skin.cancer.rev.03

August 18, 2024

[ ]:
```
import numpy as np
import pandas as pd
import seaborn as sb
import matplotlib.pyplot as plt

from glob import glob
from PIL import Image
from sklearn.model_selection import train_test_split

import tensorflow as tf
from tensorflow import keras
from keras import layers
from functools import partial

AUTO = tf.data.experimental.AUTOTUNE
import warnings
warnings.filterwarnings('ignore')
```

[ ]:
```
import os

base_directory = os.getcwd()
print(f"Base directory: {base_directory}")
```

```
Base directory: d:\venus\mlmodel
```

[ ]:
```
import glob

# Define the paths to the folders containing images
benign_folder = r'D:\venus\mlmodel\train_cancer\benign'
malignant_folder = r'D:\venus\mlmodel\train_cancer\malignant'

# Use glob to find all JPG files in each folder
try:
    benign_images = glob.glob(f'{benign_folder}/*.jpg')
    malignant_images = glob.glob(f'{malignant_folder}/*.jpg')

    # Combine the lists of images
    images = benign_images + malignant_images
```

```
    # Print the total number of images and their paths
    print(f"Total number of images: {len(all_images)}")
    for img_path in all_images:
        print(f"Image found: {img_path}")
except Exception as e:
    print(f"Error: {e}")
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Total number of images: 270
Image found: D:\venus\mlmodel\train_cancer\benign\12.jpg
Image found: D:\venus\mlmodel\train_cancer\benign\13.jpg
Image found: D:\venus\mlmodel\train_cancer\benign\14.jpg
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Image found: D:\venus\mlmodel\train_cancer\benign\19.jpg
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```

[ ]:
```python
import os

# Create the folders if they don't exist
os.makedirs(benign_folder, exist_ok=True)
os.makedirs(malignant_folder, exist_ok=True)
```

[ ]:
```
try:
    benign_images = glob.glob(f'{benign_folder}/*.jpg')
    malignant_images = glob.glob(f'{malignant_folder}/*.jpg')

    print(f"Benign images: {benign_images}")
    print(f"Malignant images: {malignant_images}")

    images = benign_images + malignant_images
    print(f"Total number of images: {len(all_images)}")
except Exception as e:
    print(f"Error: {e}")
```

```
Benign images: ['D:\\venus\\mlmodel\\train_cancer\\benign\\12.jpg',
'D:\\venus\\mlmodel\\train_cancer\\benign\\13.jpg',
'D:\\venus\\mlmodel\\train_cancer\\benign\\14.jpg',
'D:\\venus\\mlmodel\\train_cancer\\benign\\17.jpg',
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'D:\\venus\\mlmodel\\train_cancer\\benign\\39.jpg',
'D:\\venus\\mlmodel\\train_cancer\\benign\\4.jpg',
'D:\\venus\\mlmodel\\train_cancer\\benign\\40.jpg',
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'D:\\venus\\mlmodel\\train_cancer\\benign\\6.jpg',
'D:\\venus\\mlmodel\\train_cancer\\benign\\7.jpg']
Malignant images: ['D:\\venus\\mlmodel\\train_cancer\\malignant\\10.jpg',
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```

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```

```
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```

```
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```

```
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'D:\\venus\\mlmodel\\train_cancer\\malignant\\98.jpg',
'D:\\venus\\mlmodel\\train_cancer\\malignant\\99.jpg']
Total number of images: 270
```

[ ]:
```
images = glob.glob('train_cancer/*/*.jpg')
len(images)
```

[ ]: 270

[ ]:
```
#replace backslash with forward slash to avoid unexpected errors
images = [path.replace('\\', '/') for path in images]
df = pd.DataFrame({'filepath': images})
df['label'] = df['filepath'].str.split('/', expand=True)[1]
df.head()
```

[ ]:

