Import Module

In [2]:
```
import pandas as pd
import numpy as np
import os
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
from tqdm.notebook import tqdm
warnings.filterwarnings('ignore')
%matplotlib inline

!pip install tensorflow

import tensorflow as tf
from keras.preprocessing.image import load_img
from keras.models import Sequential, Model
from keras.layers import Dense, Conv2D, Dropout, Flatten, MaxPooling2D, Input
```

```
C:\Users\Lenovo\anaconda3\lib\site-packages\scipy\__init__.py:155: UserWarning: A
NumPy version >=1.18.5 and <1.25.0 is required for this version of SciPy (detected
version 1.26.0
  warnings.warn(f"A NumPy version >={np_minversion} and <{np_maxversion}"
```

```
Requirement already satisfied: tensorflow in c:\users\lenovo\anaconda3\lib\site-pa
ckages (2.14.0)
Requirement already satisfied: tensorflow-intel==2.14.0 in c:\users\lenovo\anacond
a3\lib\site-packages (from tensorflow) (2.14.0)
Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.23.1 in c:\users\le
novo\anaconda3\lib\site-packages (from tensorflow-intel==2.14.0->tensorflow) (0.3
1.0)
Requirement already satisfied: tensorflow-estimator<2.15,>=2.14.0 in c:\users\leno
vo\anaconda3\lib\site-packages (from tensorflow-intel==2.14.0->tensorflow) (2.14.
0)
Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!=4.21.
4,!=4.21.5,<5.0.0dev,>=3.20.3 in c:\users\lenovo\anaconda3\lib\site-packages (from
tensorflow-intel==2.14.0->tensorflow) (4.24.4)
Requirement already satisfied: libclang>=13.0.0 in c:\users\lenovo\anaconda3\lib\s
ite-packages (from tensorflow-intel==2.14.0->tensorflow) (16.0.6)
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e-packages (from tensorflow-intel==2.14.0->tensorflow) (2.0.0)
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Requirement already satisfied: numpy>=1.23.5 in c:\users\lenovo\anaconda3\lib\site
-packages (from tensorflow-intel==2.14.0->tensorflow) (1.26.0)
Requirement already satisfied: google-pasta>=0.1.1 in c:\users\lenovo\anaconda3\li
b\site-packages (from tensorflow-intel==2.14.0->tensorflow) (0.2.0)
Requirement already satisfied: gast!=0.5.0,!=0.5.1,!=0.5.2,>=0.2.1 in c:\users\len
ovo\anaconda3\lib\site-packages (from tensorflow-intel==2.14.0->tensorflow) (0.5.
4)
Requirement already satisfied: keras<2.15,>=2.14.0 in c:\users\lenovo\anaconda3\li
b\site-packages (from tensorflow-intel==2.14.0->tensorflow) (2.14.0)
Requirement already satisfied: setuptools in c:\users\lenovo\anaconda3\lib\site-pa
ckages (from tensorflow-intel==2.14.0->tensorflow) (63.4.1)
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b\site-packages (from tensorflow-intel==2.14.0->tensorflow) (1.59.0)
Requirement already satisfied: astunparse>=1.6.0 in c:\users\lenovo\anaconda3\lib
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ackages (from tensorflow-intel==2.14.0->tensorflow) (3.7.0)
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ackages (from tensorflow-intel==2.14.0->tensorflow) (1.16.0)
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kages (from tensorflow-intel==2.14.0->tensorflow) (21.3)
Requirement already satisfied: termcolor>=1.1.0 in c:\users\lenovo\anaconda3\lib\s
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Requirement already satisfied: ml-dtypes==0.2.0 in c:\users\lenovo\anaconda3\lib\s
ite-packages (from tensorflow-intel==2.14.0->tensorflow) (0.2.0)
Requirement already satisfied: typing-extensions>=3.6.6 in c:\users\lenovo\anacond
a3\lib\site-packages (from tensorflow-intel==2.14.0->tensorflow) (4.3.0)
Requirement already satisfied: wheel<1.0,>=0.23.0 in c:\users\lenovo\anaconda3\lib
\site-packages (from astunparse>=1.6.0->tensorflow-intel==2.14.0->tensorflow) (0.3
7.1)
Requirement already satisfied: markdown>=2.6.8 in c:\users\lenovo\anaconda3\lib\si
te-packages (from tensorboard<2.15,>=2.14->tensorflow-intel==2.14.0->tensorflow)
(3.3.4)
Requirement already satisfied: requests<3,>=2.21.0 in c:\users\lenovo\anaconda3\li
b\site-packages (from tensorboard<2.15,>=2.14->tensorflow-intel==2.14.0->tensorflo
w) (2.28.1)
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in c:\users\l
enovo\anaconda3\lib\site-packages (from tensorboard<2.15,>=2.14->tensorflow-intel=
=2.14.0->tensorflow) (0.7.1)
```

```
Requirement already satisfied: google-auth<3,>=1.6.3 in c:\users\lenovo\anaconda3
\lib\site-packages (from tensorboard<2.15,>=2.14->tensorflow-intel==2.14.0->tensor
flow) (2.23.2)
Requirement already satisfied: werkzeug>=1.0.1 in c:\users\lenovo\anaconda3\lib\si
te-packages (from tensorboard<2.15,>=2.14->tensorflow-intel==2.14.0->tensorflow)
(2.0.3)
Requirement already satisfied: google-auth-oauthlib<1.1,>=0.5 in c:\users\lenovo\a
naconda3\lib\site-packages (from tensorboard<2.15,>=2.14->tensorflow-intel==2.14.0
->tensorflow) (1.0.0)
Requirement already satisfied: pyparsing!=3.0.5,>=2.0.2 in c:\users\lenovo\anacond
a3\lib\site-packages (from packaging->tensorflow-intel==2.14.0->tensorflow) (3.0.
9)
Requirement already satisfied: pyasn1-modules>=0.2.1 in c:\users\lenovo\anaconda3
\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard<2.15,>=2.14->tensorflo
w-intel==2.14.0->tensorflow) (0.2.8)
Requirement already satisfied: rsa<5,>=3.1.4 in c:\users\lenovo\anaconda3\lib\site
-packages (from google-auth<3,>=1.6.3->tensorboard<2.15,>=2.14->tensorflow-intel==
2.14.0->tensorflow) (4.9)
Requirement already satisfied: cachetools<6.0,>=2.0.0 in c:\users\lenovo\anaconda3
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w-intel==2.14.0->tensorflow) (5.3.1)
Requirement already satisfied: requests-oauthlib>=0.7.0 in c:\users\lenovo\anacond
a3\lib\site-packages (from google-auth-oauthlib<1.1,>=0.5->tensorboard<2.15,>=2.14
->tensorflow-intel==2.14.0->tensorflow) (1.3.1)
Requirement already satisfied: idna<4,>=2.5 in c:\users\lenovo\anaconda3\lib\site-
packages (from requests<3,>=2.21.0->tensorboard<2.15,>=2.14->tensorflow-intel==2.1
4.0->tensorflow) (3.3)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\lenovo\anaconda3\lib
\site-packages (from requests<3,>=2.21.0->tensorboard<2.15,>=2.14->tensorflow-inte
l==2.14.0->tensorflow) (2022.9.14)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\lenovo\anaconda3
\lib\site-packages (from requests<3,>=2.21.0->tensorboard<2.15,>=2.14->tensorflow-
intel==2.14.0->tensorflow) (1.26.11)
Requirement already satisfied: charset-normalizer<3,>=2 in c:\users\lenovo\anacond
a3\lib\site-packages (from requests<3,>=2.21.0->tensorboard<2.15,>=2.14->tensorflo
w-intel==2.14.0->tensorflow) (2.0.4)
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in c:\users\lenovo\anaconda3\l
ib\site-packages (from pyasn1-modules>=0.2.1->google-auth<3,>=1.6.3->tensorboard<
2.15,>=2.14->tensorflow-intel==2.14.0->tensorflow) (0.4.8)
Requirement already satisfied: oauthlib>=3.0.0 in c:\users\lenovo\anaconda3\lib\si
te-packages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<1.1,>=0.5->tensor
board<2.15,>=2.14->tensorflow-intel==2.14.0->tensorflow) (3.2.2)
```

