Personal Project_04_v10_test1_3conv-layer_run23_advanced control 4

May 4, 2025

[1]:
```
from tensorflow.keras.callbacks import LearningRateScheduler
from sklearn.metrics import classification_report, confusion_matrix
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
#%matplotlib inline
import matplotlib.image as mpimg
import tensorflow as tf
import os


ACC=0.1
try_num = 1
while (ACC<0.91 and try_num<30):

    # DOE factors:
    learning_rate = 0.0005
    dropout_value = 0.5
    # n-conv_layers = 4
    n_units_last_layer = 1024
    n_filters_l1 = 8
    n_filters_l2 = 16

    # other factors:
    img_size = 130
    batch_size = 32
    validation_split = 0.1  # 10% for validation
    test_split = 0.00  # 0% for testing
    shuffle_buffer_size = 1000
    seed_num = 101
    desired_accuracy = 0.99
    loss = 'binary_crossentropy'
    optimizer = tf.keras.optimizers.Adam(learning_rate=learning_rate)
    metrics = ['accuracy']
    epochs = 25
    f_mode = 'nearest'  # fill_mode in image augmentation
```

```
    #DATA_DIR = "D:\\CS online courses\\Free DataSets\\Free Images\\Easier␣
↪portrait images_GPU_03"
    DATA_DIR = "/Users/hossein/Downloads/Easier portrait images_GPU_03"

    # Subdirectories for each class
    data_dir_woman = os.path.join(DATA_DIR, 'woman')
    data_dir_man = os.path.join(DATA_DIR, 'man')

    image_size = (img_size, img_size)  # Resize images to this size

    # Load train dataset (excluding validation & test set):
    train_dataset = tf.keras.utils.image_dataset_from_directory(
        directory = DATA_DIR,
        image_size = image_size,
        batch_size = batch_size,
        label_mode='binary',
        validation_split = validation_split + test_split,  # Total split for␣
↪val + test
        subset = "training",
        seed = seed_num
    )

    # Load validation dataset
    val_dataset = tf.keras.utils.image_dataset_from_directory(
        directory = DATA_DIR,
        image_size = image_size,
        batch_size = batch_size,
        label_mode='binary',
        validation_split = validation_split + test_split,
        subset = "validation",
        seed = seed_num
    )

    # Further manually split validation dataset to extract test dataset
    val_batches = tf.data.experimental.cardinality(val_dataset)
    test_size = round(val_batches.numpy() * (test_split / (validation_split +␣
↪test_split)))
    test_dataset = val_dataset.take(test_size)
    val_dataset = val_dataset.skip(test_size)

    # Optimize for performance
    AUTOTUNE = tf.data.AUTOTUNE
    training_dataset = train_dataset.cache().shuffle(shuffle_buffer_size).
↪prefetch(buffer_size = AUTOTUNE)
    validation_dataset = val_dataset.cache().prefetch(buffer_size = AUTOTUNE)
    test_dataset = test_dataset.cache().prefetch(buffer_size = AUTOTUNE)
```

```
# Get the first batch of images and labels
for images, labels in training_dataset.take(1):
        example_batch_images = images
        example_batch_labels = labels
max_pixel = np.max(example_batch_images)


# Reduce LR every 10 epochs (Learning rate decay factor)
def scheduler(epoch, lr):
    if epoch < 15:
        if epoch % 5 == 0 and epoch > 0:
            return lr / 1
        return lr
    elif epoch < 22:
        if epoch % 3 == 0 and epoch > 0:
            return lr / 1.1
        return lr
    elif epoch < 50:
        if epoch % 5 == 0 and epoch > 0:
            return lr / 1
        return lr
    else:
        return lr
lr_callback = LearningRateScheduler(scheduler)

# augmentation_model
def augment_model():
    augmentation_model = tf.keras.Sequential([
        tf.keras.Input(shape = (img_size, img_size, 3)),
        tf.keras.layers.RandomFlip("horizontal"),
        tf.keras.layers.RandomRotation(0.1, fill_mode = f_mode),
        ])
    return augmentation_model

def create_and_compile_model():
    augmentation_layers = augment_model()
    model = tf.keras.Sequential([
        # Note: Use Input instead of InputLayer for defining the input shape
        tf.keras.layers.Input(shape = (img_size, img_size, 3)),
        augmentation_layers,
        tf.keras.layers.Rescaling(1./255),
        #####    CONV_LAYER_1:     #####
        tf.keras.layers.Conv2D(n_filters_l1, (4, 4), activation = 'linear'),
        tf.keras.layers.MaxPooling2D(2, 2),
        #####    CONV_LAYER_2:     #####
        tf.keras.layers.Conv2D(n_filters_l2, (3, 3), activation = 'relu'),
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            tf.keras.layers.MaxPooling2D(2, 2),
            #####    CONV_LAYER_3:     #####
            tf.keras.layers.Conv2D(64, (3, 3), activation = 'relu'),
            tf.keras.layers.MaxPooling2D(2, 2),
            #####    CONV_LAYER_4:     #####
            tf.keras.layers.Conv2D(64, (3, 3), activation = 'relu'),
            tf.keras.layers.MaxPooling2D(2, 2),
            tf.keras.layers.Flatten(),
            tf.keras.layers.Dropout(dropout_value),
            #####    BEFORE_LAST_LAYER:     #####
            tf.keras.layers.Dense(n_units_last_layer, activation = 'relu'),
            # It will contain a value from 0-1 where 0 for the class 'female'␣
↪and 1 for the 'male'
            tf.keras.layers.Dense(1, activation = 'sigmoid')])
        model.compile(
            loss = loss,
            optimizer = optimizer,
            metrics = metrics
        )
        return model


    # Create the compiled but untrained model
    def reset_weights(model):
        for layer in model.layers:
            if hasattr(layer, 'kernel_initializer'):
                layer.kernel.assign(layer.kernel_initializer(layer.kernel.
↪shape))
            if hasattr(layer, 'bias_initializer'):
                layer.bias.assign(layer.bias_initializer(layer.bias.shape))

    model = create_and_compile_model()
    reset_weights(model)  # Reset all layer weights
    training_history = model.fit(training_dataset,
                                 epochs=epochs,
                                 validation_data=validation_dataset,
                                 callbacks=[lr_callback],
                                 verbose=2)
    result_history = pd.DataFrame(model.history.history)
    ACC = result_history['val_accuracy'].iloc[-1]
    print(f"Current validation accuracy: {ACC}")
    model.save('trained_model_run23_advanced_control.h5')
    # Restart script
    print("Reseting all weights...")
    print(f'Current number of trials: {try_num}')
    try_num += 1
```

```
result_history.head(15)
result_history[['loss', 'val_loss']].plot(figsize=(5, 3))
result_history[['accuracy', 'val_accuracy']].plot(figsize=(5, 3))
print(model.metrics_names)
print(model.evaluate(validation_dataset))
y_true = np.concatenate([y.numpy() for _, y in validation_dataset])
y_pred_prob = model.predict(validation_dataset)
# Convert probabilities to class labels (0:Female or 1:Male)
y_pred = (y_pred_prob > 0.5).astype(int).flatten()
print("Classification Report:\n", classification_report(y_true, y_pred,␣
 ↪target_names=['Female', 'Male']))
```

```
Found 943 files belonging to 2 classes.
Using 849 files for training.
Found 943 files belonging to 2 classes.
Using 94 files for validation.
Epoch 1/25
```

```
2025-05-04 21:04:37.327861: I tensorflow/core/framework/local_rendezvous.cc:405]
Local rendezvous is aborting with status: OUT_OF_RANGE: End of sequence
```

```
27/27 - 2s - 63ms/step - accuracy: 0.5748 - loss: 0.6768 - val_accuracy: 0.5638
- val_loss: 0.6949 - learning_rate: 5.0000e-04
Epoch 2/25
27/27 - 1s - 38ms/step - accuracy: 0.6678 - loss: 0.6076 - val_accuracy: 0.6383
- val_loss: 0.7577 - learning_rate: 5.0000e-04
Epoch 3/25
27/27 - 1s - 39ms/step - accuracy: 0.6749 - loss: 0.5934 - val_accuracy: 0.7447
- val_loss: 0.5537 - learning_rate: 5.0000e-04
Epoch 4/25
27/27 - 1s - 38ms/step - accuracy: 0.7397 - loss: 0.5191 - val_accuracy: 0.7660
- val_loss: 0.5383 - learning_rate: 5.0000e-04
Epoch 5/25
27/27 - 1s - 38ms/step - accuracy: 0.7527 - loss: 0.4968 - val_accuracy: 0.7766
- val_loss: 0.5265 - learning_rate: 5.0000e-04
Epoch 6/25
27/27 - 1s - 39ms/step - accuracy: 0.7903 - loss: 0.4661 - val_accuracy: 0.8298
- val_loss: 0.4106 - learning_rate: 5.0000e-04
