```
import matplotlib.pyplot as plt
import numpy as np
import PIL
import tensorflow as tf

from tensorflow import keras
from tensorflow.keras import layers
from tensorflow.keras.models import Sequential
import sys
```

Dataset URL -

https://www.kaggle.com/datasets/anshtanwar/jellyfish-types

```
## Mount Google drive folder if running in Colab
if('google.colab' in sys.modules):
    from google.colab import drive
    drive.mount('/content/drive', force_remount = True)
    # Change path below starting from /content/drive/MyDrive/Colab Notebooks/
    # depending on how data is organized inside your Colab Notebooks folder in
    # Google Drive
    DIR = '/content/drive/MyDrive/'
    DATA_DIR = DIR+'/Data/'
else:
    DATA_DIR = 'Data
```

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```
Mounted at /content/drive
```

```
import zipfile

# Specify the path to the uploaded zip file
zip_file_path = "/content/drive/MyDrive/Dataset_For_DL/archive (1).zip"  # Replace with the actual path

# Extract the contents of the zip file
with zipfile.ZipFile(zip_file_path, 'r') as zip_ref:
    zip_ref.extractall("/content/extracted_dataset")  # Specify the extraction directory
```

```
import os
import shutil

# Source directory containing all folders
source_dir = "/content/extracted_dataset"

# Destination directory where folders will be copied
destination_dir = "/content/jelly_fish"

# List of folders to exclude from copying
exclude_folders = ["Train_Test_Valid"]

# Get a list of all folders in the source directory
all_folders = [folder for folder in os.listdir(source_dir) if os.path.isdir(os.path.join(source_dir, folder))]

# Filter out folders to exclude
folders_to_copy = [f Disk: 27.14 GB/107.72 GB _folders if folder not in exclude_folders]

# Copy each folder to the destination directory
for folder in folders_to_copy:
    source_folder = os.path.join(source_dir, folder)
    destination_folder = os.path.join(destination_dir, folder)
    shutil.copytree(source_folder, destination_folder)

print("Folders copied successfully.")
```

```
Folders copied successfully.
```

```
batch_size = 32
img_height = 180
img_width = 180
```

```
data_dir = '/content/jelly_fish'
```

```
train_ds = tf.keras.utils.image_dataset_from_directory(
  data_dir,
  validation_split=0.2,
  subset="training",
  seed=123,
  image_size=(img_height, img_width),
  batch_size=batch_size)
```

```
Found 900 files belonging to 6 classes.
Using 720 files for training.
```

```
val_ds = tf.keras.utils.image_dataset_from_directory(
  data_dir,
  validation_split=0.2,
  subset="validation",
  seed=123,
  image_size=(img_he
  batch_size=batch_s
```

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```
Found 900 files belonging to 6 classes.
Using 180 files for validation.
```

```
class_names = train_ds.class_names
print(class_names)
```

```
['Moon_jellyfish', 'barrel_jellyfish', 'blue_jellyfish', 'compass_jellyfish', 'lions_mane_jellyfish', 'mauve_stinger_jellyfish'
```

```
import matplotlib.pyplot as plt

plt.figure(figsize=(10, 10))
for images, labels in train_ds.take(1):
  for i in range(9):
    ax = plt.subplot(3, 3, i + 1)
    plt.imshow(images[i].numpy().astype("uint8"))
    plt.title(class_names[labels[i]])
    plt.axis("off")
```

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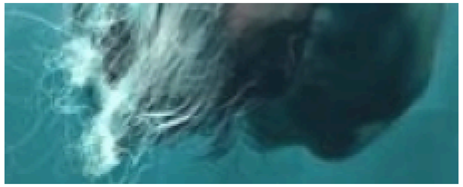
blue_jellyfish
mauve_stinger_jellyfish
mauve_stinger_jellyfish
lions_mane_jellyfish
barrel_jellyfish
compass_jellyfish
Disk: 27.14 GB/107.72 GB
lions_mane_jellyfish
blue_jellyfish
barrel_jellyfish



```
for image_batch, labels_batch in train_ds:
  print(image_batch.shape)
  print(labels_batch.shape)
  break
```

```
(32, 180, 180, 3)
(32,)
```

```
AUTOTUNE = tf.data.AUTOTUNE

train_ds = train_ds.cache().shuffle(1000).prefetch(buffer_size=AUTOTUNE)
val_ds = val_ds.cache().prefetch(buffer_size=AUTOTUNE)
```

```
normalization_layer = layers.Rescaling(1./255)
```

```
normalized_ds = train_ds.map(lambda x, y: (normalization_layer(x), y))
image_batch, labels_batch = next(iter(normalized_ds))
first_image = image_batch[0]
# Notice the pixel v                       `.
print(np.min(first_i                       ge))
```