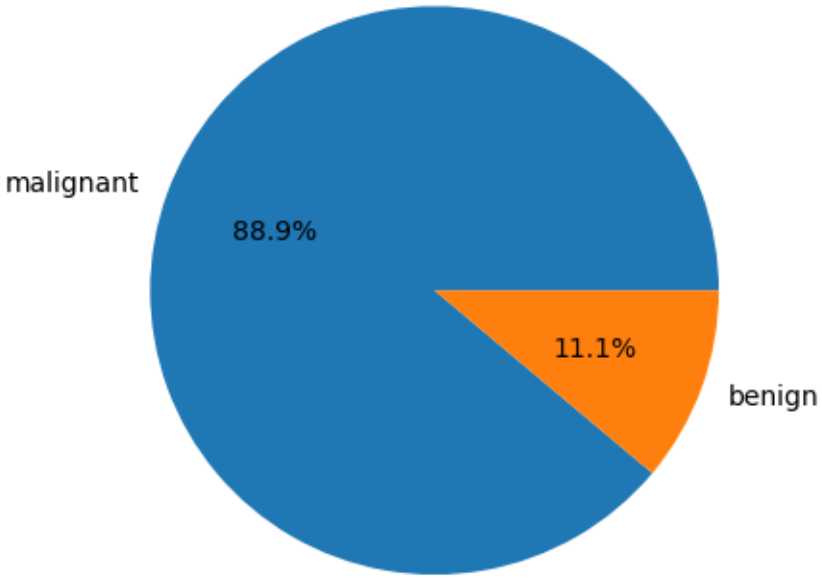
	filepath	label
0	train_cancer/benign/12.jpg	benign
1	train_cancer/benign/13.jpg	benign
2	train_cancer/benign/14.jpg	benign
3	train_cancer/benign/17.jpg	benign
4	train_cancer/benign/19.jpg	benign

[ ]:
```
df['label_bin'] = np.where(df['label'].values == 'malignant', 1, 0)
df.head()
```

[ ]:

	filepath	label	label_bin
0	train_cancer/benign/12.jpg	benign	0
1	train_cancer/benign/13.jpg	benign	0
2	train_cancer/benign/14.jpg	benign	0
3	train_cancer/benign/17.jpg	benign	0
4	train_cancer/benign/19.jpg	benign	0

[ ]:
```
x = df['label'].value_counts()
plt.pie(x.values,
                labels=x.index,
                autopct='%1.1f%%')
plt.show()
```



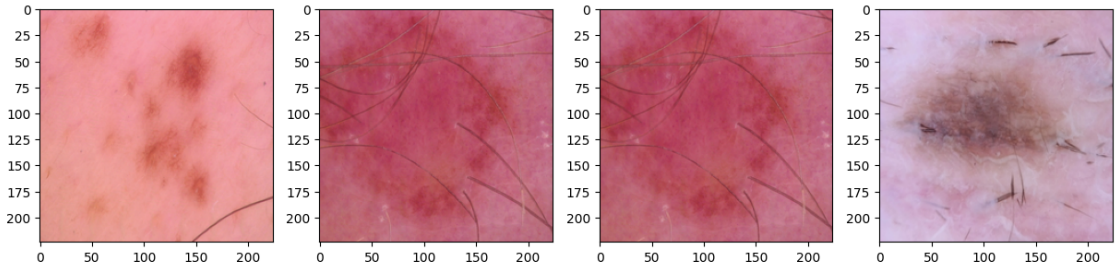
[ ]:
```
for cat in df['label'].unique():
        temp = df[df['label'] == cat]

        index_list = temp.index
        fig, ax = plt.subplots(1, 4, figsize=(15, 5))
        fig.suptitle(f'Images for {cat} category . . . .', fontsize=20)
        for i in range(4):
                index = np.random.randint(0, len(index_list))
                index = index_list[index]
                data = df.iloc[index]

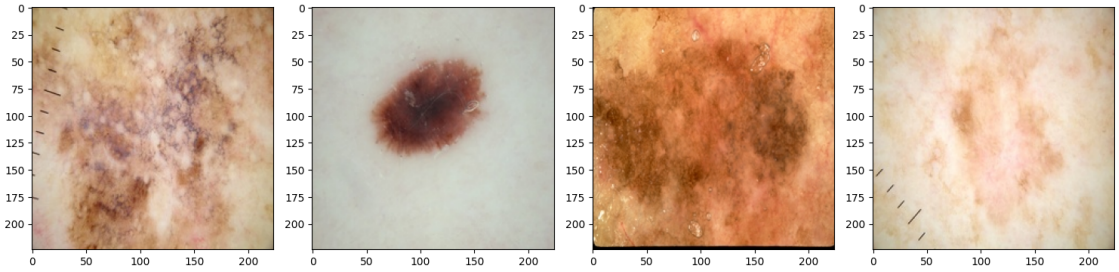
                image_path = data[0]

                img = np.array(Image.open(image_path))
                ax[i].imshow(img)
plt.tight_layout()
plt.show()
```

Images for benign category . . . .



Images for malignant category . . . .