Epoch 7/25
27/27 - 1s - 38ms/step - accuracy: 0.8092 - loss: 0.4301 - val_accuracy: 0.7553
- val_loss: 0.4530 - learning_rate: 5.0000e-04
Epoch 8/25
27/27 - 1s - 39ms/step - accuracy: 0.8009 - loss: 0.4246 - val_accuracy: 0.7979
- val_loss: 0.4836 - learning_rate: 5.0000e-04
Epoch 9/25
27/27 - 1s - 39ms/step - accuracy: 0.7915 - loss: 0.4105 - val_accuracy: 0.8298
- val_loss: 0.4950 - learning_rate: 5.0000e-04
Epoch 10/25
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```
27/27 - 1s - 39ms/step - accuracy: 0.8139 - loss: 0.4055 - val_accuracy: 0.8085
- val_loss: 0.5503 - learning_rate: 5.0000e-04
Epoch 11/25
27/27 - 1s - 39ms/step - accuracy: 0.8433 - loss: 0.3694 - val_accuracy: 0.8191
- val_loss: 0.3989 - learning_rate: 5.0000e-04
Epoch 12/25
27/27 - 1s - 39ms/step - accuracy: 0.8151 - loss: 0.3866 - val_accuracy: 0.8191
- val_loss: 0.4477 - learning_rate: 5.0000e-04
Epoch 13/25
27/27 - 1s - 39ms/step - accuracy: 0.8539 - loss: 0.3497 - val_accuracy: 0.8404
- val_loss: 0.3716 - learning_rate: 5.0000e-04
Epoch 14/25
27/27 - 1s - 39ms/step - accuracy: 0.8445 - loss: 0.3490 - val_accuracy: 0.8085
- val_loss: 0.5649 - learning_rate: 5.0000e-04
Epoch 15/25
27/27 - 1s - 39ms/step - accuracy: 0.8457 - loss: 0.3615 - val_accuracy: 0.8617
- val_loss: 0.3767 - learning_rate: 5.0000e-04
Epoch 16/25
27/27 - 1s - 40ms/step - accuracy: 0.8634 - loss: 0.3195 - val_accuracy: 0.8617
- val_loss: 0.4262 - learning_rate: 4.5455e-04
Epoch 17/25
27/27 - 1s - 39ms/step - accuracy: 0.8645 - loss: 0.3140 - val_accuracy: 0.8830
- val_loss: 0.3946 - learning_rate: 4.5455e-04
Epoch 18/25
27/27 - 1s - 39ms/step - accuracy: 0.8681 - loss: 0.3081 - val_accuracy: 0.8298
- val_loss: 0.3755 - learning_rate: 4.5455e-04
Epoch 19/25
27/27 - 1s - 39ms/step - accuracy: 0.8681 - loss: 0.3041 - val_accuracy: 0.8511
- val_loss: 0.4670 - learning_rate: 4.1322e-04
Epoch 20/25
27/27 - 1s - 39ms/step - accuracy: 0.8822 - loss: 0.2949 - val_accuracy: 0.8723
- val_loss: 0.3792 - learning_rate: 4.1322e-04
Epoch 21/25
27/27 - 1s - 39ms/step - accuracy: 0.8928 - loss: 0.2642 - val_accuracy: 0.8617
- val_loss: 0.4042 - learning_rate: 4.1322e-04
Epoch 22/25
27/27 - 1s - 39ms/step - accuracy: 0.8869 - loss: 0.2611 - val_accuracy: 0.8830
- val_loss: 0.4025 - learning_rate: 3.7566e-04
Epoch 23/25
27/27 - 1s - 39ms/step - accuracy: 0.8905 - loss: 0.2522 - val_accuracy: 0.8723
- val_loss: 0.3915 - learning_rate: 3.7566e-04
Epoch 24/25
27/27 - 1s - 39ms/step - accuracy: 0.8999 - loss: 0.2490 - val_accuracy: 0.8511
- val_loss: 0.4607 - learning_rate: 3.7566e-04
Epoch 25/25
27/27 - 1s - 39ms/step - accuracy: 0.8928 - loss: 0.2543 - val_accuracy: 0.8723
- val_loss: 0.4278 - learning_rate: 3.7566e-04
```

```
WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or
`keras.saving.save_model(model)`. This file format is considered legacy. We
recommend using instead the native Keras format, e.g.
`model.save('my_model.keras')` or `keras.saving.save_model(model,
'my_model.keras')`.

Current validation accuracy: 0.8723404407501221
Reseting all weights…
Current number of trials: 1
Found 943 files belonging to 2 classes.
Using 849 files for training.
Found 943 files belonging to 2 classes.
Using 94 files for validation.
Epoch 1/25

2025-05-04 21:05:04.583479: I tensorflow/core/framework/local_rendezvous.cc:405]
Local rendezvous is aborting with status: OUT_OF_RANGE: End of sequence

27/27 - 2s - 66ms/step - accuracy: 0.5807 - loss: 0.6755 - val_accuracy: 0.6170
- val_loss: 0.6483 - learning_rate: 5.0000e-04
Epoch 2/25
27/27 - 1s - 40ms/step - accuracy: 0.7138 - loss: 0.5905 - val_accuracy: 0.6383
- val_loss: 0.6387 - learning_rate: 5.0000e-04
Epoch 3/25
27/27 - 1s - 40ms/step - accuracy: 0.6985 - loss: 0.5627 - val_accuracy: 0.7234
- val_loss: 0.6374 - learning_rate: 5.0000e-04
Epoch 4/25
27/27 - 1s - 39ms/step - accuracy: 0.7409 - loss: 0.5069 - val_accuracy: 0.7234
- val_loss: 0.5271 - learning_rate: 5.0000e-04
Epoch 5/25
27/27 - 1s - 41ms/step - accuracy: 0.7244 - loss: 0.5299 - val_accuracy: 0.7128
- val_loss: 0.5350 - learning_rate: 5.0000e-04
Epoch 6/25
27/27 - 1s - 40ms/step - accuracy: 0.7538 - loss: 0.4936 - val_accuracy: 0.7340
- val_loss: 0.5758 - learning_rate: 5.0000e-04
Epoch 7/25
27/27 - 1s - 39ms/step - accuracy: 0.7597 - loss: 0.4778 - val_accuracy: 0.7660
- val_loss: 0.5733 - learning_rate: 5.0000e-04
Epoch 8/25
27/27 - 1s - 39ms/step - accuracy: 0.7915 - loss: 0.4425 - val_accuracy: 0.7979
- val_loss: 0.5468 - learning_rate: 5.0000e-04
Epoch 9/25
27/27 - 1s - 39ms/step - accuracy: 0.8092 - loss: 0.4248 - val_accuracy: 0.7979
- val_loss: 0.4462 - learning_rate: 5.0000e-04
Epoch 10/25
27/27 - 1s - 39ms/step - accuracy: 0.8210 - loss: 0.4143 - val_accuracy: 0.7872
- val_loss: 0.3945 - learning_rate: 5.0000e-04
Epoch 11/25
27/27 - 1s - 39ms/step - accuracy: 0.8092 - loss: 0.4271 - val_accuracy: 0.8085
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- val_loss: 0.4014 - learning_rate: 5.0000e-04
Epoch 12/25
27/27 - 1s - 40ms/step - accuracy: 0.8210 - loss: 0.3986 - val_accuracy: 0.8298
- val_loss: 0.4304 - learning_rate: 5.0000e-04
Epoch 13/25
27/27 - 1s - 39ms/step - accuracy: 0.8304 - loss: 0.4081 - val_accuracy: 0.8191
- val_loss: 0.4274 - learning_rate: 5.0000e-04
Epoch 14/25
27/27 - 1s - 40ms/step - accuracy: 0.8457 - loss: 0.3723 - val_accuracy: 0.8191
- val_loss: 0.3720 - learning_rate: 5.0000e-04
Epoch 15/25
27/27 - 1s - 40ms/step - accuracy: 0.8386 - loss: 0.3623 - val_accuracy: 0.8298
- val_loss: 0.4654 - learning_rate: 5.0000e-04
Epoch 16/25
27/27 - 1s - 40ms/step - accuracy: 0.8492 - loss: 0.3573 - val_accuracy: 0.7766
- val_loss: 0.5307 - learning_rate: 4.5455e-04
Epoch 17/25
27/27 - 1s - 39ms/step - accuracy: 0.8492 - loss: 0.3292 - val_accuracy: 0.7872
- val_loss: 0.5535 - learning_rate: 4.5455e-04
Epoch 18/25
27/27 - 1s - 40ms/step - accuracy: 0.8551 - loss: 0.3294 - val_accuracy: 0.8404
- val_loss: 0.4400 - learning_rate: 4.5455e-04
Epoch 19/25
27/27 - 1s - 40ms/step - accuracy: 0.8516 - loss: 0.3379 - val_accuracy: 0.8298
- val_loss: 0.3963 - learning_rate: 4.1322e-04
Epoch 20/25
27/27 - 1s - 41ms/step - accuracy: 0.8799 - loss: 0.2953 - val_accuracy: 0.7979
- val_loss: 0.4724 - learning_rate: 4.1322e-04
Epoch 21/25
27/27 - 1s - 40ms/step - accuracy: 0.8575 - loss: 0.3004 - val_accuracy: 0.8085
- val_loss: 0.3849 - learning_rate: 4.1322e-04
Epoch 22/25
27/27 - 1s - 40ms/step - accuracy: 0.8787 - loss: 0.2839 - val_accuracy: 0.8298
- val_loss: 0.3865 - learning_rate: 3.7566e-04
Epoch 23/25
27/27 - 1s - 40ms/step - accuracy: 0.8598 - loss: 0.3254 - val_accuracy: 0.8191
- val_loss: 0.3531 - learning_rate: 3.7566e-04
Epoch 24/25
27/27 - 1s - 39ms/step - accuracy: 0.8905 - loss: 0.2844 - val_accuracy: 0.8191
- val_loss: 0.4559 - learning_rate: 3.7566e-04
Epoch 25/25
27/27 - 1s - 40ms/step - accuracy: 0.8916 - loss: 0.2701 - val_accuracy: 0.8404
- val_loss: 0.4624 - learning_rate: 3.7566e-04

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recommend using instead the native Keras format, e.g.
`model.save('my_model.keras')` or `keras.saving.save_model(model,
```

```
'my_model.keras')`.

Current validation accuracy: 0.8404255509376526
Reseting all weights…
Current number of trials: 2
Found 943 files belonging to 2 classes.
Using 849 files for training.
Found 943 files belonging to 2 classes.
Using 94 files for validation.
Epoch 1/25
27/27 - 2s - 62ms/step - accuracy: 0.5559 - loss: 0.6738 - val_accuracy: 0.6489
- val_loss: 0.6368 - learning_rate: 5.0000e-04
Epoch 2/25
27/27 - 1s - 39ms/step - accuracy: 0.6890 - loss: 0.5821 - val_accuracy: 0.7234
- val_loss: 0.5779 - learning_rate: 5.0000e-04
Epoch 3/25
27/27 - 1s - 39ms/step - accuracy: 0.7397 - loss: 0.5264 - val_accuracy: 0.7128
- val_loss: 0.6647 - learning_rate: 5.0000e-04
Epoch 4/25
27/27 - 1s - 39ms/step - accuracy: 0.7527 - loss: 0.5118 - val_accuracy: 0.7553
- val_loss: 0.5621 - learning_rate: 5.0000e-04
Epoch 5/25
27/27 - 1s - 38ms/step - accuracy: 0.7562 - loss: 0.5055 - val_accuracy: 0.7979
- val_loss: 0.4803 - learning_rate: 5.0000e-04
Epoch 6/25
27/27 - 1s - 39ms/step - accuracy: 0.7762 - loss: 0.4759 - val_accuracy: 0.7979