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```
0.0 0.931723
```

```
import tensorflow as tf
from tensorflow.keras import layers

num_classes = len(class_names)

# Define the input shape based on img_height and img_width
# Define the input shape based on img_height and img_width
# img_height = 180
# img_width = 180
input_shape = (img_height, img_width, 3)

# Define the input layer with the specified shape
inputs = tf.keras.Input(shape=input_shape)

# Preprocessing layer: Rescaling
x = layers.Rescaling(1./255)(inputs)

# Convolutional layers
x = layers.Conv2D(32, 3, activation='relu')(x)
x = layers.MaxPooling2D()(x)
x = layers.Conv2D(32, 3, activation='relu')(x)
x = layers.MaxPooling2D()(x)
x = layers.Conv2D(32, 3, activation='relu')(x)
x = layers.MaxPooling2D()(x)

# Flatten layer
x = layers.Flatten()(x)

# Dense layers
x = layers.Dense(128, activation='relu')(x)

# Output layer
outputs = layers.Dense(num_classes)(x)

# Create the model
model = tf.keras.Model(inputs=inputs, outputs=outputs)

# Display the model summary
model.summary()
```

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```
Model: "model"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
```

```
=================================================================
 input_1 (InputLayer)        [(None, 180, 180, 3)]     0

 rescaling_1 (Rescaling)     (None, 180, 180, 3)       0

 conv2d (Conv2D)             (None, 178, 178, 32)      896

 max_pooling2d (MaxPooling2  (None, 89, 89, 32)        0
 D)

 conv2d_1 (Conv2D)           (None, 87, 87, 32)        9248

 max_pooling2d_1 (MaxPoolin  (None, 43, 43, 32)        0
 g2D)

 conv2d_2 (Conv2D)           (None, 41, 41, 32)        9248

 max_pooling2d_2 (MaxPoolin  (None, 20, 20, 32)        0
 g2D)

 flatten (Flatten)           (None, 12800)             0

 dense (Dense)               (None, 128)               1638528

 dense_1 (Dense)             (None, 6)                 774

=================================================================
Total params: 1658694 (6.33 MB)
Trainable params: 1658694 (6.33 MB)
Non-trainable p
_________________________________________________________________
```

Disk: 27.14 GB/107.72 GB

```
model.compile(optimizer='adam',
              loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),
              metrics=['accuracy'])
```

```
model.summary()
```

```
Model: "model"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 input_1 (InputLayer)        [(None, 180, 180, 3)]     0         
                                                                 
 rescaling_1 (Rescaling)     (None, 180, 180, 3)       0         
                                                                 
 conv2d (Conv2D)             (None, 178, 178, 32)      896       
                                                                 
 max_pooling2d (MaxPooling2  (None, 89, 89, 32)        0         
 D)                                                              
                                                                 
 conv2d_1 (Conv2D)           (None, 87, 87, 32)        9248      
                                                                 
 max_pooling2d_1 (MaxPoolin  (None, 43, 43, 32)        0         
 g2D)                                                            
                                                                 
 conv2d_2 (Conv2D)           (None, 41, 41, 32)        9248      
                                                                 
 max_pooling2d_2 (MaxPoolin  (None, 20, 20, 32)        0         
 g2D)                                                            
                                                                 
 flatten (Flatten)           (None, 12800)             0         
                                                                 
 dense (Dense)               (None, 128)               1638528   
                                                                 
 dense_1 (Dense)             (None, 6)                 774       
                                                                 
===============                        ==========================
Total params: 1
Trainable params: 1658694 (6.33 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

Disk: 27.14 GB/107.72 GB

```
epochs=10
history = model.fit(
  train_ds,
  validation_data=val_ds,
  epochs=epochs
)
```

