Dataloader Setup for Colab Notebooks

```
# Install Kaggle API
!pip install -q kaggle
```

```
# Import libraries
import os
from google.colab import files
import sys
import h5py
import numpy as np
import matplotlib.pyplot as plt
import matplotlib.patches as patches
import random
```

```
# Check if the API key already exists
if not os.path.exists('/root/.kaggle/kaggle.json'):
    print('Please upload your personal kaggle.json file:')

    # Prompt for upload
    uploaded = files.upload()

    # Move the file to the correct directory
    !mkdir -p ~/.kaggle
    !cp kaggle.json ~/.kaggle/
    !chmod 600 ~/.kaggle/kaggle.json
    print('\nKaggle API key configured successfully.')
else:
    print('Kaggle API key is already configured.')
```

```
Please upload your personal kaggle.json file:
Choose Files No file chosen  Upload widget is only available when the cell has been executed in the current browser session.
Please rerun this cell to enable.
Saving kaggle.json to kaggle.json

Kaggle API key configured successfully.
```

```
# Replace with your dataset id here
KAGGLE_DATASET_ID = 'andymalinsky/rsna-2022-hdf5-subset'

print('Downloading dataset...')
!kaggle datasets download -d {KAGGLE_DATASET_ID}
```

```
Downloading dataset...
Dataset URL: https://www.kaggle.com/datasets/andymalinsky/rsna-2022-hdf5-subset
License(s): CC0-1.0
Downloading rsna-2022-hdf5-subset.zip to /content
100% 3.51G/3.51G [00:40<00:00, 262MB/s]
100% 3.51G/3.51G [00:40<00:00, 92.9MB/s]
```

```
# Unzip and move to the local Colab storage for training
zip_name = KAGGLE_DATASET_ID.split('/')[-1] + '.zip'
!unzip -q '{zip_name}'

# This is the path the training script will use
HDF5_FILE_PATH = '/content/fracture_dataset_subset.h5'
```

```
# Get dataloader script from GitHub
!wget https://raw.githubusercontent.com/apmalinsky/AAI-590-Capstone/refs/heads/main/scripts/dataloader.py
```

```
--2025-11-19 14:26:18--  https://raw.githubusercontent.com/apmalinsky/AAI-590-Capstone/refs/heads/main/scripts/data
Resolving raw.githubusercontent.com (raw.githubusercontent.com)... 185.199.108.133, 185.199.109.133, 185.199.110.13
Connecting to raw.githubusercontent.com (raw.githubusercontent.com)|185.199.108.133|:443... connected.
HTTP request sent, awaiting response... 200 OK
```

```
Length: 5917 (5.8K) [text/plain]
Saving to: ‘dataloader.py’

dataloader.py       100%[===================>]   5.78K  --.-KB/s    in 0s

2025-11-19 14:26:18 (75.2 MB/s) - ‘dataloader.py’ saved [5917/5917]
```

```
# Import dataloader script
from dataloader import get_dataloaders
```

```
# View data file
data_path = 'fracture_dataset_subset.h5'

# Open the file
with h5py.File(data_path, 'r') as f:
    # View key list, essentially our 'columns'
    print(f'Keys: {list(f.keys())}')

    # View column shapes
    print('\n--- Details ---')
    for key in f.keys():
        dataset = f[key]
        print(f'\nKey: {key}')
        print(f'Shape: {dataset.shape}')
        print(f'Dtype: {dataset.dtype}')
```

