```
import numpy as np
import matplotlib.pyplot as plt
from tensorflow.keras.layers import Input, Dense, Flatten, Conv2D, MaxPooling2D, BatchNormalization, Dropout, Reshape, Concatenate, Leaky
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.optimizers import Adam
from tensorflow.keras.models import Model
```

```
image_dimensions = {'height':256, 'width':256, 'channels':3}
```

```
class Classifier:
    def __init__():
        self.model = 0

    def predict(self, x):
        return self.model.predict(x)

    def fit(self, x, y):
        return self.model.train_on_batch(x, y)

    def get_accuracy(self, x, y):
        return self.model.test_on_batch(x, y)

    def load(self, path):
        self.model.load_weights(path)
```

```
class Meso4(Classifier):
    def __init__(self, learning_rate = 0.001):
        self.model = self.init_model()
        optimizer = Adam(lr = learning_rate)
        self.model.compile(optimizer = optimizer,
                           loss = 'mean_squared_error',
                           metrics = ['accuracy'])

    def init_model(self):
        x = Input(shape = (image_dimensions['height'],
                           image_dimensions['width'],
                           image_dimensions['channels']))

        x1 = Conv2D(8, (3, 3), padding='same', activation = 'relu')(x)
        x1 = BatchNormalization()(x1)
        x1 = MaxPooling2D(pool_size=(2, 2), padding='same')(x1)

        x2 = Conv2D(8, (5, 5), padding='same', activation = 'relu')(x1)
        x2 = BatchNormalization()(x2)
        x2 = MaxPooling2D(pool_size=(2, 2), padding='same')(x2)

        x3 = Conv2D(16, (5, 5), padding='same', activation = 'relu')(x2)
        x3 = BatchNormalization()(x3)
        x3 = MaxPooling2D(pool_size=(2, 2), padding='same')(x3)

        x4 = Conv2D(16, (5, 5), padding='same', activation = 'relu')(x3)
        x4 = BatchNormalization()(x4)
        x4 = MaxPooling2D(pool_size=(4, 4), padding='same')(x4)

        y = Flatten()(x4)
        y = Dropout(0.5)(y)
        y = Dense(16)(y)
        y = LeakyReLU(alpha=0.1)(y)
        y = Dropout(0.5)(y)
        y = Dense(1, activation = 'sigmoid')(y)

        return Model(inputs = x, outputs = y)
```

```
meso.load('/content/Meso4_DF ')
```

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

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
dataGenerator = ImageDataGenerator(rescale=1./255)

generator = dataGenerator.flow_from_directory(
    '/content/drive/MyDrive/DATA/data',
    target_size=(256, 256),
    batch_size=1,
    class_mode='binary')
```

```
Found 3218 images belonging to 2 classes.
```

```
X, y = generator.next()

print(f"Predicted likelihood: {meso.predict(X)[0][0]:.4f}")
print(f"Actual label: {int(y[0])}")
print(f"\nCorrect prediction: {round(meso.predict(X)[0][0])==y[0]}")

plt.imshow(np.squeeze(X));
```

```
1/1 [==============================] - 0s 317ms/step
Predicted likelihood: 0.9096
Actual label: 1
1/1 [==============================] - 0s 56ms/step

Correct prediction: True
```

```
correct_real = []
correct_real_pred = []

correct_deepfake = []
correct_deepfake_pred = []

misclassified_real = []
misclassified_real_pred = []

misclassified_deepfake = []
misclassified_deepfake_pred = []
```

```
for i in range(len(generator.labels)):

    X, y = generator.next()
    pred = meso.predict(X)[0][0]

    if round(pred)==y[0] and y[0]==1:
        correct_real.append(X)
        correct_real_pred.append(pred)
    elif round(pred)==y[0] and y[0]==0:
        correct_deepfake.append(X)
        correct_deepfake_pred.append(pred)
    elif y[0]==1:
        misclassified_real.append(X)
        misclassified_real_pred.append(pred)
    else:
        misclassified_deepfake.append(X)
        misclassified_deepfake_pred.append(pred)

    if i % 1000 == 0:
        print(i, ' predictions completed.')