```
Epoch 1/10
23/23 [==============================] - 32s 1s/step - loss: 1.7208 - accuracy: 0.2306 - val_loss: 1.5384 - val_accuracy: 0.361
Epoch 2/10
23/23 [==============================] - 28s 1s/step - loss: 1.3920 - accuracy: 0.4264 - val_loss: 1.3235 - val_accuracy: 0.488
Epoch 3/10
23/23 [==============================] - 38s 2s/step - loss: 1.1900 - accuracy: 0.5417 - val_loss: 1.2761 - val_accuracy: 0.461
Epoch 4/10
23/23 [==============================] - 32s 1s/step - loss: 0.9293 - accuracy: 0.6264 - val_loss: 1.1163 - val_accuracy: 0.544
Epoch 5/10
23/23 [==============================] - 31s 1s/step - loss: 0.6983 - accuracy: 0.7347 - val_loss: 1.1139 - val_accuracy: 0.611
Epoch 6/10
23/23 [==============================] - 29s 1s/step - loss: 0.5596 - accuracy: 0.7972 - val_loss: 1.2533 - val_accuracy: 0.588
Epoch 7/10
23/23 [==============================] - 31s 1s/step - loss: 0.4446 - accuracy: 0.8431 - val_loss: 1.1026 - val_accuracy: 0.622
Epoch 8/10
23/23 [==============================] - 33s 1s/step - loss: 0.4066 - accuracy: 0.8625 - val_loss: 1.2268 - val_accuracy: 0.616
Epoch 9/10
23/23 [==============================] - 30s 1s/step - loss: 0.2540 - accuracy: 0.9194 - val_loss: 1.2472 - val_accuracy: 0.672
Epoch 10/10
23/23 [==============================] - 29s 1s/step - loss: 0.1607 - accuracy: 0.9583 - val_loss: 1.1454 - val_accuracy: 0.694
```

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```
    acc = history.history['accuracy']
    val_acc = history.history['val_accuracy']

    loss = history.history['loss']
    val_loss = history.history['val_loss']

    epochs_range = range(epochs)

    plt.figure(figsize=(8, 8))
    plt.subplot(1, 2, 1)
    plt.plot(epochs_range, acc, label='Training Accuracy')
    plt.plot(epochs_range, val_acc, label='Validation Accuracy')
    plt.legend(loc='lower right')
    plt.title('Training and Validation Accuracy')

    plt.subplot(1, 2, 2)
    plt.plot(epochs_range, loss, label='Training Loss')
    plt.plot(epochs_range, val_loss, label='Validation Loss')
    plt.legend(loc='upper right')
    plt.title('Training and Validation Loss')
    plt.show()
```