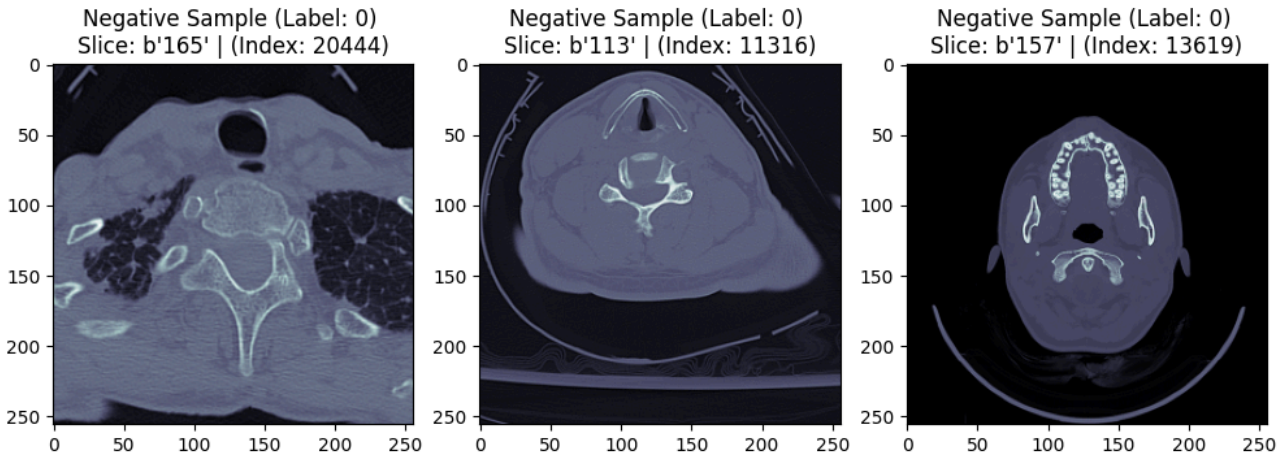
```
Keys: ['SliceNumber', 'StudyInstanceUID', 'bboxes', 'images', 'labels', 'split']

--- Details ---

Key: SliceNumber
Shape: (28868,)
Dtype: object

Key: StudyInstanceUID
Shape: (28868,)
Dtype: object

Key: bboxes
Shape: (28868, 10, 4)
Dtype: float32

Key: images
Shape: (28868, 256, 256)
Dtype: float32

Key: labels
Shape: (28868,)
Dtype: int8

Key: split
Shape: (28868,)
Dtype: int8
```

```
# View the first sample data
with h5py.File(data_path, 'r') as f:
    slice_number = f['SliceNumber'][0]
    study_instance_uid = f['StudyInstanceUID'][0]
    bbox = f['bboxes'][0]
    image = f['images'][0]
    label = f['labels'][0]
    split = f['split'][0]

print(f'SliceNumber: {slice_number}')
print(f'StudyInstanceUID: {study_instance_uid}')
print(f'Boxes: {bbox} (-1 is padding, which means no box)')
print(f'Image shape: {image.shape}')
print(f'Label: {label} (0=no fracture, 1=fracture)')
print(f'Split: {split} (0=train, 1=validation, 2=test)')
```

