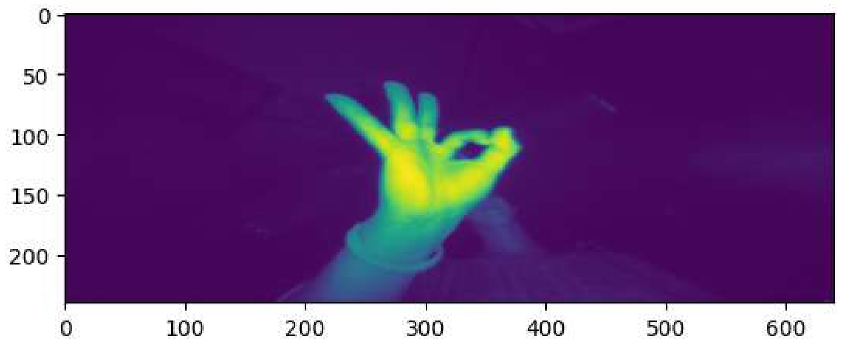
```
import os
import numpy as np
import tensorflow as tf
from tensorflow.keras import layers, models
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from tensorflow.keras.preprocessing.image import ImageDataGenerator

np.random.seed(42)
tf.random.set_seed(42)

IMAGE_SIZE = (128, 128)
BATCH_SIZE = 32
EPOCHS = 10

def load_and_preprocess_data(data_dir):
    datagen = ImageDataGenerator(rescale=1./255, validation_split=0.2)

    train_generator = datagen.flow_from_directory(
        data_dir,
        target_size=IMAGE_SIZE,
        batch_size=BATCH_SIZE,
        class_mode='categorical',
        subset='training'
    )

    validation_generator = datagen.flow_from_directory(
        data_dir,
        target_size=IMAGE_SIZE,
        batch_size=BATCH_SIZE,
        class_mode='categorical',
        subset='validation'
    )

    return train_generator, validation_generator


def create_model(num_classes):
    model = models.Sequential()
    model.add(layers.Conv2D(32, (3, 3), activation='relu', input_shape=(128, 128, 3)))
    model.add(layers.MaxPooling2D((2, 2)))
    model.add(layers.Conv2D(64, (3, 3), activation='relu'))
    model.add(layers.MaxPooling2D((2, 2)))
    model.add(layers.Conv2D(128, (3, 3), activation='relu'))
    model.add(layers.MaxPooling2D((2, 2)))
    model.add(layers.Flatten())
    model.add(layers.Dense(512, activation='relu'))
    model.add(layers.Dense(num_classes, activation='softmax'))

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

    return model

data_dir = '/content/drive/MyDrive/train03'
train_generator, validation_generator = load_and_preprocess_data(data_dir)

num_classes = len(train_generator.class_indices)

model = create_model(num_classes)

history = model.fit(
    train_generator,
    epochs=EPOCHS,
    validation_data=validation_generator
    validation_data=validation_generator
)

model.save('hand_gesture_model.h5')
```

```
Found 108 images belonging to 10 classes.
Found 24 images belonging to 10 classes.
/usr/local/lib/python3.10/dist-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not pass an
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
Epoch 1/10
/usr/local/lib/python3.10/dist-packages/keras/src/trainers/data_adapters/py_dataset_adapter.py:122: UserWarning: You
  self._warn_if_super_not_called()
4/4 ━━━━━━━━━━━━━━━━━━━━ 50s 6s/step - accuracy: 0.0668 - loss: 2.2894 - val_accuracy: 0.4583 - val_loss: 1.9065
Epoch 2/10
4/4 ━━━━━━━━━━━━━━━━━━━━ 39s 1s/step - accuracy: 0.6201 - loss: 1.7103 - val_accuracy: 0.7500 - val_loss: 0.7546
Epoch 3/10
4/4 ━━━━━━━━━━━━━━━━━━━━ 9s 1s/step - accuracy: 0.7068 - loss: 0.6731 - val_accuracy: 0.9583 - val_loss: 0.1113
Epoch 4/10
4/4 ━━━━━━━━━━━━━━━━━━━━ 7s 2s/step - accuracy: 0.9435 - loss: 0.1093 - val_accuracy: 1.0000 - val_loss: 0.0155
Epoch 5/10
