Loading and Exploring the Dataset

```
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).
```

```
import pandas as pd
import os

# إعداد البيانات
labels_file = "/content/drive/MyDrive/hajj/endupdated_hajj_data.csv"
data_path = "/content/drive/MyDrive/hajj"

# قراءة ملف التصنيفات
labels_df = pd.read_csv(labels_file)

# التحقق من الأعمدة
print("أسماء الأعمدة:", labels_df.columns)
print("أول 5 سجلات:")
print(labels_df.head())

# التحقق من وجود الصور
missing_images = []
for path in labels_df["Image Path"]:
    if not os.path.exists(path):
        missing_images.append(path)

print(f"عدد الصور المفقودة: {len(missing_images)}")
if missing_images:
    print("أمثلة للصور المفقودة:", missing_images[:5])
```

```
أسماء الأعمدة: Index(['Name', 'Country', 'Campaign', 'Supervisor', 'Supervisor Phone',
       'Image Path', 'Updated_Image_Path'],
      dtype='object')
أول 5 سجلات:
             Name       Country      Campaign    Supervisor  \
0  Fahad Bin Ahmed         Egypt      Al-Falah  Salman Yasin
1   Ali Bin Khalid      Pakistan  Makkah Stars      Ali Raza
2   Ali Bin Khalid  Saudi Arabia          Huda     Ahmed Ali
3  Fahad Bin Saeed  Saudi Arabia       Al-Noor  Hassan Tariq
4    Ali Bin Ahmed      Malaysia          Huda      Ali Raza

   Supervisor Phone                                  Image Path  \
0      9.665540e+11  /content/drive/MyDrive/hajj/Male/person_1.jpg
1      9.665360e+11  /content/drive/MyDrive/hajj/Male/person_2.jpg
2      9.665980e+11  /content/drive/MyDrive/hajj/Male/person_3.jpg
3      9.665750e+11  /content/drive/MyDrive/hajj/Male/person_4.jpg
4      9.665800e+11  /content/drive/MyDrive/hajj/Male/person_5.jpg

                                Updated_Image_Path
0  /content/drive/MyDrive/hajj/Male/20220901_1559...
1  /content/drive/MyDrive/hajj/Male/20220901_1600...
2  /content/drive/MyDrive/hajj/Male/20220901_1600...
3  /content/drive/MyDrive/hajj/Male/20220901_1559...
4  /content/drive/MyDrive/hajj/Male/20220901_1604...
عدد الصور المفقودة: 4001
أمثلة للصور المفقودة: ['/content/drive/MyDrive/hajj/Male/person_1.jpg', '/content/drive/MyDrive/hajj/Male/person_2.jpg', '/content/drive/M
```

```
# إزالة السجلات المرتبطة بالصور المفقودة
labels_df["Full_Image_Path"] = labels_df["Image Path"].apply(lambda x: os.path.join(data_path, x))
labels_df = labels_df[labels_df["Full_Image_Path"].apply(os.path.exists)]

print("عدد السجلات بعد التنظيف:", len(labels_df))
```

```
عدد السجلات بعد التنظيف: 0
```

```
print("أول 10 مسارات في العمود Image Path:")
print(labels_df["Image Path"].head(10))
```

```
أول 10 مسارات في العمود Image Path:
Series([], Name: Image Path, dtype: object)
```

```
import pandas as pd

# قراءة ملف CSV
labels_file = "/content/drive/MyDrive/hajj/endupdated_hajj_data.csv"
labels_df = pd.read_csv(labels_file)

# عرض أول 5 صفوف
print(labels_df.head())
```

```
             Name       Country      Campaign    Supervisor  \
0  Fahad Bin Ahmed         Egypt      Al-Falah  Salman Yasin
1   Ali Bin Khalid      Pakistan  Makkah Stars      Ali Raza
2   Ali Bin Khalid  Saudi Arabia          Huda     Ahmed Ali
3  Fahad Bin Saeed  Saudi Arabia       Al-Noor  Hassan Tariq
4    Ali Bin Ahmed      Malaysia          Huda      Ali Raza

   Supervisor Phone                                  Image Path  \
0      9.665540e+11  /content/drive/MyDrive/hajj/Male/person_1.jpg
1      9.665360e+11  /content/drive/MyDrive/hajj/Male/person_2.jpg
2      9.665980e+11  /content/drive/MyDrive/hajj/Male/person_3.jpg
3      9.665750e+11  /content/drive/MyDrive/hajj/Male/person_4.jpg
4      9.665800e+11  /content/drive/MyDrive/hajj/Male/person_5.jpg

                               Updated_Image_Path
0  /content/drive/MyDrive/hajj/Male/20220901_1559...
1  /content/drive/MyDrive/hajj/Male/20220901_1600...
2  /content/drive/MyDrive/hajj/Male/20220901_1600...
3  /content/drive/MyDrive/hajj/Male/20220901_1559...
4  /content/drive/MyDrive/hajj/Male/20220901_1604...
```

Enhancing Image Processing for Better Predictions

```
import os

male_images = os.listdir("/content/drive/MyDrive/hajj/Male")
female_images = os.listdir("/content/drive/MyDrive/hajj/Female")

print("عدد صور الذكور:", len(male_images))
print("عدد صور الإناث:", len(female_images))
```

```
عدد صور الذكور: 1000
عدد صور الإناث: 1000
```

```
# دالة لتحديث المسار بناءً على الجنس
def update_image_path(row):
    if "Male" in row["Image Path"]:
        # إذا كانت الصورة تخص الذكور
        if male_images:
            return f"/content/drive/MyDrive/hajj/Male/{male_images.pop(0)}"
    elif "Female" in row["Image Path"]:
        # إذا كانت الصورة تخص الإناث
        if female_images:
            return f"/content/drive/MyDrive/hajj/Female/{female_images.pop(0)}"
    return None

# تحديث العمود
labels_df["Updated_Image_Path"] = labels_df.apply(update_image_path, axis=1)
```

```
print(labels_df[["Image Path", "Updated_Image_Path"]].head(10))
```

```
                                  Image Path  \
0   /content/drive/MyDrive/hajj/Male/person_1.jpg
1   /content/drive/MyDrive/hajj/Male/person_2.jpg
2   /content/drive/MyDrive/hajj/Male/person_3.jpg
3   /content/drive/MyDrive/hajj/Male/person_4.jpg
4   /content/drive/MyDrive/hajj/Male/person_5.jpg
5   /content/drive/MyDrive/hajj/Male/person_6.jpg
```

```
6   /content/drive/MyDrive/hajj/Male/person_7.jpg
7   /content/drive/MyDrive/hajj/Male/person_8.jpg
8   /content/drive/MyDrive/hajj/Male/person_9.jpg
9  /content/drive/MyDrive/hajj/Male/person_10.jpg

                                Updated_Image_Path
0  /content/drive/MyDrive/hajj/Male/20220901_1559...
1  /content/drive/MyDrive/hajj/Male/20220901_1600...
2  /content/drive/MyDrive/hajj/Male/20220901_1600...
3  /content/drive/MyDrive/hajj/Male/20220901_1559...
4  /content/drive/MyDrive/hajj/Male/20220901_1604...
5  /content/drive/MyDrive/hajj/Male/20220901_1603...
6  /content/drive/MyDrive/hajj/Male/20220901_1601...
7  /content/drive/MyDrive/hajj/Male/20220901_1602...
8  /content/drive/MyDrive/hajj/Male/20220901_1604...
9  /content/drive/MyDrive/hajj/Male/20220901_1603...
```

```
labels_df = labels_df[labels_df["Updated_Image_Path"].notnull()]
print("عدد السجلات بعد التنظيف:", len(labels_df))
```

```
عدد السجلات بعد التنظيف: 2000
```

```
# حفظ الملف في المسار المحلي
local_file = "updated_hajj_data.csv"
labels_df.to_csv(local_file, index=False)
print(f"تم حفظ الملف محليًا: {local_file}")
```

```
تم حفظ الملف محليًا: updated_hajj_data.csv
```

```
!cp updated_hajj_data.csv "/content/drive/MyDrive/hajjalso"
```

```
print(labels_df.head())
print(f"عدد السجلات: {len(labels_df)}")
```

```
             Name       Country      Campaign    Supervisor  \
0  Fahad Bin Ahmed         Egypt      Al-Falah  Salman Yasin
1   Ali Bin Khalid      Pakistan  Makkah Stars      Ali Raza
2   Ali Bin Khalid  Saudi Arabia          Huda     Ahmed Ali
3  Fahad Bin Saeed  Saudi Arabia       Al-Noor  Hassan Tariq
4    Ali Bin Ahmed      Malaysia          Huda      Ali Raza

   Supervisor Phone                                  Image Path  \
0      9.665540e+11  /content/drive/MyDrive/hajj/Male/person_1.jpg
1      9.665360e+11  /content/drive/MyDrive/hajj/Male/person_2.jpg
2      9.665980e+11  /content/drive/MyDrive/hajj/Male/person_3.jpg
3      9.665750e+11  /content/drive/MyDrive/hajj/Male/person_4.jpg
4      9.665800e+11  /content/drive/MyDrive/hajj/Male/person_5.jpg

                                Updated_Image_Path
0  /content/drive/MyDrive/hajj/Male/20220901_1559...
1  /content/drive/MyDrive/hajj/Male/20220901_1600...
2  /content/drive/MyDrive/hajj/Male/20220901_1600...
3  /content/drive/MyDrive/hajj/Male/20220901_1559...
4  /content/drive/MyDrive/hajj/Male/20220901_1604...
عدد السجلات: 2000
```

```
from tensorflow.keras.preprocessing.image import load_img, img_to_array
```

```
# مثال لتجربة تحميل صورة واحدة
test_image_path = labels_df["Updated_Image_Path"].iloc[0]  # تأكد أن الصورة موجودة
img = load_img(test_image_path, target_size=(128, 128))
img_array = img_to_array(img) / 255.0

print(f"تم تحميل الصورة بحجم: {img_array.shape}")
```

```
تم تحميل الصورة بحجم: (128, 128, 3)
```

```
def copy_image_and_update_path(image_path):
    # التحقق من المجلد الذي يحتوي على الصورة
    if os.path.exists(os.path.join(male_images_dir, image_path)):
```

```
        images_dir = male_images_dir
        target_dir = male_images_new_dir
    elif os.path.exists(os.path.join(female_images_dir, image_path)):
        images_dir = female_images_dir
        target_dir = female_images_new_dir
    else:
        return image_path  # إذا لم تكن الصورة موجودة في أي من المجلدين

    # مسار الصورة الأصلية
    original_path = os.path.join(images_dir, image_path)
    base, ext = os.path.splitext(image_path)
    new_image_path = f"{base}_copy{ext}"  # إنشاء اسم جديد للصورة
    new_full_path = os.path.join(target_dir, new_image_path)

    # نسخ الصورة فعليًا
    shutil.copy(original_path, new_full_path)
    return new_image_path  # إرجاع اسم الصورة الجديدة
```

