IST 718 | Final Project | Playground | Group/Team 2

Project Overview:

- Classifying radiology images: Normal vs Pneumonia
- [Click here to find the dataset on Kaggle]

The code utilizes a pre-trained computer vision model called 'ResNet18' on radiology image data. The model is then fine tuned on the data. The deep learning model is tuned with three (3) epochs with a theoretical error rate of 1.1% and is exported to a `.pkl` file for future use.

Configuring Google Drive, Kaggle

- Create free Kaggle API key
  - Needed to download the dataset from Kaggle
- Upload kaggle.json to Google Drive
  - Kaggle configuration settings
- Mount Google Drive to Colab
  - Data source copy directory
- Ensure Colab has GPU settings turned on for training

```
!python -V
```

```
Python 3.9.16
```

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

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

```
%pwd
```

```
'/content'
```

```
!mkdir -p
%cd '/content/drive/MyDrive/IST 718/Final Project'
```

```
mkdir: missing operand
Try 'mkdir --help' for more information.
/content/drive/MyDrive/IST 718/Final Project
```

```
%ls -a
```

```
chest-xray-pneumonia/     Final_Project_Playground.ipynb
chest-xray-pneumonia.zip  kaggle.json
```

```
import os
os.environ['KAGGLE_CONFIG_DIR'] = '/content/drive/MyDrive/IST 718/Final Project'
```

```
!kaggle datasets download -d paultimothymooney/chest-xray-pneumonia
```

```
Downloading chest-xray-pneumonia.zip to /content/drive/MyDrive/IST 718/Final
100% 2.29G/2.29G [00:31<00:00, 104MB/s]
100% 2.29G/2.29G [00:31<00:00, 78.4MB/s]
```

```
!unzip '/content/drive/MyDrive/IST 718/Final Project/chest-xray-pneumonia.zip' -d
```

```
Streaming output truncated to the last 5000 lines.
  inflating: /content/drive/MyDrive/IST 718/Final Project/chest-xray-pneumoni
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```
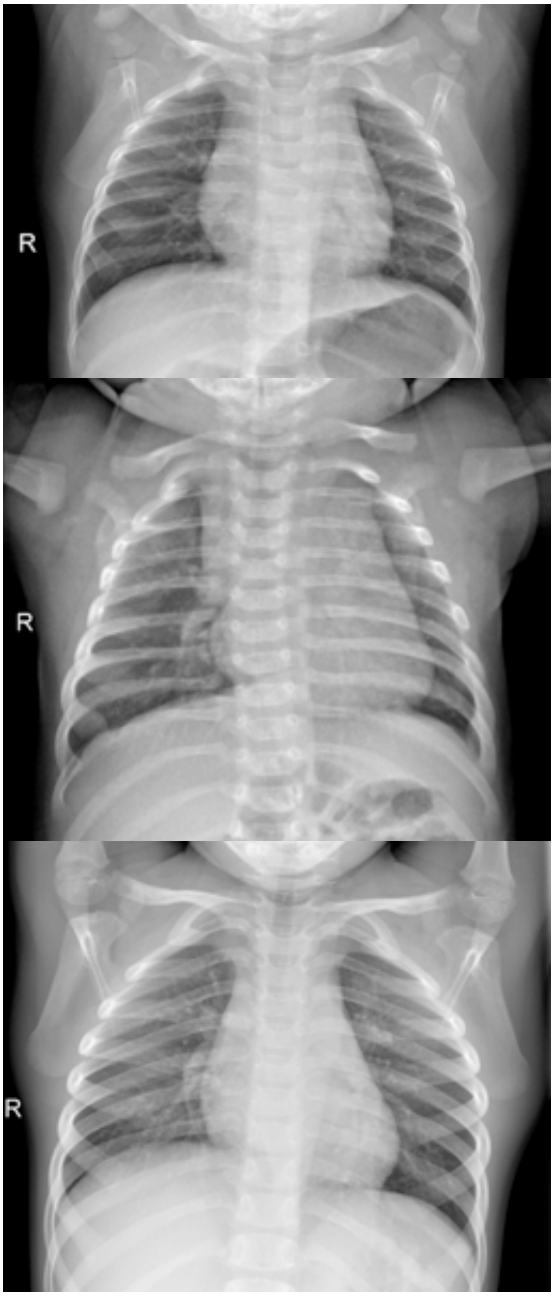

Review Data Samples

Examples of 3 'normal' cases:

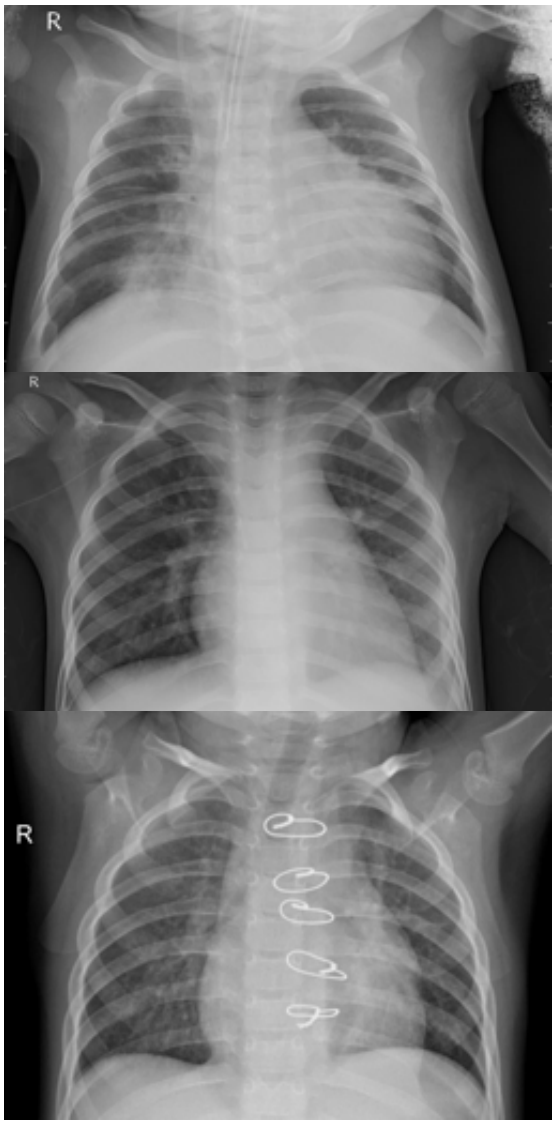
```
import os
import random
from PIL import Image