Load the Dataset

In [3]:
```
BASE_DIR=r'C:\Users\Lenovo\Documents\CC_Project\UTKFace'
```

In [4]:
```
# labels age, gender
image_paths=[]
age_labels=[]
gender_labels=[]

for filename in tqdm(os.listdir(BASE_DIR)):
    image_path=os.path.join(BASE_DIR, filename)
    temp=filename.split('_')
    age =int(temp[0])
    gender=int(temp[1])
    image_paths.append(image_path)
    age_labels.append(age)
    gender_labels.append(gender)
```

```
  0%|          | 0/23708 [00:00<?, ?it/s]
```

In [5]:
```
# convert to dataframe
df=pd.DataFrame()
df['image'],df['age'],df['gender']=image_paths, age_labels, gender_labels
df.head()
```

Out[5]:

	image	age	gender
0	C:\Users\Lenovo\Documents\CC_Project\UTKFace\1...	100	0
1	C:\Users\Lenovo\Documents\CC_Project\UTKFace\1...	100	0
2	C:\Users\Lenovo\Documents\CC_Project\UTKFace\1...	100	1
3	C:\Users\Lenovo\Documents\CC_Project\UTKFace\1...	100	1
4	C:\Users\Lenovo\Documents\CC_Project\UTKFace\1...	100	1

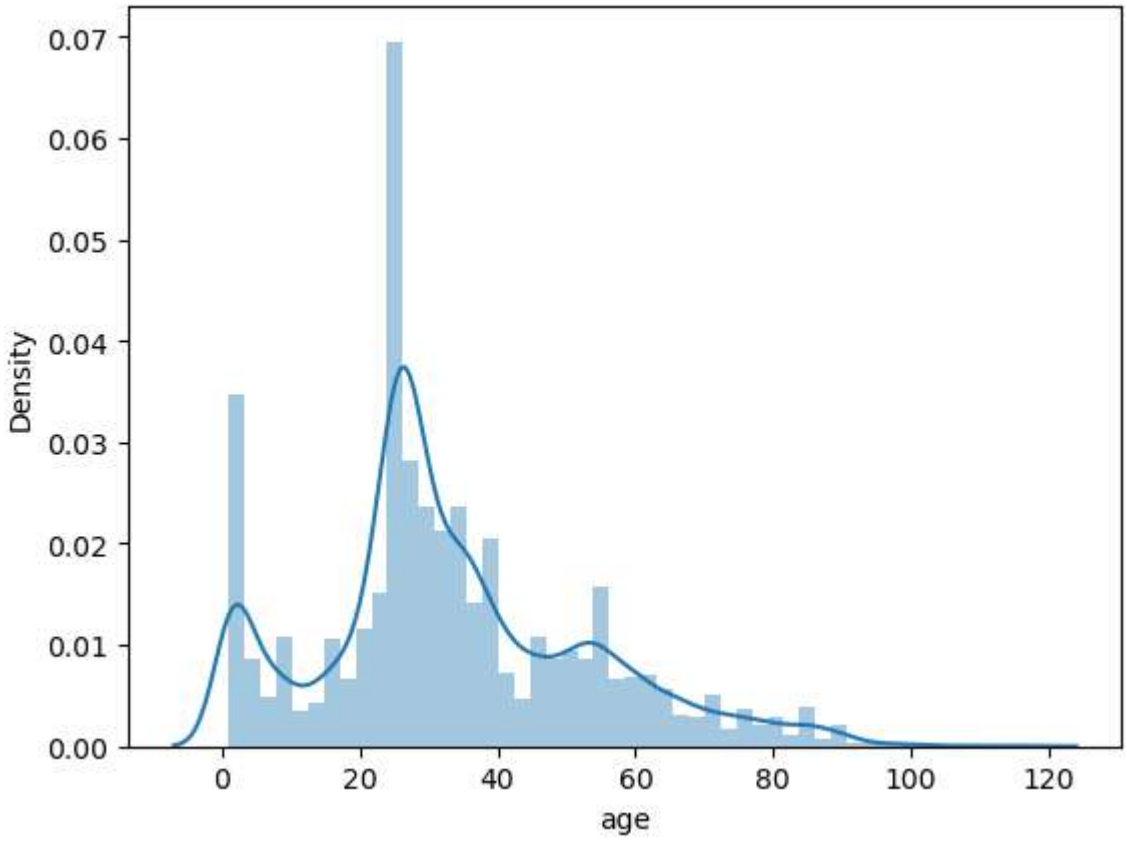
In [6]:
```
#map labels of gender
gender_dict={0:'Male', 1:'Female'}
```