Training the Model for Accurate Predictions

```
from sklearn.model_selection import train_test_split
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.preprocessing.image import load_img, img_to_array
import numpy as np
import pandas as pd
import os

# تحميل ملف البيانات
csv_path = "/content/drive/MyDrive/hajj/endupdated_hajj_data.csv"
labels_df = pd.read_csv(csv_path)


# التأكد من أن العمود 'Updated_Image_Path' يحتوي على المسارات الصحيحة
images = []
labels = []

for _, row in labels_df.iterrows():
    img_path = row["Updated_Image_Path"]  # مسار الصورة
    if os.path.exists(img_path):  # التحقق من وجود الصورة
        # تحميل الصورة
        img = load_img(img_path, target_size=(128, 128))  # 128 تغيير الحجم إلى 128x
        img_array = img_to_array(img) / 255.0  # [1 ,0] تحويل الصورة إلى مصفوفة وتطبيع القيم إلى
        images.append(img_array)
        labels.append(row["Name"])  # اسم الفئة
    else:
        print(f"الصورة غير موجودة: {img_path}")
# تحويل الصور والتصنيفات إلى مصفوفات NumPy
images = np.array(images)
labels = np.array(labels)

# تحويل التصنيفات النصية إلى أرقام
unique_labels = sorted(set(labels))
label_to_index = {label: idx for idx, label in enumerate(unique_labels)}  # تحويل النصوص إلى أرقام
labels = np.array([label_to_index[label] for label in labels])
```

```
# تقسيم البيانات إلى تدريب واختبار
X_train, X_test, y_train, y_test = train_test_split(images, labels, test_size=0.2, random_state=42)

# تحويل التصنيفات إلى One-Hot Encoding
y_train = to_categorical(y_train, num_classes=len(unique_labels))
y_test = to_categorical(y_test, num_classes=len(unique_labels))

# عرض أحجام بيانات التدريب والاختبار
print("حجم بيانات التدريب:", X_train.shape, y_train.shape)
print("حجم بيانات الاختبار:", X_test.shape, y_test.shape)
```

```
حجم بيانات التدريب: (3200, 128, 128, 3) (3200, 80)
حجم بيانات الاختبار: (801, 128, 128, 3) (801, 80)
```

```
print("عدد الصور المحملة:", len(images))
print("عدد التصنيفات:", len(unique_labels))
print("التصنيفات:", unique_labels)
```

```
عدد الصور المحملة: 4001
عدد التصنيفات: 80
التصنيفات: ['Ahmed Bin Ahmed', 'Ahmed Bin Ali', 'Ahmed Bin Khalid', 'Ahmed Bin Saeed', 'Aisha Ahmed', 'Aisha Ali', 'Aisha Mohammed', '
```

MODEL1

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense, Dropout

model = Sequential([
    Conv2D(32, (3, 3), activation='relu', input_shape=(128, 128, 3)),
    MaxPooling2D((2, 2)),
    Conv2D(64, (3, 3), activation='relu'),
    MaxPooling2D((2, 2)),
    Flatten(),
    Dense(128, activation='relu'),
    Dropout(0.5),
    Dense(len(unique_labels), activation='softmax')
])

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

print(model.summary())
```

Model: "sequential_1"

Layer (type)	Output Shape	Param #
conv2d_2 (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d_2 (MaxPooling2D)	(None, 63, 63, 32)	0
conv2d_3 (Conv2D)	(None, 61, 61, 64)	18,496
max_pooling2d_3 (MaxPooling2D)	(None, 30, 30, 64)	0
flatten_1 (Flatten)	(None, 57600)	0
dense_2 (Dense)	(None, 128)	7,372,928
dropout_1 (Dropout)	(None, 128)	0
dense_3 (Dense)	(None, 80)	10,320

Total params: 7,402,640 (28.24 MB)
Trainable params: 7,402,640 (28.24 MB)
Non-trainable params: 0 (0.00 B)

```
history = model.fit(
    X_train, y_train,
    epochs=5,
    batch_size=32,
    validation_data=(X_test, y_test)
)
```

```
Epoch 1/5
100/100 ━━━━━━━━━━━━━━━━━━━━ 87s 845ms/step - accuracy: 0.0189 - loss: 4.4570 - val_accuracy: 0.0212 - val_loss: 4.3747
Epoch 2/5
100/100 ━━━━━━━━━━━━━━━━━━━━ 143s 856ms/step - accuracy: 0.0447 - loss: 4.3092 - val_accuracy: 0.0787 - val_loss: 4.1335
Epoch 3/5
100/100 ━━━━━━━━━━━━━━━━━━━━ 141s 855ms/step - accuracy: 0.1472 - loss: 3.6997 - val_accuracy: 0.2235 - val_loss: 3.4561
Epoch 4/5
100/100 ━━━━━━━━━━━━━━━━━━━━ 138s 816ms/step - accuracy: 0.3563 - loss: 2.6398 - val_accuracy: 0.4869 - val_loss: 2.5699
Epoch 5/5
100/100 ━━━━━━━━━━━━━━━━━━━━ 92s 910ms/step - accuracy: 0.5707 - loss: 1.6787 - val_accuracy: 0.6654 - val_loss: 1.9542
```

```
test_loss, test_accuracy = model.evaluate(X_test, y_test)
print(f"دقة الاختبار: {test_accuracy * 100:.2f}%")
```

```
26/26 ━━━━━━━━━━━━━━━━━━━━ 5s 172ms/step - accuracy: 0.6578 - loss: 1.9267
دقة الاختبار: 66.54%
```

```
import matplotlib.pyplot as plt
import numpy as np
from tensorflow.keras.preprocessing.image import load_img, img_to_array

# List of class labels the model was trained on
class_labels = unique_labels  # The names or classes used during training

def predict_and_display_multiple(labels_df, model, num_people=20, columns=5):
    """
    Function to display multiple images (e.g., 20 people) in a grid.
    Shows actual labels, predicted labels, and whether the prediction is correct.
    """
    # Randomly select people from the dataset
    selected_rows = labels_df.sample(min(num_people, len(labels_df)))

    # Set up the grid dimensions
    rows = (num_people + columns - 1) // columns  # Calculate required rows
    plt.figure(figsize=(columns * 4, rows * 4))  # Adjust figure size dynamically

    for i, (_, row) in enumerate(selected_rows.iterrows()):
        # Extract image path and actual label
        img_path = row["Updated_Image_Path"]
        actual_label = row["Name"]

        # Load and preprocess the image
        try:
            img = load_img(img_path, target_size=(128, 128))  # Resize to match training input
        except FileNotFoundError:
            print(f"⚠️ Image not found: {img_path}")
            continue

        img_array = img_to_array(img) / 255.0  # Normalize values
        img_array = np.expand_dims(img_array, axis=0)  # Add batch dimension

        # Pass the image to the model to get predictions
        predictions = model.predict(img_array)
        predicted_class_index = np.argmax(predictions)
        predicted_class_name = class_labels[predicted_class_index]
        is_correct = "Correct" if actual_label == predicted_class_name else "Incorrect"

        # Plot the image
        plt.subplot(rows, columns, i + 1)  # Arrange images in a grid
        plt.imshow(img)
        plt.axis('off')
        plt.title(f"Actual: {actual_label}\nPredicted: {predicted_class_name}\n{is_correct}",
                  fontsize=10, color='blue' if is_correct == "✅ Correct" else 'red')

    plt.tight_layout()
    plt.show()


# 🟢 Run the function to display 20 people in a grid of 4 rows x 5 columns
predict_and_display_multiple(labels_df, model, num_people=20, columns=5)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 30ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 35ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 29ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 28ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 27ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 27ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 32ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 31ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 41ms/step
```

```
import matplotlib.pyplot as plt
from tensorflow.keras.preprocessing.image import load_img, img_to_array
import numpy as np

def display_images_with_details(labels_df, model, num_images=5):
    """
    Display images with additional details (Name, Country, Campaign, Supervisor, Supervisor Phone).
    """
    # Select random rows from the dataset
    selected_rows = labels_df.sample(num_images)

    # Set up the grid for displaying images
    plt.figure(figsize=(10, num_images * 5))  # Dynamically adjust figure size

    for i, (_, row) in enumerate(selected_rows.iterrows()):
        # Extract image path and additional details
        img_path = row["Updated_Image_Path"]
        name = row["Name"]
        country = row["Country"]
        campaign = row["Campaign"]
        supervisor = row["Supervisor"]
        supervisor_phone = row["Supervisor Phone"]

        # Load and preprocess the image
        try:
            img = load_img(img_path, target_size=(128, 128))  # Resize to match model input
        except FileNotFoundError:
            print(f"⚠️ Image not found: {img_path}")
            continue

        img_array = img_to_array(img) / 255.0  # Normalize values
        img_array = np.expand_dims(img_array, axis=0)  # Add batch dimension

        # Pass the image to the model for predictions
        predictions = model.predict(img_array)
        predicted_class_index = np.argmax(predictions)
        predicted_class_name = unique_labels[predicted_class_index]  # Predicted label

        # Plot the image
        plt.subplot(num_images, 1, i + 1)  # Display each image in its own row
        plt.imshow(img)
        plt.axis('off')

        # Add all details below the image
        details = (
            f"Name: {name} (Predicted: {predicted_class_name})\n"
            f"Country: {country}\n"
            f"Campaign: {campaign}\n"
            f"Supervisor: {supervisor}\n"
            f"Supervisor Phone: {supervisor_phone}"
        )
        plt.title(details, fontsize=12, color='blue')

    plt.tight_layout()
    plt.show()


