already satisfied: google-cloud-firestore==2.16.1 in /usr/local/lib/pyth
on3.10/dist-packages (from -r requirements.txt (line 143)) (2.16.1)
Requirement already satisfied: google-cloud-functions==1.16.5 in /usr/local/lib/pyth
on3.10/dist-packages (from -r requirements.txt (line 144)) (1.16.5)
Requirement already satisfied: google-cloud-iam==2.16.0 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 145)) (2.16.0)
Requirement already satisfied: google-cloud-language==2.13.4 in /usr/local/lib/pytho
n3.10/dist-packages (from -r requirements.txt (line 146)) (2.13.4)
Requirement already satisfied: google-cloud-pubsub==2.25.0 in /usr/local/lib/python
3.10/dist-packages (from -r requirements.txt (line 147)) (2.25.0)

Requirement already satisfied: google-cloud-resource-manager==1.13.0 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 148)) (1.13.0)
Requirement already satisfied: google-cloud-storage==2.8.0 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 149)) (2.8.0)
Requirement already satisfied: google-cloud-translate==3.15.5 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 150)) (3.15.5)
Requirement already satisfied: google-colab==1.0.0 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 151)) (1.0.0)
Requirement already satisfied: google-crc32c==1.6.0 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 152)) (1.6.0)
Requirement already satisfied: google-generativeai==0.8.3 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 153)) (0.8.3)
Requirement already satisfied: google-pasta==0.2.0 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 154)) (0.2.0)
Requirement already satisfied: google-resumable-media==2.7.2 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 155)) (2.7.2)
Requirement already satisfied: googleapis-common-protos==1.65.0 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 156)) (1.65.0)
Requirement already satisfied: googledrivedownloader==0.4 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 157)) (0.4)
Requirement already satisfied: graphviz==0.20.3 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 158)) (0.20.3)
Requirement already satisfied: greenlet==3.1.1 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 159)) (3.1.1)
Requirement already satisfied: grpc-google-iam-v1==0.13.1 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 160)) (0.13.1)
Requirement already satisfied: grpcio==1.64.1 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 161)) (1.64.1)
Requirement already satisfied: grpcio-status==1.48.2 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 162)) (1.48.2)
Requirement already satisfied: gspread==6.0.2 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 163)) (6.0.2)
Requirement already satisfied: gspread-dataframe==3.3.1 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 164)) (3.3.1)
Requirement already satisfied: gym==0.25.2 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 165)) (0.25.2)
Requirement already satisfied: gym-notices==0.0.8 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 166)) (0.0.8)
Requirement already satisfied: h11==0.14.0 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 167)) (0.14.0)
Requirement already satisfied: h5netcdf==1.4.0 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 168)) (1.4.0)
Requirement already satisfied: h5py==3.12.1 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 169)) (3.12.1)
Requirement already satisfied: holidays==0.59 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 170)) (0.59)
Requirement already satisfied: holoviews==1.19.1 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 171)) (1.19.1)
Requirement already satisfied: html5lib==1.1 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 172)) (1.1)
Requirement already satisfied: httpcore==1.0.6 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 173)) (1.0.6)
Requirement already satisfied: httpimport==1.4.0 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 174)) (1.4.0)
Requirement already satisfied: httplib2==0.22.0 in /usr/local/lib/python3.10/dist-packages (from -r requirements.txt (line 175)) (0.22.0)

```
Requirement already satisfied: httpx==0.27.2 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 176)) (0.27.2)
Requirement already satisfied: huggingface-hub==0.24.7 in /usr/local/lib/python3.10/
dist-packages (from -r requirements.txt (line 177)) (0.24.7)
Requirement already satisfied: humanize==4.11.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 178)) (4.11.0)
Requirement already satisfied: hyperopt==0.2.7 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 179)) (0.2.7)
Requirement already satisfied: ibis-framework==9.2.0 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 180)) (9.2.0)
Requirement already satisfied: idna==3.10 in /usr/local/lib/python3.10/dist-packages
(from -r requirements.txt (line 181)) (3.10)
Requirement already satisfied: imageio==2.36.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 182)) (2.36.0)
Requirement already satisfied: imageio-ffmpeg==0.5.1 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 183)) (0.5.1)
Requirement already satisfied: imagesize==1.4.1 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 184)) (1.4.1)
Requirement already satisfied: imbalanced-learn==0.12.4 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 185)) (0.12.4)
Requirement already satisfied: imgaug==0.4.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 186)) (0.4.0)
Requirement already satisfied: immutabledict==4.2.0 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 187)) (4.2.0)
Requirement already satisfied: importlib_metadata==8.5.0 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 188)) (8.5.0)
Requirement already satisfied: importlib_resources==6.4.5 in /usr/local/lib/python3.
10/dist-packages (from -r requirements.txt (line 189)) (6.4.5)
Requirement already satisfied: imutils==0.5.4 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 190)) (0.5.4)
Requirement already satisfied: inflect==7.4.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 191)) (7.4.0)
Requirement already satisfied: iniconfig==2.0.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 192)) (2.0.0)
Requirement already satisfied: intel-cmplr-lib-ur==2025.0.0 in /usr/local/lib/python
3.10/dist-packages (from -r requirements.txt (line 193)) (2025.0.0)
Requirement already satisfied: intel-openmp==2025.0.0 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 194)) (2025.0.0)
Requirement already satisfied: ipyevents==2.0.2 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 195)) (2.0.2)
Requirement already satisfied: ipyfilechooser==0.6.0 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 196)) (0.6.0)
Requirement already satisfied: ipykernel==5.5.6 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 197)) (5.5.6)
Requirement already satisfied: ipyleaflet==0.19.2 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 198)) (0.19.2)
Requirement already satisfied: ipyparallel==8.8.0 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 199)) (8.8.0)
Requirement already satisfied: ipython==7.34.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 200)) (7.34.0)
Requirement already satisfied: ipython-genutils==0.2.0 in /usr/local/lib/python3.10/
dist-packages (from -r requirements.txt (line 201)) (0.2.0)
Requirement already satisfied: ipython-sql==0.5.0 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 202)) (0.5.0)
Requirement already satisfied: ipytree==0.2.2 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 203)) (0.2.2)
```