Exploratory Data Analysis

In [7]:
```
from PIL import Image
img=Image.open(df['image'][0])
plt.axis('off')
plt.imshow(img);
```

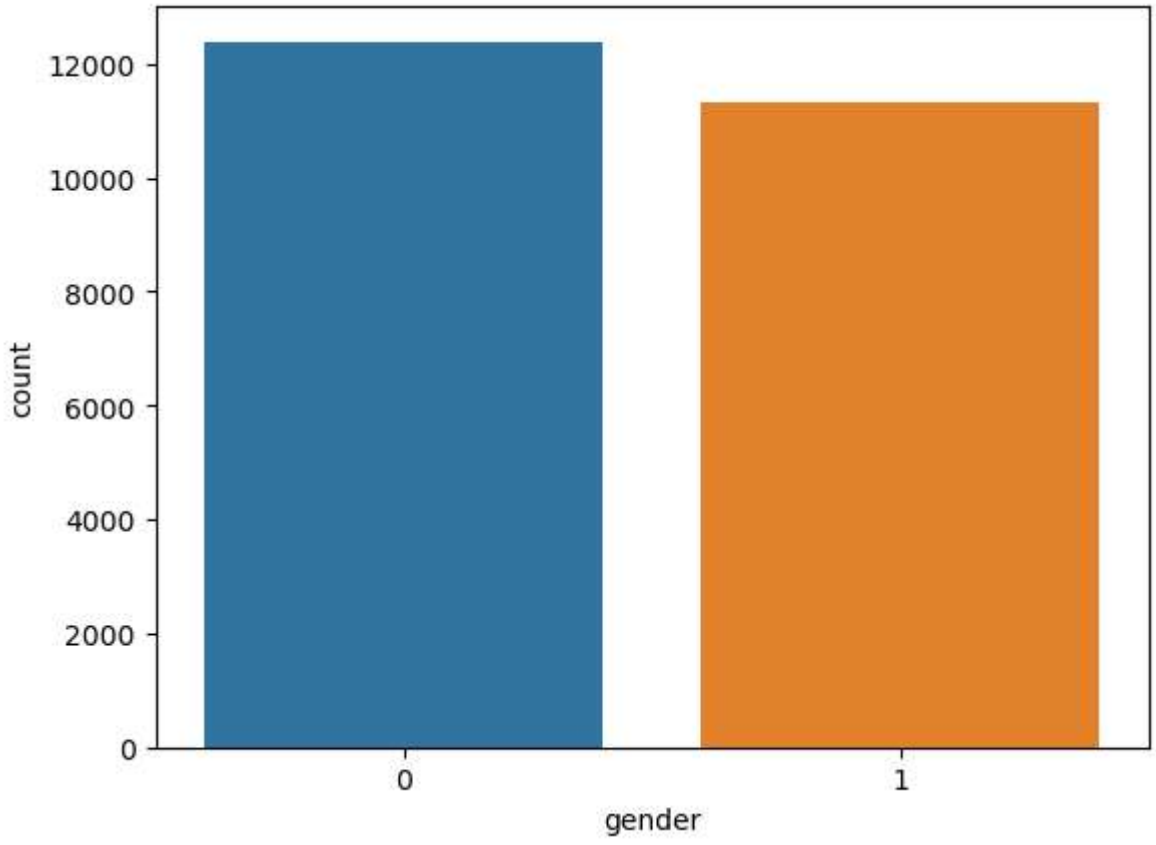
In [8]:
```
sns.distplot(df['age'])
```

Out[8]:
```
<AxesSubplot:xlabel='age', ylabel='Density'>
```



In [9]:
```
sns.countplot(df['gender'])
```

Out[9]:
```
<AxesSubplot:xlabel='gender', ylabel='count'>
```



In [10]:
```
#to display grid of images
'''plt.figure(figsize=(20,20))
files=df.iloc[0:25]

for index,file,age,gender in files.itertuples():
```