- val_loss: 0.4752 - learning_rate: 5.0000e-04
Epoch 7/25
27/27 - 1s - 39ms/step - accuracy: 0.8045 - loss: 0.4331 - val_accuracy: 0.7872
- val_loss: 0.5353 - learning_rate: 5.0000e-04
Epoch 8/25
27/27 - 1s - 39ms/step - accuracy: 0.8151 - loss: 0.4238 - val_accuracy: 0.7872
- val_loss: 0.5057 - learning_rate: 5.0000e-04
Epoch 9/25
27/27 - 1s - 40ms/step - accuracy: 0.7903 - loss: 0.4498 - val_accuracy: 0.7553
- val_loss: 0.5065 - learning_rate: 5.0000e-04
Epoch 10/25
27/27 - 1s - 39ms/step - accuracy: 0.8115 - loss: 0.4104 - val_accuracy: 0.8511
- val_loss: 0.4487 - learning_rate: 5.0000e-04
Epoch 11/25
27/27 - 1s - 39ms/step - accuracy: 0.8257 - loss: 0.4006 - val_accuracy: 0.8511
- val_loss: 0.4085 - learning_rate: 5.0000e-04
Epoch 12/25
27/27 - 1s - 39ms/step - accuracy: 0.8245 - loss: 0.3861 - val_accuracy: 0.8404
- val_loss: 0.4320 - learning_rate: 5.0000e-04
Epoch 13/25
27/27 - 1s - 39ms/step - accuracy: 0.8245 - loss: 0.3837 - val_accuracy: 0.8723
- val_loss: 0.4027 - learning_rate: 5.0000e-04
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Epoch 14/25
27/27 - 1s - 39ms/step - accuracy: 0.8339 - loss: 0.3658 - val_accuracy: 0.8617
- val_loss: 0.3746 - learning_rate: 5.0000e-04
Epoch 15/25
27/27 - 1s - 39ms/step - accuracy: 0.8410 - loss: 0.3562 - val_accuracy: 0.8191
- val_loss: 0.3788 - learning_rate: 5.0000e-04
Epoch 16/25
27/27 - 1s - 39ms/step - accuracy: 0.8634 - loss: 0.3223 - val_accuracy: 0.8191
- val_loss: 0.5254 - learning_rate: 4.5455e-04
Epoch 17/25
27/27 - 1s - 39ms/step - accuracy: 0.8422 - loss: 0.3528 - val_accuracy: 0.8723
- val_loss: 0.4208 - learning_rate: 4.5455e-04
Epoch 18/25
27/27 - 1s - 39ms/step - accuracy: 0.8575 - loss: 0.3107 - val_accuracy: 0.8723
- val_loss: 0.4070 - learning_rate: 4.5455e-04
Epoch 19/25
27/27 - 1s - 39ms/step - accuracy: 0.8751 - loss: 0.2994 - val_accuracy: 0.8617
- val_loss: 0.4146 - learning_rate: 4.1322e-04
Epoch 20/25
27/27 - 1s - 39ms/step - accuracy: 0.8846 - loss: 0.2921 - val_accuracy: 0.8617
- val_loss: 0.3799 - learning_rate: 4.1322e-04
Epoch 21/25
27/27 - 1s - 39ms/step - accuracy: 0.8857 - loss: 0.2830 - val_accuracy: 0.8617
- val_loss: 0.3763 - learning_rate: 4.1322e-04
Epoch 22/25
27/27 - 1s - 39ms/step - accuracy: 0.8645 - loss: 0.3015 - val_accuracy: 0.8830
- val_loss: 0.3641 - learning_rate: 3.7566e-04
Epoch 23/25
27/27 - 1s - 39ms/step - accuracy: 0.8716 - loss: 0.2979 - val_accuracy: 0.8830
- val_loss: 0.4083 - learning_rate: 3.7566e-04
Epoch 24/25
27/27 - 1s - 39ms/step - accuracy: 0.8857 - loss: 0.2828 - val_accuracy: 0.8830
- val_loss: 0.2985 - learning_rate: 3.7566e-04
Epoch 25/25
27/27 - 1s - 40ms/step - accuracy: 0.8940 - loss: 0.2652 - val_accuracy: 0.8936
- val_loss: 0.4444 - learning_rate: 3.7566e-04

WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or
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recommend using instead the native Keras format, e.g.
`model.save('my_model.keras')` or `keras.saving.save_model(model,
'my_model.keras')`.

Current validation accuracy: 0.8936170339584351
Reseting all weights…
Current number of trials: 3
Found 943 files belonging to 2 classes.
Using 849 files for training.
Found 943 files belonging to 2 classes.
```

```
Using 94 files for validation.
Epoch 1/25
2025-05-04 21:05:59.710473: I tensorflow/core/framework/local_rendezvous.cc:405]
Local rendezvous is aborting with status: OUT_OF_RANGE: End of sequence
27/27 - 2s - 63ms/step - accuracy: 0.5960 - loss: 0.6720 - val_accuracy: 0.5319
- val_loss: 0.6674 - learning_rate: 5.0000e-04
Epoch 2/25
27/27 - 1s - 40ms/step - accuracy: 0.6879 - loss: 0.6082 - val_accuracy: 0.6383
- val_loss: 0.6386 - learning_rate: 5.0000e-04
Epoch 3/25
27/27 - 1s - 40ms/step - accuracy: 0.7208 - loss: 0.5610 - val_accuracy: 0.7128
- val_loss: 0.6500 - learning_rate: 5.0000e-04
Epoch 4/25
27/27 - 1s - 40ms/step - accuracy: 0.7515 - loss: 0.5145 - val_accuracy: 0.7234
- val_loss: 0.5818 - learning_rate: 5.0000e-04
Epoch 5/25
27/27 - 1s - 40ms/step - accuracy: 0.7809 - loss: 0.4961 - val_accuracy: 0.7447
- val_loss: 0.5384 - learning_rate: 5.0000e-04
Epoch 6/25
27/27 - 1s - 40ms/step - accuracy: 0.7609 - loss: 0.4840 - val_accuracy: 0.7872
- val_loss: 0.4917 - learning_rate: 5.0000e-04
Epoch 7/25
27/27 - 1s - 40ms/step - accuracy: 0.7809 - loss: 0.4808 - val_accuracy: 0.7979
- val_loss: 0.4780 - learning_rate: 5.0000e-04
Epoch 8/25
27/27 - 1s - 40ms/step - accuracy: 0.7691 - loss: 0.4664 - val_accuracy: 0.8191
- val_loss: 0.4963 - learning_rate: 5.0000e-04
Epoch 9/25
27/27 - 1s - 40ms/step - accuracy: 0.8021 - loss: 0.4582 - val_accuracy: 0.8404
- val_loss: 0.4335 - learning_rate: 5.0000e-04
Epoch 10/25
27/27 - 1s - 40ms/step - accuracy: 0.7868 - loss: 0.4585 - val_accuracy: 0.8511
- val_loss: 0.4379 - learning_rate: 5.0000e-04
Epoch 11/25
27/27 - 1s - 40ms/step - accuracy: 0.7962 - loss: 0.4443 - val_accuracy: 0.8191
- val_loss: 0.5239 - learning_rate: 5.0000e-04
Epoch 12/25
27/27 - 1s - 40ms/step - accuracy: 0.8210 - loss: 0.3988 - val_accuracy: 0.8298
- val_loss: 0.4336 - learning_rate: 5.0000e-04
Epoch 13/25
27/27 - 1s - 41ms/step - accuracy: 0.8210 - loss: 0.4002 - val_accuracy: 0.8617
- val_loss: 0.4333 - learning_rate: 5.0000e-04
Epoch 14/25
27/27 - 1s - 41ms/step - accuracy: 0.8292 - loss: 0.3811 - val_accuracy: 0.8191
- val_loss: 0.4191 - learning_rate: 5.0000e-04
Epoch 15/25
27/27 - 1s - 40ms/step - accuracy: 0.8057 - loss: 0.4012 - val_accuracy: 0.8617
```

```
- val_loss: 0.4087 - learning_rate: 5.0000e-04
Epoch 16/25
27/27 - 1s - 40ms/step - accuracy: 0.8304 - loss: 0.3811 - val_accuracy: 0.8298
- val_loss: 0.4730 - learning_rate: 4.5455e-04
Epoch 17/25
27/27 - 1s - 40ms/step - accuracy: 0.8398 - loss: 0.3621 - val_accuracy: 0.8298
- val_loss: 0.4818 - learning_rate: 4.5455e-04
Epoch 18/25
27/27 - 1s - 39ms/step - accuracy: 0.8363 - loss: 0.3679 - val_accuracy: 0.8511
- val_loss: 0.4417 - learning_rate: 4.5455e-04
Epoch 19/25
27/27 - 1s - 40ms/step - accuracy: 0.8610 - loss: 0.3427 - val_accuracy: 0.8617
- val_loss: 0.4256 - learning_rate: 4.1322e-04
Epoch 20/25
27/27 - 1s - 41ms/step - accuracy: 0.8539 - loss: 0.3303 - val_accuracy: 0.8404
- val_loss: 0.4090 - learning_rate: 4.1322e-04
Epoch 21/25
27/27 - 1s - 40ms/step - accuracy: 0.8457 - loss: 0.3425 - val_accuracy: 0.8617
- val_loss: 0.3785 - learning_rate: 4.1322e-04
Epoch 22/25
27/27 - 1s - 40ms/step - accuracy: 0.8681 - loss: 0.3045 - val_accuracy: 0.8617
- val_loss: 0.4266 - learning_rate: 3.7566e-04
Epoch 23/25
27/27 - 1s - 40ms/step - accuracy: 0.8528 - loss: 0.3105 - val_accuracy: 0.8404
- val_loss: 0.4907 - learning_rate: 3.7566e-04
Epoch 24/25
27/27 - 1s - 39ms/step - accuracy: 0.8740 - loss: 0.2854 - val_accuracy: 0.8511
- val_loss: 0.4194 - learning_rate: 3.7566e-04
Epoch 25/25
27/27 - 1s - 40ms/step - accuracy: 0.8728 - loss: 0.2996 - val_accuracy: 0.8617
- val_loss: 0.3727 - learning_rate: 3.7566e-04

WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or
`keras.saving.save_model(model)`. This file format is considered legacy. We
recommend using instead the native Keras format, e.g.
`model.save('my_model.keras')` or `keras.saving.save_model(model,
'my_model.keras')`.

Current validation accuracy: 0.8617021441459656
Reseting all weights…
Current number of trials: 4
Found 943 files belonging to 2 classes.
Using 849 files for training.
Found 943 files belonging to 2 classes.
Using 94 files for validation.
Epoch 1/25
27/27 - 2s - 62ms/step - accuracy: 0.5889 - loss: 0.6641 - val_accuracy: 0.6170
- val_loss: 0.6322 - learning_rate: 5.0000e-04
Epoch 2/25
```

```
27/27 - 1s - 40ms/step - accuracy: 0.6996 - loss: 0.5767 - val_accuracy: 0.6596
- val_loss: 0.6690 - learning_rate: 5.0000e-04
Epoch 3/25
27/27 - 1s - 40ms/step - accuracy: 0.7244 - loss: 0.5526 - val_accuracy: 0.7660
- val_loss: 0.5569 - learning_rate: 5.0000e-04
Epoch 4/25
27/27 - 1s - 39ms/step - accuracy: 0.7468 - loss: 0.5170 - val_accuracy: 0.7021
- val_loss: 0.6621 - learning_rate: 5.0000e-04
Epoch 5/25
27/27 - 1s - 39ms/step - accuracy: 0.7574 - loss: 0.5025 - val_accuracy: 0.7553
- val_loss: 0.5784 - learning_rate: 5.0000e-04
Epoch 6/25