# Set the seed for the random number generator
random.seed(69)

# Set the path of the directory containing the images
dir_path = '/content/drive/MyDrive/IST 718/Final Project/chest-xray-pneumonia/ches
```

```
# Get a list of all the image files in the directory
files = [f for f in os.listdir(dir_path) if f.endswith('.jpeg')]

# Choose 3 random files from the list
random_files = random.sample(files, 3)

# Loop through each file and print it to the screen as a thumbnail
for file in random_files:
    im = Image.open(os.path.join(dir_path, file))
    im.thumbnail((256, 256))
    im.show()
```



Examples of 3 'abnormal' cases:

```
# Set the seed for the random number generator
random.seed(69)

# Set the path of the directory containing the images
dir_path = '/content/drive/MyDrive/IST 718/Final Project/chest-xray-pneumonia/ches

# Get a list of all the image files in the directory
files = [f for f in os.listdir(dir_path) if f.endswith('.jpeg')]

# Choose 3 random files from the list
random_files = random.sample(files, 3)

# Loop through each file and print it to the screen as a thumbnail
for file in random_files:
    im = Image.open(os.path.join(dir_path, file))
    im.thumbnail((256, 256))
    im.show()
```



Exploring

- Ideas:
  - See how many images were in the dataset
  - See how big the files are (histogram of image sizes?)

Train fastai Model

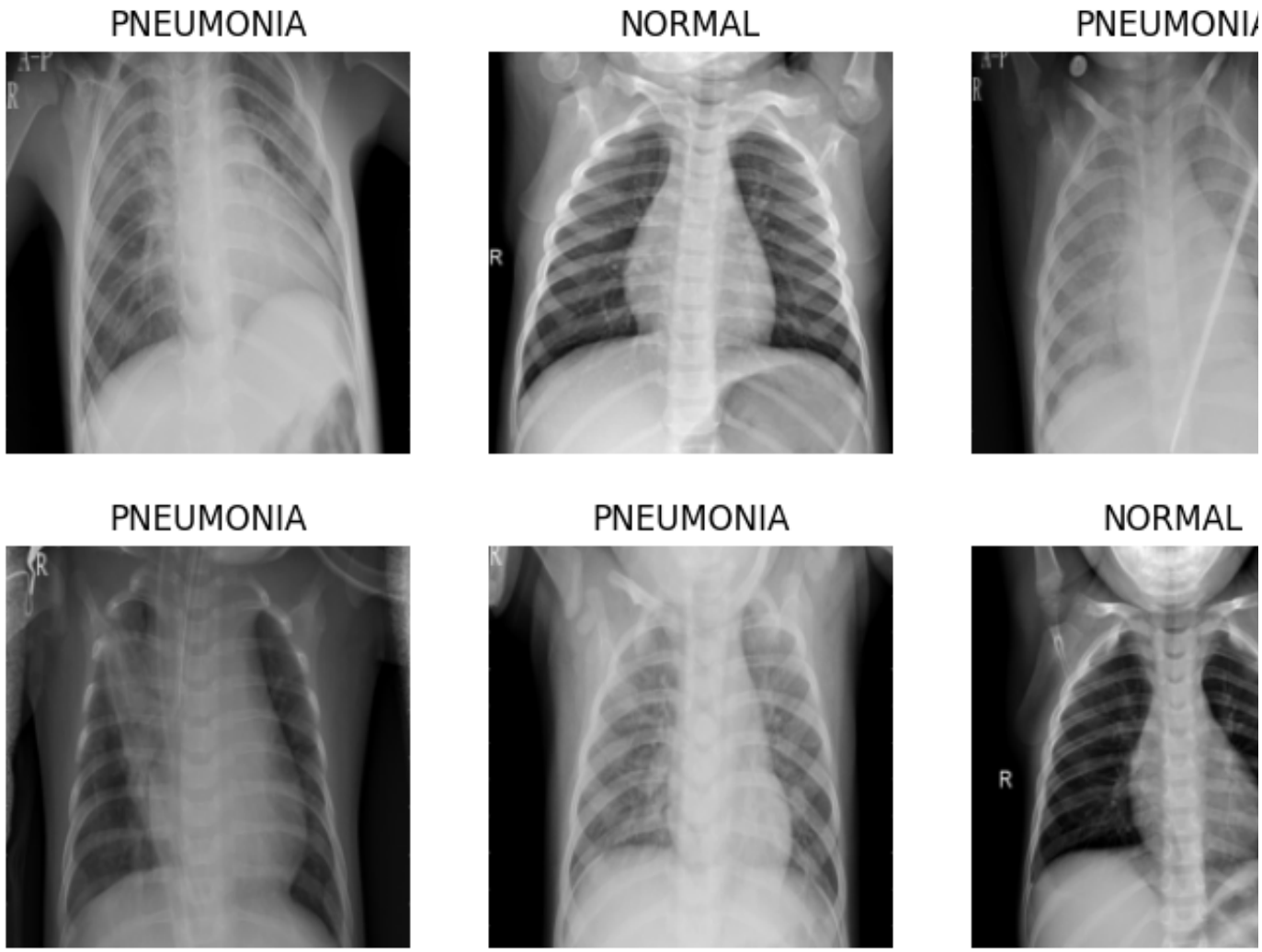
- Tip
  - Make sure you have your Colab GPU settings turned on...or training will take....wait for it.....forever :-)