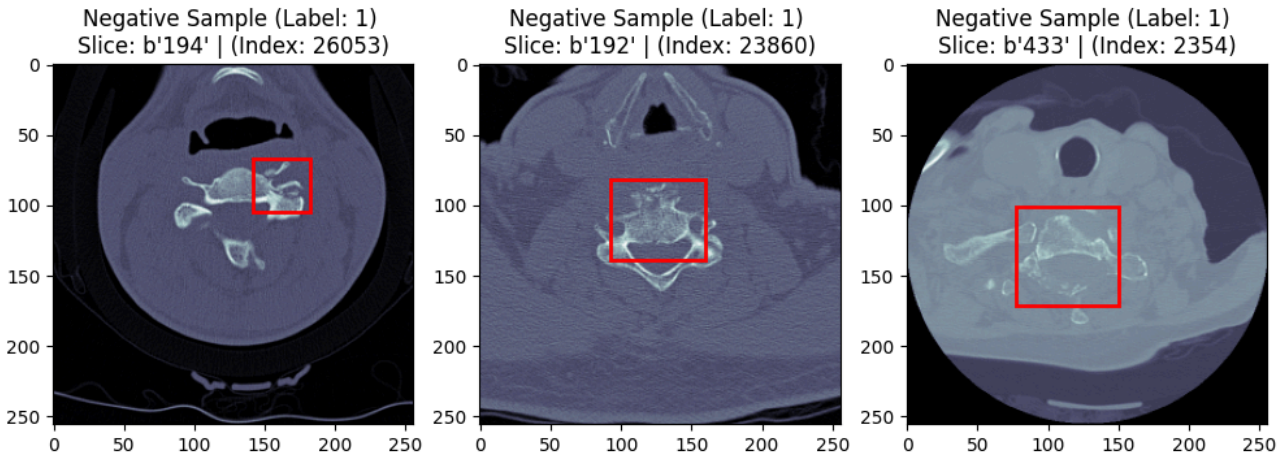
```
SliceNumber: b'59'
StudyInstanceUID: b'1.2.826.0.1.3680043.14345'
Boxes: [[-1. -1. -1. -1.]
 [-1. -1. -1. -1.]
 [-1. -1. -1. -1.]
 [-1. -1. -1. -1.]
 [-1. -1. -1. -1.]
 [-1. -1. -1. -1.]
 [-1. -1. -1. -1.]
 [-1. -1. -1. -1.]
 [-1. -1. -1. -1.]]] (-1 is padding, which means no box)
Image shape: (256, 256)
Label: 0 (0=no fracture, 1=fracture)
Split: 0 (0=train, 1=validation, 2=test)
```

```python
# Define visualizer function
def visualize_samples(num_samples, label):
    with h5py.File(data_path, 'r') as hf:
        # Load all labels and find the indices for the desired sample type
        all_labels = hf['labels'][:]
        indices_to_sample_from = np.where(all_labels == label)[0]
        sample_indices = random.sample(list(indices_to_sample_from), num_samples)
        fig, axes = plt.subplots(1, num_samples, figsize=(10, 10))

        for ax, idx in zip(axes, sample_indices):
            # Load the data for this one sample
            image = hf['images'][idx]
            bboxes = hf['bboxes'][idx]
            uid = hf['StudyInstanceUID'][idx]
            slice_num = hf['SliceNumber'][idx]
            label = hf['labels'][idx]

            # Filter out the "-1" padding on the bounding boxes
            bboxes = [box for box in bboxes if box[0] != -1.0]

            # Plot the image
            ax.imshow(image, cmap='bone')
            # Set title
            ax.set_title(f'Negative Sample (Label: {label}) \nSlice: {slice_num} | (Index: {idx})')

            # Plot each bounding box
            for box in bboxes:
                x, y, w, h = box # the box value contains its coordinates and dimensions

                # Draw the bounding box on the image
                rect = patches.Rectangle(
                    (x, y), w, h,
                    linewidth=2,
                    edgecolor='r',
                    facecolor='none'
                )
                ax.add_patch(rect)

        plt.tight_layout()
        plt.show()
```

```python
# View 3 sample negative images
visualize_samples(3, 0)
```




```
# View 3 sample positive images
visualize_samples(3, 1)
```



Classification Dataloaders

- Returns: (images, labels)
- Images: A single tensor: [BatchSize, 1, 256, 256]
- Labels: A single tensor: [BatchSize] (with values 0 or 1)

```
# Get data loaders for classification
batch_size = 32

train_loader_cls, val_loader_cls, test_loader_cls = get_dataloaders(
    hdf5_path=data_path,
    batch_size=batch_size,
    task='classification'
)
```

```
Loading dataset for task: 'classification'...
Loading pre-defined train/val/test splits...
Total samples: 28868
  Training indices:   20207
  Validation indices: 4330
  Test indices:       4331
DataLoaders created successfully.
```

Detection Dataloaders

- Returns: (images, targets)
- Images: A list of image tensors (length BatchSize)
- Targets: A list of target dictionaries (length BatchSize)

```
# Get data loaders for detection
batch_size = 8 # lower batch size since detection models need more memory

train_loader_det, val_loader_det, test_loader_det = get_dataloaders(
    hdf5_path=data_path,
    batch_size=batch_size,
    task='detection'
)
```

```
Loading dataset for task: 'detection'...
Loading pre-defined train/val/test splits...
Total samples: 28868
  Training indices:   20207
  Validation indices: 4330
  Test indices:       4331
DataLoaders created successfully.
```

Use the Dataloaders for Model Training and Evaluation

1. Get the dataloaders for your task (classification vs detection)
2. Define your model
3. Perform training loop
    - Load images in batches "for images, labels in tqdm(train_loader_cls, desc='Training Batch'):"