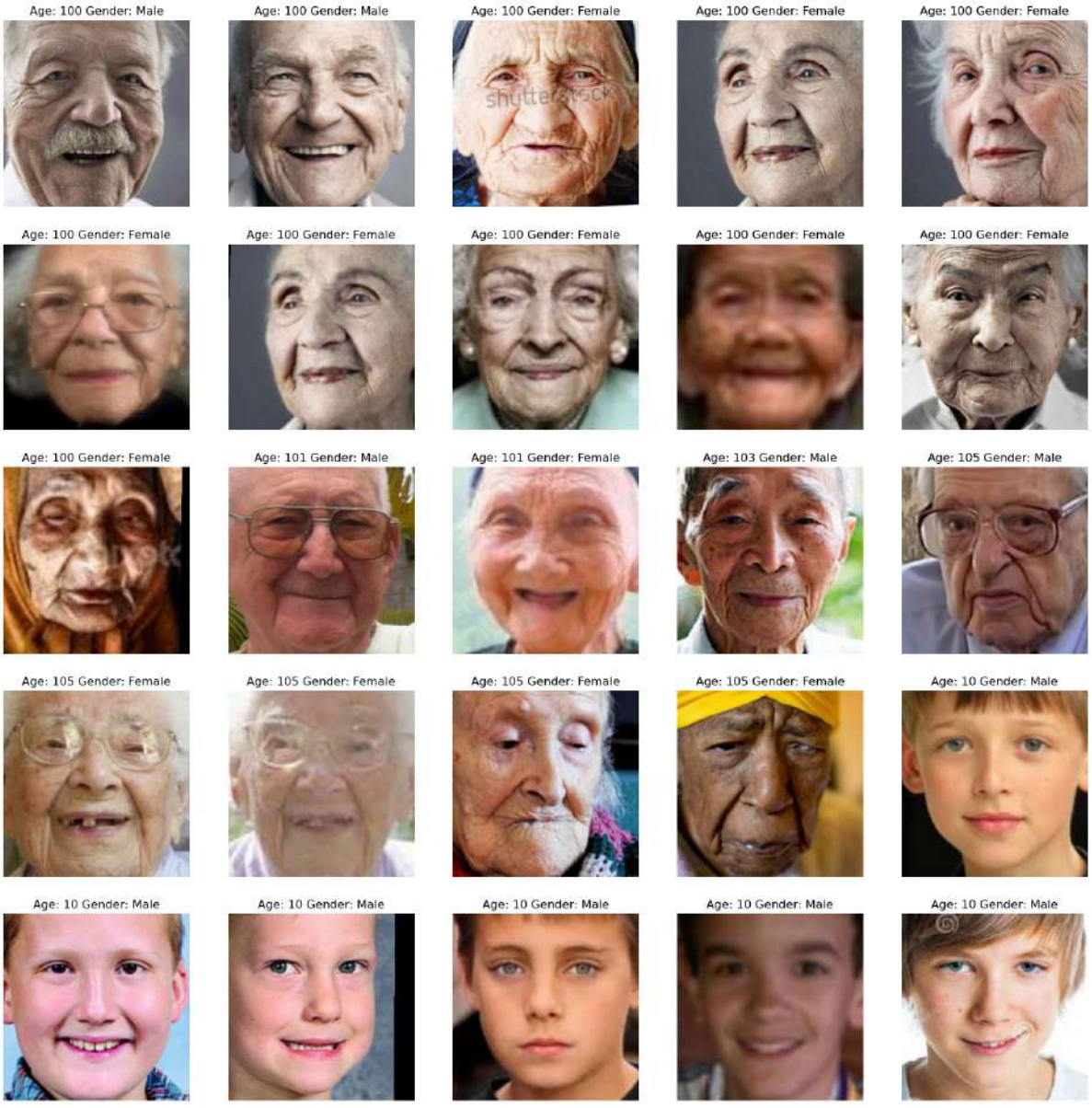
```
    plt.subplot(5,5,index+1)
    imp=load_img(file)
    img=np.array(img)
    plt.imshow(img)
    plt.title(f"Age:{age} Gender:{gender_dict[gender]}")
    plt.axis('off')'''


import matplotlib.pyplot as plt
from PIL import Image

plt.figure(figsize=(20, 20))
files = df.iloc[0:25]

for index, row in files.iterrows():
    file, age, gender = row
    plt.subplot(5, 5, index + 1)
    img = Image.open(file)  # Load image using PIL
    img = np.array(img)
    plt.imshow(img)
    plt.title(f"Age: {age} Gender: {gender_dict[gender]}")
    plt.axis('off')

plt.show()
```



Feature Extraction

In [11]:
```
def extract_features(images):
    features=[]
    for image in tqdm(images):
        img=load_img(image,grayscale=True)
        img=img.resize((128,128),Image.ANTIALIAS)
        img=np.array(img)
        features.append(img)
    features=np.array(features)
    features=features.reshape(len(features),128,128,1)
    return features
```

In [12]:
```
X=extract_features(df['image'])
```

```
  0%|          | 0/23708 [00:00<?, ?it/s]
```

In [13]:
```
X.shape
```

Out[13]:
```
(23708, 128, 128, 1)
```

In [14]:
```
# normalize the images
X=X/255.0
```

In [15]:
```
y_gender=np.array(df['gender'])
y_age=np.array(df['age'])
```

In [16]:
```
input_shape=(128,128,1)
```

Model Creation

In [17]:
```
inputs=Input((input_shape))
conv_1=Conv2D(32, kernel_size=(3,3), activation='relu') (inputs)
maxp_1=MaxPooling2D(pool_size=(2,2)) (conv_1)
conv_2=Conv2D(64, kernel_size=(3,3), activation='relu') (maxp_1)
maxp_2=MaxPooling2D(pool_size=(2,2)) (conv_2)
conv_3=Conv2D(128, kernel_size=(3,3), activation='relu') (maxp_2)
maxp_3=MaxPooling2D(pool_size=(2,2)) (conv_3)
conv_4=Conv2D(256, kernel_size=(3,3), activation='relu') (maxp_3)
maxp_4=MaxPooling2D(pool_size=(2,2)) (conv_4)

flatten=Flatten() (maxp_4)

# fully connected layers
dense_1=Dense(256, activation='relu') (flatten)
dense_2=Dense(256, activation='relu') (flatten)

dropout_1=Dropout(0.3)(dense_1)
dropout_2=Dropout(0.3)(dense_2)

output_1=Dense(1, activation='sigmoid', name='gender_out') (dropout_1)
output_2=Dense(1, activation='relu', name='age_out') (dropout_2)

model = Model(inputs=[inputs], outputs=[output_1, output_2])

model.compile(loss=['binary_crossentropy', 'mae'],optimizer='adam', metrics=['accu
```

In [28]:
```
# plot the model
'''!pip install pydot
!pip install graphviz
import graphviz'''

from tensorflow.keras.utils import plot_model
plot_model(model)
```

```
You must install pydot (`pip install pydot`) and install graphviz (see instruction
s at https://graphviz.gitlab.io/download/) for plot_model to work.
```