Requirement already satisfied: ipywidgets==7.7.1 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 204)) (7.7.1)
Requirement already satisfied: itsdangerous==2.2.0 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 205)) (2.2.0)
Requirement already satisfied: jax==0.4.33 in /usr/local/lib/python3.10/dist-package
s (from -r requirements.txt (line 206)) (0.4.33)
Requirement already satisfied: jax-cuda12-pjrt==0.4.33 in /usr/local/lib/python3.10/
dist-packages (from -r requirements.txt (line 207)) (0.4.33)
Requirement already satisfied: jax-cuda12-plugin==0.4.33 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 208)) (0.4.33)
Requirement already satisfied: jaxlib==0.4.33 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 209)) (0.4.33)
Requirement already satisfied: jeepney==0.7.1 in /usr/lib/python3/dist-packages (fro
m -r requirements.txt (line 210)) (0.7.1)
Requirement already satisfied: jellyfish==1.1.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 211)) (1.1.0)
Requirement already satisfied: jieba==0.42.1 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 212)) (0.42.1)
Requirement already satisfied: Jinja2==3.1.4 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 213)) (3.1.4)
Requirement already satisfied: jiter==0.6.1 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 214)) (0.6.1)
Requirement already satisfied: joblib==1.4.2 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 215)) (1.4.2)
Requirement already satisfied: jsonpatch==1.33 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 216)) (1.33)
Requirement already satisfied: jsonpickle==3.3.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 217)) (3.3.0)
Requirement already satisfied: jsonpointer==3.0.0 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 218)) (3.0.0)
Requirement already satisfied: jsonschema==4.23.0 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 219)) (4.23.0)
Requirement already satisfied: jsonschema-specifications==2024.10.1 in /usr/local/li
b/python3.10/dist-packages (from -r requirements.txt (line 220)) (2024.10.1)
Requirement already satisfied: jupyter-client==6.1.12 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 221)) (6.1.12)
Requirement already satisfied: jupyter-console==6.1.0 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 222)) (6.1.0)
Requirement already satisfied: jupyter-leaflet==0.19.2 in /usr/local/lib/python3.10/
dist-packages (from -r requirements.txt (line 223)) (0.19.2)
Requirement already satisfied: jupyter-server==1.24.0 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 224)) (1.24.0)
Requirement already satisfied: jupyter_core==5.7.2 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 225)) (5.7.2)
Requirement already satisfied: jupyterlab_pygments==0.3.0 in /usr/local/lib/python3.
10/dist-packages (from -r requirements.txt (line 226)) (0.3.0)
Requirement already satisfied: jupyterlab_widgets==3.0.13 in /usr/local/lib/python3.
10/dist-packages (from -r requirements.txt (line 227)) (3.0.13)
Requirement already satisfied: kaggle==1.6.17 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 228)) (1.6.17)
Requirement already satisfied: kagglehub==0.3.3 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 229)) (0.3.3)
Requirement already satisfied: keras==3.4.1 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 230)) (3.4.1)
Requirement already satisfied: keyring==23.5.0 in /usr/lib/python3/dist-packages (fr
om -r requirements.txt (line 231)) (23.5.0)

```
Requirement already satisfied: kiwisolver==1.4.7 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 232)) (1.4.7)
Requirement already satisfied: langchain==0.3.4 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 233)) (0.3.4)
Requirement already satisfied: langchain-core==0.3.13 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 234)) (0.3.13)
Requirement already satisfied: langchain-text-splitters==0.3.0 in /usr/local/lib/pyt
hon3.10/dist-packages (from -r requirements.txt (line 235)) (0.3.0)
Requirement already satisfied: langcodes==3.4.1 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 236)) (3.4.1)
Requirement already satisfied: langsmith==0.1.137 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 237)) (0.1.137)
Requirement already satisfied: language_data==1.2.0 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 238)) (1.2.0)
Requirement already satisfied: launchpadlib==1.10.16 in /usr/lib/python3/dist-packag
es (from -r requirements.txt (line 239)) (1.10.16)
Requirement already satisfied: lazr.restfulclient==0.14.4 in /usr/lib/python3/dist-p
ackages (from -r requirements.txt (line 240)) (0.14.4)
Requirement already satisfied: lazr.uri==1.0.6 in /usr/lib/python3/dist-packages (fr
om -r requirements.txt (line 241)) (1.0.6)
Requirement already satisfied: lazy_loader==0.4 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 242)) (0.4)
Requirement already satisfied: libclang==18.1.1 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 243)) (18.1.1)
Requirement already satisfied: librosa==0.10.2.post1 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 245)) (0.10.2.post1)
Requirement already satisfied: lightgbm==4.5.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 246)) (4.5.0)
Requirement already satisfied: linkify-it-py==2.0.3 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 247)) (2.0.3)
Requirement already satisfied: llvmlite==0.43.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 248)) (0.43.0)
Requirement already satisfied: locket==1.0.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 249)) (1.0.0)
Requirement already satisfied: logical-unification==0.4.6 in /usr/local/lib/python3.
10/dist-packages (from -r requirements.txt (line 250)) (0.4.6)
Requirement already satisfied: lxml==5.3.0 in /usr/local/lib/python3.10/dist-package
s (from -r requirements.txt (line 251)) (5.3.0)
Requirement already satisfied: marisa-trie==1.2.1 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 252)) (1.2.1)
Requirement already satisfied: Markdown==3.7 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 253)) (3.7)
Requirement already satisfied: markdown-it-py==3.0.0 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 254)) (3.0.0)
Requirement already satisfied: MarkupSafe==3.0.2 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 255)) (3.0.2)
Requirement already satisfied: matplotlib==3.8.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 256)) (3.8.0)
Requirement already satisfied: matplotlib-inline==0.1.7 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 257)) (0.1.7)
Requirement already satisfied: matplotlib-venn==1.1.1 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 258)) (1.1.1)
Requirement already satisfied: mdit-py-plugins==0.4.2 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 259)) (0.4.2)
Requirement already satisfied: mdurl==0.1.2 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 260)) (0.1.2)
```

```
Requirement already satisfied: miniKanren==1.0.3 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 261)) (1.0.3)
Requirement already satisfied: missingno==0.5.2 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 262)) (0.5.2)
Requirement already satisfied: mistune==3.0.2 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 263)) (3.0.2)
Requirement already satisfied: mizani==0.13.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 264)) (0.13.0)
Requirement already satisfied: mkl==2024.2.2 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 265)) (2024.2.2)
Requirement already satisfied: ml-dtypes==0.4.1 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 266)) (0.4.1)
Requirement already satisfied: mlxtend==0.23.1 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 267)) (0.23.1)
Requirement already satisfied: more-itertools==10.5.0 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 268)) (10.5.0)
Requirement already satisfied: moviepy==1.0.3 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 269)) (1.0.3)
Requirement already satisfied: mpmath==1.3.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 270)) (1.3.0)
Requirement already satisfied: msgpack==1.1.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 271)) (1.1.0)
Requirement already satisfied: multidict==6.1.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 272)) (6.1.0)
Requirement already satisfied: multipledispatch==1.0.0 in /usr/local/lib/python3.10/
dist-packages (from -r requirements.txt (line 273)) (1.0.0)
Requirement already satisfied: multitasking==0.0.11 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 274)) (0.0.11)
Requirement already satisfied: murmurhash==1.0.10 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 275)) (1.0.10)
Requirement already satisfied: music21==9.1.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 276)) (9.1.0)
Requirement already satisfied: namex==0.0.8 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 277)) (0.0.8)
Requirement already satisfied: natsort==8.4.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 278)) (8.4.0)
Requirement already satisfied: nbclassic==1.1.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 279)) (1.1.0)
Requirement already satisfied: nbclient==0.10.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 280)) (0.10.0)
Requirement already satisfied: nbconvert==7.16.4 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 281)) (7.16.4)
Requirement already satisfied: nbformat==5.10.4 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 282)) (5.10.4)
Requirement already satisfied: nest-asyncio==1.6.0 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 283)) (1.6.0)
Requirement already satisfied: networkx==3.4.2 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 284)) (3.4.2)
Requirement already satisfied: nibabel==5.3.2 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 285)) (5.3.2)
Requirement already satisfied: nltk==3.8.1 in /usr/local/lib/python3.10/dist-package
s (from -r requirements.txt (line 286)) (3.8.1)
Requirement already satisfied: notebook==6.5.5 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 287)) (6.5.5)
Requirement already satisfied: notebook_shim==0.2.4 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 288)) (0.2.4)
```

Requirement already satisfied: numba==0.60.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 289)) (0.60.0)
Requirement already satisfied: numexpr==2.10.1 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 290)) (2.10.1)
Requirement already satisfied: numpy==1.26.4 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 291)) (1.26.4)
Requirement already satisfied: nvidia-cublas-cu12==12.6.3.3 in /usr/local/lib/python
3.10/dist-packages (from -r requirements.txt (line 292)) (12.6.3.3)
Requirement already satisfied: nvidia-cuda-cupti-cu12==12.6.80 in /usr/local/lib/pyt
hon3.10/dist-packages (from -r requirements.txt (line 293)) (12.6.80)
Requirement already satisfied: nvidia-cuda-nvcc-cu12==12.6.77 in /usr/local/lib/pyth
on3.10/dist-packages (from -r requirements.txt (line 294)) (12.6.77)
Requirement already satisfied: nvidia-cuda-runtime-cu12==12.6.77 in /usr/local/lib/p
ython3.10/dist-packages (from -r requirements.txt (line 295)) (12.6.77)
Requirement already satisfied: nvidia-cudnn-cu12==9.5.1.17 in /usr/local/lib/python
3.10/dist-packages (from -r requirements.txt (line 296)) (9.5.1.17)
Requirement already satisfied: nvidia-cufft-cu12==11.3.0.4 in /usr/local/lib/python
3.10/dist-packages (from -r requirements.txt (line 297)) (11.3.0.4)
Requirement already satisfied: nvidia-curand-cu12==10.3.7.77 in /usr/local/lib/pytho
n3.10/dist-packages (from -r requirements.txt (line 298)) (10.3.7.77)
Requirement already satisfied: nvidia-cusolver-cu12==11.7.1.2 in /usr/local/lib/pyth
on3.10/dist-packages (from -r requirements.txt (line 299)) (11.7.1.2)
Requirement already satisfied: nvidia-cusparse-cu12==12.5.4.2 in /usr/local/lib/pyth
on3.10/dist-packages (from -r requirements.txt (line 300)) (12.5.4.2)
Requirement already satisfied: nvidia-nccl-cu12==2.23.4 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 301)) (2.23.4)
Requirement already satisfied: nvidia-nvjitlink-cu12==12.6.77 in /usr/local/lib/pyth
on3.10/dist-packages (from -r requirements.txt (line 302)) (12.6.77)
Requirement already satisfied: nvtx==0.2.10 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 303)) (0.2.10)
Requirement already satisfied: oauth2client==4.1.3 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 305)) (4.1.3)
Requirement already satisfied: oauthlib==3.2.2 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 306)) (3.2.2)
Requirement already satisfied: openai==1.52.2 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 307)) (1.52.2)
Requirement already satisfied: opencv-contrib-python==4.10.0.84 in /usr/local/lib/py
thon3.10/dist-packages (from -r requirements.txt (line 308)) (4.10.0.84)
Requirement already satisfied: opencv-python==4.10.0.84 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 309)) (4.10.0.84)
Requirement already satisfied: opencv-python-headless==4.10.0.84 in /usr/local/lib/p
ython3.10/dist-packages (from -r requirements.txt (line 310)) (4.10.0.84)
Requirement already satisfied: openpyxl==3.1.5 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 311)) (3.1.5)
Requirement already satisfied: opentelemetry-api==1.16.0 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 312)) (1.16.0)
Requirement already satisfied: opentelemetry-sdk==1.16.0 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 313)) (1.16.0)
Requirement already satisfied: opentelemetry-semantic-conventions==0.37b0 in /usr/lo
cal/lib/python3.10/dist-packages (from -r requirements.txt (line 314)) (0.37b0)
Requirement already satisfied: opt_einsum==3.4.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 315)) (3.4.0)
Requirement already satisfied: optax==0.2.3 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 316)) (0.2.3)
Requirement already satisfied: optree==0.13.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 317)) (0.13.0)