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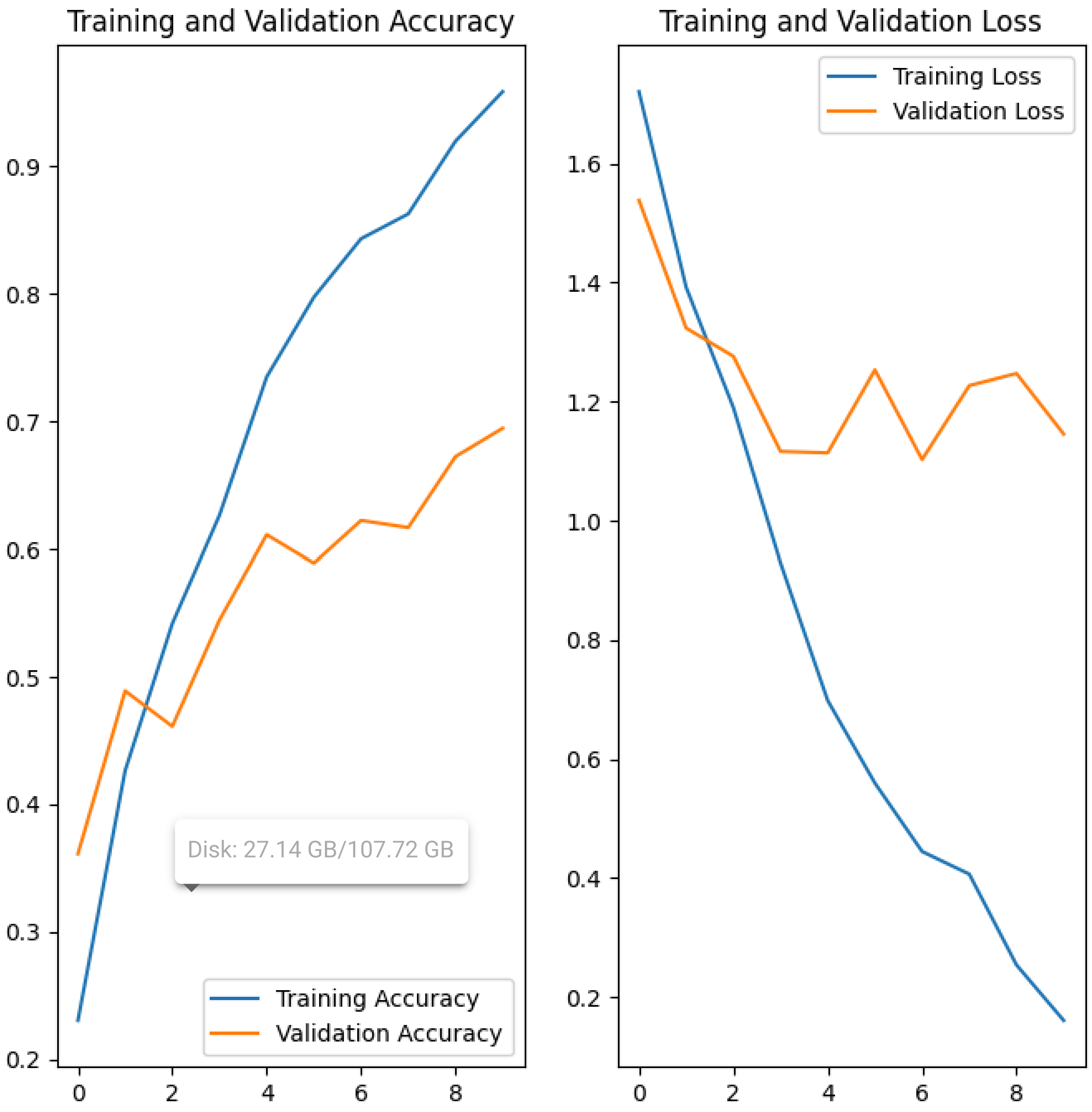
Training and Validation Accuracy
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0
2
4
6
8
Training Accuracy
Validation Accuracy
Disk: 27.14 GB/107.72 GB
Training and Validation Loss
Training Loss
Validation Loss
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
2
4
6
8

```
inputs = tf.keras.Input(shape=(img_height, img_width, 3))

# Data augmentation layers
x = layers.RandomFlip("horizontal")(inputs)
x = layers.RandomRotation(0.1)(x)
x = layers.RandomZoom(0.1)(x)

# Create a model using the input and output layers
data_augmentation_model = tf.keras.Model(inputs=inputs, outputs=x)

# Display the model summary
data_augmentation_model.summary()
```

```
Model: "model_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 input_2 (InputLayer)        [(None, 180, 180, 3)]     0         
                                                                 
 random_flip (RandomFlip)    (None, 180, 180, 3)       0         
                                                                 
 random_rotation (RandomRot  (None, 180, 180, 3)       0         
 ation)                                                          
                                                                 
 random_zoom (RandomZoom)    (None, 180, 180, 3)       0         
                                                                 
=================================================================
Total params: 0 (0.00 Byte)
Trainable param
Non-trainable p
_________________________________________________________________
```

Disk: 27.14 GB/107.72 GB

```
    plt.figure(figsize=(10, 10))
    for images, _ in train_ds.take(1):
      for i in range(9):
        augmented_images = data_augmentation_model(images)
        ax = plt.subplot(3, 3, i + 1)
        plt.imshow(augmented_images[0].numpy().astype("uint8"))
        plt.axis("off")
```