    if i == len(generator.labels)-1:
        print("All", len(generator.labels), "predictions completed")
```

```
1/1 [==============================] - 0s 40ms/step
0  predictions completed.
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 54ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 40ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 41ms/step
1/1 [==============================] - 0s 42ms/step
1/1 [==============================] - 0s 50ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 42ms/step
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 36ms/step
1/1 [==============================] - 0s 38ms/step
1/1 [==============================] - 0s 43ms/step
1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 42ms/step
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1/1 [==============================] - 0s 37ms/step
1/1 [==============================] - 0s 39ms/step
1/1 [==============================] - 0s 49ms/step
1/1 [==============================] - 0s 44ms/step
1/1 [==============================] - 0s 36ms/step
1/1 [==============================] - 0s 44ms/step
```
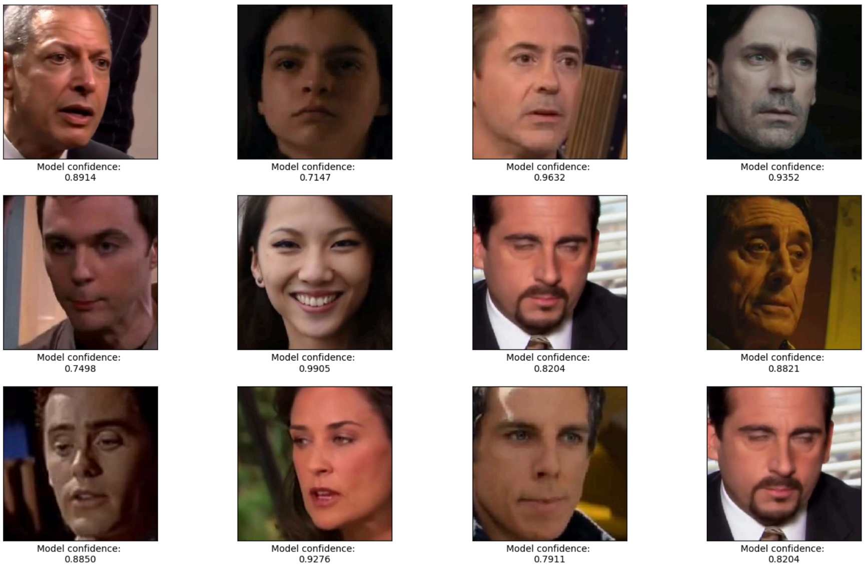

```
def plotter(images, preds):
    fig, axes = plt.subplots(3, 4, figsize=(16, 9))
    subset = np.random.choice(len(images), 12, replace=False)

    for i, ax in enumerate(axes.flatten()):
        idx = subset[i]
        ax.imshow(np.squeeze(images[idx]))
        ax.set_xlabel(f"Model confidence: \n{preds[idx]:.4f}")
        ax.set_xticks([])
        ax.set_yticks([])

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

```
plotter(correct_real, correct_real_pred)
```



```
def plotter(images,preds):
    if len(images) <= 1:
        print("Not enough images to plot.")
        return

    fig = plt.figure(figsize=(16,9))
    num_images = min(12, len(images))
    subset = np.random.randint(0, len(images), num_images)
    for i,j in enumerate(subset):
        fig.add_subplot(3,4,i+1)
        plt.imshow(np.squeeze(images[j]))
        plt.xlabel(f"Model confidence: \n{preds[j]:.4f}")
        plt.tight_layout()
        ax = plt.gca()
        ax.axes.xaxis.set_ticks([])
        ax.axes.yaxis.set_ticks([])
    plt.show();
    return
```

```
plotter(misclassified_real, misclassified_real_pred)
```