bonefractures-1

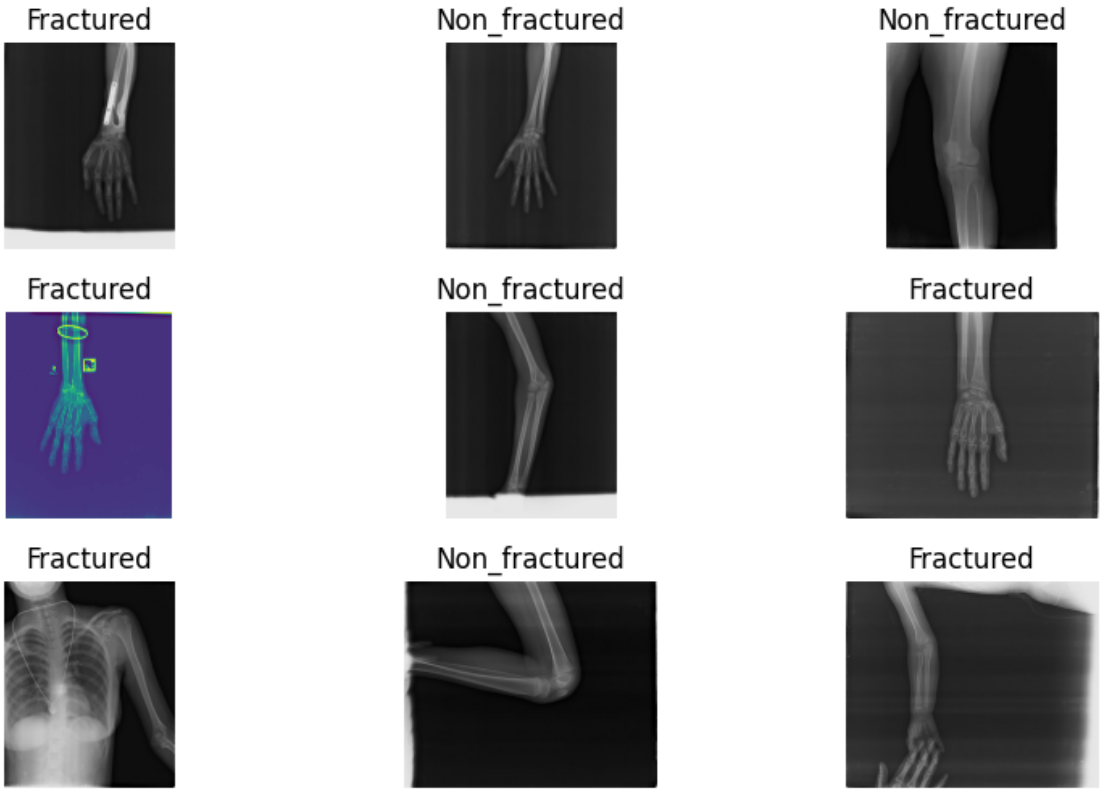
May 8, 2024

[1]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import PIL
import matplotlib.pyplot as plt
import tensorflow as tf
from tensorflow.keras.preprocessing.image import ImageDataGenerator
import keras
from keras.models import Sequential
from keras.layers import Conv2D, MaxPooling2D, Flatten, Dense
```

```
2024-05-08 03:05:32.369841: E
external/local_xla/xla/stream_executor/cuda/cuda_dnn.cc:9261] Unable to register
cuDNN factory: Attempting to register factory for plugin cuDNN when one has
already been registered
2024-05-08 03:05:32.369974: E
external/local_xla/xla/stream_executor/cuda/cuda_fft.cc:607] Unable to register
cuFFT factory: Attempting to register factory for plugin cuFFT when one has
already been registered
2024-05-08 03:05:32.550414: E
external/local_xla/xla/stream_executor/cuda/cuda_blas.cc:1515] Unable to
register cuBLAS factory: Attempting to register factory for plugin cuBLAS when
one has already been registered
```

[2]:
```
import os
import random
import matplotlib.pyplot as plt
from PIL import Image
main_dir = '/kaggle/input/cnn-for-bone-fractures-dataset/FracAtlas/images'
labels = ['Fractured','Non_fractured']
rows, cols = 3, 3
fig, axes = plt.subplots(rows, cols, figsize=(10, 6))
for ax in axes.flatten():
    label = random.choice(labels)
    class_folder = os.path.join(main_dir, label)
    image_files = os.listdir(class_folder)
    random_image = random.choice(image_files)
    image_path = os.path.join(class_folder, random_image)
```