27/27 - 1s - 39ms/step - accuracy: 0.7491 - loss: 0.4968 - val_accuracy: 0.7766
- val_loss: 0.5367 - learning_rate: 5.0000e-04
Epoch 7/25
27/27 - 1s - 38ms/step - accuracy: 0.8033 - loss: 0.4553 - val_accuracy: 0.8085
- val_loss: 0.4889 - learning_rate: 5.0000e-04
Epoch 8/25
27/27 - 1s - 39ms/step - accuracy: 0.7739 - loss: 0.4687 - val_accuracy: 0.7872
- val_loss: 0.4443 - learning_rate: 5.0000e-04
Epoch 9/25
27/27 - 1s - 39ms/step - accuracy: 0.7703 - loss: 0.4706 - val_accuracy: 0.7660
- val_loss: 0.5468 - learning_rate: 5.0000e-04
Epoch 10/25
27/27 - 1s - 39ms/step - accuracy: 0.8057 - loss: 0.4602 - val_accuracy: 0.8085
- val_loss: 0.4880 - learning_rate: 5.0000e-04
Epoch 11/25
27/27 - 1s - 39ms/step - accuracy: 0.7951 - loss: 0.4373 - val_accuracy: 0.8404
- val_loss: 0.3809 - learning_rate: 5.0000e-04
Epoch 12/25
27/27 - 1s - 39ms/step - accuracy: 0.8033 - loss: 0.4217 - val_accuracy: 0.7872
- val_loss: 0.4048 - learning_rate: 5.0000e-04
Epoch 13/25
27/27 - 1s - 38ms/step - accuracy: 0.8198 - loss: 0.4007 - val_accuracy: 0.8404
- val_loss: 0.3676 - learning_rate: 5.0000e-04
Epoch 14/25
27/27 - 1s - 39ms/step - accuracy: 0.8398 - loss: 0.3963 - val_accuracy: 0.8404
- val_loss: 0.3751 - learning_rate: 5.0000e-04
Epoch 15/25
27/27 - 1s - 39ms/step - accuracy: 0.8068 - loss: 0.4146 - val_accuracy: 0.7872
- val_loss: 0.4043 - learning_rate: 5.0000e-04
Epoch 16/25
27/27 - 1s - 39ms/step - accuracy: 0.8292 - loss: 0.3838 - val_accuracy: 0.8404
- val_loss: 0.3954 - learning_rate: 4.5455e-04
Epoch 17/25
27/27 - 1s - 38ms/step - accuracy: 0.8351 - loss: 0.3711 - val_accuracy: 0.8085
- val_loss: 0.4050 - learning_rate: 4.5455e-04
Epoch 18/25
```

```
27/27 - 1s - 40ms/step - accuracy: 0.8457 - loss: 0.3547 - val_accuracy: 0.7766
- val_loss: 0.4158 - learning_rate: 4.5455e-04
Epoch 19/25
27/27 - 1s - 39ms/step - accuracy: 0.8339 - loss: 0.3889 - val_accuracy: 0.8936
- val_loss: 0.3559 - learning_rate: 4.1322e-04
Epoch 20/25
27/27 - 1s - 39ms/step - accuracy: 0.8516 - loss: 0.3474 - val_accuracy: 0.8404
- val_loss: 0.3515 - learning_rate: 4.1322e-04
Epoch 21/25
27/27 - 1s - 39ms/step - accuracy: 0.8551 - loss: 0.3438 - val_accuracy: 0.8404
- val_loss: 0.3568 - learning_rate: 4.1322e-04
Epoch 22/25
27/27 - 1s - 40ms/step - accuracy: 0.8398 - loss: 0.3554 - val_accuracy: 0.8298
- val_loss: 0.3267 - learning_rate: 3.7566e-04
Epoch 23/25
27/27 - 1s - 39ms/step - accuracy: 0.8740 - loss: 0.3145 - val_accuracy: 0.8191
- val_loss: 0.3611 - learning_rate: 3.7566e-04
Epoch 24/25
27/27 - 1s - 39ms/step - accuracy: 0.8657 - loss: 0.2883 - val_accuracy: 0.8617
- val_loss: 0.3277 - learning_rate: 3.7566e-04
Epoch 25/25
27/27 - 1s - 40ms/step - accuracy: 0.8751 - loss: 0.2826 - val_accuracy: 0.8085
- val_loss: 0.3448 - learning_rate: 3.7566e-04

WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or
`keras.saving.save_model(model)`. This file format is considered legacy. We
recommend using instead the native Keras format, e.g.
`model.save('my_model.keras')` or `keras.saving.save_model(model,
'my_model.keras')`.

Current validation accuracy: 0.8085106611251831
Reseting all weights…
Current number of trials: 5
Found 943 files belonging to 2 classes.
Using 849 files for training.
Found 943 files belonging to 2 classes.
Using 94 files for validation.
Epoch 1/25
27/27 - 2s - 63ms/step - accuracy: 0.5701 - loss: 0.6863 - val_accuracy: 0.5957
- val_loss: 0.6449 - learning_rate: 5.0000e-04
Epoch 2/25
27/27 - 1s - 40ms/step - accuracy: 0.6714 - loss: 0.6161 - val_accuracy: 0.6489
- val_loss: 0.6276 - learning_rate: 5.0000e-04
Epoch 3/25
27/27 - 1s - 40ms/step - accuracy: 0.7279 - loss: 0.5543 - val_accuracy: 0.7766
- val_loss: 0.5456 - learning_rate: 5.0000e-04
Epoch 4/25
27/27 - 1s - 39ms/step - accuracy: 0.7197 - loss: 0.5593 - val_accuracy: 0.7234
- val_loss: 0.6068 - learning_rate: 5.0000e-04
```

```
Epoch 5/25
27/27 - 1s - 39ms/step - accuracy: 0.7326 - loss: 0.5482 - val_accuracy: 0.7660
- val_loss: 0.4943 - learning_rate: 5.0000e-04
Epoch 6/25
27/27 - 1s - 39ms/step - accuracy: 0.7515 - loss: 0.5038 - val_accuracy: 0.7553
- val_loss: 0.4961 - learning_rate: 5.0000e-04
Epoch 7/25
27/27 - 1s - 40ms/step - accuracy: 0.7609 - loss: 0.4995 - val_accuracy: 0.7766
- val_loss: 0.4827 - learning_rate: 5.0000e-04
Epoch 8/25
27/27 - 1s - 38ms/step - accuracy: 0.7951 - loss: 0.4709 - val_accuracy: 0.7340
- val_loss: 0.4811 - learning_rate: 5.0000e-04
Epoch 9/25
27/27 - 1s - 39ms/step - accuracy: 0.7892 - loss: 0.4594 - val_accuracy: 0.8085
- val_loss: 0.4978 - learning_rate: 5.0000e-04
Epoch 10/25
27/27 - 1s - 40ms/step - accuracy: 0.7762 - loss: 0.4690 - val_accuracy: 0.8085
- val_loss: 0.4243 - learning_rate: 5.0000e-04
Epoch 11/25
27/27 - 1s - 39ms/step - accuracy: 0.8021 - loss: 0.4268 - val_accuracy: 0.7979
- val_loss: 0.4065 - learning_rate: 5.0000e-04
Epoch 12/25
27/27 - 1s - 39ms/step - accuracy: 0.7939 - loss: 0.4378 - val_accuracy: 0.8511
- val_loss: 0.3932 - learning_rate: 5.0000e-04
Epoch 13/25
27/27 - 1s - 39ms/step - accuracy: 0.7986 - loss: 0.4329 - val_accuracy: 0.8404
- val_loss: 0.4162 - learning_rate: 5.0000e-04
Epoch 14/25
27/27 - 1s - 39ms/step - accuracy: 0.8080 - loss: 0.4083 - val_accuracy: 0.8298
- val_loss: 0.3675 - learning_rate: 5.0000e-04
Epoch 15/25
27/27 - 1s - 40ms/step - accuracy: 0.8127 - loss: 0.4114 - val_accuracy: 0.8511
- val_loss: 0.3672 - learning_rate: 5.0000e-04
Epoch 16/25
27/27 - 1s - 39ms/step - accuracy: 0.8327 - loss: 0.3901 - val_accuracy: 0.8723
- val_loss: 0.4188 - learning_rate: 4.5455e-04
Epoch 17/25
27/27 - 1s - 39ms/step - accuracy: 0.8280 - loss: 0.3888 - val_accuracy: 0.8191
- val_loss: 0.4188 - learning_rate: 4.5455e-04
Epoch 18/25
27/27 - 1s - 39ms/step - accuracy: 0.8245 - loss: 0.3880 - val_accuracy: 0.8191
- val_loss: 0.3735 - learning_rate: 4.5455e-04
Epoch 19/25
27/27 - 1s - 39ms/step - accuracy: 0.8504 - loss: 0.3425 - val_accuracy: 0.8511
- val_loss: 0.3921 - learning_rate: 4.1322e-04
Epoch 20/25
27/27 - 1s - 39ms/step - accuracy: 0.8410 - loss: 0.3449 - val_accuracy: 0.8298
- val_loss: 0.3842 - learning_rate: 4.1322e-04
```

```
Epoch 21/25
27/27 - 1s - 39ms/step - accuracy: 0.8304 - loss: 0.3602 - val_accuracy: 0.8617
- val_loss: 0.3650 - learning_rate: 4.1322e-04
Epoch 22/25
27/27 - 1s - 41ms/step - accuracy: 0.8645 - loss: 0.3086 - val_accuracy: 0.8617
- val_loss: 0.3764 - learning_rate: 3.7566e-04
Epoch 23/25
27/27 - 1s - 40ms/step - accuracy: 0.8657 - loss: 0.3245 - val_accuracy: 0.8617
- val_loss: 0.3496 - learning_rate: 3.7566e-04
Epoch 24/25
27/27 - 1s - 39ms/step - accuracy: 0.8645 - loss: 0.3210 - val_accuracy: 0.8617
- val_loss: 0.3375 - learning_rate: 3.7566e-04
Epoch 25/25
27/27 - 1s - 40ms/step - accuracy: 0.8787 - loss: 0.2918 - val_accuracy: 0.8723
- val_loss: 0.3895 - learning_rate: 3.7566e-04

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recommend using instead the native Keras format, e.g.
`model.save('my_model.keras')` or `keras.saving.save_model(model,
'my_model.keras')`.

Current validation accuracy: 0.8723404407501221
Reseting all weights…
Current number of trials: 6
Found 943 files belonging to 2 classes.
Using 849 files for training.
Found 943 files belonging to 2 classes.
Using 94 files for validation.
Epoch 1/25
27/27 - 2s - 66ms/step - accuracy: 0.5736 - loss: 0.6722 - val_accuracy: 0.6383
- val_loss: 0.6594 - learning_rate: 5.0000e-04
Epoch 2/25
27/27 - 1s - 39ms/step - accuracy: 0.6667 - loss: 0.6095 - val_accuracy: 0.7234
- val_loss: 0.5803 - learning_rate: 5.0000e-04
Epoch 3/25
27/27 - 1s - 39ms/step - accuracy: 0.7338 - loss: 0.5464 - val_accuracy: 0.7872
- val_loss: 0.4934 - learning_rate: 5.0000e-04
Epoch 4/25
27/27 - 1s - 39ms/step - accuracy: 0.7668 - loss: 0.5134 - val_accuracy: 0.7979
- val_loss: 0.4957 - learning_rate: 5.0000e-04
Epoch 5/25
27/27 - 1s - 38ms/step - accuracy: 0.7668 - loss: 0.4809 - val_accuracy: 0.8298
- val_loss: 0.4358 - learning_rate: 5.0000e-04
Epoch 6/25
27/27 - 1s - 39ms/step - accuracy: 0.7915 - loss: 0.4571 - val_accuracy: 0.8298
- val_loss: 0.4631 - learning_rate: 5.0000e-04
Epoch 7/25
27/27 - 1s - 39ms/step - accuracy: 0.7845 - loss: 0.4612 - val_accuracy: 0.7979
```