In [29]:
```
# train model
history = model.fit(x=X, y=[y_gender,y_age], batch_size=32, epochs=30, validation_s
```

```
Epoch 1/30
593/593 [==============================] - 226s 380ms/step - loss: 3.1785 - gender
_out_loss: 0.0675 - age_out_loss: 3.1110 - gender_out_accuracy: 0.9706 - age_out_a
ccuracy: 0.0547 - val_loss: 18.8174 - val_gender_out_loss: 0.8905 - val_age_out_lo
ss: 17.9270 - val_gender_out_accuracy: 0.8376 - val_age_out_accuracy: 0.0000e+00
Epoch 2/30
593/593 [==============================] - 224s 377ms/step - loss: 3.1074 - gender
_out_loss: 0.0658 - age_out_loss: 3.0416 - gender_out_accuracy: 0.9718 - age_out_a
ccuracy: 0.0547 - val_loss: 17.6388 - val_gender_out_loss: 0.8445 - val_age_out_lo
ss: 16.7943 - val_gender_out_accuracy: 0.8368 - val_age_out_accuracy: 0.0000e+00
Epoch 3/30
593/593 [==============================] - 228s 385ms/step - loss: 3.0063 - gender
_out_loss: 0.0662 - age_out_loss: 2.9401 - gender_out_accuracy: 0.9713 - age_out_a
ccuracy: 0.0546 - val_loss: 20.3451 - val_gender_out_loss: 0.8128 - val_age_out_lo
ss: 19.5323 - val_gender_out_accuracy: 0.8338 - val_age_out_accuracy: 0.0000e+00
Epoch 4/30
593/593 [==============================] - 225s 380ms/step - loss: 2.9763 - gender
_out_loss: 0.0598 - age_out_loss: 2.9166 - gender_out_accuracy: 0.9730 - age_out_a
ccuracy: 0.0540 - val_loss: 18.9429 - val_gender_out_loss: 1.0580 - val_age_out_lo
ss: 17.8849 - val_gender_out_accuracy: 0.8307 - val_age_out_accuracy: 0.0000e+00
Epoch 5/30
593/593 [==============================] - 219s 370ms/step - loss: 2.9882 - gender
_out_loss: 0.0592 - age_out_loss: 2.9291 - gender_out_accuracy: 0.9738 - age_out_a
ccuracy: 0.0544 - val_loss: 18.4267 - val_gender_out_loss: 1.0172 - val_age_out_lo
ss: 17.4095 - val_gender_out_accuracy: 0.8321 - val_age_out_accuracy: 0.0000e+00
Epoch 6/30
593/593 [==============================] - 219s 370ms/step - loss: 2.9364 - gender
_out_loss: 0.0604 - age_out_loss: 2.8761 - gender_out_accuracy: 0.9738 - age_out_a
ccuracy: 0.0536 - val_loss: 17.3723 - val_gender_out_loss: 1.0211 - val_age_out_lo
ss: 16.3511 - val_gender_out_accuracy: 0.8347 - val_age_out_accuracy: 0.0000e+00
Epoch 7/30
593/593 [==============================] - 558s 942ms/step - loss: 2.9681 - gender
_out_loss: 0.0591 - age_out_loss: 2.9090 - gender_out_accuracy: 0.9743 - age_out_a
ccuracy: 0.0535 - val_loss: 19.7724 - val_gender_out_loss: 1.1714 - val_age_out_lo
ss: 18.6010 - val_gender_out_accuracy: 0.8359 - val_age_out_accuracy: 0.0000e+00
Epoch 8/30
593/593 [==============================] - 225s 380ms/step - loss: 2.8952 - gender
_out_loss: 0.0535 - age_out_loss: 2.8416 - gender_out_accuracy: 0.9771 - age_out_a
ccuracy: 0.0541 - val_loss: 17.9722 - val_gender_out_loss: 1.1109 - val_age_out_lo
ss: 16.8614 - val_gender_out_accuracy: 0.8328 - val_age_out_accuracy: 0.0000e+00
Epoch 9/30
593/593 [==============================] - 256s 432ms/step - loss: 2.8774 - gender
_out_loss: 0.0506 - age_out_loss: 2.8268 - gender_out_accuracy: 0.9764 - age_out_a
ccuracy: 0.0554 - val_loss: 18.0050 - val_gender_out_loss: 1.0021 - val_age_out_lo
ss: 17.0029 - val_gender_out_accuracy: 0.8319 - val_age_out_accuracy: 0.0000e+00
Epoch 10/30
593/593 [==============================] - 1020s 2s/step - loss: 2.8544 - gender_o
ut_loss: 0.0549 - age_out_loss: 2.7995 - gender_out_accuracy: 0.9760 - age_out_acc
uracy: 0.0553 - val_loss: 19.0269 - val_gender_out_loss: 1.1168 - val_age_out_los
s: 17.9101 - val_gender_out_accuracy: 0.8340 - val_age_out_accuracy: 0.0000e+00
Epoch 11/30
593/593 [==============================] - 261s 440ms/step - loss: 2.7980 - gender
_out_loss: 0.0498 - age_out_loss: 2.7482 - gender_out_accuracy: 0.9770 - age_out_a
ccuracy: 0.0553 - val_loss: 20.1296 - val_gender_out_loss: 1.0367 - val_age_out_lo
ss: 19.0929 - val_gender_out_accuracy: 0.8296 - val_age_out_accuracy: 0.0000e+00
Epoch 12/30
593/593 [==============================] - 250s 422ms/step - loss: 2.7713 - gender
_out_loss: 0.0448 - age_out_loss: 2.7264 - gender_out_accuracy: 0.9792 - age_out_a
ccuracy: 0.0552 - val_loss: 19.0551 - val_gender_out_loss: 1.2098 - val_age_out_lo
ss: 17.8453 - val_gender_out_accuracy: 0.8311 - val_age_out_accuracy: 0.0000e+00
Epoch 13/30
593/593 [==============================] - 230s 389ms/step - loss: 2.7539 - gender
_out_loss: 0.0467 - age_out_loss: 2.7072 - gender_out_accuracy: 0.9782 - age_out_a
ccuracy: 0.0547 - val_loss: 17.6717 - val_gender_out_loss: 1.1482 - val_age_out_lo
```

```
ss: 16.5236 - val_gender_out_accuracy: 0.8313 - val_age_out_accuracy: 0.0000e+00
Epoch 14/30
593/593 [==============================] - 215s 362ms/step - loss: 2.7315 - gender
_out_loss: 0.0429 - age_out_loss: 2.6886 - gender_out_accuracy: 0.9789 - age_out_a
ccuracy: 0.0555 - val_loss: 18.7198 - val_gender_out_loss: 1.0018 - val_age_out_lo
ss: 17.7180 - val_gender_out_accuracy: 0.8281 - val_age_out_accuracy: 0.0000e+00
Epoch 15/30
593/593 [==============================] - 178s 300ms/step - loss: 2.7603 - gender
_out_loss: 0.0454 - age_out_loss: 2.7149 - gender_out_accuracy: 0.9791 - age_out_a
ccuracy: 0.0555 - val_loss: 18.7271 - val_gender_out_loss: 1.1802 - val_age_out_lo