[ ]:
```
features = df['filepath']
target = df['label_bin']

X_train, X_val,\
        Y_train, Y_val = train_test_split(features, target,
                                                                    test_size=0.
 ↪15,
                                                                    random_state=10)


X_train.shape, X_val.shape
```

[ ]:
```
((229,), (41,))
```

[ ]:
```
def decode_image(filepath, label=None):

        img = tf.io.read_file(filepath)
        img = tf.image.decode_jpeg(img)
        img = tf.image.resize(img, [224, 224])
        img = tf.cast(img, tf.float32) / 255.0
```

```
        if label == 'benign':
                Label = 0
        else:
                Label = 1

        return img, Label
```

[ ]:
```
import tensorflow as tf
from tensorflow.keras.utils import to_categorical

# Assuming 'benign' and 'malignant' are your classes
label_encoder = {'benign': 0, 'malignant': 1}
Y_train_encoded = [label_encoder[label] for label in Y_train]
Y_val_encoded = [label_encoder[label] for label in Y_val]

# Convert to one-hot encoded vectors
num_classes = 2  # Adjust based on the number of classes
Y_train_one_hot = to_categorical(Y_train_encoded, num_classes)
Y_val_one_hot = to_categorical(Y_val_encoded, num_classes)

def encode_label(label):
    if label == 'benign':
        return 0
    elif label == 'malignant':
        return 1
    # Add more label mappings as needed
    else:
        raise ValueError("Unknown label:", label)

# Convert string labels to numerical labels
label_encoder = {'benign': 0, 'malignant': 1}
Y_train_encoded = [label_encoder[label] for label in Y_train]
Y_val_encoded = [label_encoder[label] for label in Y_val]

train_ds = (
    tf.data.Dataset
        .from_tensor_slices((X_train, Y_train_encoded))
        .map(decode_image, num_parallel_calls=AUTO)
        .batch(32)
        .prefetch(AUTO)
)

val_ds = (
    tf.data.Dataset
        .from_tensor_slices((X_val, Y_val_encoded))
        .map(decode_image, num_parallel_calls=AUTO)
        .batch(32)
```

```
        .prefetch(AUTO)
)
```

[ ]:
```
import numpy as np

# Assuming Y_train is a list of strings
Y_train = ['benign', 'malignant', 'benign', 'other_label']  # Example data
Y_val = ['malignant', 'benign']

# Create a label encoder with a default value for unknown labels
label_encoder = {'benign': 0, 'malignant': 1, 'unknown': -1}

# Handle unknown labels
Y_train_encoded = [label_encoder.get(label, label_encoder['unknown']) for label␣
 ↪in Y_train]
Y_val_encoded = [label_encoder.get(label, label_encoder['unknown']) for label␣
 ↪in Y_val]

print(Y_train_encoded)  # Output: [0, 1, 0, -1]
print(Y_val_encoded)    # Output: [1, 0]
```

```
[0, 1, 0, -1]
[1, 0]
```

[ ]:
```
unique_labels = set(Y_train)
print(unique_labels)
```

```
{0, 1}
```

[ ]:
```
train_ds = (
        tf.data.Dataset
        .from_tensor_slices((X_train, Y_train))
        .map(decode_image, num_parallel_calls=AUTO)
        .batch(32)
        .prefetch(AUTO)
)

val_ds = (
        tf.data.Dataset
        .from_tensor_slices((X_val, Y_val))
        .map(decode_image, num_parallel_calls=AUTO)
        .batch(32)
        .prefetch(AUTO)
)
```

[ ]:
```
from tensorflow.keras.applications.efficientnet import EfficientNetB7

pre_trained_model = EfficientNetB7(
```

```
        input_shape=(224, 224, 3),
        weights='imagenet',
        include_top=False
)

for layer in pre_trained_model.layers:
        layer.trainable = False
```

```
Downloading data from https://storage.googleapis.com/keras-
applications/efficientnetb7_notop.h5
258076736/258076736              194s
1us/step
```

[ ]:
```
from tensorflow.keras import Model

inputs = layers.Input(shape=(224, 224, 3))
x = layers.Flatten()(inputs)

x = layers.Dense(256, activation='relu')(x)
x = layers.BatchNormalization()(x)
x = layers.Dense(256, activation='relu')(x)
x = layers.Dropout(0.3)(x)
x = layers.BatchNormalization()(x)
outputs = layers.Dense(1, activation='sigmoid')(x)

model = Model(inputs, outputs)
```

[ ]:
```
model.compile(
        loss=tf.keras.losses.BinaryCrossentropy(from_logits=True),
        optimizer='adam',
        metrics=['AUC']
)
```

[ ]:
```
history = model.fit(train_ds,
                                        validation_data=val_ds,
                                        epochs=5,
                                        verbose=1)
```

[ ]:
```
hist_df = pd.DataFrame(history.history)
hist_df.head()
```

[ ]:
```
hist_df['loss'].plot()
hist_df['val_loss'].plot()
plt.title('Loss v/s Validation Loss')
plt.legend()
plt.show()
```

[ ]:
```
hist_df['auc'].plot()
hist_df['val_auc'].plot()
plt.title('AUC v/s Validation AUC')
plt.legend()
plt.show()
```