```
from fastai.vision.all import *
```

```
path = Path('/content/drive/MyDrive/IST 718/Final Project/chest-xray-pneumonia/che
path
```

```
Path('/content/drive/MyDrive/IST 718/Final Project/chest-xray-
pneumonia/chest_xray/train')
```

```
dls·=·DataBlock(
····blocks=(ImageBlock,·CategoryBlock),·
····get_items=get_image_files,·
····splitter=RandomSplitter(valid_pct=0.2,·seed=1),
····get_y=parent_label,
····item_tfms=[Resize(192,·method='squish')]
).dataloaders(path,·bs=32)

dls.show_batch(max_n=6)
```



```
learn = vision_learner(dls, resnet18, metrics=error_rate)
learn.fine_tune(3)
```

```
/usr/local/lib/python3.9/dist-packages/torchvision/models/_utils.py:208: User
  warnings.warn(
/usr/local/lib/python3.9/dist-packages/torchvision/models/_utils.py:223: User
  warnings.warn(msg)
Downloading: "https://download.pytorch.org/models/resnet18-f37072fd.pth" to /
100%|██████████| 44.7M/44.7M [00:00<00:00, 165MB/s]
```

epoch	train_loss	valid_loss	error_rate	time
0	0.421595	0.138715	0.051557	02:13

epoch	train_loss	valid_loss	error_rate	time
0	0.144851	0.106104	0.026853	02:05
1	0.087914	0.045733	0.016112	02:04
2	0.038532	0.039775	0.011815	02:07

```
import os

# Save the model for future use
learn.export(f"{os.environ['KAGGLE_CONFIG_DIR']}/IST_718_Group-2_Radiology_Model_C
```

```
#·Load·the·model
learn·=·load_learner(f"{os.environ['KAGGLE_CONFIG_DIR']}/IST_718_Group-2_Radiolog
learn
```

```
<fastai.learner.Learner at 0x7f175804d190>
```

Test Prediction on Sample Image

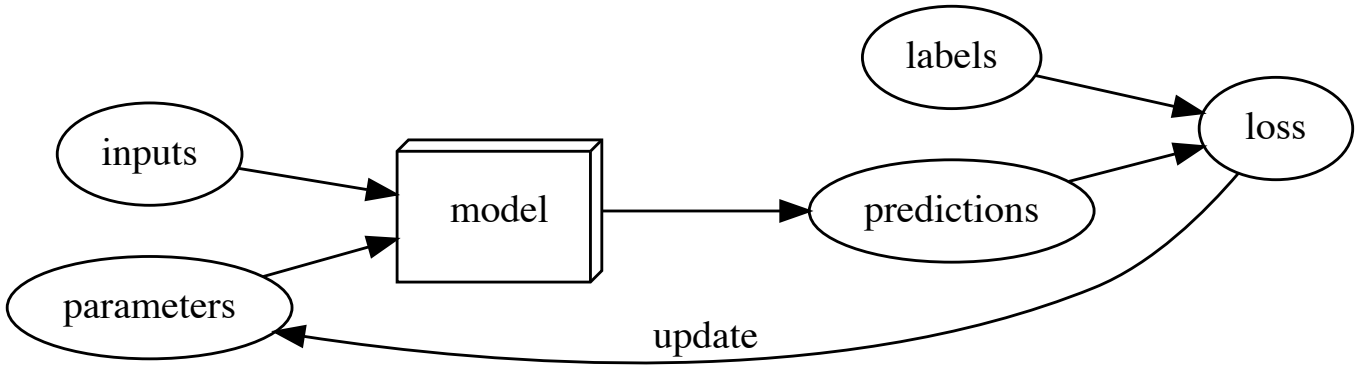
```
is_normal,_,probs = learn.predict(PILImage.create('/content/drive/MyDrive/IST 718/
print(f"This is a: {is_normal}.")
print(f"Probability of normal chest x-ray without findings: {probs[0]:.4f}")
```

```
This is a: NORMAL.
Probability of the patient not having pneumonia: 0.9152
```

Overview of Model Architecture | Diagram