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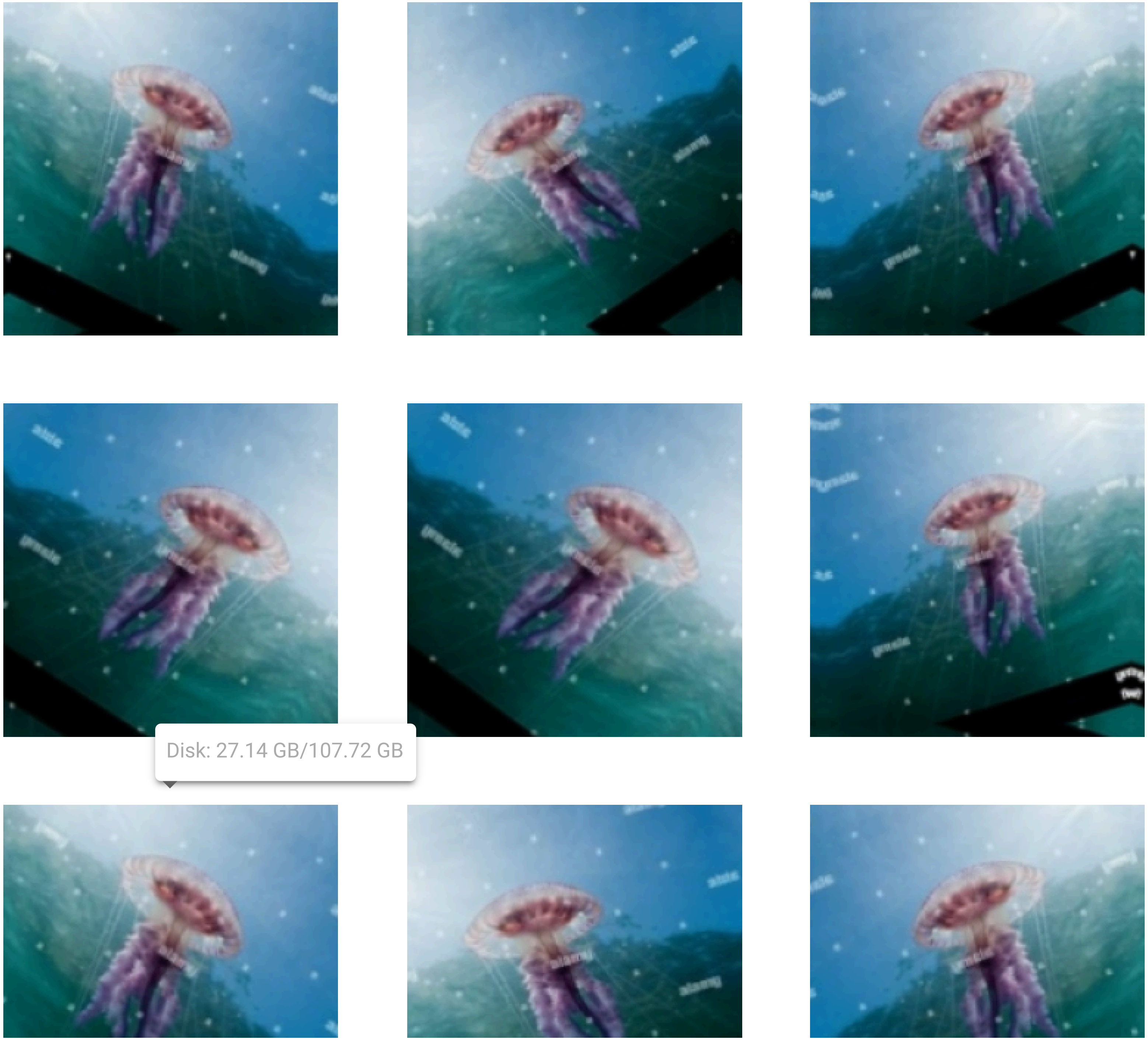
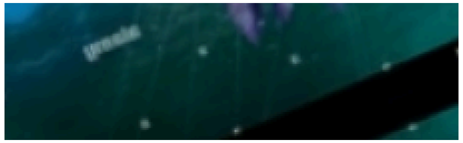