```
    image = Image.open(image_path)
    ax.imshow(image)
    ax.set_title(label)
    ax.axis('off')
plt.subplots_adjust(wspace=0.2, hspace=0.3)
plt.show()
```



[3]:
```
data_gen = ImageDataGenerator(
    rescale=1./255,
    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=True,
    validation_split=0.2

)

# second step is creating data generators to apply the augmentation:

train_generator = data_gen.flow_from_directory(
    main_dir,
    target_size=(224, 224),
```

```
    batch_size=32,
    class_mode='categorical',
    subset='training'

)

test_generator = data_gen.flow_from_directory(
    main_dir,
    target_size=(224, 224),
    batch_size=32,
    class_mode='categorical',
    subset='validation'
)
```

```
Found 3267 images belonging to 2 classes.
Found 816 images belonging to 2 classes.
```

[5]:
```
import warnings
warnings.simplefilter(action='ignore', category=UserWarning)

from PIL import ImageFile
ImageFile.LOAD_TRUNCATED_IMAGES = True

model = Sequential()

model.add(Conv2D(32, (3, 3), activation='relu', input_shape=(224, 224, 3)))
model.add(MaxPooling2D((2, 2)))
model.add(Conv2D(64, (3, 3), activation='relu'))
model.add(MaxPooling2D((2, 2)))
model.add(Conv2D(128, (3, 3), activation='relu'))
model.add(MaxPooling2D((2, 2)))
model.add(Flatten())
model.add(Dense(128, activation='relu'))
model.add(Dense(2, activation='softmax'))
```

[6]:
```
model.compile(optimizer='adam', loss='categorical_crossentropy',
              metrics=['accuracy'])
```

[7]:
```
history = model.fit(train_generator, epochs=20, validation_data=test_generator)
```

```
Epoch 1/20
103/103             251s 2s/step -
accuracy: 0.8081 - loss: 0.5190 - val_accuracy: 0.8027 - val_loss: 0.4869
Epoch 2/20
103/103             253s 2s/step -
accuracy: 0.8463 - loss: 0.3891 - val_accuracy: 0.6618 - val_loss: 0.6790
Epoch 3/20
```