Requirement already satisfied: orbax-checkpoint==0.6.4 in /usr/local/lib/python3.10/
dist-packages (from -r requirements.txt (line 318)) (0.6.4)
Requirement already satisfied: orjson==3.10.10 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 319)) (3.10.10)
Requirement already satisfied: osqp==0.6.7.post3 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 320)) (0.6.7.post3)
Requirement already satisfied: packaging==24.1 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 321)) (24.1)
Requirement already satisfied: pandas==2.2.2 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 322)) (2.2.2)
Requirement already satisfied: pandas-datareader==0.10.0 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 323)) (0.10.0)
Requirement already satisfied: pandas-gbq==0.24.0 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 324)) (0.24.0)
Requirement already satisfied: pandas-stubs==2.2.2.240909 in /usr/local/lib/python3.
10/dist-packages (from -r requirements.txt (line 325)) (2.2.2.240909)
Requirement already satisfied: pandocfilters==1.5.1 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 326)) (1.5.1)
Requirement already satisfied: panel==1.4.5 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 327)) (1.4.5)
Requirement already satisfied: param==2.1.1 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 328)) (2.1.1)
Requirement already satisfied: parso==0.8.4 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 329)) (0.8.4)
Requirement already satisfied: parsy==2.1 in /usr/local/lib/python3.10/dist-packages
(from -r requirements.txt (line 330)) (2.1)
Requirement already satisfied: partd==1.4.2 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 331)) (1.4.2)
Requirement already satisfied: pathlib==1.0.1 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 332)) (1.0.1)
Requirement already satisfied: patsy==0.5.6 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 333)) (0.5.6)
Requirement already satisfied: peewee==3.17.7 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 334)) (3.17.7)
Requirement already satisfied: peft==0.13.2 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 335)) (0.13.2)
Requirement already satisfied: pexpect==4.9.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 336)) (4.9.0)
Requirement already satisfied: pickleshare==0.7.5 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 337)) (0.7.5)
Requirement already satisfied: pillow==10.4.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 338)) (10.4.0)
Requirement already satisfied: platformdirs==4.3.6 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 339)) (4.3.6)
Requirement already satisfied: plotly==5.24.1 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 340)) (5.24.1)
Requirement already satisfied: plotnine==0.14.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 341)) (0.14.0)
Requirement already satisfied: pluggy==1.5.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 342)) (1.5.0)
Requirement already satisfied: polars==1.9.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 343)) (1.9.0)
Requirement already satisfied: pooch==1.8.2 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 344)) (1.8.2)
Requirement already satisfied: portpicker==1.5.2 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 345)) (1.5.2)

Requirement already satisfied: preshed==3.0.9 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 346)) (3.0.9)
Requirement already satisfied: prettytable==3.11.0 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 347)) (3.11.0)
Requirement already satisfied: proglog==0.1.10 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 348)) (0.1.10)
Requirement already satisfied: progressbar2==4.5.0 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 349)) (4.5.0)
Requirement already satisfied: prometheus_client==0.21.0 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 350)) (0.21.0)
Requirement already satisfied: promise==2.3 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 351)) (2.3)
Requirement already satisfied: prompt_toolkit==3.0.48 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 352)) (3.0.48)
Requirement already satisfied: propcache==0.2.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 353)) (0.2.0)
Requirement already satisfied: prophet==1.1.6 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 354)) (1.1.6)
Requirement already satisfied: proto-plus==1.25.0 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 355)) (1.25.0)
Requirement already satisfied: protobuf==3.20.3 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 356)) (3.20.3)
Requirement already satisfied: psutil==5.9.5 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 357)) (5.9.5)
Requirement already satisfied: psycopg2==2.9.10 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 358)) (2.9.10)
Requirement already satisfied: ptyprocess==0.7.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 359)) (0.7.0)
Requirement already satisfied: py-cpuinfo==9.0.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 360)) (9.0.0)
Requirement already satisfied: py4j==0.10.9.7 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 361)) (0.10.9.7)
Requirement already satisfied: pyarrow==17.0.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 362)) (17.0.0)
Requirement already satisfied: pyarrow-hotfix==0.6 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 363)) (0.6)
Requirement already satisfied: pyasn1==0.6.1 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 364)) (0.6.1)
Requirement already satisfied: pyasn1_modules==0.4.1 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 365)) (0.4.1)
Requirement already satisfied: pycocoevalcap==1.2 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 366)) (1.2)
Requirement already satisfied: pycocotools==2.0.8 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 367)) (2.0.8)
Requirement already satisfied: pycparser==2.22 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 368)) (2.22)
Requirement already satisfied: pydantic==2.9.2 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 369)) (2.9.2)
Requirement already satisfied: pydantic_core==2.23.4 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 370)) (2.23.4)
Requirement already satisfied: pydata-google-auth==1.8.2 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 371)) (1.8.2)
Requirement already satisfied: pydot==3.0.2 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 372)) (3.0.2)
Requirement already satisfied: pydotplus==2.0.2 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 373)) (2.0.2)

```
Requirement already satisfied: PyDrive==1.3.1 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 374)) (1.3.1)
Requirement already satisfied: PyDrive2==1.20.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 375)) (1.20.0)
Requirement already satisfied: pyerfa==2.0.1.4 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 376)) (2.0.1.4)
Requirement already satisfied: pygame==2.6.1 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 377)) (2.6.1)
Requirement already satisfied: pygit2==1.16.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 378)) (1.16.0)
Requirement already satisfied: Pygments==2.18.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 379)) (2.18.0)
Requirement already satisfied: PyJWT==2.9.0 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 381)) (2.9.0)
Requirement already satisfied: pylibcugraph-cu12==24.10.0 in /usr/local/lib/python3.
10/dist-packages (from -r requirements.txt (line 383)) (24.10.0)
Requirement already satisfied: pylibraft-cu12==24.10.0 in /usr/local/lib/python3.10/
dist-packages (from -r requirements.txt (line 384)) (24.10.0)
Requirement already satisfied: pymc==5.17.0 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 385)) (5.17.0)
Requirement already satisfied: pymystem3==0.2.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 386)) (0.2.0)
Requirement already satisfied: pynvjitlink-cu12==0.4.0 in /usr/local/lib/python3.10/
dist-packages (from -r requirements.txt (line 387)) (0.4.0)
Requirement already satisfied: pyogrio==0.10.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 388)) (0.10.0)
Requirement already satisfied: PyOpenGL==3.1.7 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 389)) (3.1.7)
Requirement already satisfied: pyOpenSSL==24.2.1 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 390)) (24.2.1)
Requirement already satisfied: pyparsing==3.2.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 391)) (3.2.0)
Requirement already satisfied: pyperclip==1.9.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 392)) (1.9.0)
Requirement already satisfied: pyproj==3.7.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 393)) (3.7.0)
Requirement already satisfied: pyshp==2.3.1 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 394)) (2.3.1)
Requirement already satisfied: PySocks==1.7.1 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 395)) (1.7.1)
Requirement already satisfied: pyspark==3.5.3 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 396)) (3.5.3)
Requirement already satisfied: pytensor==2.25.5 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 397)) (2.25.5)
Requirement already satisfied: pytest==7.4.4 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 398)) (7.4.4)
Requirement already satisfied: python-apt==0.0.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 399)) (0.0.0)
Requirement already satisfied: python-box==7.2.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 400)) (7.2.0)
Requirement already satisfied: python-dateutil==2.8.2 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 401)) (2.8.2)
Requirement already satisfied: python-louvain==0.16 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 402)) (0.16)
Requirement already satisfied: python-slugify==8.0.4 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 403)) (8.0.4)
```

Requirement already satisfied: python-utils==3.9.0 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 404)) (3.9.0)
Requirement already satisfied: pytz==2024.2 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 405)) (2024.2)
Requirement already satisfied: pyviz_comms==3.0.3 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 406)) (3.0.3)
Requirement already satisfied: PyYAML==6.0.2 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 407)) (6.0.2)
Requirement already satisfied: pyzmq==24.0.1 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 408)) (24.0.1)
Requirement already satisfied: qdldl==0.1.7.post4 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 409)) (0.1.7.post4)
Requirement already satisfied: ratelim==0.1.6 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 410)) (0.1.6)
Requirement already satisfied: referencing==0.35.1 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 411)) (0.35.1)
Requirement already satisfied: regex==2024.9.11 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 412)) (2024.9.11)
Requirement already satisfied: requests==2.32.3 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 413)) (2.32.3)
Requirement already satisfied: requests-oauthlib==1.3.1 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 414)) (1.3.1)
Requirement already satisfied: requests-toolbelt==1.0.0 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 415)) (1.0.0)
Requirement already satisfied: requirements-parser==0.9.0 in /usr/local/lib/python3.
10/dist-packages (from -r requirements.txt (line 416)) (0.9.0)
Requirement already satisfied: rich==13.9.3 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 417)) (13.9.3)
Requirement already satisfied: rmm-cu12==24.10.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 418)) (24.10.0)
Requirement already satisfied: rpds-py==0.20.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 419)) (0.20.0)
Requirement already satisfied: rpy2==3.4.2 in /usr/local/lib/python3.10/dist-package
s (from -r requirements.txt (line 420)) (3.4.2)
Requirement already satisfied: rsa==4.9 in /usr/local/lib/python3.10/dist-packages
(from -r requirements.txt (line 421)) (4.9)
Requirement already satisfied: safetensors==0.4.5 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 422)) (0.4.5)
Requirement already satisfied: scikit-image==0.24.0 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 423)) (0.24.0)
Requirement already satisfied: scikit-learn==1.5.2 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 424)) (1.5.2)
Requirement already satisfied: scipy==1.13.1 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 425)) (1.13.1)
Requirement already satisfied: scooby==0.10.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 426)) (0.10.0)
Requirement already satisfied: scs==3.2.7 in /usr/local/lib/python3.10/dist-packages
(from -r requirements.txt (line 427)) (3.2.7)
Requirement already satisfied: seaborn==0.13.2 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 428)) (0.13.2)
Requirement already satisfied: SecretStorage==3.3.1 in /usr/lib/python3/dist-package
s (from -r requirements.txt (line 429)) (3.3.1)
Requirement already satisfied: Send2Trash==1.8.3 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 430)) (1.8.3)
Requirement already satisfied: sentence-transformers==3.2.1 in /usr/local/lib/python
3.10/dist-packages (from -r requirements.txt (line 431)) (3.2.1)