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- val_loss: 0.4563 - learning_rate: 5.0000e-04
Epoch 8/25
27/27 - 1s - 38ms/step - accuracy: 0.8139 - loss: 0.4403 - val_accuracy: 0.8298
- val_loss: 0.4393 - learning_rate: 5.0000e-04
Epoch 9/25
27/27 - 1s - 38ms/step - accuracy: 0.8115 - loss: 0.4196 - val_accuracy: 0.8085
- val_loss: 0.4656 - learning_rate: 5.0000e-04
Epoch 10/25
27/27 - 1s - 39ms/step - accuracy: 0.8221 - loss: 0.4088 - val_accuracy: 0.8617
- val_loss: 0.3614 - learning_rate: 5.0000e-04
Epoch 11/25
27/27 - 1s - 40ms/step - accuracy: 0.8198 - loss: 0.3977 - val_accuracy: 0.7872
- val_loss: 0.4708 - learning_rate: 5.0000e-04
Epoch 12/25
27/27 - 1s - 39ms/step - accuracy: 0.8280 - loss: 0.3999 - val_accuracy: 0.8511
- val_loss: 0.3512 - learning_rate: 5.0000e-04
Epoch 13/25
27/27 - 1s - 39ms/step - accuracy: 0.8398 - loss: 0.3617 - val_accuracy: 0.8830
- val_loss: 0.3276 - learning_rate: 5.0000e-04
Epoch 14/25
27/27 - 1s - 39ms/step - accuracy: 0.8386 - loss: 0.3554 - val_accuracy: 0.8830
- val_loss: 0.3120 - learning_rate: 5.0000e-04
Epoch 15/25
27/27 - 1s - 39ms/step - accuracy: 0.8398 - loss: 0.3689 - val_accuracy: 0.8511
- val_loss: 0.3806 - learning_rate: 5.0000e-04
Epoch 16/25
27/27 - 1s - 39ms/step - accuracy: 0.8504 - loss: 0.3398 - val_accuracy: 0.8511
- val_loss: 0.3954 - learning_rate: 4.5455e-04
Epoch 17/25
27/27 - 1s - 39ms/step - accuracy: 0.8775 - loss: 0.3193 - val_accuracy: 0.8511
- val_loss: 0.3376 - learning_rate: 4.5455e-04
Epoch 18/25
27/27 - 1s - 38ms/step - accuracy: 0.8587 - loss: 0.3257 - val_accuracy: 0.8298
- val_loss: 0.4035 - learning_rate: 4.5455e-04
Epoch 19/25
27/27 - 1s - 39ms/step - accuracy: 0.8728 - loss: 0.2985 - val_accuracy: 0.8617
- val_loss: 0.3078 - learning_rate: 4.1322e-04
Epoch 20/25
27/27 - 1s - 39ms/step - accuracy: 0.8657 - loss: 0.3190 - val_accuracy: 0.8298
- val_loss: 0.3874 - learning_rate: 4.1322e-04
Epoch 21/25
27/27 - 1s - 38ms/step - accuracy: 0.8834 - loss: 0.2870 - val_accuracy: 0.8404
- val_loss: 0.2956 - learning_rate: 4.1322e-04
Epoch 22/25
27/27 - 1s - 38ms/step - accuracy: 0.8787 - loss: 0.2878 - val_accuracy: 0.8830
- val_loss: 0.3253 - learning_rate: 3.7566e-04
Epoch 23/25
27/27 - 1s - 38ms/step - accuracy: 0.8740 - loss: 0.2826 - val_accuracy: 0.8511
```