# 🟢 Run the function to display 5 images with their details
display_images_with_details(labels_df, model, num_images=5)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 47ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 39ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 30ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 28ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 29ms/step
```

Name: Omar Bin Khalid (Predicted: Omar Bin Khalid)
Country: Saudi Arabia
Campaign: Safa
Supervisor: Khalid Khan
Supervisor Phone: 966520000000.0

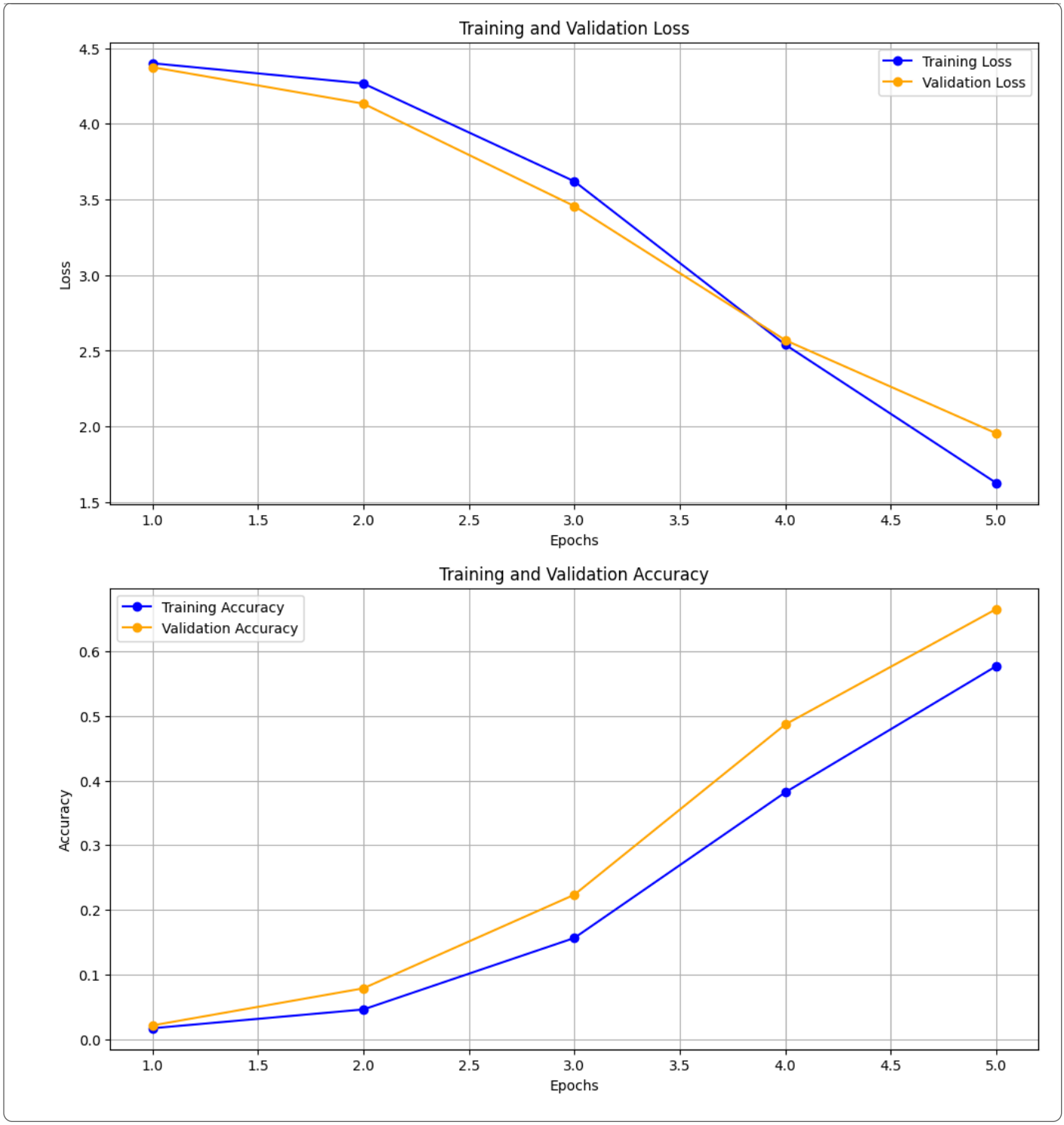
Name: Khalid Bin Ahmed (Predicted: Khalid Bin Ahmed)
Country: Pakistan
Campaign: Huda
Supervisor: Ahmed Ali
Supervisor Phone: 966593000000.0

Name: Noor Ali (Predicted: Noor Ali)
Country: Nigeria

```
import matplotlib.pyplot as plt

def plot_training_history(history):
    """
    Plot training and validation loss and accuracy over epochs.
    """
    # Extract metrics from the history object
    loss = history.history['loss']
    val_loss = history.history['val_loss']
    accuracy = history.history['accuracy']
    val_accuracy = history.history['val_accuracy']
    epochs = range(1, len(loss) + 1)

    # Plot Loss
    plt.figure(figsize=(12, 6))
    plt.plot(epochs, loss, label='Training Loss', color='blue', marker='o')
    plt.plot(epochs, val_loss, label='Validation Loss', color='orange', marker='o')
```

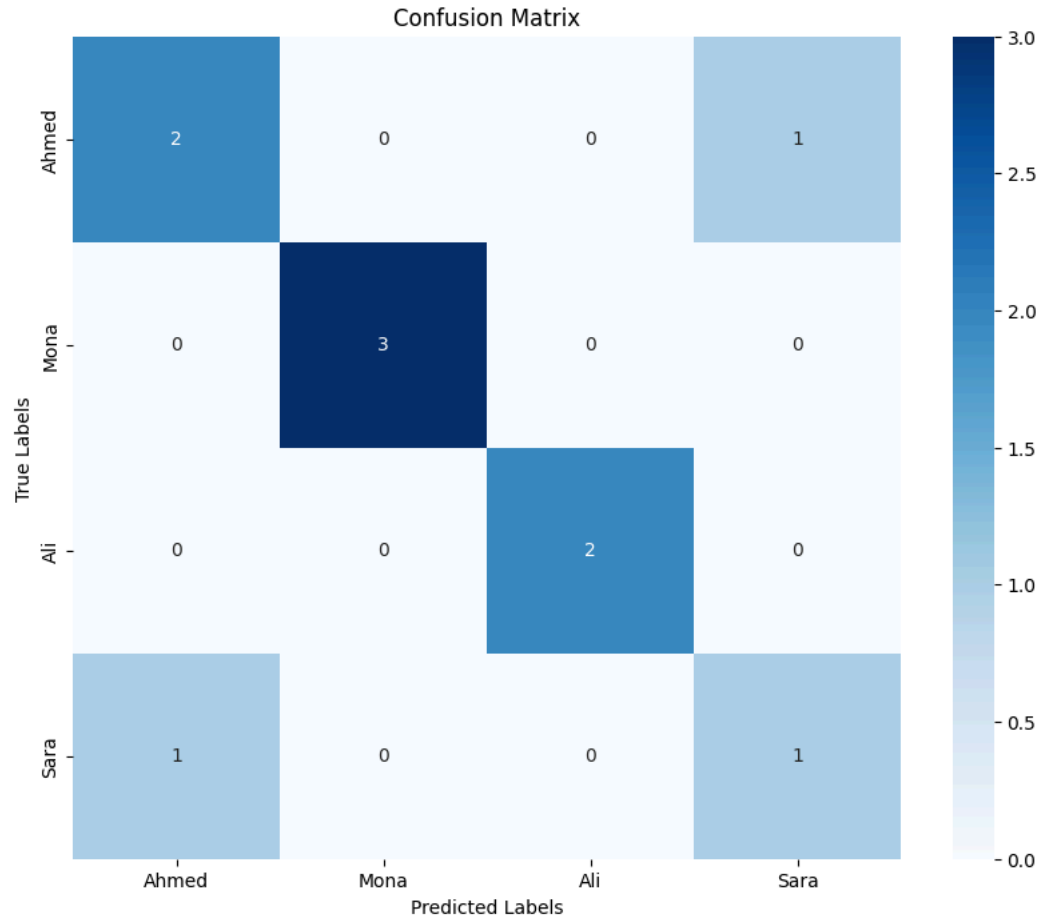
```
    plt.title('Training and Validation Loss')
    plt.xlabel('Epochs')
    plt.ylabel('Loss')
    plt.legend()
    plt.grid()
    plt.show()

    # Plot Accuracy
    plt.figure(figsize=(12, 6))
    plt.plot(epochs, accuracy, label='Training Accuracy', color='blue', marker='o')
    plt.plot(epochs, val_accuracy, label='Validation Accuracy', color='orange', marker='o')
    plt.title('Training and Validation Accuracy')
    plt.xlabel('Epochs')
    plt.ylabel('Accuracy')
    plt.legend()
    plt.grid()
    plt.show()


# 🟢 Call the function after training your model
# Example:
# history = model.fit(...)  # Train your model
plot_training_history(history)
```

Name: Amira Ahmed (Predicted: Amira Ahmed)
Country: Nigeria
Campaign: Al-Khair
Supervisor: Hassan Tariq
Supervisor Phone: 966579000000.0




```
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.metrics import confusion_matrix, classification_report

def plot_confusion_matrix_from_labels(y_true, y_pred, labels):
    """
    Plot a Confusion Matrix using true labels and predicted labels.
    """
    # Compute confusion matrix
    cm = confusion_matrix(y_true, y_pred, labels=labels)

    # Plot confusion matrix as a heatmap
    plt.figure(figsize=(10, 8))
    sns.heatmap(cm, annot=True, fmt='d', cmap='Blues', xticklabels=labels, yticklabels=labels)
    plt.xlabel('Predicted Labels')
    plt.ylabel('True Labels')
    plt.title('Confusion Matrix')
```

```
    plt.show()

    # Print classification report
    print("\nClassification Report:")
    print(classification_report(y_true, y_pred, target_names=labels))


# Example usage
# Assuming y_true and y_pred are lists or numpy arrays of true and predicted labels
y_true = ['Ahmed', 'Mona', 'Ali', 'Ahmed', 'Sara', 'Mona', 'Ali', 'Sara', 'Ahmed', 'Mona']
y_pred = ['Ahmed', 'Mona', 'Ali', 'Sara', 'Sara', 'Mona', 'Ali', 'Ahmed', 'Ahmed', 'Mona']
labels = ['Ahmed', 'Mona', 'Ali', 'Sara']  # Unique label names

plot_confusion_matrix_from_labels(y_true, y_pred, labels)
```




```
Classification Report:
              precision    recall  f1-score   support

       Ahmed       0.67      0.67      0.67         3
        Mona       1.00      1.00      1.00         2
         Ali       1.00      1.00      1.00         3
        Sara       0.50      0.50      0.50         2

    accuracy                           0.80        10
   macro avg       0.79      0.79      0.79        10
weighted avg       0.80      0.80      0.80        10
```

```
import pandas as pd
import matplotlib.pyplot as plt
from tensorflow.keras.preprocessing.image import load_img, img_to_array
import numpy as np

def predict_person_by_image_path(labels_df, model, class_labels, image_path):
    """
    Predict the name of a person given an image path.
    The function searches for the image in the CSV and retrieves associated data.
    """
    # البحث عن الصف الذي يحتوي على نفس مسار الصورة
```