Requirement already satisfied: sentencepiece==0.2.0 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 432)) (0.2.0)
Requirement already satisfied: sentry-sdk==2.17.0 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 433)) (2.17.0)
Requirement already satisfied: setproctitle==1.3.3 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 434)) (1.3.3)
Requirement already satisfied: shap==0.46.0 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 435)) (0.46.0)
Requirement already satisfied: shapely==2.0.6 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 436)) (2.0.6)
Requirement already satisfied: shellingham==1.5.4 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 437)) (1.5.4)
Requirement already satisfied: simple-parsing==0.1.6 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 438)) (0.1.6)
Requirement already satisfied: six==1.16.0 in /usr/local/lib/python3.10/dist-package
s (from -r requirements.txt (line 439)) (1.16.0)
Requirement already satisfied: sklearn-pandas==2.2.0 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 440)) (2.2.0)
Requirement already satisfied: slicer==0.0.8 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 441)) (0.0.8)
Requirement already satisfied: smart-open==7.0.5 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 442)) (7.0.5)
Requirement already satisfied: smmap==5.0.1 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 443)) (5.0.1)
Requirement already satisfied: sniffio==1.3.1 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 444)) (1.3.1)
Requirement already satisfied: snowballstemmer==2.2.0 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 445)) (2.2.0)
Requirement already satisfied: soundfile==0.12.1 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 446)) (0.12.1)
Requirement already satisfied: soupsieve==2.6 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 447)) (2.6)
Requirement already satisfied: soxr==0.5.0.post1 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 448)) (0.5.0.post1)
Requirement already satisfied: spacy==3.7.5 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 449)) (3.7.5)
Requirement already satisfied: spacy-legacy==3.0.12 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 450)) (3.0.12)
Requirement already satisfied: spacy-loggers==1.0.5 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 451)) (1.0.5)
Requirement already satisfied: Sphinx==5.0.2 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 452)) (5.0.2)
Requirement already satisfied: sphinxcontrib-applehelp==2.0.0 in /usr/local/lib/pyth
on3.10/dist-packages (from -r requirements.txt (line 453)) (2.0.0)
Requirement already satisfied: sphinxcontrib-devhelp==2.0.0 in /usr/local/lib/python
3.10/dist-packages (from -r requirements.txt (line 454)) (2.0.0)
Requirement already satisfied: sphinxcontrib-htmlhelp==2.1.0 in /usr/local/lib/pytho
n3.10/dist-packages (from -r requirements.txt (line 455)) (2.1.0)
Requirement already satisfied: sphinxcontrib-jsmath==1.0.1 in /usr/local/lib/python
3.10/dist-packages (from -r requirements.txt (line 456)) (1.0.1)
Requirement already satisfied: sphinxcontrib-qthelp==2.0.0 in /usr/local/lib/python
3.10/dist-packages (from -r requirements.txt (line 457)) (2.0.0)
Requirement already satisfied: sphinxcontrib-serializinghtml==2.0.0 in /usr/local/li
b/python3.10/dist-packages (from -r requirements.txt (line 458)) (2.0.0)
Requirement already satisfied: SQLAlchemy==2.0.36 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 459)) (2.0.36)

Requirement already satisfied: sqlglot==25.1.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 460)) (25.1.0)
Requirement already satisfied: sqlparse==0.5.1 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 461)) (0.5.1)
Requirement already satisfied: srsly==2.4.8 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 462)) (2.4.8)
Requirement already satisfied: stanio==0.5.1 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 463)) (0.5.1)
Requirement already satisfied: statsmodels==0.14.4 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 464)) (0.14.4)
Requirement already satisfied: StrEnum==0.4.15 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 465)) (0.4.15)
Requirement already satisfied: stringzilla==3.10.6 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 466)) (3.10.6)
Requirement already satisfied: sympy==1.13.1 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 467)) (1.13.1)
Requirement already satisfied: tables==3.8.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 468)) (3.8.0)
Requirement already satisfied: tabulate==0.9.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 469)) (0.9.0)
Requirement already satisfied: tbb==2021.13.1 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 470)) (2021.13.1)
Requirement already satisfied: tcmlib==1.2.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 471)) (1.2.0)
Requirement already satisfied: tenacity==9.0.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 472)) (9.0.0)
Requirement already satisfied: tensorboard==2.17.0 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 473)) (2.17.0)
Requirement already satisfied: tensorboard-data-server==0.7.2 in /usr/local/lib/pyth
on3.10/dist-packages (from -r requirements.txt (line 474)) (0.7.2)
Requirement already satisfied: tensorflow==2.17.0 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 475)) (2.17.0)
Requirement already satisfied: tensorflow-datasets==4.9.6 in /usr/local/lib/python3.
10/dist-packages (from -r requirements.txt (line 476)) (4.9.6)
Requirement already satisfied: tensorflow-hub==0.16.1 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 477)) (0.16.1)
Requirement already satisfied: tensorflow-io-gcs-filesystem==0.37.1 in /usr/local/li
b/python3.10/dist-packages (from -r requirements.txt (line 478)) (0.37.1)
Requirement already satisfied: tensorflow-metadata==1.16.1 in /usr/local/lib/python
3.10/dist-packages (from -r requirements.txt (line 479)) (1.16.1)
Requirement already satisfied: tensorflow-probability==0.24.0 in /usr/local/lib/pyth
on3.10/dist-packages (from -r requirements.txt (line 480)) (0.24.0)
Requirement already satisfied: tensorstore==0.1.67 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 481)) (0.1.67)
Requirement already satisfied: termcolor==2.5.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 482)) (2.5.0)
Requirement already satisfied: terminado==0.18.1 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 483)) (0.18.1)
Requirement already satisfied: text-unidecode==1.3 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 484)) (1.3)
Requirement already satisfied: textblob==0.17.1 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 485)) (0.17.1)
Requirement already satisfied: tf-slim==1.1.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 486)) (1.1.0)
Requirement already satisfied: tf_keras==2.17.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 487)) (2.17.0)

Requirement already satisfied: thinc==8.2.5 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 488)) (8.2.5)
Requirement already satisfied: threadpoolctl==3.5.0 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 489)) (3.5.0)
Requirement already satisfied: tifffile==2024.9.20 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 490)) (2024.9.20)
Requirement already satisfied: timm==1.0.11 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 491)) (1.0.11)
Requirement already satisfied: tinycss2==1.4.0 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 492)) (1.4.0)
Requirement already satisfied: tokenizers==0.19.1 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 493)) (0.19.1)
Requirement already satisfied: toml==0.10.2 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 494)) (0.10.2)
Requirement already satisfied: tomli==2.0.2 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 495)) (2.0.2)
Requirement already satisfied: toolz==0.12.1 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 496)) (0.12.1)
Requirement already satisfied: torchsummary==1.5.1 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 499)) (1.5.1)
Requirement already satisfied: tornado==6.3.3 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 501)) (6.3.3)
Requirement already satisfied: tqdm==4.66.6 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 502)) (4.66.6)
Requirement already satisfied: traitlets==5.7.1 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 503)) (5.7.1)
Requirement already satisfied: traittypes==0.2.1 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 504)) (0.2.1)
Requirement already satisfied: transformers==4.44.2 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 505)) (4.44.2)
Requirement already satisfied: tweepy==4.14.0 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 506)) (4.14.0)
Requirement already satisfied: typeguard==4.4.0 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 507)) (4.4.0)
Requirement already satisfied: typer==0.12.5 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 508)) (0.12.5)
Requirement already satisfied: types-pytz==2024.2.0.20241003 in /usr/local/lib/pytho
n3.10/dist-packages (from -r requirements.txt (line 509)) (2024.2.0.20241003)
Requirement already satisfied: types-setuptools==75.3.0.20241107 in /usr/local/lib/p
ython3.10/dist-packages (from -r requirements.txt (line 510)) (75.3.0.20241107)
Requirement already satisfied: typing_extensions==4.12.2 in /usr/local/lib/python3.1
0/dist-packages (from -r requirements.txt (line 511)) (4.12.2)
Requirement already satisfied: tzdata==2024.2 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 512)) (2024.2)
Requirement already satisfied: tzlocal==5.2 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 513)) (5.2)
Requirement already satisfied: uc-micro-py==1.0.3 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 514)) (1.0.3)
Requirement already satisfied: umf==0.9.0 in /usr/local/lib/python3.10/dist-packages
(from -r requirements.txt (line 515)) (0.9.0)
Requirement already satisfied: uritemplate==4.1.1 in /usr/local/lib/python3.10/dist-
packages (from -r requirements.txt (line 516)) (4.1.1)
Requirement already satisfied: urllib3==2.2.3 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 517)) (2.2.3)
Requirement already satisfied: vega-datasets==0.9.0 in /usr/local/lib/python3.10/dis
t-packages (from -r requirements.txt (line 518)) (0.9.0)