Disk: 27.14 GB/107.72 GB



Disk: 27.14 GB/107.72 GB

```
inputs = tf.keras.Input(shape=(img_height, img_width, 3))

# Data augmentation layers
x = layers.RandomFlip("horizontal")(inputs)
x = layers.RandomRotation(0.1)(x)
x = layers.RandomZoom(0.1)(x)

x = layers.Rescaling(1./255)(x)

# Convolutional layers
x = layers.Conv2D(16, 3, padding='same', activation='relu')(x)
x = layers.MaxPooling2D()(x)
x = layers.Conv2D(32, 3, padding='same', activation='relu')(x)
x = layers.MaxPooling2D()(x)
x = layers.Conv2D(64, 3, padding='same', activation='relu')(x)
x = layers.MaxPooling2D()(x)

# Dropout layer
x = layers.Dropout(0.2)(x)

# Flatten layer
x = layers.Flatten()(x)

# Dense layers
x = layers.Dense(128, activation='relu')(x)

# Output layer
outputs = layers.Den Disk: 27.14 GB/107.72 GB ion='softmax', name="outputs")(x)

# Create the model
model = tf.keras.Model(inputs=inputs, outputs=outputs)

# Display the model summary
model.summary()
```

```
Model: "model_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
```

```
=================================================================
 input_3 (InputLayer)        [(None, 180, 180, 3)]     0

 random_flip_1 (RandomFlip)  (None, 180, 180, 3)       0

 random_rotation_1 (RandomR  (None, 180, 180, 3)       0
 otation)

 random_zoom_1 (RandomZoom)  (None, 180, 180, 3)       0

 rescaling_2 (Rescaling)     (None, 180, 180, 3)       0

 conv2d_3 (Conv2D)           (None, 180, 180, 16)      448

 max_pooling2d_3 (MaxPoolin  (None, 90, 90, 16)        0
 g2D)

 conv2d_4 (Conv2D)           (None, 90, 90, 32)        4640

 max_pooling2d_4 (MaxPoolin  (None, 45, 45, 32)        0
 g2D)

 conv2d_5 (Conv2D)           (None, 45, 45, 64)        18496

 max_pooling2d_5 (MaxPoolin  (None, 22, 22, 64)        0
 g2D)

 dropout (Dropout)           (None, 22, 22, 64)        0

 flatten_1 (Fla                   976)                 0
                Disk: 27.14 GB/107.72 GB
 dense_2 (Dense)             (None, 128)               3965056

 outputs (Dense)             (None, 6)                 774

=================================================================
Total params: 3989414 (15.22 MB)
Trainable params: 3989414 (15.22 MB)
Non-trainable params: 0 (0.00 Byte)
```

```
model.compile(optimizer='adam',
              loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),
              metrics=['accuracy'])


model.summary()
```

```
Model: "model_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 input_3 (InputLayer)        [(None, 180, 180, 3)]     0         
                                                                 
 random_flip_1 (RandomFlip)  (None, 180, 180, 3)       0         
                                                                 
 random_rotation_1 (RandomR  (None, 180, 180, 3)       0         
 otation)                                                        
                                                                 
 random_zoom_1 (RandomZoom)  (None, 180, 180, 3)       0         
                                                                 
 rescaling_2 (Rescaling)     (None, 180, 180, 3)       0         
                                                                 
 conv2d_3 (Conv2D)           (None, 180, 180, 16)      448       
                                                                 
 max_pooling2d_3 (MaxPoolin  (None, 90, 90, 16)        0         
 g2D)                                                            
                                                                 
 conv2d_4 (Conv Disk: 27.14 GB/107.72 GB ), 90, 32)    4640      
                                                                 
 max_pooling2d_4 (MaxPoolin  (None, 45, 45, 32)        0         
 g2D)                                                            
                                                                 
 conv2d_5 (Conv2D)           (None, 45, 45, 64)        18496     
                                                                 
 max_pooling2d_5 (MaxPoolin  (None, 22, 22, 64)        0         
 g2D)                                                            
                                                                 
 dropout (Dropout)           (None, 22, 22, 64)        0         
 flatten_1 (Flatten)         (None, 30976)             0

 dense_2 (Dense)             (None, 128)               3965056

 outputs (Dense)             (None, 6)                 774

=================================================================
Total params: 3989414 (15.22 MB)
Trainable params: 3989414 (15.22 MB)
Non-trainable params: 0 (0.00 Byte)
_________________________________________________________________
```

```
epochs = 15
history = model.fit(
  train_ds,
```

Disk: 27.14 GB/107.72 GB