4/4 ━━━━━━━━━━━━━━━━━━━━ 8s 1s/step - accuracy: 1.0000 - loss: 0.0161 - val_accuracy: 1.0000 - val_loss: 0.0039
Epoch 6/10
4/4 ━━━━━━━━━━━━━━━━━━━━ 7s 2s/step - accuracy: 1.0000 - loss: 0.0018 - val_accuracy: 1.0000 - val_loss: 0.0026
Epoch 7/10
4/4 ━━━━━━━━━━━━━━━━━━━━ 8s 1s/step - accuracy: 1.0000 - loss: 0.0021 - val_accuracy: 1.0000 - val_loss: 0.0034
Epoch 8/10
4/4 ━━━━━━━━━━━━━━━━━━━━ 7s 2s/step - accuracy: 1.0000 - loss: 0.0013 - val_accuracy: 1.0000 - val_loss: 9.9402e-04
Epoch 9/10
4/4 ━━━━━━━━━━━━━━━━━━━━ 5s 1s/step - accuracy: 1.0000 - loss: 5.4408e-04 - val_accuracy: 1.0000 - val_loss: 1.6305e
Epoch 10/10
4/4 ━━━━━━━━━━━━━━━━━━━━ 5s 1s/step - accuracy: 1.0000 - loss: 1.6416e-04 - val_accuracy: 1.0000 - val_loss: 7.6340e
WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or `keras.saving.save_model(model)`. This
```

```
import numpy as np
from tensorflow.keras.preprocessing import image
from skimage.io import imread
import matplotlib.pyplot as plt

model = tf.keras.models.load_model('hand_gesture_model.h5')

def predict_hand_gesture(image_path):
    img = image.load_img(image_path, target_size=IMAGE_SIZE)
    img_array = image.img_to_array(img)
    img_array = np.expand_dims(img_array, axis=0)
    img_array /= 255.0

    prediction = model.predict(img_array)
    predicted_class = np.argmax(prediction)

    class_labels = list(train_generator.class_indices.keys())
    predicted_gesture = class_labels[predicted_class]

    return predicted_gesture

image_path_to_predict = '/content/drive/MyDrive/train03/ok/frame_09_07_0174.png'
predicted_gesture = predict_hand_gesture(image_path_to_predict)

img=imread(image_path_to_predict)
plt.imshow(img)
plt.show()

print(f"The predicted hand gesture is: {predicted_gesture}")
```

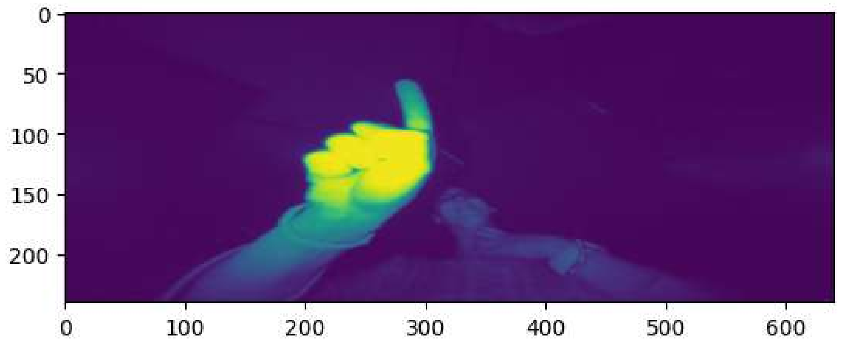
```
WARNING:absl:Compiled the loaded model, but the compiled metrics have yet to be built. `model.compile_metrics` will
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 234ms/step
```



```
The predicted hand gesture is: ok
```

```
image_path_to_predict = '/content/drive/MyDrive/train03/index/frame_09_06_0163.png'
predicted_gesture = predict_hand_gesture(image_path_to_predict)

img=imread(image_path_to_predict)
plt.imshow(img)
plt.show()

print(f"The predicted hand gesture is: {predicted_gesture}")
```

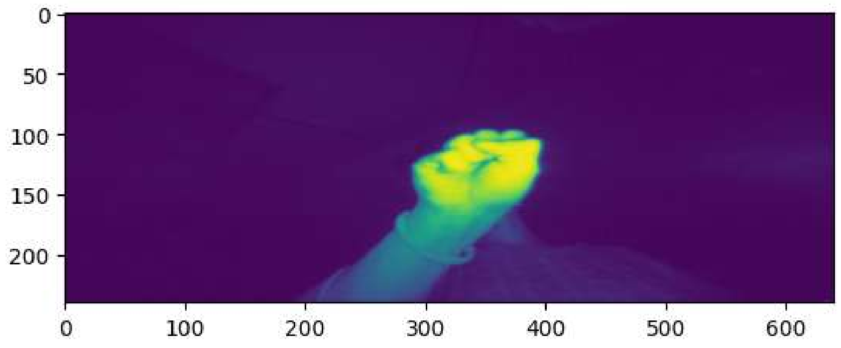
```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 35ms/step
```



```
The predicted hand gesture is: index
```

```
image_path_to_predict = '/content/drive/MyDrive/train03/fist/frame_09_03_0194.png'
predicted_gesture = predict_hand_gesture(image_path_to_predict)

img=imread(image_path_to_predict)
plt.imshow(img)
plt.show()

print(f"The predicted hand gesture is: {predicted_gesture}")
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 33ms/step
```



```
The predicted hand gesture is: fist
```