```
- val_loss: 0.3552 - learning_rate: 3.7566e-04
Epoch 24/25
27/27 - 1s - 38ms/step - accuracy: 0.8846 - loss: 0.2704 - val_accuracy: 0.8511
- val_loss: 0.3967 - learning_rate: 3.7566e-04
Epoch 25/25
27/27 - 1s - 38ms/step - accuracy: 0.8916 - loss: 0.2563 - val_accuracy: 0.8723
- val_loss: 0.3828 - learning_rate: 3.7566e-04

WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or
`keras.saving.save_model(model)`. This file format is considered legacy. We
recommend using instead the native Keras format, e.g.
`model.save('my_model.keras')` or `keras.saving.save_model(model,
'my_model.keras')`.

Current validation accuracy: 0.8723404407501221
Reseting all weights…
Current number of trials: 7
Found 943 files belonging to 2 classes.
Using 849 files for training.
Found 943 files belonging to 2 classes.
Using 94 files for validation.
Epoch 1/25

2025-05-04 21:07:49.570311: I tensorflow/core/framework/local_rendezvous.cc:405]
Local rendezvous is aborting with status: OUT_OF_RANGE: End of sequence

27/27 - 2s - 63ms/step - accuracy: 0.6302 - loss: 0.6489 - val_accuracy: 0.6489
- val_loss: 0.6466 - learning_rate: 5.0000e-04
Epoch 2/25
27/27 - 1s - 39ms/step - accuracy: 0.6584 - loss: 0.6130 - val_accuracy: 0.7447
- val_loss: 0.5583 - learning_rate: 5.0000e-04
Epoch 3/25
27/27 - 1s - 40ms/step - accuracy: 0.7609 - loss: 0.5230 - val_accuracy: 0.7766
- val_loss: 0.4733 - learning_rate: 5.0000e-04
Epoch 4/25
27/27 - 1s - 39ms/step - accuracy: 0.7621 - loss: 0.5089 - val_accuracy: 0.7872
- val_loss: 0.5023 - learning_rate: 5.0000e-04
Epoch 5/25
27/27 - 1s - 38ms/step - accuracy: 0.7868 - loss: 0.4649 - val_accuracy: 0.8404
- val_loss: 0.4064 - learning_rate: 5.0000e-04
Epoch 6/25
27/27 - 1s - 39ms/step - accuracy: 0.7927 - loss: 0.4533 - val_accuracy: 0.8404
- val_loss: 0.3600 - learning_rate: 5.0000e-04
Epoch 7/25
27/27 - 1s - 39ms/step - accuracy: 0.7915 - loss: 0.4285 - val_accuracy: 0.8404
- val_loss: 0.3077 - learning_rate: 5.0000e-04
Epoch 8/25
27/27 - 1s - 38ms/step - accuracy: 0.8221 - loss: 0.3879 - val_accuracy: 0.8511
- val_loss: 0.3732 - learning_rate: 5.0000e-04
Epoch 9/25
```

```
27/27 - 1s - 38ms/step - accuracy: 0.8245 - loss: 0.3960 - val_accuracy: 0.8511
- val_loss: 0.3496 - learning_rate: 5.0000e-04
Epoch 10/25
27/27 - 1s - 39ms/step - accuracy: 0.8375 - loss: 0.3619 - val_accuracy: 0.8404
- val_loss: 0.3994 - learning_rate: 5.0000e-04
Epoch 11/25
27/27 - 1s - 39ms/step - accuracy: 0.8363 - loss: 0.3691 - val_accuracy: 0.7979
- val_loss: 0.3828 - learning_rate: 5.0000e-04
Epoch 12/25
27/27 - 1s - 39ms/step - accuracy: 0.8280 - loss: 0.3790 - val_accuracy: 0.8404
- val_loss: 0.4007 - learning_rate: 5.0000e-04
Epoch 13/25
27/27 - 1s - 40ms/step - accuracy: 0.8504 - loss: 0.3419 - val_accuracy: 0.8404
- val_loss: 0.4646 - learning_rate: 5.0000e-04
Epoch 14/25
27/27 - 1s - 39ms/step - accuracy: 0.8504 - loss: 0.3497 - val_accuracy: 0.8404
- val_loss: 0.4196 - learning_rate: 5.0000e-04
Epoch 15/25
27/27 - 1s - 39ms/step - accuracy: 0.8846 - loss: 0.3091 - val_accuracy: 0.8511
- val_loss: 0.3910 - learning_rate: 5.0000e-04
Epoch 16/25
27/27 - 1s - 41ms/step - accuracy: 0.8681 - loss: 0.3076 - val_accuracy: 0.8298
- val_loss: 0.4100 - learning_rate: 4.5455e-04
Epoch 17/25
27/27 - 1s - 40ms/step - accuracy: 0.8716 - loss: 0.3018 - val_accuracy: 0.8723
- val_loss: 0.3334 - learning_rate: 4.5455e-04
Epoch 18/25
27/27 - 1s - 39ms/step - accuracy: 0.8822 - loss: 0.2825 - val_accuracy: 0.8617
- val_loss: 0.3377 - learning_rate: 4.5455e-04
Epoch 19/25
27/27 - 1s - 39ms/step - accuracy: 0.8799 - loss: 0.2708 - val_accuracy: 0.8617
- val_loss: 0.3457 - learning_rate: 4.1322e-04
Epoch 20/25
27/27 - 1s - 39ms/step - accuracy: 0.8987 - loss: 0.2525 - val_accuracy: 0.8617
- val_loss: 0.3306 - learning_rate: 4.1322e-04
Epoch 21/25
27/27 - 1s - 39ms/step - accuracy: 0.8775 - loss: 0.2739 - val_accuracy: 0.8511
- val_loss: 0.3637 - learning_rate: 4.1322e-04
Epoch 22/25
27/27 - 1s - 39ms/step - accuracy: 0.8987 - loss: 0.2474 - val_accuracy: 0.8404
- val_loss: 0.5024 - learning_rate: 3.7566e-04
Epoch 23/25
27/27 - 1s - 40ms/step - accuracy: 0.8905 - loss: 0.2541 - val_accuracy: 0.8617
- val_loss: 0.3147 - learning_rate: 3.7566e-04
Epoch 24/25
27/27 - 1s - 39ms/step - accuracy: 0.8928 - loss: 0.2555 - val_accuracy: 0.8723
- val_loss: 0.4028 - learning_rate: 3.7566e-04
Epoch 25/25
```

```
27/27 - 1s - 38ms/step - accuracy: 0.8928 - loss: 0.2508 - val_accuracy: 0.8511
- val_loss: 0.3031 - learning_rate: 3.7566e-04

WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or
`keras.saving.save_model(model)`. This file format is considered legacy. We
recommend using instead the native Keras format, e.g.
`model.save('my_model.keras')` or `keras.saving.save_model(model,
'my_model.keras')`.

Current validation accuracy: 0.8510638475418091
Reseting all weights…
Current number of trials: 8
Found 943 files belonging to 2 classes.
Using 849 files for training.
Found 943 files belonging to 2 classes.
Using 94 files for validation.
Epoch 1/25
27/27 - 2s - 63ms/step - accuracy: 0.6160 - loss: 0.6603 - val_accuracy: 0.5957
- val_loss: 0.6198 - learning_rate: 5.0000e-04
Epoch 2/25
27/27 - 1s - 40ms/step - accuracy: 0.7091 - loss: 0.5671 - val_accuracy: 0.7447
- val_loss: 0.5814 - learning_rate: 5.0000e-04
Epoch 3/25
27/27 - 1s - 40ms/step - accuracy: 0.7267 - loss: 0.5437 - val_accuracy: 0.7766
- val_loss: 0.5074 - learning_rate: 5.0000e-04
Epoch 4/25
27/27 - 1s - 40ms/step - accuracy: 0.7409 - loss: 0.5173 - val_accuracy: 0.7766
- val_loss: 0.4760 - learning_rate: 5.0000e-04
Epoch 5/25
27/27 - 1s - 41ms/step - accuracy: 0.7633 - loss: 0.4902 - val_accuracy: 0.7979
- val_loss: 0.4610 - learning_rate: 5.0000e-04
Epoch 6/25
27/27 - 1s - 39ms/step - accuracy: 0.7797 - loss: 0.4801 - val_accuracy: 0.8298
- val_loss: 0.4370 - learning_rate: 5.0000e-04
Epoch 7/25
27/27 - 1s - 40ms/step - accuracy: 0.7939 - loss: 0.4547 - val_accuracy: 0.7979
- val_loss: 0.4763 - learning_rate: 5.0000e-04
Epoch 8/25
27/27 - 1s - 40ms/step - accuracy: 0.7727 - loss: 0.4793 - val_accuracy: 0.8085
- val_loss: 0.5136 - learning_rate: 5.0000e-04
Epoch 9/25
27/27 - 1s - 39ms/step - accuracy: 0.8198 - loss: 0.4246 - val_accuracy: 0.8404
- val_loss: 0.4511 - learning_rate: 5.0000e-04
Epoch 10/25
27/27 - 1s - 40ms/step - accuracy: 0.8115 - loss: 0.4237 - val_accuracy: 0.8298
- val_loss: 0.4530 - learning_rate: 5.0000e-04
Epoch 11/25
27/27 - 1s - 40ms/step - accuracy: 0.8068 - loss: 0.4128 - val_accuracy: 0.7447
- val_loss: 0.5575 - learning_rate: 5.0000e-04
```