```
103/103            262s 2s/step -
accuracy: 0.8536 - loss: 0.3770 - val_accuracy: 0.7733 - val_loss: 0.5399
Epoch 4/20
103/103            242s 2s/step -
accuracy: 0.8586 - loss: 0.3797 - val_accuracy: 0.7255 - val_loss: 0.6375
Epoch 5/20
103/103            260s 2s/step -
accuracy: 0.8564 - loss: 0.3777 - val_accuracy: 0.6262 - val_loss: 1.0089
Epoch 6/20
103/103            261s 2s/step -
accuracy: 0.8672 - loss: 0.3569 - val_accuracy: 0.5895 - val_loss: 0.9689
Epoch 7/20
103/103            261s 2s/step -
accuracy: 0.8611 - loss: 0.3546 - val_accuracy: 0.6716 - val_loss: 0.8064
Epoch 8/20
103/103            241s 2s/step -
accuracy: 0.8805 - loss: 0.3340 - val_accuracy: 0.6887 - val_loss: 0.8442
Epoch 9/20
103/103            241s 2s/step -
accuracy: 0.8840 - loss: 0.3315 - val_accuracy: 0.7316 - val_loss: 0.6734
Epoch 10/20
103/103            239s 2s/step -
accuracy: 0.8747 - loss: 0.3188 - val_accuracy: 0.6360 - val_loss: 1.0909
Epoch 11/20
103/103            263s 2s/step -
accuracy: 0.8789 - loss: 0.3242 - val_accuracy: 0.7218 - val_loss: 0.8089
Epoch 12/20
103/103            262s 2s/step -
accuracy: 0.8807 - loss: 0.3104 - val_accuracy: 0.6961 - val_loss: 0.8632
Epoch 13/20
103/103            276s 2s/step -
accuracy: 0.8819 - loss: 0.3085 - val_accuracy: 0.6495 - val_loss: 1.0034
Epoch 14/20
103/103            259s 2s/step -
accuracy: 0.8930 - loss: 0.2785 - val_accuracy: 0.6544 - val_loss: 1.0971
Epoch 15/20
103/103            243s 2s/step -
accuracy: 0.9046 - loss: 0.2681 - val_accuracy: 0.6605 - val_loss: 0.9843
Epoch 16/20
103/103            259s 2s/step -
accuracy: 0.8988 - loss: 0.2701 - val_accuracy: 0.6422 - val_loss: 1.3865
Epoch 17/20
103/103            241s 2s/step -
accuracy: 0.9052 - loss: 0.2502 - val_accuracy: 0.5870 - val_loss: 1.8024
Epoch 18/20
103/103            262s 2s/step -
accuracy: 0.9087 - loss: 0.2374 - val_accuracy: 0.6483 - val_loss: 1.1822
Epoch 19/20
```

```
103/103             262s 2s/step -
accuracy: 0.9114 - loss: 0.2293 - val_accuracy: 0.7341 - val_loss: 0.7529
Epoch 20/20
103/103             238s 2s/step -
accuracy: 0.9108 - loss: 0.2396 - val_accuracy: 0.6507 - val_loss: 1.3760
```

[9]:
```
final_train_accuracy = history.history['accuracy'][-1]
final_val_accuracy = history.history['val_accuracy'][-1]

print("Final Training Accuracy (Epoch 20):", final_train_accuracy)
print("Final Validation Accuracy (Epoch 20):", final_val_accuracy)
```

```
Final Training Accuracy (Epoch 20): 0.9103152751922607
Final Validation Accuracy (Epoch 20): 0.6507353186607361
```

Previous Trainings on the same dataset by other people:
103/103 73s 677ms/step - **accuracy: 0.8683** - loss: 0.3529 - val_accuracy: 0.7414 - val_loss: 0.6749

our Training: 103/103 238s 2s/step - **accuracy: 0.9108** - loss: 0.2396 - val_accuracy: 0.6507 - val_loss: 1.3760

Reducing Overfitting

[11]:
```
from keras.layers import Dropout

# Define the model architecture with dropout layers
modelWithoutOverfitting = Sequential()

modelWithoutOverfitting.add(Conv2D(32, (3, 3), activation='relu',␣
 ↪input_shape=(224, 224, 3)))
modelWithoutOverfitting.add(MaxPooling2D((2, 2)))
modelWithoutOverfitting.add(Dropout(0.25))  # Adding dropout layer

modelWithoutOverfitting.add(Conv2D(64, (3, 3), activation='relu'))
modelWithoutOverfitting.add(MaxPooling2D((2, 2)))
modelWithoutOverfitting.add(Dropout(0.25))  # Adding dropout layer

modelWithoutOverfitting.add(Conv2D(128, (3, 3), activation='relu'))
modelWithoutOverfitting.add(MaxPooling2D((2, 2)))
modelWithoutOverfitting.add(Dropout(0.25))  # Adding dropout layer

modelWithoutOverfitting.add(Flatten())
modelWithoutOverfitting.add(Dense(128, activation='relu'))
modelWithoutOverfitting.add(Dropout(0.5))  # Adding dropout layer
modelWithoutOverfitting.add(Dense(2, activation='softmax'))
```

[12]:
```
modelWithoutOverfitting.compile(optimizer='adam',␣
 ↪loss='categorical_crossentropy', metrics=['accuracy'])
```

[13]:
```
history = modelWithoutOverfitting.fit(train_generator, epochs=20,␣
↪validation_data=test_generator)
```