```
!pip install -Uqq graphviz

import graphviz
def gv(s):
  return graphviz.Source('digraph G{ rankdir="LR"' + s + '; }')
```

```
gv('''ordering=in
model[shape=box3d width=1 height=0.7 label=model]
inputs->model->predictions; parameters->model; labels->loss; predictions->loss
loss->parameters[constraint=false label=update]''')
```



Predict on Test Data

```
test_path = Path('/content/drive/MyDrive/IST 718/Final Project/chest-xray-pneumoni
test_files = get_image_files(test_path)
test_dl = dls.test_dl(test_files)
preds = learn.get_preds(dl=test_dl)
```

```
Exception ignored in: <function _MultiProcessingDataLoaderIter.__del__ at 0x7
Traceback (most recent call last):
  File "/usr/local/lib/python3.9/dist-packages/torch/utils/data/dataloader.py
    self._shutdown_workers()
  File "/usr/local/lib/python3.9/dist-packages/torch/utils/data/dataloader.py
    if w.is_alive():
  File "/usr/lib/python3.9/multiprocessing/process.py", line 160, in is_alive
    assert self._parent_pid == os.getpid(), 'can only test a child process'
AssertionError: can only test a child process
Exception ignored in: <function _MultiProcessingDataLoaderIter.__del__ at 0x7
Traceback (most recent call last):
  File "/usr/local/lib/python3.9/dist-packages/torch/utils/data/dataloader.py
    self._shutdown_workers()
  File "/usr/local/lib/python3.9/dist-packages/torch/utils/data/dataloader.py
    if w.is_alive():
  File "/usr/lib/python3.9/multiprocessing/process.py", line 160, in is_alive
    assert self._parent_pid == os.getpid(), 'can only test a child process'
AssertionError: can only test a child process
Exception ignored in: <function _MultiProcessingDataLoaderIter.__del__ at 0x7
Traceback (most recent call last):
  File "/usr/local/lib/python3.9/dist-packages/torch/utils/data/dataloader.py
    self._shutdown_workers()
  File "/usr/local/lib/python3.9/dist-packages/torch/utils/data/dataloader.py
    if w.is_alive():
  File "/usr/lib/python3.9/multiprocessing/process.py", line 160, in is_alive
    assert self._parent_pid == os.getpid(), 'can only test a child process'
AssertionError: can only test a child process
Exception ignored in: <function _MultiProcessingDataLoaderIter.__del__ at 0x7
Traceback (most recent call last):
  File "/usr/local/lib/python3.9/dist-packages/torch/utils/data/dataloader.py
    self._shutdown_workers()
  File "/usr/local/lib/python3.9/dist-packages/torch/utils/data/dataloader.py
    if w.is_alive():
  File "/usr/lib/python3.9/multiprocessing/process.py", line 160, in is_alive
    assert self._parent_pid == os.getpid(), 'can only test a child process'
AssertionError: can only test a child process
```

```
pred_labels = preds[0].argmax(dim=1)
pred_labels
```

```
tensor([1, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0,
0,
        1, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 1, 0, 0, 1,
0,
        0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 1, 0, 1, 0,
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        1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1])
```

```
pred_class_names = [dls.vocab[label] for label in pred_labels]
pred_class_names
```

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```

```
true_labels = [parent_label(img) for img in test_files]
correct_predictions = sum([true == pred for true, pred in zip(true_labels, pred_cl
accuracy = correct_predictions / len(test_files) * 100
```

```
for img_file, pred_class in zip(test_files, pred_class_names):
    print(f"{img_file}: {pred_class}")
```

```
/content/drive/MyDrive/IST 718/Final Project/chest-xray-pneumonia/chest_xray/
/content/drive/MyDrive/IST 718/Final Project/chest-xray-pneumonia/chest_xray/
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```
print(f"Accuracy: {accuracy:.2f}%")
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Accuracy: 83.33%
```

Colab paid products - Cancel contracts here

0s completed at 3:07 PM