```
Epoch 12/25
27/27 - 1s - 39ms/step - accuracy: 0.8151 - loss: 0.4011 - val_accuracy: 0.8298
- val_loss: 0.4071 - learning_rate: 5.0000e-04
Epoch 13/25
27/27 - 1s - 39ms/step - accuracy: 0.8151 - loss: 0.3859 - val_accuracy: 0.8723
- val_loss: 0.3415 - learning_rate: 5.0000e-04
Epoch 14/25
27/27 - 1s - 40ms/step - accuracy: 0.8304 - loss: 0.3867 - val_accuracy: 0.8191
- val_loss: 0.3758 - learning_rate: 5.0000e-04
Epoch 15/25
27/27 - 1s - 39ms/step - accuracy: 0.8210 - loss: 0.3726 - val_accuracy: 0.8085
- val_loss: 0.3467 - learning_rate: 5.0000e-04
Epoch 16/25
27/27 - 1s - 39ms/step - accuracy: 0.8492 - loss: 0.3381 - val_accuracy: 0.8936
- val_loss: 0.3214 - learning_rate: 4.5455e-04
Epoch 17/25
27/27 - 1s - 40ms/step - accuracy: 0.8634 - loss: 0.3315 - val_accuracy: 0.8830
- val_loss: 0.3366 - learning_rate: 4.5455e-04
Epoch 18/25
27/27 - 1s - 39ms/step - accuracy: 0.8457 - loss: 0.3229 - val_accuracy: 0.8617
- val_loss: 0.3762 - learning_rate: 4.5455e-04
Epoch 19/25
27/27 - 1s - 40ms/step - accuracy: 0.8634 - loss: 0.3229 - val_accuracy: 0.8830
- val_loss: 0.3482 - learning_rate: 4.1322e-04
Epoch 20/25
27/27 - 1s - 41ms/step - accuracy: 0.8787 - loss: 0.2974 - val_accuracy: 0.8830
- val_loss: 0.3799 - learning_rate: 4.1322e-04
Epoch 21/25
27/27 - 1s - 40ms/step - accuracy: 0.8645 - loss: 0.3012 - val_accuracy: 0.8723
- val_loss: 0.3911 - learning_rate: 4.1322e-04
Epoch 22/25
27/27 - 1s - 40ms/step - accuracy: 0.8657 - loss: 0.3138 - val_accuracy: 0.8617
- val_loss: 0.3884 - learning_rate: 3.7566e-04
Epoch 23/25
27/27 - 1s - 39ms/step - accuracy: 0.8587 - loss: 0.3193 - val_accuracy: 0.8723
- val_loss: 0.3306 - learning_rate: 3.7566e-04
Epoch 24/25
27/27 - 1s - 39ms/step - accuracy: 0.8846 - loss: 0.2861 - val_accuracy: 0.8617
- val_loss: 0.3635 - learning_rate: 3.7566e-04
Epoch 25/25
27/27 - 1s - 39ms/step - accuracy: 0.8834 - loss: 0.2668 - val_accuracy: 0.8830
- val_loss: 0.3125 - learning_rate: 3.7566e-04

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recommend using instead the native Keras format, e.g.
`model.save('my_model.keras')` or `keras.saving.save_model(model,
'my_model.keras')`.
```

```
Current validation accuracy: 0.8829787373542786
Reseting all weights…
Current number of trials: 9
Found 943 files belonging to 2 classes.
Using 849 files for training.
Found 943 files belonging to 2 classes.
Using 94 files for validation.
Epoch 1/25
27/27 - 2s - 63ms/step - accuracy: 0.5771 - loss: 0.6804 - val_accuracy: 0.5106
- val_loss: 0.7149 - learning_rate: 5.0000e-04
Epoch 2/25
27/27 - 1s - 39ms/step - accuracy: 0.6796 - loss: 0.6157 - val_accuracy: 0.6702
- val_loss: 0.5929 - learning_rate: 5.0000e-04
Epoch 3/25
27/27 - 1s - 40ms/step - accuracy: 0.7079 - loss: 0.5520 - val_accuracy: 0.6809
- val_loss: 0.5414 - learning_rate: 5.0000e-04
Epoch 4/25
27/27 - 1s - 40ms/step - accuracy: 0.7173 - loss: 0.5443 - val_accuracy: 0.7447
- val_loss: 0.5092 - learning_rate: 5.0000e-04
Epoch 5/25
27/27 - 1s - 39ms/step - accuracy: 0.7409 - loss: 0.5248 - val_accuracy: 0.7766
- val_loss: 0.4819 - learning_rate: 5.0000e-04
Epoch 6/25
27/27 - 1s - 39ms/step - accuracy: 0.7338 - loss: 0.5249 - val_accuracy: 0.7234
- val_loss: 0.5618 - learning_rate: 5.0000e-04
Epoch 7/25
27/27 - 1s - 39ms/step - accuracy: 0.7715 - loss: 0.4931 - val_accuracy: 0.7660
- val_loss: 0.4892 - learning_rate: 5.0000e-04
Epoch 8/25
27/27 - 1s - 38ms/step - accuracy: 0.7585 - loss: 0.4937 - val_accuracy: 0.8191
- val_loss: 0.4540 - learning_rate: 5.0000e-04
Epoch 9/25
27/27 - 1s - 40ms/step - accuracy: 0.7562 - loss: 0.4897 - val_accuracy: 0.7979
- val_loss: 0.4785 - learning_rate: 5.0000e-04
Epoch 10/25
27/27 - 1s - 39ms/step - accuracy: 0.7868 - loss: 0.4745 - val_accuracy: 0.8085
- val_loss: 0.4545 - learning_rate: 5.0000e-04
Epoch 11/25
27/27 - 1s - 39ms/step - accuracy: 0.7845 - loss: 0.4506 - val_accuracy: 0.8191
- val_loss: 0.4282 - learning_rate: 5.0000e-04
Epoch 12/25
27/27 - 1s - 38ms/step - accuracy: 0.7962 - loss: 0.4183 - val_accuracy: 0.8298
- val_loss: 0.4502 - learning_rate: 5.0000e-04
Epoch 13/25
27/27 - 1s - 39ms/step - accuracy: 0.8198 - loss: 0.3953 - val_accuracy: 0.8085
- val_loss: 0.3604 - learning_rate: 5.0000e-04
Epoch 14/25
27/27 - 1s - 39ms/step - accuracy: 0.8127 - loss: 0.3949 - val_accuracy: 0.7872
```

```
- val_loss: 0.4408 - learning_rate: 5.0000e-04
Epoch 15/25
27/27 - 1s - 39ms/step - accuracy: 0.8151 - loss: 0.3935 - val_accuracy: 0.8511
- val_loss: 0.3674 - learning_rate: 5.0000e-04
Epoch 16/25
27/27 - 1s - 39ms/step - accuracy: 0.8221 - loss: 0.3820 - val_accuracy: 0.8298
- val_loss: 0.3984 - learning_rate: 4.5455e-04
Epoch 17/25
27/27 - 1s - 39ms/step - accuracy: 0.8575 - loss: 0.3665 - val_accuracy: 0.8191
- val_loss: 0.3691 - learning_rate: 4.5455e-04
Epoch 18/25
27/27 - 1s - 39ms/step - accuracy: 0.8339 - loss: 0.3727 - val_accuracy: 0.8404
- val_loss: 0.3796 - learning_rate: 4.5455e-04
Epoch 19/25
27/27 - 1s - 39ms/step - accuracy: 0.8504 - loss: 0.3411 - val_accuracy: 0.8617
- val_loss: 0.3728 - learning_rate: 4.1322e-04
Epoch 20/25
27/27 - 1s - 39ms/step - accuracy: 0.8704 - loss: 0.3011 - val_accuracy: 0.8617
- val_loss: 0.4243 - learning_rate: 4.1322e-04
Epoch 21/25
27/27 - 1s - 39ms/step - accuracy: 0.8504 - loss: 0.3543 - val_accuracy: 0.8617
- val_loss: 0.3644 - learning_rate: 4.1322e-04
Epoch 22/25
27/27 - 1s - 39ms/step - accuracy: 0.8740 - loss: 0.3134 - val_accuracy: 0.8404
- val_loss: 0.4176 - learning_rate: 3.7566e-04
Epoch 23/25
27/27 - 1s - 39ms/step - accuracy: 0.8634 - loss: 0.3187 - val_accuracy: 0.8404
- val_loss: 0.3414 - learning_rate: 3.7566e-04
Epoch 24/25
27/27 - 1s - 40ms/step - accuracy: 0.8669 - loss: 0.3169 - val_accuracy: 0.8404
- val_loss: 0.4139 - learning_rate: 3.7566e-04
Epoch 25/25
27/27 - 1s - 39ms/step - accuracy: 0.8716 - loss: 0.3096 - val_accuracy: 0.8617
- val_loss: 0.3312 - learning_rate: 3.7566e-04

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'my_model.keras')`.