ss: 17.5469 - val_gender_out_accuracy: 0.8256 - val_age_out_accuracy: 0.0000e+00
Epoch 16/30
593/593 [==============================] - 175s 295ms/step - loss: 2.6797 - gender
_out_loss: 0.0457 - age_out_loss: 2.6340 - gender_out_accuracy: 0.9793 - age_out_a
ccuracy: 0.0558 - val_loss: 17.0875 - val_gender_out_loss: 1.0839 - val_age_out_lo
ss: 16.0037 - val_gender_out_accuracy: 0.8313 - val_age_out_accuracy: 0.0000e+00
Epoch 17/30
593/593 [==============================] - 190s 321ms/step - loss: 2.6923 - gender
_out_loss: 0.0415 - age_out_loss: 2.6509 - gender_out_accuracy: 0.9815 - age_out_a
ccuracy: 0.0549 - val_loss: 21.9382 - val_gender_out_loss: 1.1267 - val_age_out_lo
ss: 20.8115 - val_gender_out_accuracy: 0.8309 - val_age_out_accuracy: 0.0000e+00
Epoch 18/30
593/593 [==============================] - 257s 434ms/step - loss: 2.6690 - gender
_out_loss: 0.0459 - age_out_loss: 2.6231 - gender_out_accuracy: 0.9799 - age_out_a
ccuracy: 0.0553 - val_loss: 18.7676 - val_gender_out_loss: 1.0694 - val_age_out_lo
ss: 17.6982 - val_gender_out_accuracy: 0.8347 - val_age_out_accuracy: 0.0000e+00
Epoch 19/30
593/593 [==============================] - 180s 304ms/step - loss: 2.6377 - gender
_out_loss: 0.0378 - age_out_loss: 2.5999 - gender_out_accuracy: 0.9811 - age_out_a
ccuracy: 0.0555 - val_loss: 18.6183 - val_gender_out_loss: 1.3761 - val_age_out_lo
ss: 17.2422 - val_gender_out_accuracy: 0.8353 - val_age_out_accuracy: 0.0000e+00
Epoch 20/30
593/593 [==============================] - 179s 301ms/step - loss: 2.6932 - gender
_out_loss: 0.0459 - age_out_loss: 2.6473 - gender_out_accuracy: 0.9793 - age_out_a
ccuracy: 0.0560 - val_loss: 19.5167 - val_gender_out_loss: 1.4014 - val_age_out_lo
ss: 18.1153 - val_gender_out_accuracy: 0.8271 - val_age_out_accuracy: 0.0000e+00
Epoch 21/30
593/593 [==============================] - 178s 300ms/step - loss: 2.5846 - gender
_out_loss: 0.0398 - age_out_loss: 2.5449 - gender_out_accuracy: 0.9829 - age_out_a
ccuracy: 0.0548 - val_loss: 19.2236 - val_gender_out_loss: 1.2512 - val_age_out_lo
ss: 17.9724 - val_gender_out_accuracy: 0.8321 - val_age_out_accuracy: 0.0000e+00
Epoch 22/30
593/593 [==============================] - 186s 313ms/step - loss: 2.5740 - gender
_out_loss: 0.0388 - age_out_loss: 2.5352 - gender_out_accuracy: 0.9839 - age_out_a
ccuracy: 0.0554 - val_loss: 18.1658 - val_gender_out_loss: 1.2074 - val_age_out_lo
ss: 16.9583 - val_gender_out_accuracy: 0.8288 - val_age_out_accuracy: 0.0000e+00
Epoch 23/30
593/593 [==============================] - 188s 317ms/step - loss: 2.5905 - gender
_out_loss: 0.0432 - age_out_loss: 2.5473 - gender_out_accuracy: 0.9814 - age_out_a
ccuracy: 0.0554 - val_loss: 21.4555 - val_gender_out_loss: 1.2218 - val_age_out_lo
ss: 20.2336 - val_gender_out_accuracy: 0.8359 - val_age_out_accuracy: 0.0000e+00
Epoch 24/30
593/593 [==============================] - 190s 320ms/step - loss: 2.5742 - gender
_out_loss: 0.0386 - age_out_loss: 2.5356 - gender_out_accuracy: 0.9828 - age_out_a
ccuracy: 0.0557 - val_loss: 18.5152 - val_gender_out_loss: 1.2018 - val_age_out_lo
ss: 17.3133 - val_gender_out_accuracy: 0.8290 - val_age_out_accuracy: 0.0000e+00
Epoch 25/30
593/593 [==============================] - 184s 311ms/step - loss: 2.5677 - gender
_out_loss: 0.0365 - age_out_loss: 2.5313 - gender_out_accuracy: 0.9844 - age_out_a
ccuracy: 0.0554 - val_loss: 18.9463 - val_gender_out_loss: 1.3343 - val_age_out_lo
ss: 17.6120 - val_gender_out_accuracy: 0.8357 - val_age_out_accuracy: 0.0000e+00
Epoch 26/30
593/593 [==============================] - 179s 302ms/step - loss: 2.5597 - gender
_out_loss: 0.0357 - age_out_loss: 2.5240 - gender_out_accuracy: 0.9844 - age_out_a
```

```
ccuracy: 0.0561 - val_loss: 19.0072 - val_gender_out_loss: 1.3686 - val_age_out_lo
ss: 17.6386 - val_gender_out_accuracy: 0.8370 - val_age_out_accuracy: 0.0000e+00
Epoch 27/30
593/593 [==============================] - 179s 302ms/step - loss: 2.5168 - gender
_out_loss: 0.0355 - age_out_loss: 2.4813 - gender_out_accuracy: 0.9839 - age_out_a
ccuracy: 0.0556 - val_loss: 18.8321 - val_gender_out_loss: 1.3487 - val_age_out_lo
ss: 17.4834 - val_gender_out_accuracy: 0.8353 - val_age_out_accuracy: 0.0000e+00
Epoch 28/30
593/593 [==============================] - 180s 304ms/step - loss: 2.5115 - gender
_out_loss: 0.0344 - age_out_loss: 2.4771 - gender_out_accuracy: 0.9846 - age_out_a
ccuracy: 0.0553 - val_loss: 19.7014 - val_gender_out_loss: 1.5295 - val_age_out_lo
ss: 18.1719 - val_gender_out_accuracy: 0.8317 - val_age_out_accuracy: 0.0000e+00
Epoch 29/30
593/593 [==============================] - 180s 303ms/step - loss: 2.4763 - gender
_out_loss: 0.0414 - age_out_loss: 2.4350 - gender_out_accuracy: 0.9828 - age_out_a
ccuracy: 0.0555 - val_loss: 20.8138 - val_gender_out_loss: 1.2405 - val_age_out_lo
ss: 19.5732 - val_gender_out_accuracy: 0.8302 - val_age_out_accuracy: 0.0000e+00
Epoch 30/30
593/593 [==============================] - 179s 303ms/step - loss: 2.5052 - gender
_out_loss: 0.0328 - age_out_loss: 2.4724 - gender_out_accuracy: 0.9852 - age_out_a
ccuracy: 0.0558 - val_loss: 19.0397 - val_gender_out_loss: 1.5560 - val_age_out_lo
ss: 17.4837 - val_gender_out_accuracy: 0.8281 - val_age_out_accuracy: 0.0000e+00
```