Requirement already satisfied: wadllib==1.3.6 in /usr/lib/python3/dist-packages (fro
m -r requirements.txt (line 519)) (1.3.6)
Requirement already satisfied: wandb==0.18.5 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 520)) (0.18.5)
Requirement already satisfied: wasabi==1.1.3 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 521)) (1.1.3)
Requirement already satisfied: wcwidth==0.2.13 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 522)) (0.2.13)
Requirement already satisfied: weasel==0.4.1 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 523)) (0.4.1)
Requirement already satisfied: webcolors==24.8.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 524)) (24.8.0)
Requirement already satisfied: webencodings==0.5.1 in /usr/local/lib/python3.10/dist
-packages (from -r requirements.txt (line 525)) (0.5.1)
Requirement already satisfied: websocket-client==1.8.0 in /usr/local/lib/python3.10/
dist-packages (from -r requirements.txt (line 526)) (1.8.0)
Requirement already satisfied: Werkzeug==3.0.6 in /usr/local/lib/python3.10/dist-pac
kages (from -r requirements.txt (line 527)) (3.0.6)
Requirement already satisfied: widgetsnbextension==3.6.10 in /usr/local/lib/python3.
10/dist-packages (from -r requirements.txt (line 528)) (3.6.10)
Requirement already satisfied: wordcloud==1.9.3 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 529)) (1.9.3)
Requirement already satisfied: wrapt==1.16.0 in /usr/local/lib/python3.10/dist-packa
ges (from -r requirements.txt (line 530)) (1.16.0)
Requirement already satisfied: xarray==2024.10.0 in /usr/local/lib/python3.10/dist-p
ackages (from -r requirements.txt (line 531)) (2024.10.0)
Requirement already satisfied: xarray-einstats==0.8.0 in /usr/local/lib/python3.10/d
ist-packages (from -r requirements.txt (line 532)) (0.8.0)
Requirement already satisfied: xgboost==2.1.2 in /usr/local/lib/python3.10/dist-pack
ages (from -r requirements.txt (line 533)) (2.1.2)
Requirement already satisfied: xlrd==2.0.1 in /usr/local/lib/python3.10/dist-package
s (from -r requirements.txt (line 534)) (2.0.1)
Requirement already satisfied: xyzservices==2024.9.0 in /usr/local/lib/python3.10/di
st-packages (from -r requirements.txt (line 535)) (2024.9.0)
Requirement already satisfied: yarl==1.17.0 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 536)) (1.17.0)
Requirement already satisfied: yellowbrick==1.5 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 537)) (1.5)
Requirement already satisfied: yfinance==0.2.48 in /usr/local/lib/python3.10/dist-pa
ckages (from -r requirements.txt (line 538)) (0.2.48)
Requirement already satisfied: zipp==3.20.2 in /usr/local/lib/python3.10/dist-packag
es (from -r requirements.txt (line 539)) (3.20.2)
Requirement already satisfied: setuptools>=60.0.0 in /usr/local/lib/python3.10/dist-
packages (from arviz==0.20.0->-r requirements.txt (line 15)) (75.1.0)
Requirement already satisfied: wheel<1.0,>=0.23.0 in /usr/local/lib/python3.10/dist-
packages (from astunparse==1.6.3->-r requirements.txt (line 18)) (0.44.0)
Requirement already satisfied: pip in /usr/local/lib/python3.10/dist-packages (from
fastai==2.7.18->-r requirements.txt (line 98)) (24.1.2)
Collecting jedi>=0.16 (from ipython==7.34.0->-r requirements.txt (line 200))
  Downloading jedi-0.19.1-py2.py3-none-any.whl.metadata (22 kB)
Downloading jedi-0.19.1-py2.py3-none-any.whl (1.6 MB)
━━ 1.6/1.6 MB 56.3 MB/s eta 0:00:00
Installing collected packages: jedi
Successfully installed jedi-0.19.1

Training

This cell kicks off a training session with a batch size of 50. When training completes, it
proceeds to test and score the model.

```
In [8]:  %cd '/content/image_captioning'

         ! python run_project.py --batch_size 50 \
                             --features_path "/content/drive/MyDrive/Colab Notebooks/ece570
                             --annotation_folder "/content/drive/MyDrive/Colab Notebooks/ec
                             --save_path "/content/drive/MyDrive/Colab Notebooks/ece570_pro
```

```
/content/image_captioning
2024-11-10 20:39:32.402899: I tensorflow/core/util/port.cc:153] oneDNN custom operat
ions are on. You may see slightly different numerical results due to floating-point
round-off errors from different computation orders. To turn them off, set the enviro
nment variable `TF_ENABLE_ONEDNN_OPTS=0`.
2024-11-10 20:39:32.420913: E external/local_xla/xla/stream_executor/cuda/cuda_fft.c
c:485] Unable to register cuFFT factory: Attempting to register factory for plugin c
uFFT when one has already been registered
2024-11-10 20:39:32.442254: E external/local_xla/xla/stream_executor/cuda/cuda_dnn.c
c:8454] Unable to register cuDNN factory: Attempting to register factory for plugin
cuDNN when one has already been registered
2024-11-10 20:39:32.448759: E external/local_xla/xla/stream_executor/cuda/cuda_blas.
cc:1452] Unable to register cuBLAS factory: Attempting to register factory for plugi
n cuBLAS when one has already been registered
2024-11-10 20:39:32.464389: I tensorflow/core/platform/cpu_feature_guard.cc:210] Thi
s TensorFlow binary is optimized to use available CPU instructions in performance-cr
itical operations.
To enable the following instructions: AVX2 AVX512F AVX512_VNNI FMA, in other operati
ons, rebuild TensorFlow with the appropriate compiler flags.
2024-11-10 20:39:33.597668: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38]
TF-TRT Warning: Could not find TensorRT
Namespace(exp_name='GET', save_path='/content/drive/MyDrive/Colab Notebooks/ece570_p
roject', load_model=None, batch_size=50, features_path='/content/drive/MyDrive/Colab
Notebooks/ece570_project/meshed-memory-transformer/coco_detections.hdf5', annotation
_folder='/content/drive/MyDrive/Colab Notebooks/ece570_project/meshed-memory-transfo
rmer/annotations')
Image Captioning Project
loading annotations into memory...
Done (t=0.66s)
creating index...
index created!
loading annotations into memory...
Done (t=0.32s)
creating index...
index created!
Training Dataset size: 18000
Test Dataset size: 1800
<torch.utils.data.dataloader.DataLoader object at 0x7c7de40d7fd0>
/usr/local/lib/python3.10/dist-packages/transformers/tokenization_utils_base.py:160
1: FutureWarning: `clean_up_tokenization_spaces` was not set. It will be set to `Tru
e` by default. This behavior will be depracted in transformers v4.45, and will be th
en set to `False` by default. For more details check this issue: https://github.com/
huggingface/transformers/issues/31884
  warnings.warn(
Starting training...

Batch 0 of 361

--------------------------------
Epoch 1: [0/18000] Loss: 10842.509
--------------------------------

Batch 1 of 361
Batch 2 of 361
Batch 3 of 361
```

```
--------------------------------
Epoch 1: [150/18000] Loss: 11358.889
--------------------------------

Batch 4 of 361
Batch 5 of 361
Batch 6 of 361

--------------------------------
Epoch 1: [300/18000] Loss: 11352.889
--------------------------------

Batch 7 of 361
Batch 8 of 361
Batch 9 of 361

--------------------------------
Epoch 1: [450/18000] Loss: 10889.889
--------------------------------

Batch 10 of 361
Batch 11 of 361
Batch 12 of 361

--------------------------------
Epoch 1: [600/18000] Loss: 10425.576
--------------------------------

Batch 13 of 361
Batch 14 of 361
Batch 15 of 361

--------------------------------
Epoch 1: [750/18000] Loss: 9491.949
--------------------------------

Batch 16 of 361
Batch 17 of 361
Batch 18 of 361

--------------------------------
Epoch 1: [900/18000] Loss: 11364.201
--------------------------------

Batch 19 of 361
Batch 20 of 361
Batch 21 of 361

--------------------------------
Epoch 1: [1050/18000] Loss: 14166.080
--------------------------------

Batch 22 of 361
Batch 23 of 361
Batch 24 of 361
```

```
--------------------------------
Epoch 1: [1200/18000] Loss: 15103.706
--------------------------------

Batch 25 of 361
Batch 26 of 361
Batch 27 of 361

--------------------------------
Epoch 1: [1350/18000] Loss: 10904.889
--------------------------------

Batch 28 of 361
Batch 29 of 361
Batch 30 of 361

--------------------------------
Epoch 1: [1500/18000] Loss: 9466.949
--------------------------------

Batch 31 of 361
Batch 32 of 361
Batch 33 of 361

--------------------------------
Epoch 1: [1650/18000] Loss: 13234.453
--------------------------------

Batch 34 of 361
Batch 35 of 361
Batch 36 of 361

--------------------------------
Epoch 1: [1800/18000] Loss: 8529.323
--------------------------------

Batch 37 of 361
Batch 38 of 361
Batch 39 of 361

--------------------------------
Epoch 1: [1950/18000] Loss: 9502.949
--------------------------------

Batch 40 of 361
Batch 41 of 361
Batch 42 of 361

--------------------------------
Epoch 1: [2100/18000] Loss: 10430.576
--------------------------------

Batch 43 of 361
Batch 44 of 361
Batch 45 of 361
```

```
--------------------------------
Epoch 1: [2250/18000] Loss: 8994.637
--------------------------------

Batch 46 of 361
Batch 47 of 361
Batch 48 of 361

--------------------------------
Epoch 1: [2400/18000] Loss: 9011.637
--------------------------------

Batch 49 of 361
Batch 50 of 361
Batch 51 of 361

--------------------------------
Epoch 1: [2550/18000] Loss: 12326.827
--------------------------------

Batch 52 of 361
Batch 53 of 361
Batch 54 of 361

--------------------------------
Epoch 1: [2700/18000] Loss: 11364.201
--------------------------------

Batch 55 of 361
Batch 56 of 361
Batch 57 of 361

--------------------------------
Epoch 1: [2850/18000] Loss: 13698.767
--------------------------------

Batch 58 of 361
Batch 59 of 361
Batch 60 of 361

--------------------------------
Epoch 1: [3000/18000] Loss: 11833.514
--------------------------------

Batch 61 of 361
Batch 62 of 361
Batch 63 of 361

--------------------------------
Epoch 1: [3150/18000] Loss: 13228.453
--------------------------------

Batch 64 of 361
Batch 65 of 361
Batch 66 of 361
```

```
--------------------------------
Epoch 1: [3300/18000] Loss: 10920.889
--------------------------------

Batch 67 of 361
Batch 68 of 361
Batch 69 of 361

--------------------------------
Epoch 1: [3450/18000] Loss: 9487.949
--------------------------------

Batch 70 of 361
Batch 71 of 361
Batch 72 of 361

--------------------------------
Epoch 1: [3600/18000] Loss: 14194.080
--------------------------------

Batch 73 of 361
Batch 74 of 361
Batch 75 of 361

--------------------------------
Epoch 1: [3750/18000] Loss: 10908.889
--------------------------------

Batch 76 of 361
Batch 77 of 361
Batch 78 of 361

--------------------------------
Epoch 1: [3900/18000] Loss: 10899.889
--------------------------------

Batch 79 of 361
Batch 80 of 361
Batch 81 of 361

--------------------------------
Epoch 1: [4050/18000] Loss: 10453.576
--------------------------------

Batch 82 of 361
Batch 83 of 361
Batch 84 of 361

--------------------------------
Epoch 1: [4200/18000] Loss: 10420.576
--------------------------------

Batch 85 of 361
Batch 86 of 361
Batch 87 of 361
```

```
--------------------------------
Epoch 1: [4350/18000] Loss: 11359.201
--------------------------------

Batch 88 of 361
Batch 89 of 361
Batch 90 of 361


--------------------------------
Epoch 1: [4500/18000] Loss: 11372.201
--------------------------------

Batch 91 of 361
Batch 92 of 361
Batch 93 of 361


--------------------------------
Epoch 1: [4650/18000] Loss: 10896.889
--------------------------------

Batch 94 of 361
Batch 95 of 361
Batch 96 of 361


--------------------------------
Epoch 1: [4800/18000] Loss: 8561.323
--------------------------------

Batch 97 of 361
Batch 98 of 361
Batch 99 of 361


--------------------------------
Epoch 1: [4950/18000] Loss: 9989.262
--------------------------------

Batch 100 of 361
Batch 101 of 361
Batch 102 of 361


--------------------------------
Epoch 1: [5100/18000] Loss: 10416.576
--------------------------------

Batch 103 of 361
Batch 104 of 361
Batch 105 of 361


--------------------------------
Epoch 1: [5250/18000] Loss: 10417.576
--------------------------------

Batch 106 of 361
Batch 107 of 361
Batch 108 of 361
```

```
--------------------------------
Epoch 1: [5400/18000] Loss: 14695.393
--------------------------------

Batch 109 of 361
Batch 110 of 361
Batch 111 of 361


--------------------------------
Epoch 1: [5550/18000] Loss: 12291.827
--------------------------------

Batch 112 of 361
Batch 113 of 361
Batch 114 of 361


--------------------------------
Epoch 1: [5700/18000] Loss: 11823.514
--------------------------------

Batch 115 of 361
Batch 116 of 361
Batch 117 of 361


--------------------------------
Epoch 1: [5850/18000] Loss: 9960.262
--------------------------------

Batch 118 of 361
Batch 119 of 361
Batch 120 of 361


--------------------------------
Epoch 1: [6000/18000] Loss: 8987.637
--------------------------------

Batch 121 of 361
Batch 122 of 361
Batch 123 of 361


--------------------------------
Epoch 1: [6150/18000] Loss: 13716.767
--------------------------------

Batch 124 of 361
Batch 125 of 361
Batch 126 of 361


--------------------------------
Epoch 1: [6300/18000] Loss: 9955.262
--------------------------------

Batch 127 of 361
Batch 128 of 361
Batch 129 of 361
```

```
--------------------------------
Epoch 1: [6450/18000] Loss: 9042.637
--------------------------------

Batch 130 of 361
Batch 131 of 361
Batch 132 of 361


--------------------------------
Epoch 1: [6600/18000] Loss: 12786.141
--------------------------------

Batch 133 of 361
Batch 134 of 361
Batch 135 of 361


--------------------------------
Epoch 1: [6750/18000] Loss: 8539.323
--------------------------------

Batch 136 of 361
Batch 137 of 361
Batch 138 of 361


--------------------------------
Epoch 1: [6900/18000] Loss: 10423.576
--------------------------------

Batch 139 of 361
Batch 140 of 361
Batch 141 of 361


--------------------------------
Epoch 1: [7050/18000] Loss: 9031.637
--------------------------------

Batch 142 of 361
Batch 143 of 361
Batch 144 of 361


--------------------------------
Epoch 1: [7200/18000] Loss: 10478.576
--------------------------------

Batch 145 of 361
Batch 146 of 361
Batch 147 of 361


--------------------------------
Epoch 1: [7350/18000] Loss: 12778.141
--------------------------------

Batch 148 of 361
Batch 149 of 361
Batch 150 of 361
```

```
--------------------------------
Epoch 1: [7500/18000] Loss: 9008.637
--------------------------------

Batch 151 of 361
Batch 152 of 361
Batch 153 of 361


--------------------------------
Epoch 1: [7650/18000] Loss: 13226.453
--------------------------------

Batch 154 of 361
Batch 155 of 361
Batch 156 of 361


--------------------------------
Epoch 1: [7800/18000] Loss: 12309.827
--------------------------------

Batch 157 of 361
Batch 158 of 361
Batch 159 of 361


--------------------------------
Epoch 1: [7950/18000] Loss: 10895.889
--------------------------------

Batch 160 of 361
Batch 161 of 361
Batch 162 of 361


--------------------------------
Epoch 1: [8100/18000] Loss: 10446.576
--------------------------------

Batch 163 of 361
Batch 164 of 361
Batch 165 of 361


--------------------------------
Epoch 1: [8250/18000] Loss: 14181.080
--------------------------------

Batch 166 of 361
Batch 167 of 361
Batch 168 of 361


--------------------------------
Epoch 1: [8400/18000] Loss: 10434.576
--------------------------------

Batch 169 of 361
Batch 170 of 361
Batch 171 of 361
```

```
--------------------------------
Epoch 1: [8550/18000] Loss: 9010.637
--------------------------------

Batch 172 of 361
Batch 173 of 361
Batch 174 of 361


--------------------------------
Epoch 1: [8700/18000] Loss: 12317.827
--------------------------------

Batch 175 of 361
Batch 176 of 361
Batch 177 of 361


--------------------------------
Epoch 1: [8850/18000] Loss: 11363.201
--------------------------------

Batch 178 of 361
Batch 179 of 361
Batch 180 of 361


--------------------------------
Epoch 1: [9000/18000] Loss: 10427.576
--------------------------------

Batch 181 of 361
Batch 182 of 361
Batch 183 of 361


--------------------------------
Epoch 1: [9150/18000] Loss: 9950.262
--------------------------------

Batch 184 of 361
Batch 185 of 361
Batch 186 of 361


--------------------------------
Epoch 1: [9300/18000] Loss: 9497.949
--------------------------------

Batch 187 of 361
Batch 188 of 361
Batch 189 of 361


--------------------------------
Epoch 1: [9450/18000] Loss: 10455.576
--------------------------------

Batch 190 of 361
Batch 191 of 361
Batch 192 of 361
```

```
--------------------------------
Epoch 1: [9600/18000] Loss: 9466.949
--------------------------------

Batch 193 of 361
Batch 194 of 361
Batch 195 of 361

--------------------------------
Epoch 1: [9750/18000] Loss: 11369.201
--------------------------------

Batch 196 of 361
Batch 197 of 361
Batch 198 of 361

--------------------------------
Epoch 1: [9900/18000] Loss: 10462.576
--------------------------------

Batch 199 of 361
Batch 200 of 361
Batch 201 of 361

--------------------------------
Epoch 1: [10050/18000] Loss: 13707.767
--------------------------------

Batch 202 of 361
Batch 203 of 361
Batch 204 of 361

--------------------------------
Epoch 1: [10200/18000] Loss: 11407.201
--------------------------------

Batch 205 of 361
Batch 206 of 361
Batch 207 of 361

--------------------------------
Epoch 1: [10350/18000] Loss: 8063.005
--------------------------------

Batch 208 of 361
Batch 209 of 361
Batch 210 of 361

--------------------------------
Epoch 1: [10500/18000] Loss: 10871.889
--------------------------------

Batch 211 of 361
Batch 212 of 361
Batch 213 of 361
```

```
--------------------------------
Epoch 1: [10650/18000] Loss: 10890.889
--------------------------------

Batch 214 of 361
Batch 215 of 361
Batch 216 of 361

--------------------------------
Epoch 1: [10800/18000] Loss: 11340.201
--------------------------------

Batch 217 of 361
Batch 218 of 361
Batch 219 of 361

--------------------------------
Epoch 1: [10950/18000] Loss: 11367.201
--------------------------------

Batch 220 of 361
Batch 221 of 361
Batch 222 of 361

--------------------------------
Epoch 1: [11100/18000] Loss: 9030.637
--------------------------------

Batch 223 of 361
Batch 224 of 361
Batch 225 of 361

--------------------------------
Epoch 1: [11250/18000] Loss: 12764.141
--------------------------------

Batch 226 of 361
Batch 227 of 361
Batch 228 of 361

--------------------------------
Epoch 1: [11400/18000] Loss: 11399.201
--------------------------------

Batch 229 of 361
Batch 230 of 361
Batch 231 of 361

--------------------------------
Epoch 1: [11550/18000] Loss: 11368.201
--------------------------------

Batch 232 of 361
Batch 233 of 361
Batch 234 of 361
```

```
--------------------------------
Epoch 1: [11700/18000] Loss: 9957.262
--------------------------------

Batch 235 of 361
Batch 236 of 361
Batch 237 of 361

--------------------------------
Epoch 1: [11850/18000] Loss: 9040.637
--------------------------------

Batch 238 of 361
Batch 239 of 361
Batch 240 of 361

--------------------------------
Epoch 1: [12000/18000] Loss: 11834.514
--------------------------------

Batch 241 of 361
Batch 242 of 361
Batch 243 of 361

--------------------------------
Epoch 1: [12150/18000] Loss: 9028.637
--------------------------------

Batch 244 of 361
Batch 245 of 361
Batch 246 of 361

--------------------------------
Epoch 1: [12300/18000] Loss: 9465.949
--------------------------------

Batch 247 of 361
Batch 248 of 361
Batch 249 of 361

--------------------------------
Epoch 1: [12450/18000] Loss: 9481.949
--------------------------------

Batch 250 of 361
Batch 251 of 361
Batch 252 of 361

--------------------------------
Epoch 1: [12600/18000] Loss: 16058.316
--------------------------------

Batch 253 of 361
Batch 254 of 361
Batch 255 of 361
```

```
--------------------------------
Epoch 1: [12750/18000] Loss: 10898.889
--------------------------------

Batch 256 of 361
Batch 257 of 361
Batch 258 of 361

--------------------------------
Epoch 1: [12900/18000] Loss: 16547.629
--------------------------------

Batch 259 of 361
Batch 260 of 361
Batch 261 of 361

--------------------------------
Epoch 1: [13050/18000] Loss: 11843.514
--------------------------------

Batch 262 of 361
Batch 263 of 361
Batch 264 of 361

--------------------------------
Epoch 1: [13200/18000] Loss: 12299.827
--------------------------------

Batch 265 of 361
Batch 266 of 361
Batch 267 of 361

--------------------------------
Epoch 1: [13350/18000] Loss: 11380.201
--------------------------------

Batch 268 of 361
Batch 269 of 361
Batch 270 of 361

--------------------------------
Epoch 1: [13500/18000] Loss: 10876.889
--------------------------------

Batch 271 of 361
Batch 272 of 361
Batch 273 of 361

--------------------------------
Epoch 1: [13650/18000] Loss: 9961.262
--------------------------------

Batch 274 of 361
Batch 275 of 361
Batch 276 of 361
```

```
--------------------------------
Epoch 1: [13800/18000] Loss: 11354.201
--------------------------------

Batch 277 of 361
Batch 278 of 361
Batch 279 of 361

--------------------------------
Epoch 1: [13950/18000] Loss: 11837.514
--------------------------------

Batch 280 of 361
Batch 281 of 361
Batch 282 of 361

--------------------------------
Epoch 1: [14100/18000] Loss: 9493.949
--------------------------------

Batch 283 of 361
Batch 284 of 361
Batch 285 of 361

--------------------------------
Epoch 1: [14250/18000] Loss: 12311.827
--------------------------------

Batch 286 of 361
Batch 287 of 361
Batch 288 of 361

--------------------------------
Epoch 1: [14400/18000] Loss: 14178.080
--------------------------------

Batch 289 of 361
Batch 290 of 361
Batch 291 of 361

--------------------------------
Epoch 1: [14550/18000] Loss: 12778.141
--------------------------------

Batch 292 of 361
Batch 293 of 361
Batch 294 of 361

--------------------------------
Epoch 1: [14700/18000] Loss: 9021.637
--------------------------------

Batch 295 of 361
Batch 296 of 361
Batch 297 of 361
```

```
--------------------------------
Epoch 1: [14850/18000] Loss: 9953.262
--------------------------------

Batch 298 of 361
Batch 299 of 361
Batch 300 of 361

--------------------------------
Epoch 1: [15000/18000] Loss: 9978.262
--------------------------------

Batch 301 of 361
Batch 302 of 361
Batch 303 of 361

--------------------------------
Epoch 1: [15150/18000] Loss: 9019.637
--------------------------------

Batch 304 of 361
Batch 305 of 361
Batch 306 of 361

--------------------------------
Epoch 1: [15300/18000] Loss: 11356.201
--------------------------------

Batch 307 of 361
Batch 308 of 361
Batch 309 of 361

--------------------------------
Epoch 1: [15450/18000] Loss: 10436.576
--------------------------------

Batch 310 of 361
Batch 311 of 361
Batch 312 of 361

--------------------------------
Epoch 1: [15600/18000] Loss: 12781.141
--------------------------------

Batch 313 of 361
Batch 314 of 361
Batch 315 of 361

--------------------------------
Epoch 1: [15750/18000] Loss: 15568.020
--------------------------------

Batch 316 of 361
Batch 317 of 361
Batch 318 of 361
```

```
--------------------------------
Epoch 1: [15900/18000] Loss: 11366.201
--------------------------------

Batch 319 of 361
Batch 320 of 361
Batch 321 of 361

--------------------------------
Epoch 1: [16050/18000] Loss: 10902.889
--------------------------------

Batch 322 of 361
Batch 323 of 361
Batch 324 of 361

--------------------------------
Epoch 1: [16200/18000] Loss: 11382.201
--------------------------------

Batch 325 of 361
Batch 326 of 361
Batch 327 of 361

--------------------------------
Epoch 1: [16350/18000] Loss: 10476.576
--------------------------------

Batch 328 of 361
Batch 329 of 361
Batch 330 of 361

--------------------------------
Epoch 1: [16500/18000] Loss: 11853.514
--------------------------------

Batch 331 of 361
Batch 332 of 361
Batch 333 of 361

--------------------------------
Epoch 1: [16650/18000] Loss: 10442.576
--------------------------------

Batch 334 of 361
Batch 335 of 361
Batch 336 of 361

--------------------------------
Epoch 1: [16800/18000] Loss: 8998.637
--------------------------------

Batch 337 of 361
Batch 338 of 361
Batch 339 of 361
```

```
--------------------------------
Epoch 1: [16950/18000] Loss: 12314.827
--------------------------------

Batch 340 of 361
Batch 341 of 361
Batch 342 of 361

--------------------------------
Epoch 1: [17100/18000] Loss: 8563.323
--------------------------------

Batch 343 of 361
Batch 344 of 361
Batch 345 of 361

--------------------------------
Epoch 1: [17250/18000] Loss: 9969.262
--------------------------------

Batch 346 of 361
Batch 347 of 361
Batch 348 of 361

--------------------------------
Epoch 1: [17400/18000] Loss: 10886.889
--------------------------------

Batch 349 of 361
Batch 350 of 361
Batch 351 of 361

--------------------------------
Epoch 1: [17550/18000] Loss: 12313.827
--------------------------------

Batch 352 of 361
Batch 353 of 361
Batch 354 of 361

--------------------------------
Epoch 1: [17700/18000] Loss: 11375.201
--------------------------------

Batch 355 of 361
Batch 356 of 361
Batch 357 of 361

--------------------------------
Epoch 1: [17850/18000] Loss: 9959.262
--------------------------------

Batch 358 of 361
Batch 359 of 361
Training complete. Saving model...
```

```
Beginning tests...

Batch 0 of 37
Batch 1 of 37
Traceback (most recent call last):
  File "/content/image_captioning/run_project.py", line 94, in generate_test_strings
    pred = model.decoder(input_tokens, enc_output, enc_output, g_out, batch_size=1)
  File "/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py", line 17
36, in _wrapped_call_impl
    return self._call_impl(*args, **kwargs)
  File "/usr/local/lib/python3.10/dist-packages/torch/nn/modules/module.py", line 17
47, in _call_impl
    return forward_call(*args, **kwargs)
  File "/content/image_captioning/model/decoder.py", line 78, in forward
    out = self.word_emb(x) + self.get_positional_encoding(self.d_model, x.size(1),
x.device)
  File "/content/image_captioning/model/decoder.py", line 61, in get_positional_enco
ding
    pe[i][(2*j)+1] = math.cos((i)/pow(10000, (2*j)/d_model))
KeyboardInterrupt

During handling of the above exception, another exception occurred:

Traceback (most recent call last):
  File "/content/image_captioning/run_project.py", line 300, in <module>
    main(args)
  File "/content/image_captioning/run_project.py", line 281, in main
    result = test(model, criterion, test_loader, tokenizer, batch_size_test, epoch)
  File "/content/image_captioning/run_project.py", line 148, in test
    test_predictions = generate_test_strings(model, images, ids, tokenizer, test_pre
dictions)
  File "/content/image_captioning/run_project.py", line 94, in generate_test_strings
    pred = model.decoder(input_tokens, enc_output, enc_output, g_out, batch_size=1)
KeyboardInterrupt
```

Evaluation

The previous cell both trains and tests the model. However, if you wanted to skip training
and test using a pre-trained model, you could skip the previous cell and just run this one.

This cell will produce the average loss of the model and the CIDEr score for 100 images in
the test dataset.

**Note that the cell will take a very long time for the first two batches while captions are
generated, but will then go much faster.**

```
In [14]:  %cd '/content/image_captioning'

          ! python run_project.py --batch_size 50 \
                               --features_path "/content/drive/MyDrive/Colab Notebooks/ece570
                               --annotation_folder "/content/drive/MyDrive/Colab Notebooks/ec
```

```
                          --save_path "/content/drive/MyDrive/Colab Notebooks/ece570_pro
                          --load_model "/content/drive/MyDrive/Colab Notebooks/ece570_pr
```

--save_path "/content/drive/MyDrive/Colab Notebooks/ece570_pro
--load_model "/content/drive/MyDrive/Colab Notebooks/ece570_pr

/content/image_captioning
2024-11-10 23:31:50.756138: I tensorflow/core/util/port.cc:153] oneDNN custom operat
ions are on. You may see slightly different numerical results due to floating-point
round-off errors from different computation orders. To turn them off, set the enviro
nment variable `TF_ENABLE_ONEDNN_OPTS=0`.
2024-11-10 23:31:50.774500: E external/local_xla/xla/stream_executor/cuda/cuda_fft.c
c:485] Unable to register cuFFT factory: Attempting to register factory for plugin c
uFFT when one has already been registered
2024-11-10 23:31:50.795846: E external/local_xla/xla/stream_executor/cuda/cuda_dnn.c
c:8454] Unable to register cuDNN factory: Attempting to register factory for plugin
cuDNN when one has already been registered
2024-11-10 23:31:50.802376: E external/local_xla/xla/stream_executor/cuda/cuda_blas.
cc:1452] Unable to register cuBLAS factory: Attempting to register factory for plugi
n cuBLAS when one has already been registered
2024-11-10 23:31:50.817903: I tensorflow/core/platform/cpu_feature_guard.cc:210] Thi
s TensorFlow binary is optimized to use available CPU instructions in performance-cr
itical operations.
To enable the following instructions: AVX2 AVX512F AVX512_VNNI FMA, in other operati
ons, rebuild TensorFlow with the appropriate compiler flags.
2024-11-10 23:31:51.966443: W tensorflow/compiler/tf2tensorrt/utils/py_utils.cc:38]
TF-TRT Warning: Could not find TensorRT
Namespace(exp_name='GET', save_path='/content/drive/MyDrive/Colab Notebooks/ece570_p
roject', load_model='/content/drive/MyDrive/Colab Notebooks/ece570_project/GET-11-1
0.pth', batch_size=50, features_path='/content/drive/MyDrive/Colab Notebooks/ece570_
project/meshed-memory-transformer/coco_detections.hdf5', annotation_folder='/conten
t/drive/MyDrive/Colab Notebooks/ece570_project/meshed-memory-transformer/annotation
s')
Image Captioning Project
loading annotations into memory...
Done (t=0.66s)
creating index...
index created!
loading annotations into memory...
Done (t=0.32s)
creating index...
index created!
Training Dataset size: 18000
Test Dataset size: 1800
/usr/local/lib/python3.10/dist-packages/transformers/tokenization_utils_base.py:160
1: FutureWarning: `clean_up_tokenization_spaces` was not set. It will be set to `Tru
e` by default. This behavior will be depracted in transformers v4.45, and will be th
en set to `False` by default. For more details check this issue: https://github.com/
huggingface/transformers/issues/31884
  warnings.warn(
Loading model...
Beginning tests...

Batch 0 of 37
Batch 1 of 37
Batch 2 of 37
Batch 3 of 37
Batch 4 of 37
Batch 5 of 37
Batch 6 of 37
Batch 7 of 37
Batch 8 of 37

```
Batch 9 of 37
Batch 10 of 37
Batch 11 of 37
Batch 12 of 37
Batch 13 of 37
Batch 14 of 37
Batch 15 of 37
Batch 16 of 37
Batch 17 of 37
Batch 18 of 37
Batch 19 of 37
Batch 20 of 37
Batch 21 of 37
Batch 22 of 37
Batch 23 of 37
Batch 24 of 37
Batch 25 of 37
Batch 26 of 37
Batch 27 of 37
Batch 28 of 37
Batch 29 of 37
Batch 30 of 37
Batch 31 of 37
Batch 32 of 37
Batch 33 of 37
Batch 34 of 37
Batch 35 of 37
Test result on epoch 1: Avg loss: 10127.903
Testing complete.

Evaluating CIDEr...

==============================
 CIDEr Score: 0.0
==============================

Example generations:

Expected Caption: 203564
Generated Caption: 203564

Expected Caption: 179765
Generated Caption: 179765

Expected Caption: 322141
Generated Caption: 322141

Expected Caption: 16977
Generated Caption: 16977

Expected Caption: 106140
Generated Caption: 106140
```

It takes an extremely long time to generate the actual strings when testing with the run_project.py script. However, the repo contains pre-generated captions from the best

model created. The following cell can be run to skip the lengthy generation process and immediately get the CIDEr score from the existing json files.

```python
In [23]: %cd '/content/image_captioning'

         import json
         from pycocoevalcap.cider.cider import Cider

         def evaluate(generations, references):
             """
             Scores model based on various image captioning metrics
                 generations: Generated captions
                 references: Original captions
             """

             print("Evaluating CIDEr...")

             # Ensure dictionaries have same keys
             possibly_missing_data = generations.keys()
             to_delete = []
             for key in references.keys():
               if key not in possibly_missing_data:
                 to_delete.append(key)

             # Delete keys that do not match between reference and generated
             for key in to_delete:
                 del references[key]

             # Cider expects captions as lists so we convert the strings to
             # lists of strings here
             cider_refs = {key: [val] for key, val in references.items()}
             cider_preds = {key: [val] for key, val in generations.items()}

             # Compute score
             cider_eval = Cider()
             cider_score, _ = cider_eval.compute_score(cider_refs, cider_preds)

             print("\n===============================")
             print(f" CIDEr Score: {cider_score}")
             print("===============================\n")

             # Print out 5 example captions and what the input was
             print("Example generations:")
             i = 0
             for gen, ref in zip(generations.values(), references.values()):
                 print(f"\nExpected Caption: {ref}")
                 print(f"Generated Caption: {gen}")
                 i += 1

                 if i == 5:
                     break

         ref = {}
         gen = {}
         with open('/content/image_captioning/saved_models/generations_GET.json') as f_in:
```

```
        gen = json.load(f_in)

with open('/content/image_captioning/saved_models/references_GET.json') as f_in:
        ref = json.load(f_in)

evaluate(gen, ref)
```

```
/content/image_captioning
Evaluating CIDEr...


===============================
 CIDEr Score: 0.0
===============================


Example generations:

Expected Caption: A clock with the appearance of the wheel of a bicycle
Generated Caption: [unused0] [unused0] [unused0] [unused2] [unused2] [unused4] [unus
ed0] [unused4] [unused2] [unused5] [unused11] [unused5] [unused1] [unused2] [unused
6] [unused17] [unused1] [unused2] [unused19] [unused10] [unused6] [unused23] [unused
4] [unused18] [unused26] [unused17] [unused5] [unused16] [unused15] [unused4] [unuse
d6] [unused3] [unused22] [unused26] [unused24] [unused12] [unused39] [unused22] [unu
sed24] [unused39] [unused22] [unused30] [unused4] [unused27] [unused15] [unused2]

Expected Caption: A motorcycle with its brake extended standing outside
Generated Caption: [unused0] [unused1] [unused3] [unused1] [unused0] [unused1] [unus
ed2] [unused5] [unused7] [unused3] [unused8] [unused2] [unused9] [unused4] [unused2]
[unused7] [unused5] [unused7] [unused10] [unused16] [unused23] [unused7] [unused24]
[unused16] [unused9] [unused26] [unused30] [unused1] [unused23] [unused17] [unused8]
[unused25] [unused18] [unused8] [unused10] [unused20] [unused23] [unused9] [unused2
7] [unused2] [unused33] [unused35] [unused8] [unused4]

Expected Caption: A bathroom with walls that are painted baby blue.
Generated Caption: [unused1] [unused2] [unused3] [unused3] [unused1] [unused3] [unus
ed0] [unused0] [unused4] [unused8] [unused5] [unused1] [unused3] [unused3] [unused9]
[unused16] [unused9] [unused16] [unused6] [unused20] [unused10] [unused19] [unused2
1] [unused25] [unused16] [unused23] [unused4] [unused28] [unused21] [unused4] [unuse
d7] [unused1] [unused28] [unused36] [unused37] [unused6] [unused8] [unused2] [unused
13] [unused3] [unused41] [unused38] [unused44] [unused36] [unused13] [unused48]

Expected Caption: A couple of cars parked in a busy street sidewalk.
Generated Caption: [unused0] [unused2] [unused0] [unused3] [unused0] [unused2] [unus
ed1] [unused3] [unused0] [unused1] [unused10] [unused10] [unused10] [unused9] [unuse
d4] [unused5] [unused16] [unused7] [unused4] [unused2] [unused3] [unused10] [unused2
1] [unused15] [unused9] [unused26] [unused1] [unused23] [unused21] [unused28] [unuse
d15] [unused26] [unused9] [unused9] [unused9] [unused12] [unused15] [unused13] [unus
ed19] [unused19] [unused21] [unused18] [unused43] [unused37] [unused33] [unused6] [u
nused45]

Expected Caption: A passenger plane taking off into the sky.
Generated Caption: [unused0] [unused0] [unused1] [unused2] [unused6] [unused6] [unus
ed6] [unused6] [unused3] [unused6] [unused3] [unused8] [unused10] [unused0] [unused
7] [unused3] [unused15] [unused5] [unused1] [unused0] [unused0] [unused9] [unused0]
[unused12] [unused18] [unused4] [unused20] [unused9] [unused21] [unused13] [unused1
7] [unused2] [unused35] [unused15] [unused2] [unused17] [unused35] [unused21] [unuse
d24] [unused27] [unused17] [unused15] [unused19] [unused7] [unused44] [unused40]
```