Current validation accuracy: 0.8617021441459656
Reseting all weights…
Current number of trials: 10
Found 943 files belonging to 2 classes.
Using 849 files for training.
Found 943 files belonging to 2 classes.
Using 94 files for validation.
Epoch 1/25
```

```
27/27 - 2s - 63ms/step - accuracy: 0.5854 - loss: 0.6842 - val_accuracy: 0.6064
- val_loss: 0.6548 - learning_rate: 5.0000e-04
Epoch 2/25
27/27 - 1s - 38ms/step - accuracy: 0.6855 - loss: 0.5858 - val_accuracy: 0.6489
- val_loss: 0.5961 - learning_rate: 5.0000e-04
Epoch 3/25
27/27 - 1s - 38ms/step - accuracy: 0.7208 - loss: 0.5472 - val_accuracy: 0.7234
- val_loss: 0.5518 - learning_rate: 5.0000e-04
Epoch 4/25
27/27 - 1s - 38ms/step - accuracy: 0.7220 - loss: 0.5622 - val_accuracy: 0.7021
- val_loss: 0.5679 - learning_rate: 5.0000e-04
Epoch 5/25
27/27 - 1s - 38ms/step - accuracy: 0.7515 - loss: 0.4999 - val_accuracy: 0.7660
- val_loss: 0.5166 - learning_rate: 5.0000e-04
Epoch 6/25
27/27 - 1s - 38ms/step - accuracy: 0.7680 - loss: 0.4922 - val_accuracy: 0.7872
- val_loss: 0.4784 - learning_rate: 5.0000e-04
Epoch 7/25
27/27 - 1s - 38ms/step - accuracy: 0.7644 - loss: 0.5103 - val_accuracy: 0.7766
- val_loss: 0.4967 - learning_rate: 5.0000e-04
Epoch 8/25
27/27 - 1s - 38ms/step - accuracy: 0.7762 - loss: 0.4748 - val_accuracy: 0.8298
- val_loss: 0.4762 - learning_rate: 5.0000e-04
Epoch 9/25
27/27 - 1s - 38ms/step - accuracy: 0.7962 - loss: 0.4472 - val_accuracy: 0.8404
- val_loss: 0.4844 - learning_rate: 5.0000e-04
Epoch 10/25
27/27 - 1s - 38ms/step - accuracy: 0.7880 - loss: 0.4631 - val_accuracy: 0.7979
- val_loss: 0.4726 - learning_rate: 5.0000e-04
Epoch 11/25
27/27 - 1s - 39ms/step - accuracy: 0.7951 - loss: 0.4389 - val_accuracy: 0.8298
- val_loss: 0.4641 - learning_rate: 5.0000e-04
Epoch 12/25
27/27 - 1s - 39ms/step - accuracy: 0.8151 - loss: 0.4112 - val_accuracy: 0.8085
- val_loss: 0.4821 - learning_rate: 5.0000e-04
Epoch 13/25
27/27 - 1s - 38ms/step - accuracy: 0.8186 - loss: 0.4075 - val_accuracy: 0.8298
- val_loss: 0.4667 - learning_rate: 5.0000e-04
Epoch 14/25
27/27 - 1s - 40ms/step - accuracy: 0.7856 - loss: 0.4293 - val_accuracy: 0.8085
- val_loss: 0.4175 - learning_rate: 5.0000e-04
Epoch 15/25
27/27 - 1s - 38ms/step - accuracy: 0.8186 - loss: 0.3894 - val_accuracy: 0.8404
- val_loss: 0.4638 - learning_rate: 5.0000e-04
Epoch 16/25
27/27 - 1s - 38ms/step - accuracy: 0.8363 - loss: 0.3748 - val_accuracy: 0.8511
- val_loss: 0.4406 - learning_rate: 4.5455e-04
Epoch 17/25
```

```
27/27 - 1s - 39ms/step - accuracy: 0.8375 - loss: 0.3625 - val_accuracy: 0.8298
- val_loss: 0.4244 - learning_rate: 4.5455e-04
Epoch 18/25
27/27 - 1s - 39ms/step - accuracy: 0.8210 - loss: 0.3662 - val_accuracy: 0.8511
- val_loss: 0.4600 - learning_rate: 4.5455e-04
Epoch 19/25
27/27 - 1s - 38ms/step - accuracy: 0.8092 - loss: 0.4006 - val_accuracy: 0.8511
- val_loss: 0.3899 - learning_rate: 4.1322e-04
Epoch 20/25
27/27 - 1s - 38ms/step - accuracy: 0.8598 - loss: 0.3249 - val_accuracy: 0.8511
- val_loss: 0.4512 - learning_rate: 4.1322e-04
Epoch 21/25
27/27 - 1s - 39ms/step - accuracy: 0.8716 - loss: 0.3076 - val_accuracy: 0.8723
- val_loss: 0.4020 - learning_rate: 4.1322e-04
Epoch 22/25
27/27 - 1s - 39ms/step - accuracy: 0.8657 - loss: 0.3013 - val_accuracy: 0.8830
- val_loss: 0.3970 - learning_rate: 3.7566e-04
Epoch 23/25
27/27 - 1s - 39ms/step - accuracy: 0.8657 - loss: 0.3126 - val_accuracy: 0.8723
- val_loss: 0.3964 - learning_rate: 3.7566e-04
Epoch 24/25
27/27 - 1s - 38ms/step - accuracy: 0.8775 - loss: 0.3014 - val_accuracy: 0.8830
- val_loss: 0.3860 - learning_rate: 3.7566e-04
Epoch 25/25
27/27 - 1s - 38ms/step - accuracy: 0.8704 - loss: 0.3006 - val_accuracy: 0.9149
- val_loss: 0.3344 - learning_rate: 3.7566e-04

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`keras.saving.save_model(model)`. This file format is considered legacy. We
recommend using instead the native Keras format, e.g.
`model.save('my_model.keras')` or `keras.saving.save_model(model,
'my_model.keras')`.

Current validation accuracy: 0.914893627166748
Reseting all weights…
Current number of trials: 11
['loss', 'compile_metrics']
3/3            0s 9ms/step -
accuracy: 0.9106 - loss: 0.3617
[0.33439356088638306, 0.914893627166748]
3/3            0s 22ms/step
Classification Report:
              precision    recall  f1-score   support

      Female       0.85      0.98      0.91        41
        Male       0.98      0.87      0.92        53

    accuracy                           0.91        94
   macro avg       0.91      0.92      0.91        94
```
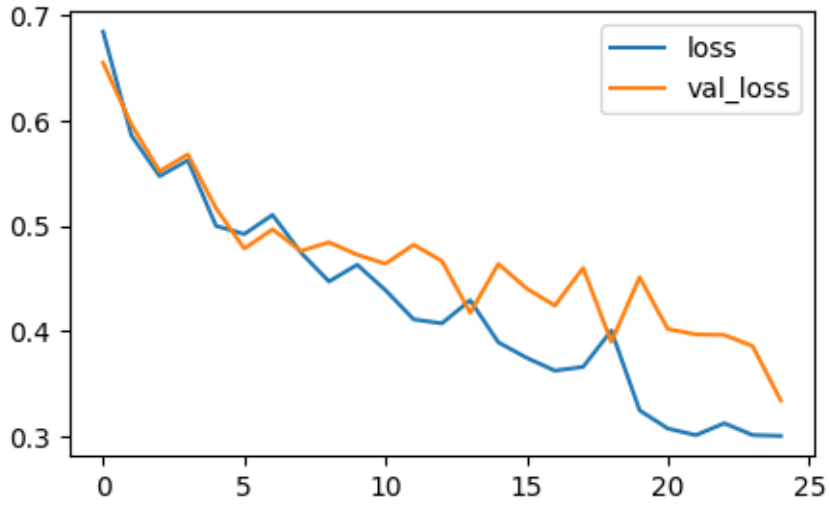
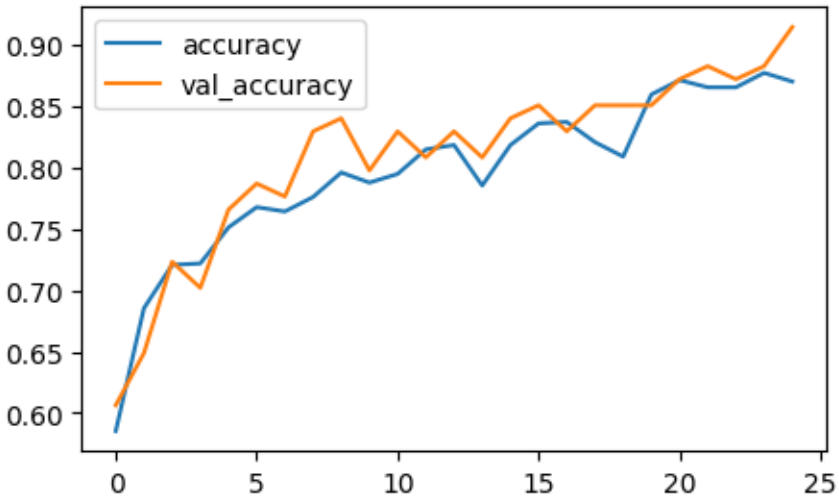

```
weighted avg       0.92      0.91      0.92         94
```





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