```
Epoch 1/20
103/103             258s 2s/step -
accuracy: 0.7799 - loss: 0.7502 - val_accuracy: 0.8248 - val_loss: 0.4571
Epoch 2/20
103/103             260s 2s/step -
accuracy: 0.8182 - loss: 0.4732 - val_accuracy: 0.7953 - val_loss: 0.4875
Epoch 3/20
103/103             260s 2s/step -
accuracy: 0.8388 - loss: 0.4181 - val_accuracy: 0.7917 - val_loss: 0.4939
Epoch 4/20
103/103             253s 2s/step -
accuracy: 0.8486 - loss: 0.3983 - val_accuracy: 0.7745 - val_loss: 0.5180
Epoch 5/20
103/103             252s 2s/step -
accuracy: 0.8599 - loss: 0.3855 - val_accuracy: 0.7843 - val_loss: 0.5253
Epoch 6/20
103/103             251s 2s/step -
accuracy: 0.8350 - loss: 0.4114 - val_accuracy: 0.7488 - val_loss: 0.5745
Epoch 7/20
103/103             250s 2s/step -
accuracy: 0.8525 - loss: 0.3945 - val_accuracy: 0.7733 - val_loss: 0.5533
Epoch 8/20
103/103             251s 2s/step -
accuracy: 0.8593 - loss: 0.3722 - val_accuracy: 0.7402 - val_loss: 0.5760
Epoch 9/20
103/103             262s 2s/step -
accuracy: 0.8658 - loss: 0.3608 - val_accuracy: 0.7647 - val_loss: 0.5342
Epoch 10/20
103/103             263s 2s/step -
accuracy: 0.8558 - loss: 0.3768 - val_accuracy: 0.7721 - val_loss: 0.5386
Epoch 13/20
103/103             251s 2s/step -
accuracy: 0.8730 - loss: 0.3398 - val_accuracy: 0.6716 - val_loss: 0.7321
Epoch 14/20
103/103             265s 2s/step -
accuracy: 0.8732 - loss: 0.3457 - val_accuracy: 0.7610 - val_loss: 0.5323
Epoch 15/20
103/103             259s 2s/step -
accuracy: 0.8624 - loss: 0.3650 - val_accuracy: 0.7659 - val_loss: 0.5643
Epoch 16/20
103/103             263s 2s/step -
accuracy: 0.8689 - loss: 0.3316 - val_accuracy: 0.7426 - val_loss: 0.6025
Epoch 17/20
103/103             260s 2s/step -
```

```
accuracy: 0.8746 - loss: 0.3356 - val_accuracy: 0.7426 - val_loss: 0.6561
Epoch 18/20
103/103             260s 2s/step -
accuracy: 0.8723 - loss: 0.3324 - val_accuracy: 0.7402 - val_loss: 0.6328
Epoch 19/20
103/103             264s 2s/step -
accuracy: 0.8610 - loss: 0.3530 - val_accuracy: 0.7488 - val_loss: 0.5981
Epoch 20/20
103/103             264s 2s/step -
accuracy: 0.8712 - loss: 0.3225 - val_accuracy: 0.6961 - val_loss: 0.8373
```

[14]:
```python
final_train_accuracy = history.history['accuracy'][-1]
final_val_accuracy = history.history['val_accuracy'][-1]

print("Final Training Accuracy (Epoch 20):", final_train_accuracy)
print("Final Validation Accuracy (Epoch 20):", final_val_accuracy)
```

```
Final Training Accuracy (Epoch 20): 0.8650137782096863
Final Validation Accuracy (Epoch 20): 0.6960784196853638
```

[15]:
```python
# Save the original model without dropout layers
model.save("original_model.h5")
```

[16]:
```python
# Save the model with dropout layers
modelWithoutOverfitting.save("model_with_dropout.h5")
```