```
    matched_rows = labels_df[labels_df["Updated_Image_Path"] == image_path]

    if matched_rows.empty:
        print(f"⚠️ No matching record found for image: {image_path}")
        return

    # استخراج المعلومات من ملف CSV
    selected_row = matched_rows.iloc[0]  # أول صف متطابق
    true_label = selected_row["Name"]
    full_info = selected_row.to_dict()  # جميع المعلومات المرتبطة بالصورة

    # تحميل ومعالجة الصورة
    try:
        img = load_img(image_path, target_size=(128, 128))  # تعديل الحجم
        img_array = img_to_array(img) / 255.0  # تطبيع الصورة
        img_array = np.expand_dims(img_array, axis=0)  # إضافة بُعد إضافي للنموذج
    except FileNotFoundError:
        print(f"⚠️ Image not found: {image_path}")
        return

    # التنبؤ باستخدام النموذج
    predictions = model.predict(img_array)
    predicted_class_index = np.argmax(predictions)  # استخراج الفئة المتوقعة
    predicted_class_name = class_labels[predicted_class_index]  # اسم الفئة المتوقعة
    confidence = predictions[0][predicted_class_index]  # نسبة الثقة

    # طباعة جميع المعلومات من ملف CSV
    print("\n📌 **Image Information from CSV:**")
    for key, value in full_info.items():
        print(f" 🔹 {key}: {value}")

    print("\n🎯 **Prediction Results:**")
    print(f"✅ True Name: {true_label}")
    print(f"🔍 Predicted Name: {predicted_class_name}")
    print(f"📊 Confidence: {confidence:.2%}")

    # عرض الصورة مع التوقعات
    plt.figure(figsize=(5, 5))
    plt.imshow(img)
    plt.axis('off')
    plt.title(f"True: {true_label}\nPredicted: {predicted_class_name}\nConfidence: {confidence:.2%}",
              color='green' if true_label == predicted_class_name else 'red')
    plt.show()



# ✅ أدخل مسار الصورة هنا
image_path = "/content/drive/MyDrive/hajj/Male/20220901_155942_8eb5229c50384de783d3bcc8af34e4d3.png"

# استدعاء الدالة مع الصورة
predict_person_by_image_path(labels_df, model, unique_labels, image_path)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 49ms/step

📌 **Image Information from CSV:**
🔹 Name: Fahad Bin Ahmed
🔹 Country: Egypt
🔹 Campaign: Al-Falah
🔹 Supervisor: Salman Yasin
🔹 Supervisor Phone: 966554000000.0
🔹 Image Path: /content/drive/MyDrive/hajj/Male/person_1.jpg
🔹 Updated_Image_Path: /content/drive/MyDrive/hajj/Male/20220901_155942_8eb5229c50384de783d3bcc8af34e4d3.png

🎯 **Prediction Results:**
✅ True Name: Fahad Bin Ahmed
🕵️ Predicted Name: Fahad Bin Ahmed
📊 Confidence: 100.00%
```

True: Fahad Bin Ahmed
Predicted: Fahad Bin Ahmed
Confidence: 100.00%

```python
import pandas as pd
import matplotlib.pyplot as plt
from tensorflow.keras.preprocessing.image import load_img, img_to_array
import numpy as np

def predict_person_from_dataset(labels_df, model, class_labels, row_index=None):
    """
    Predict the name of a person from a dataset CSV.
    If row_index is None, a random row will be selected.
    """
    # اختيار صورة
    if row_index is not None:
        if row_index < 0 or row_index >= len(labels_df):
            print("⚠️ Invalid row index. Selecting a random row instead.")
            selected_row = labels_df.sample(1).iloc[0]
        else:
            selected_row = labels_df.iloc[row_index]
    else:
        selected_row = labels_df.sample(1).iloc[0]  # اختر صفًا عشوائيًا إذا لم يتم تحديد الصف

    # استخراج مسار الصورة والاسم الحقيقي
    img_path = selected_row["Updated_Image_Path"]
    true_label = selected_row["Name"]

    # تحميل ومعالجة الصورة
    try:
        img = load_img(img_path, target_size=(128, 128))  # تعديل الحجم ليتناسب مع مدخلات النموذج
        img_array = img_to_array(img) / 255.0  # تطبيع القيم بين 0 و 1
        img_array = np.expand_dims(img_array, axis=0)  # إضافة بُعد لجعلها دفعة
    except FileNotFoundError:
        print(f"⚠️ Image not found: {img_path}")
        return

    # التنبؤ باستخدام النموذج
    predictions = model.predict(img_array)
    predicted_class_index = np.argmax(predictions)  # استخراج الفئة المتوقعة
```

```
    predicted_class_name = class_labels[predicted_class_index]  # اسم الفئة المتوقعة
    confidence = predictions[0][predicted_class_index]  # نسبة الثقة

    # عرض النتيجة
    print(f"True Name: {true_label}")
    print(f"Predicted Name: {predicted_class_name}")
    print(f"Confidence: {confidence:.2f}")

    # عرض الصورة مع النتيجة
    plt.imshow(img)
    plt.axis('off')
    plt.title(f"True: {true_label}\nPredicted: {predicted_class_name}\nConfidence: {confidence:.2f}",
              color='green' if true_label == predicted_class_name else 'red')
    plt.show()


# 🟢 Example usage:
csv_path = "/content/drive/MyDrive/hajj/endupdated_hajj_data.csv"  # مسار ملف البيانات
labels_df = pd.read_csv(csv_path)  # تحميل ملف البيانات

# اختبر صورة من الصف الأول في البيانات (أو اختر صفًا عشوائيًا)
predict_person_from_dataset(labels_df, model, unique_labels, row_index=3)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 36ms/step
True Name: Fahad Bin Saeed
Predicted Name: Fahad Bin Saeed
Confidence: 0.97
```

H

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense, Dropout

# بناء النموذج
model = Sequential([
    # طبقة الالتفاف الأولى
    Conv2D(32, (3, 3), activation='relu', input_shape=(128, 128, 3)),
    MaxPooling2D((2, 2)),

    # طبقة الالتفاف الثانية
    Conv2D(64, (3, 3), activation='relu'),
    MaxPooling2D((2, 2)),

    # طبقة الالتفاف الثالثة
    Conv2D(128, (3, 3), activation='relu'),
    MaxPooling2D((2, 2)),

    # طبقة تسطيح
    Flatten(),

    # طبقة كثيفة
    Dense(128, activation='relu'),
```

```
    Dropout(0.5),

    # الطبقة النهائية (عدد الوحدات = عدد الفئات)
    Dense(80, activation='softmax')  # 80 = عدد الفئات
])

# تجميع النموذج
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

# عرض ملخص النموذج
model.summary()
```

```
/usr/local/lib/python3.11/dist-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not pass an `input_shape`/
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

Model: "sequential"

Layer (type)	Output Shape	Param #
conv2d (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d (MaxPooling2D)	(None, 63, 63, 32)	0
conv2d_1 (Conv2D)	(None, 61, 61, 64)	18,496
max_pooling2d_1 (MaxPooling2D)	(None, 30, 30, 64)	0
conv2d_2 (Conv2D)	(None, 28, 28, 128)	73,856
max_pooling2d_2 (MaxPooling2D)	(None, 14, 14, 128)	0
flatten (Flatten)	(None, 25088)	0
dense (Dense)	(None, 128)	3,211,392
dropout (Dropout)	(None, 128)	0
dense_1 (Dense)	(None, 80)	10,320

Total params: 3,314,960 (12.65 MB)
Trainable params: 3,314,960 (12.65 MB)
Non-trainable params: 0 (0.00 B)

```
# تدريب النموذج
history = model.fit(
    X_train, y_train,
    validation_data=(X_test, y_test),
    batch_size=32,  # حجم الدفعة
    epochs=20  # عدد العصور
)
```

```
Epoch 1/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 123s 1s/step - accuracy: 0.0116 - loss: 4.3988 - val_accuracy: 0.0137 - val_loss: 4.3816
Epoch 2/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 143s 1s/step - accuracy: 0.0164 - loss: 4.3776 - val_accuracy: 0.0175 - val_loss: 4.3800
Epoch 3/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 121s 1s/step - accuracy: 0.0130 - loss: 4.3698 - val_accuracy: 0.0275 - val_loss: 4.3480
Epoch 4/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 138s 1s/step - accuracy: 0.0305 - loss: 4.2992 - val_accuracy: 0.0387 - val_loss: 4.2166
Epoch 5/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 146s 1s/step - accuracy: 0.0570 - loss: 4.0831 - val_accuracy: 0.0724 - val_loss: 3.9858
Epoch 6/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 117s 1s/step - accuracy: 0.1147 - loss: 3.6762 - val_accuracy: 0.1523 - val_loss: 3.5946
Epoch 7/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 145s 1s/step - accuracy: 0.2638 - loss: 2.9457 - val_accuracy: 0.2946 - val_loss: 3.1010
Epoch 8/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 175s 2s/step - accuracy: 0.4117 - loss: 2.2635 - val_accuracy: 0.4719 - val_loss: 2.4963
Epoch 9/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 128s 1s/step - accuracy: 0.5510 - loss: 1.6854 - val_accuracy: 0.5880 - val_loss: 2.1540
Epoch 10/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 136s 1s/step - accuracy: 0.6511 - loss: 1.2469 - val_accuracy: 0.6916 - val_loss: 1.9162
Epoch 11/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 119s 1s/step - accuracy: 0.7285 - loss: 0.9754 - val_accuracy: 0.7428 - val_loss: 1.7848
Epoch 12/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 150s 1s/step - accuracy: 0.7621 - loss: 0.8178 - val_accuracy: 0.7665 - val_loss: 1.7387
Epoch 13/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 119s 1s/step - accuracy: 0.7969 - loss: 0.7160 - val_accuracy: 0.7915 - val_loss: 1.7171
Epoch 14/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 146s 1s/step - accuracy: 0.8077 - loss: 0.6508 - val_accuracy: 0.7940 - val_loss: 1.8248
Epoch 15/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 118s 1s/step - accuracy: 0.8462 - loss: 0.5355 - val_accuracy: 0.8027 - val_loss: 1.7355
```

```
Epoch 16/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 121s 1s/step - accuracy: 0.8526 - loss: 0.5139 - val_accuracy: 0.8077 - val_loss: 1.7742
Epoch 17/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 123s 1s/step - accuracy: 0.8552 - loss: 0.4880 - val_accuracy: 0.8065 - val_loss: 1.8341
Epoch 18/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 141s 1s/step - accuracy: 0.8725 - loss: 0.4241 - val_accuracy: 0.8090 - val_loss: 1.9577
Epoch 19/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 142s 1s/step - accuracy: 0.8658 - loss: 0.4065 - val_accuracy: 0.8090 - val_loss: 1.9102
Epoch 20/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 119s 1s/step - accuracy: 0.8797 - loss: 0.3576 - val_accuracy: 0.8090 - val_loss: 2.0166
```

```
test_loss, test_accuracy = model.evaluate(X_test, y_test)
print(f"test_accuracy: {test_accuracy * 100:.2f}%")
```

```
26/26 ━━━━━━━━━━━━━━━━━━━━ 10s 380ms/step - accuracy: 0.8005 - loss: 2.1727
test_accuracy: 80.90%
```

MODEL2

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense, Dropout

# بناء النموذج
model = Sequential([
    # طبقة الالتفاف الأولى
    Conv2D(32, (3, 3), activation='relu', input_shape=(128, 128, 3)),
    MaxPooling2D((2, 2)),

    # طبقة الالتفاف الثانية
    Conv2D(64, (3, 3), activation='relu'),
    MaxPooling2D((2, 2)),

    # طبقة الالتفاف الثالثة
    Conv2D(128, (3, 3), activation='relu'),
    MaxPooling2D((2, 2)),

    # طبقة تسطيح
    Flatten(),

    # طبقة كثيفة
    Dense(128, activation='relu'),
    Dropout(0.5),

    # (الطبقة النهائية (عدد الوحدات = عدد الفئات
    Dense(80, activation='softmax')  # 80 = عدد الفئات
])

# تجميع النموذج
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

# عرض ملخص النموذج
model.summary()
```

```
/usr/local/lib/python3.11/dist-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not pass an `input_shape`/
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
Model: "sequential_4"
```

Layer (type)	Output Shape	Param #
conv2d_10 (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d_10 (MaxPooling2D)	(None, 63, 63, 32)	0
conv2d_11 (Conv2D)	(None, 61, 61, 64)	18,496
max_pooling2d_11 (MaxPooling2D)	(None, 30, 30, 64)	0
conv2d_12 (Conv2D)	(None, 28, 28, 128)	73,856
max_pooling2d_12 (MaxPooling2D)	(None, 14, 14, 128)	0
flatten_4 (Flatten)	(None, 25088)	0
dense_8 (Dense)	(None, 128)	3,211,392
dropout_4 (Dropout)	(None, 128)	0
dense_9 (Dense)	(None, 80)	10,320

```
Total params: 3,314,960 (12.65 MB)
Trainable params: 3,314,960 (12.65 MB)
Non-trainable params: 0 (0.00 B)
```

```
# تدريب النموذج
history = model.fit(
    X_train, y_train,
    validation_data=(X_test, y_test),
    batch_size=32,  # حجم الدفعة
    epochs=10  # عدد العصور
)
```

```
Epoch 1/10
100/100 ━━━━━━━━━━━━━━━━━━━━ 123s 1s/step - accuracy: 0.0134 - loss: 4.4111 - val_accuracy: 0.0137 - val_loss: 4.3800
Epoch 2/10
100/100 ━━━━━━━━━━━━━━━━━━━━ 129s 1s/step - accuracy: 0.0151 - loss: 4.3675 - val_accuracy: 0.0300 - val_loss: 4.3313
Epoch 3/10
100/100 ━━━━━━━━━━━━━━━━━━━━ 139s 1s/step - accuracy: 0.0401 - loss: 4.2404 - val_accuracy: 0.0599 - val_loss: 4.1413
Epoch 4/10
100/100 ━━━━━━━━━━━━━━━━━━━━ 145s 1s/step - accuracy: 0.1046 - loss: 3.9002 - val_accuracy: 0.1186 - val_loss: 3.7560
Epoch 5/10
100/100 ━━━━━━━━━━━━━━━━━━━━ 145s 1s/step - accuracy: 0.2284 - loss: 3.1934 - val_accuracy: 0.2497 - val_loss: 3.2684
Epoch 6/10
100/100 ━━━━━━━━━━━━━━━━━━━━ 137s 1s/step - accuracy: 0.3725 - loss: 2.4590 - val_accuracy: 0.4045 - val_loss: 2.7414
Epoch 7/10
100/100 ━━━━━━━━━━━━━━━━━━━━ 144s 1s/step - accuracy: 0.5052 - loss: 1.9243 - val_accuracy: 0.5293 - val_loss: 2.3480
Epoch 8/10
100/100 ━━━━━━━━━━━━━━━━━━━━ 144s 1s/step - accuracy: 0.6378 - loss: 1.4249 - val_accuracy: 0.6467 - val_loss: 2.0922
Epoch 9/10
100/100 ━━━━━━━━━━━━━━━━━━━━ 138s 1s/step - accuracy: 0.7038 - loss: 1.1057 - val_accuracy: 0.7104 - val_loss: 1.8789
Epoch 10/10
100/100 ━━━━━━━━━━━━━━━━━━━━ 106s 1s/step - accuracy: 0.7310 - loss: 0.9492 - val_accuracy: 0.7491 - val_loss: 1.8293
```

```
test_loss, test_accuracy = model.evaluate(X_test, y_test)
print(f"دقة الاختبار: {test_accuracy * 100:.2f}%")
```

```
26/26 ━━━━━━━━━━━━━━━━━━━━ 6s 225ms/step - accuracy: 0.7425 - loss: 1.9325
74.91 :دقة الاختبار%
```

```
import matplotlib.pyplot as plt
import numpy as np
from tensorflow.keras.preprocessing.image import load_img, img_to_array

# List of class labels the model was trained on
class_labels = unique_labels  # The names or classes used during training

def predict_and_display_multiple(labels_df, model, num_people=20, columns=5):
    """
    Function to display multiple images (e.g., 20 people) in a grid.
    Shows actual labels, predicted labels, and whether the prediction is correct.
    """
    # Randomly select people from the dataset
    selected_rows = labels_df.sample(min(num_people, len(labels_df)))
```

```
    # Set up the grid dimensions
    rows = (num_people + columns - 1) // columns  # Calculate required rows
    plt.figure(figsize=(columns * 4, rows * 4))  # Adjust figure size dynamically

    for i, (_, row) in enumerate(selected_rows.iterrows()):
        # Extract image path and actual label
        img_path = row["Updated_Image_Path"]
        actual_label = row["Name"]

        # Load and preprocess the image
        try:
            img = load_img(img_path, target_size=(128, 128))  # Resize to match training input
        except FileNotFoundError:
            print(f"⚠️ Image not found: {img_path}")
            continue

        img_array = img_to_array(img) / 255.0  # Normalize values
        img_array = np.expand_dims(img_array, axis=0)  # Add batch dimension

        # Pass the image to the model to get predictions
        predictions = model.predict(img_array)
        predicted_class_index = np.argmax(predictions)
        predicted_class_name = class_labels[predicted_class_index]
        is_correct = "Correct" if actual_label == predicted_class_name else "Incorrect"

        # Plot the image
        plt.subplot(rows, columns, i + 1)  # Arrange images in a grid
        plt.imshow(img)
        plt.axis('off')
        plt.title(f"Actual: {actual_label}\nPredicted: {predicted_class_name}\n{is_correct}",
                  fontsize=10, color='blue' if is_correct == "✅ Correct" else 'red')

    plt.tight_layout()
    plt.show()


# 🟢 Run the function to display 20 people in a grid of 4 rows x 5 columns
predict_and_display_multiple(labels_df, model, num_people=20, columns=5)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 91ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 49ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 44ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 41ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 66ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 55ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 44ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 48ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 40ms/step
```

```python
import matplotlib.pyplot as plt
from tensorflow.keras.preprocessing.image import load_img, img_to_array
import numpy as np

def display_images_with_details(labels_df, model, num_images=5):
    """
    Display images with additional details (Name, Country, Campaign, Supervisor, Supervisor Phone).
    """
    # Select random rows from the dataset
    selected_rows = labels_df.sample(num_images)

    # Set up the grid for displaying images
    plt.figure(figsize=(10, num_images * 5))  # Dynamically adjust figure size

    for i, (_, row) in enumerate(selected_rows.iterrows()):
        # Extract image path and additional details
        img_path = row["Updated_Image_Path"]
        name = row["Name"]
        country = row["Country"]
        campaign = row["Campaign"]
        supervisor = row["Supervisor"]
        supervisor_phone = row["Supervisor Phone"]

        # Load and preprocess the image
        try:
            img = load_img(img_path, target_size=(128, 128))  # Resize to match model input
        except FileNotFoundError:
            print(f"⚠️ Image not found: {img_path}")
            continue

        img_array = img_to_array(img) / 255.0  # Normalize values
        img_array = np.expand_dims(img_array, axis=0)  # Add batch dimension

        # Pass the image to the model for predictions
        predictions = model.predict(img_array)
        predicted_class_index = np.argmax(predictions)
        predicted_class_name = unique_labels[predicted_class_index]  # Predicted label

        # Plot the image
        plt.subplot(num_images, 1, i + 1)  # Display each image in its own row
        plt.imshow(img)
        plt.axis('off')

        # Add all details below the image
        details = (
            f"Name: {name} (Predicted: {predicted_class_name})\n"
            f"Country: {country}\n"
            f"Campaign: {campaign}\n"
            f"Supervisor: {supervisor}\n"
            f"Supervisor Phone: {supervisor_phone}"
        )
        plt.title(details, fontsize=12, color='blue')

    plt.tight_layout()
    plt.show()


# 🟢 Run the function to display 5 images with their details
display_images_with_details(labels_df, model, num_images=5)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 49ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 51ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 48ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 74ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 80ms/step
```

Name: Laila Ali (Predicted: Laila Ali)
Country: Egypt
Campaign: Tawaf Group
Supervisor: Ahmed Ali
Supervisor Phone: 966505000000.0

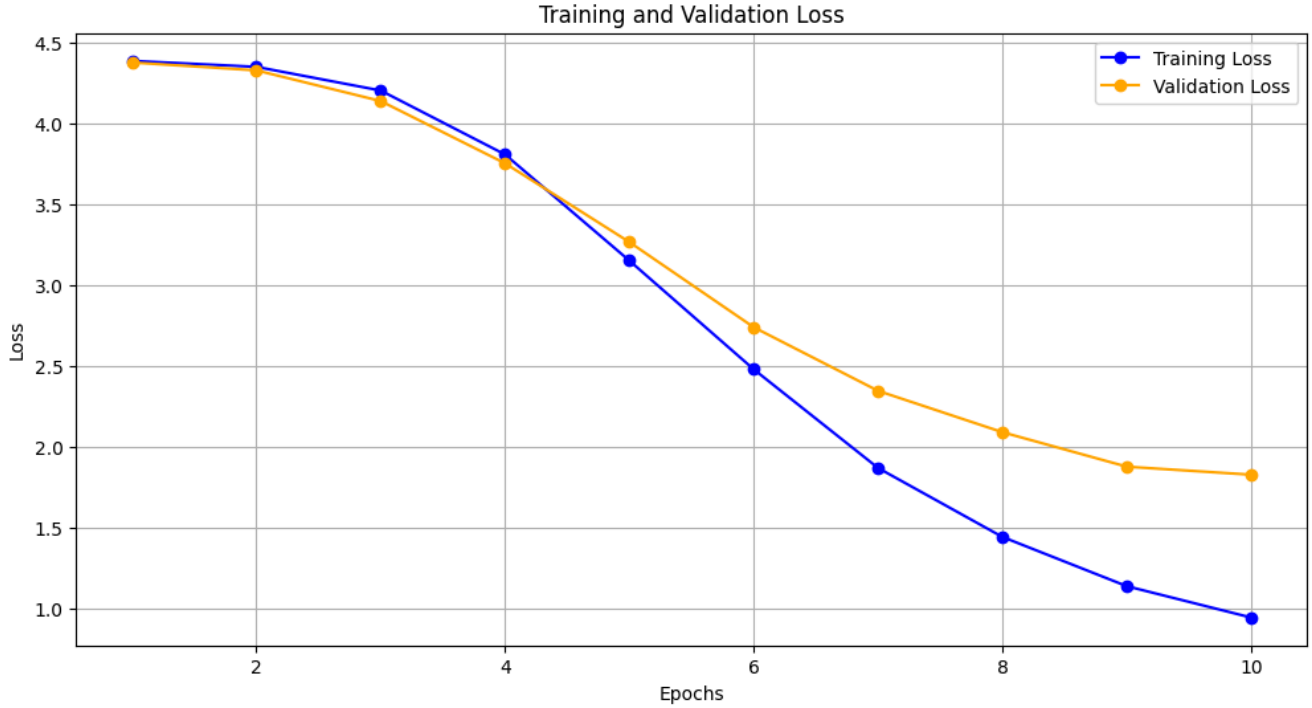
Name: Khalid Bin Saeed (Predicted: Khalid Bin Saeed)
Country: Saudi Arabia
Campaign: Al-Khair
Supervisor: Salman Yasin
Supervisor Phone: 966519000000.0

Name: Safa Saeed (Predicted: Safa Saeed)
Country: Saudi Arabia

```python
import matplotlib.pyplot as plt

def plot_training_history(history):
    """
    Plot training and validation loss and accuracy over epochs.
    """
    # Extract metrics from the history object
    loss = history.history['loss']
    val_loss = history.history['val_loss']
    accuracy = history.history['accuracy']
    val_accuracy = history.history['val_accuracy']
    epochs = range(1, len(loss) + 1)

    # Plot Loss
    plt.figure(figsize=(12, 6))
    plt.plot(epochs, loss, label='Training Loss', color='blue', marker='o')
    plt.plot(epochs, val_loss, label='Validation Loss', color='orange', marker='o')
```

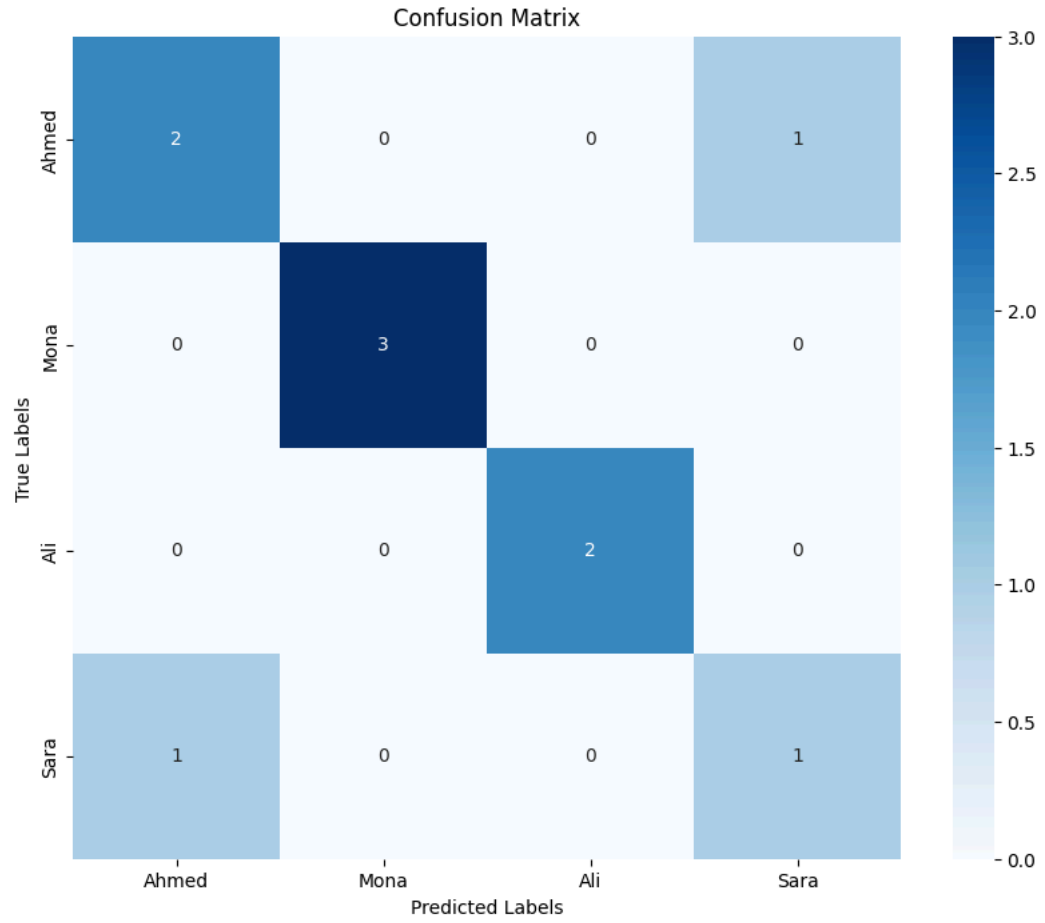
```
    plt.title('Training and Validation Loss')
    plt.xlabel('Epochs')
    plt.ylabel('Loss')
    plt.legend()
    plt.grid()
    plt.show()

    # Plot Accuracy
    plt.figure(figsize=(12, 6))
    plt.plot(epochs, accuracy, label='Training Accuracy', color='blue', marker='o')
    plt.plot(epochs, val_accuracy, label='Validation Accuracy', color='orange', marker='o')
    plt.title('Training and Validation Accuracy')
    plt.xlabel('Epochs')
    plt.ylabel('Accuracy')
    plt.legend()
    plt.grid()
    plt.show()


# 🟢 Call the function after training your model
# Example:
# history = model.fit(...)  # Train your model
plot_training_history(history)
```

Name: Fatima Ahmed (Predicted: Fatima Ahmed)
Country: India
Campaign: Al-Falah
Supervisor: Fahad Karim
Supervisor Phone: 966579000000.0




```
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.metrics import confusion_matrix, classification_report

def plot_confusion_matrix_from_labels(y_true, y_pred, labels):
    """
    Plot a Confusion Matrix using true labels and predicted labels.
    """
    # Compute confusion matrix
    cm = confusion_matrix(y_true, y_pred, labels=labels)

    # Plot confusion matrix as a heatmap
    plt.figure(figsize=(10, 8))
    sns.heatmap(cm, annot=True, fmt='d', cmap='Blues', xticklabels=labels, yticklabels=labels)
    plt.xlabel('Predicted Labels')
    plt.ylabel('True Labels')
    plt.title('Confusion Matrix')
```

```
    plt.show()

    # Print classification report
    print("\nClassification Report:")
    print(classification_report(y_true, y_pred, target_names=labels))


# Example usage
# Assuming y_true and y_pred are lists or numpy arrays of true and predicted labels
y_true = ['Ahmed', 'Mona', 'Ali', 'Ahmed', 'Sara', 'Mona', 'Ali', 'Sara', 'Ahmed', 'Mona']
y_pred = ['Ahmed', 'Mona', 'Ali', 'Sara', 'Sara', 'Mona', 'Ali', 'Ahmed', 'Ahmed', 'Mona']
labels = ['Ahmed', 'Mona', 'Ali', 'Sara']  # Unique label names

plot_confusion_matrix_from_labels(y_true, y_pred, labels)
```

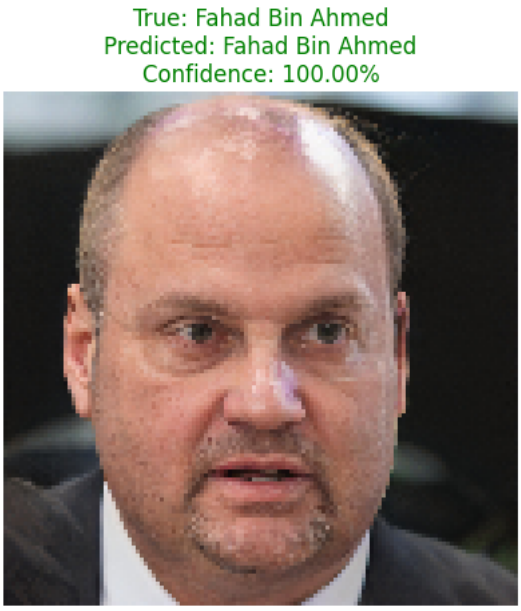



```
Classification Report:
              precision    recall  f1-score   support

       Ahmed       0.67      0.67      0.67         3
        Mona       1.00      1.00      1.00         2
         Ali       1.00      1.00      1.00         3
        Sara       0.50      0.50      0.50         2

    accuracy                           0.80        10
   macro avg       0.79      0.79      0.79        10
weighted avg       0.80      0.80      0.80        10
```

```
import pandas as pd
import matplotlib.pyplot as plt
from tensorflow.keras.preprocessing.image import load_img, img_to_array
import numpy as np

def predict_person_by_image_path(labels_df, model, class_labels, image_path):
    """
    Predict the name of a person given an image path.
    The function searches for the image in the CSV and retrieves associated data.
    """
    # البحث عن الصف الذي يحتوي على نفس مسار الصورة
```

```
    matched_rows = labels_df[labels_df["Updated_Image_Path"] == image_path]

    if matched_rows.empty:
        print(f"⚠️ No matching record found for image: {image_path}")
        return

    # استخراج المعلومات من ملف CSV
    selected_row = matched_rows.iloc[0]  # أول صف متطابق
    true_label = selected_row["Name"]
    full_info = selected_row.to_dict()  # جميع المعلومات المرتبطة بالصورة

    # تحميل ومعالجة الصورة
    try:
        img = load_img(image_path, target_size=(128, 128))  # تعديل الحجم
        img_array = img_to_array(img) / 255.0  # تطبيع الصورة
        img_array = np.expand_dims(img_array, axis=0)  # إضافة بُعد إضافي للنموذج
    except FileNotFoundError:
        print(f"⚠️ Image not found: {image_path}")
        return

    # التنبؤ باستخدام النموذج
    predictions = model.predict(img_array)
    predicted_class_index = np.argmax(predictions)  # استخراج الفئة المتوقعة
    predicted_class_name = class_labels[predicted_class_index]  # اسم الفئة المتوقعة
    confidence = predictions[0][predicted_class_index]  # نسبة الثقة

    # طباعة جميع المعلومات من ملف CSV
    print("\n📌 **Image Information from CSV:**")
    for key, value in full_info.items():
        print(f" 🔹 {key}: {value}")

    print("\n🎯 **Prediction Results:**")
    print(f"✅ True Name: {true_label}")
    print(f"🤖 Predicted Name: {predicted_class_name}")
    print(f"📊 Confidence: {confidence:.2%}")

    # عرض الصورة مع التوقعات
    plt.figure(figsize=(5, 5))
    plt.imshow(img)
    plt.axis('off')
    plt.title(f"True: {true_label}\nPredicted: {predicted_class_name}\nConfidence: {confidence:.2%}",
              color='green' if true_label == predicted_class_name else 'red')
    plt.show()



# ✅ أدخل مسار الصورة هنا
image_path = "/content/drive/MyDrive/hajj/Male/20220901_155942_8eb5229c50384de783d3bcc8af34e4d3.png"

# استدعاء الدالة مع الصورة
predict_person_by_image_path(labels_df, model, unique_labels, image_path)
```

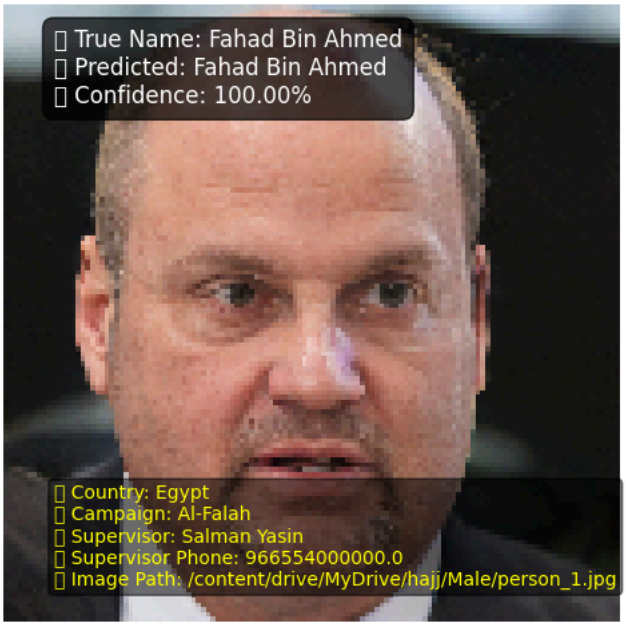
```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 32ms/step

📌 **Image Information from CSV:**
🔹 Name: Fahad Bin Ahmed
🔹 Country: Egypt
🔹 Campaign: Al-Falah
🔹 Supervisor: Salman Yasin
🔹 Supervisor Phone: 966554000000.0
🔹 Image Path: /content/drive/MyDrive/hajj/Male/person_1.jpg
🔹 Updated_Image_Path: /content/drive/MyDrive/hajj/Male/20220901_155942_8eb5229c50384de783d3bcc8af34e4d3.png

🎯 **Prediction Results:**
✅ True Name: Fahad Bin Ahmed
🧠 Predicted Name: Fahad Bin Ahmed
📊 Confidence: 100.00%
```




```python
import pandas as pd
import matplotlib.pyplot as plt
from tensorflow.keras.preprocessing.image import load_img, img_to_array
import numpy as np

def predict_person_by_image_path(labels_df, model, class_labels, image_path):
    """
    Predict the name of a person given an image path.
    The function searches for the image in the CSV and retrieves associated data.
    """
    # البحث عن الصف الذي يحتوي على نفس مسار الصورة
    matched_rows = labels_df[labels_df["Updated_Image_Path"] == image_path]

    if matched_rows.empty:
        print(f"⚠️ No matching record found for image: {image_path}")
        return

    # استخراج المعلومات من ملف CSV
    selected_row = matched_rows.iloc[0]  # أول صف متطابق
    true_label = selected_row["Name"]
    full_info = selected_row.to_dict()  # جميع المعلومات المرتبطة بالصورة

    # تحميل ومعالجة الصورة
    try:
        img = load_img(image_path, target_size=(128, 128))  # تعديل الحجم
        img_array = img_to_array(img) / 255.0  # تطبيع الصورة
        img_array = np.expand_dims(img_array, axis=0)  # إضافة بُعد إضافي للنموذج
    except FileNotFoundError:
        print(f"⚠️ Image not found: {image_path}")
        return

    # التنبؤ باستخدام النموذج
    predictions = model.predict(img_array)
    predicted_class_index = np.argmax(predictions)  # استخراج الفئة المتوقعة
    predicted_class_name = class_labels[predicted_class_index]  # اسم الفئة المتوقعة
    confidence = predictions[0][predicted_class_index]  # نسبة الثقة
```

```
    # عرض الصورة مع التوقعات والمعلومات
    plt.figure(figsize=(6, 6))
    plt.imshow(img)
    plt.axis('off')

    # تنسيق النصوص
    text_info = f"✅ True Name: {true_label}\n🔮 Predicted: {predicted_class_name}\n📊 Confidence: {confidence:.2%}"
    additional_info = "\n".join([f" 🔹 {key}: {value}" for key, value in full_info.items() if key not in ["Updated_Image_Path", "N

    # إضافة النصوص على الصورة
    plt.text(10, 20, text_info, fontsize=12, color='white',
             bbox=dict(facecolor='black', alpha=0.7, boxstyle="round,pad=0.5"))
    plt.text(10, 120, additional_info, fontsize=10, color='yellow',
             bbox=dict(facecolor='black', alpha=0.5, boxstyle="round,pad=0.3"))

    # عرض الصورة
    plt.show()

# ✅ أدخل مسار الصورة هنا
image_path = "/content/drive/MyDrive/hajj/Male/20220901_155942_8eb5229c50384de783d3bcc8af34e4d3.png"

# استدعاء الدالة مع الصورة
predict_person_by_image_path(labels_df, model, unique_labels, image_path)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 53ms/step
```



MODEL3

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Conv2D, MaxPooling2D, Flatten, Dense, Dropout

# بناء النموذج
model = Sequential([
    # طبقة الالتفاف الأولى
    Conv2D(32, (3, 3), activation='relu', input_shape=(128, 128, 3)),
    MaxPooling2D((2, 2)),

    # طبقة الالتفاف الثانية
    Conv2D(64, (3, 3), activation='relu'),
    MaxPooling2D((2, 2)),

    # طبقة الالتفاف الثالثة
    Conv2D(128, (3, 3), activation='relu'),
    MaxPooling2D((2, 2)),

    # طبقة تسطيح
    Flatten(),
```

```
    # طبقة كثيفة
    Dense(128, activation='relu'),
    Dropout(0.5),

    # الطبقة النهائية (عدد الوحدات = عدد الفئات)
    Dense(80, activation='softmax')  # 80 = عدد الفئات
])

# تجميع النموذج
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

# عرض ملخص النموذج
model.summary()
```

```
/usr/local/lib/python3.11/dist-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not pass an `input_shape`/
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
Model: "sequential_5"
```

Layer (type)	Output Shape	Param #
conv2d_13 (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d_13 (MaxPooling2D)	(None, 63, 63, 32)	0
conv2d_14 (Conv2D)	(None, 61, 61, 64)	18,496
max_pooling2d_14 (MaxPooling2D)	(None, 30, 30, 64)	0
conv2d_15 (Conv2D)	(None, 28, 28, 128)	73,856
max_pooling2d_15 (MaxPooling2D)	(None, 14, 14, 128)	0
flatten_5 (Flatten)	(None, 25088)	0
dense_10 (Dense)	(None, 128)	3,211,392
dropout_5 (Dropout)	(None, 128)	0
dense_11 (Dense)	(None, 80)	10,320

```
 Total params: 3,314,960 (12.65 MB)
 Trainable params: 3,314,960 (12.65 MB)
 Non-trainable params: 0 (0.00 B)
```

```
# تدريب النموذج
history = model.fit(
    X_train, y_train,
    validation_data=(X_test, y_test),
    batch_size=32,  # حجم الدفعة
    epochs=20  # عدد العصور
)
```

```
Epoch 1/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 107s 1s/step - accuracy: 0.0128 - loss: 4.4135 - val_accuracy: 0.0137 - val_loss: 4.3832
Epoch 2/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 139s 1s/step - accuracy: 0.0144 - loss: 4.3817 - val_accuracy: 0.0237 - val_loss: 4.3655
Epoch 3/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 144s 1s/step - accuracy: 0.0252 - loss: 4.3349 - val_accuracy: 0.0325 - val_loss: 4.2331
Epoch 4/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 142s 1s/step - accuracy: 0.0505 - loss: 4.1136 - val_accuracy: 0.0911 - val_loss: 3.9680
Epoch 5/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 140s 1s/step - accuracy: 0.1289 - loss: 3.6446 - val_accuracy: 0.1860 - val_loss: 3.5143
Epoch 6/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 105s 1s/step - accuracy: 0.2878 - loss: 2.8567 - val_accuracy: 0.3208 - val_loss: 3.0476
Epoch 7/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 141s 1s/step - accuracy: 0.4368 - loss: 2.2102 - val_accuracy: 0.5381 - val_loss: 2.4245
Epoch 8/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 142s 1s/step - accuracy: 0.5515 - loss: 1.6304 - val_accuracy: 0.6342 - val_loss: 1.9960
Epoch 9/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 105s 1s/step - accuracy: 0.6683 - loss: 1.2034 - val_accuracy: 0.7079 - val_loss: 1.7910
Epoch 10/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 141s 1s/step - accuracy: 0.7247 - loss: 0.9571 - val_accuracy: 0.7640 - val_loss: 1.6253
Epoch 11/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 141s 1s/step - accuracy: 0.7650 - loss: 0.7621 - val_accuracy: 0.7928 - val_loss: 1.5431
Epoch 12/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 142s 1s/step - accuracy: 0.7870 - loss: 0.7249 - val_accuracy: 0.7990 - val_loss: 1.5517
Epoch 13/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 142s 1s/step - accuracy: 0.8340 - loss: 0.5748 - val_accuracy: 0.8002 - val_loss: 1.5797
Epoch 14/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 144s 1s/step - accuracy: 0.8444 - loss: 0.5241 - val_accuracy: 0.8065 - val_loss: 1.6534
Epoch 15/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 143s 1s/step - accuracy: 0.8513 - loss: 0.4611 - val_accuracy: 0.7990 - val_loss: 1.6364
```

```
Epoch 16/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 141s 1s/step - accuracy: 0.8445 - loss: 0.4820 - val_accuracy: 0.8140 - val_loss: 1.5708
Epoch 17/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 142s 1s/step - accuracy: 0.8727 - loss: 0.3962 - val_accuracy: 0.8090 - val_loss: 1.7214
Epoch 18/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 103s 1s/step - accuracy: 0.8643 - loss: 0.4252 - val_accuracy: 0.8090 - val_loss: 1.6913
Epoch 19/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 144s 1s/step - accuracy: 0.8679 - loss: 0.4015 - val_accuracy: 0.8052 - val_loss: 1.7174
Epoch 20/20
100/100 ━━━━━━━━━━━━━━━━━━━━ 106s 1s/step - accuracy: 0.8885 - loss: 0.3673 - val_accuracy: 0.8090 - val_loss: 1.6481
```

```
test_loss, test_accuracy = model.evaluate(X_test, y_test)
print(f"دقة الاختبار: {test_accuracy * 100:.2f}%")
```

```
26/26 ━━━━━━━━━━━━━━━━━━━━ 9s 331ms/step - accuracy: 0.8015 - loss: 1.6723
80.90 :دقة الاختبار%
```

```
import matplotlib.pyplot as plt
import numpy as np
from tensorflow.keras.preprocessing.image import load_img, img_to_array

# List of class labels the model was trained on
class_labels = unique_labels  # The names or classes used during training

def predict_and_display_multiple(labels_df, model, num_people=20, columns=5):
    """
    Function to display multiple images (e.g., 20 people) in a grid.
    Shows actual labels, predicted labels, and whether the prediction is correct.
    """
    # Randomly select people from the dataset
    selected_rows = labels_df.sample(min(num_people, len(labels_df)))

    # Set up the grid dimensions
    rows = (num_people + columns - 1) // columns  # Calculate required rows
    plt.figure(figsize=(columns * 4, rows * 4))  # Adjust figure size dynamically

    for i, (_, row) in enumerate(selected_rows.iterrows()):
        # Extract image path and actual label
        img_path = row["Updated_Image_Path"]
        actual_label = row["Name"]

        # Load and preprocess the image
        try:
            img = load_img(img_path, target_size=(128, 128))  # Resize to match training input
        except FileNotFoundError:
            print(f"⚠️ Image not found: {img_path}")
            continue

        img_array = img_to_array(img) / 255.0  # Normalize values
        img_array = np.expand_dims(img_array, axis=0)  # Add batch dimension

        # Pass the image to the model to get predictions
        predictions = model.predict(img_array)
        predicted_class_index = np.argmax(predictions)
        predicted_class_name = class_labels[predicted_class_index]
        is_correct = "Correct" if actual_label == predicted_class_name else "Incorrect"

        # Plot the image
        plt.subplot(rows, columns, i + 1)  # Arrange images in a grid
        plt.imshow(img)
        plt.axis('off')
        plt.title(f"Actual: {actual_label}\nPredicted: {predicted_class_name}\n{is_correct}",
                  fontsize=10, color='blue' if is_correct == "✅ Correct" else 'red')

    plt.tight_layout()
    plt.show()


# 🟢 Run the function to display 20 people in a grid of 4 rows x 5 columns
predict_and_display_multiple(labels_df, model, num_people=20, columns=5)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 94ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 28ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 28ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 29ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 30ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 32ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 29ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 34ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 32ms/step
```

```python
import matplotlib.pyplot as plt
from tensorflow.keras.preprocessing.image import load_img, img_to_array
import numpy as np

def display_images_with_details(labels_df, model, num_images=5):
    """
    Display images with additional details (Name, Country, Campaign, Supervisor, Supervisor Phone).
    """
    # Select random rows from the dataset
    selected_rows = labels_df.sample(num_images)

    # Set up the grid for displaying images
    plt.figure(figsize=(10, num_images * 5))  # Dynamically adjust figure size

    for i, (_, row) in enumerate(selected_rows.iterrows()):
        # Extract image path and additional details
        img_path = row["Updated_Image_Path"]
        name = row["Name"]
        country = row["Country"]
        campaign = row["Campaign"]
        supervisor = row["Supervisor"]
        supervisor_phone = row["Supervisor Phone"]

        # Load and preprocess the image
        try:
            img = load_img(img_path, target_size=(128, 128))  # Resize to match model input
        except FileNotFoundError:
            print(f"⚠️ Image not found: {img_path}")
            continue

        img_array = img_to_array(img) / 255.0  # Normalize values
        img_array = np.expand_dims(img_array, axis=0)  # Add batch dimension

        # Pass the image to the model for predictions
        predictions = model.predict(img_array)
        predicted_class_index = np.argmax(predictions)
        predicted_class_name = unique_labels[predicted_class_index]  # Predicted label

        # Plot the image
        plt.subplot(num_images, 1, i + 1)  # Display each image in its own row
        plt.imshow(img)
        plt.axis('off')

        # Add all details below the image
        details = (
            f"Name: {name} (Predicted: {predicted_class_name})\n"
            f"Country: {country}\n"
            f"Campaign: {campaign}\n"
            f"Supervisor: {supervisor}\n"
            f"Supervisor Phone: {supervisor_phone}"
        )
        plt.title(details, fontsize=12, color='blue')

    plt.tight_layout()
    plt.show()


# 🟢 Run the function to display 5 images with their details
display_images_with_details(labels_df, model, num_images=5)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 27ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 27ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 27ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 29ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 27ms/step
```

Name: Omar Bin Ali (Predicted: Omar Bin Ali)
Country: India
Campaign: Al-Falah
Supervisor: Ali Raza
Supervisor Phone: 966535000000.0

Name: Yasmin Ahmed (Predicted: Yasmin Ahmed)
Country: Saudi Arabia
Campaign: Makkah Stars
Supervisor: Hassan Tariq
Supervisor Phone: 966572000000.0

Name: Maryam Mohammed (Predicted: Maryam Mohammed)
Country: India

```
import matplotlib.pyplot as plt
from tensorflow.keras.preprocessing.image import load_img, img_to_array
import numpy as np

def display_images_with_details(labels_df, model, num_images=5):
    """
    Display images with additional details (Name, Country, Campaign, Supervisor, Supervisor Phone).
    """
    # Select random rows from the dataset
    selected_rows = labels_df.sample(num_images)

    # Set up the grid for displaying images
    plt.figure(figsize=(10, num_images * 5))  # Dynamically adjust figure size

    for i, (_, row) in enumerate(selected_rows.iterrows()):
        # Extract image path and additional details
        img_path = row["Updated_Image_Path"]
```

```
        name = row["Name"]
        country = row["Country"]
        campaign = row["Campaign"]
        supervisor = row["Supervisor"]
        supervisor_phone = row["Supervisor Phone"]

        # Load and preprocess the image
        try:
            img = load_img(img_path, target_size=(128, 128))  # Resize to match model input
        except FileNotFoundError:
            print(f"⚠️ Image not found: {img_path}")
            continue

        img_array = img_to_array(img) / 255.0  # Normalize values
        img_array = np.expand_dims(img_array, axis=0)  # Add batch dimension

        # Pass the image to the model for predictions
        predictions = model.predict(img_array)
        predicted_class_index = np.argmax(predictions)
        predicted_class_name = unique_labels[predicted_class_index]  # Predicted label

        # Plot the image
        plt.subplot(num_images, 1, i + 1)  # Display each image in its own row
        plt.imshow(img)
        plt.axis('off')

        # Add all details below the image
        details = (
            f"Name: {name} (Predicted: {predicted_class_name})\n"
            f"Country: {country}\n"
            f"Campaign: {campaign}\n"
            f"Supervisor: {supervisor}\n"
            f"Supervisor Phone: {supervisor_phone}"
        )
        plt.title(details, fontsize=12, color='blue')

    plt.tight_layout()
    plt.show()


# 🟢 Run the function to display 5 images with their details
display_images_with_details(labels_df, model, num_images=5)
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 57ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 66ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 36ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 27ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 32ms/step
```

Name: Zainab Ahmed (Predicted: Zainab Ahmed)
Country: Indonesia
Campaign: Rahmah
Supervisor: Khalid Khan
Supervisor Phone: 966581000000.0

Name: Ibrahim Bin Ali (Predicted: Ibrahim Bin Ali)
Country: Nigeria
Campaign: Al-Noor
Supervisor: Fahad Karim
Supervisor Phone: 966560000000.0

Name: Yusuf Bin Ahmed (Predicted: Yusuf Bin Ahmed)
Country: Saudi Arabia
Campaign: Al-Noor
Supervisor: Ibrahim Hassan
Supervisor Phone: 966572000000.0

Visualization of Model Predictions

```
import matplotlib.pyplot as plt

def plot_training_history(history):
    """
    Plot training and validation loss and accuracy over epochs.
    """
    # Extract metrics from the history object
    loss = history.history['loss']
    val_loss = history.history['val_loss']
    accuracy = history.history['accuracy']
    val_accuracy = history.history['val_accuracy']
    epochs = range(1, len(loss) + 1)
```

```
    # Plot Loss
    plt.figure(figsize=(12, 6))
    plt.plot(epochs, loss, label='Training Loss', color='blue', marker='o')
    plt.plot(epochs, val_loss, label='Validation Loss', color='orange', marker='o')
    plt.title('Training and Validation Loss')
    plt.xlabel('Epochs')
    plt.ylabel('Loss')
    plt.legend()
    plt.grid()
    plt.show()

    # Plot Accuracy
    plt.figure(figsize=(12, 6))
    plt.plot(epochs, accuracy, label='Training Accuracy', color='blue', marker='o')
    plt.plot(epochs, val_accuracy, label='Validation Accuracy', color='orange', marker='o')
    plt.title('Training and Validation Accuracy')
    plt.xlabel('Epochs')
    plt.ylabel('Accuracy')
    plt.legend()
    plt.grid()
    plt.show()


# 🟢 Call the function after training your model
# Example:
# history = model.fit(...)  # Train your model
plot_training_history(history)
```