Plot the Results

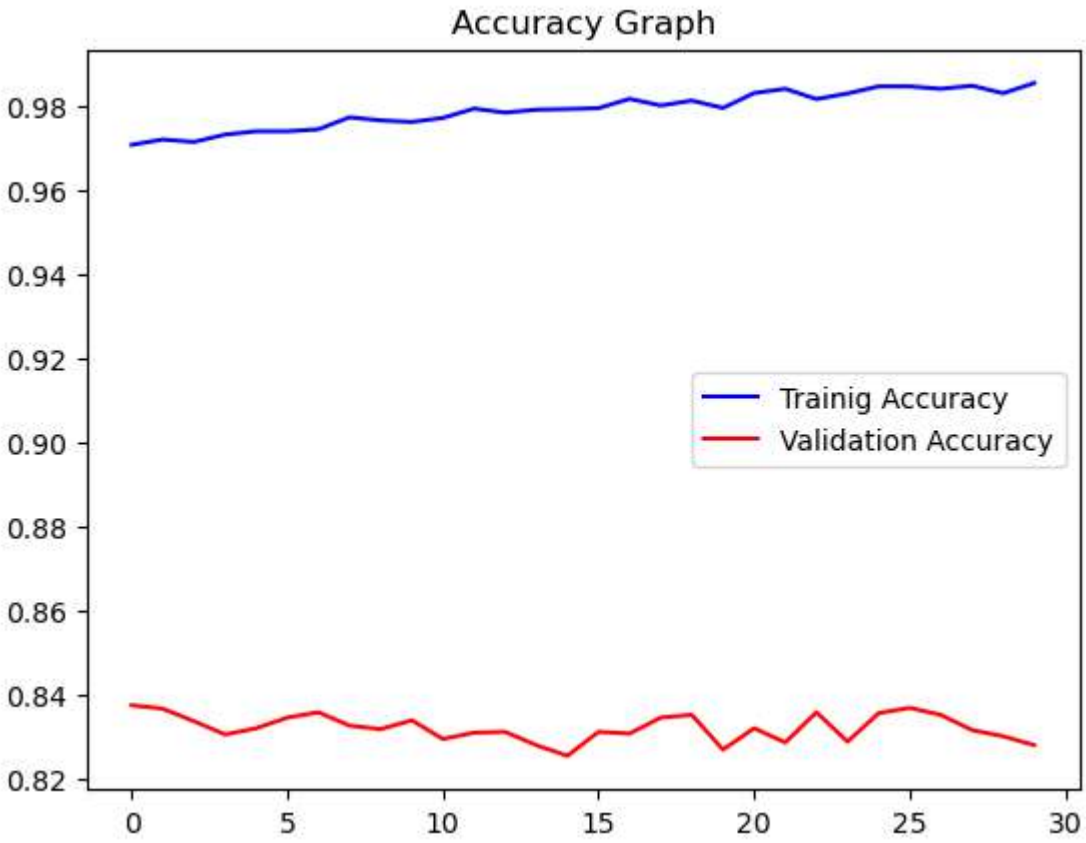
In [32]:

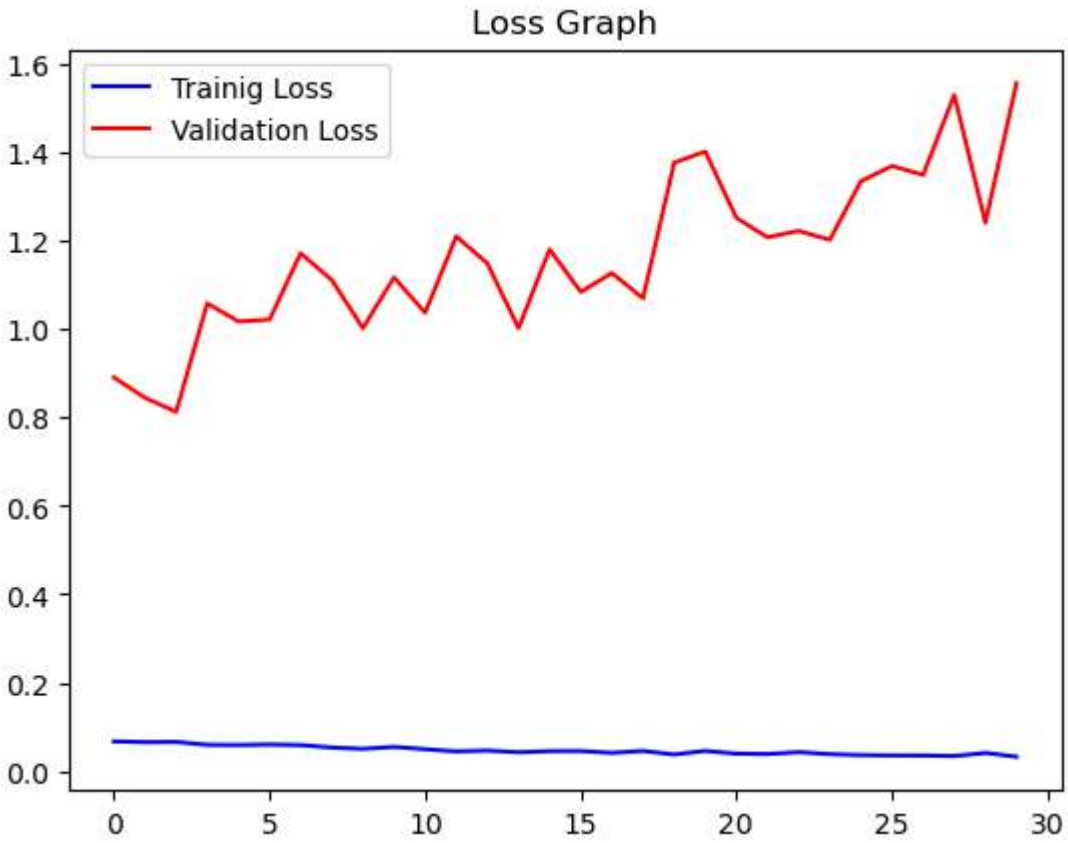
```python
#plot results for gender
acc = history.history['gender_out_accuracy']
val_acc = history.history['val_gender_out_accuracy']
epochs=range(len(acc))

plt.plot(epochs,acc,'b', label='Trainig Accuracy')
plt.plot(epochs,val_acc,'r', label='Validation Accuracy')
plt.title('Accuracy Graph')
plt.legend()
plt.figure()

loss = history.history['gender_out_loss']
val_loss = history.history['val_gender_out_loss']
epochs=range(len(acc))

plt.plot(epochs,loss,'b', label='Trainig Loss')
plt.plot(epochs,val_loss,'r', label='Validation Loss')
plt.title('Loss Graph')
plt.legend()
plt.show()
```





In [34]:
```
# plot result for age

loss = history.history['age_out_loss']
val_loss = history.history['val_age_out_loss']
epochs=range(len(acc))

plt.plot(epochs,loss,'b', label='Trainig Loss')
plt.plot(epochs,val_loss,'r', label='Validation Loss')
plt.title('Loss Graph')
```

```
plt.legend()
plt.show()
```

Prediction with Test Data

In [43]:
```
image_index=100
print("Original Gender:", gender_dict[y_gender[image_index]], "Original Age:", y_ag
# pridict from model
pred=model.predict(X[image_index].reshape(1,128,128,1))
pred_gender=gender_dict[round(pred[0][0][0])]
pred_age=round(pred[1][0][0])
print("Predicted Gender:", pred_gender, "Predicted Age:", pred_age)
plt.axis('off')
plt.imshow(X[image_index].reshape(128,128), cmap='gray');
```

```
Original Gender: Male Original Age: 10
1/1 [==============================] - 0s 25ms/step
Predicted Gender: Male Predicted Age: 10
```

In [36]:
```
image_index=3500
print("Original Gender:", gender_dict[y_gender[image_index]], "Original Age:", y_ag
# pridict from model
pred=model.predict(X[image_index].reshape(1,128,128,1))
pred_gender=gender_dict[round(pred[0][0][0])]
pred_age=round(pred[1][0][0])
print("Predicted Gender:", pred_gender, "Predicted Age:", pred_age)
plt.axis('off')
plt.imshow(X[image_index].reshape(128,128), cmap='gray');
```

```
Original Gender: Female Original Age: 22
1/1 [==============================] - 0s 20ms/step
Predicted Gender: Female Predicted Age: 22
```

In [37]:
```
image_index=3000
print("Original Gender:", gender_dict[y_gender[image_index]], "Original Age:", y_ag
# pridict from model
pred=model.predict(X[image_index].reshape(1,128,128,1))
pred_gender=gender_dict[round(pred[0][0][0])]
pred_age=round(pred[1][0][0])
print("Predicted Gender:", pred_gender, "Predicted Age:", pred_age)
plt.axis('off')
plt.imshow(X[image_index].reshape(128,128), cmap='gray');
```

```
Original Gender: Male Original Age: 21
1/1 [==============================] - 0s 20ms/step
Predicted Gender: Male Predicted Age: 20
```

In [38]:
```
image_index=2000
print("Original Gender:", gender_dict[y_gender[image_index]], "Original Age:", y_ag
# pridict from model
pred=model.predict(X[image_index].reshape(1,128,128,1))
pred_gender=gender_dict[round(pred[0][0][0])]
pred_age=round(pred[1][0][0])
print("Predicted Gender:", pred_gender, "Predicted Age:", pred_age)
plt.axis('off')
plt.imshow(X[image_index].reshape(128,128), cmap='gray');
```

```
Original Gender: Male Original Age: 1
1/1 [==============================] - 0s 24ms/step
Predicted Gender: Male Predicted Age: 1
```

In [ ]: