Kelompok 5

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-- Mengimport Library yang di Perlukan

In [1]:
```
import matplotlib.pyplot as plt
import numpy as np
import PIL
import tensorflow as tf
import tensorflow_datasets as tfds
from tensorflow import keras
from keras import layers
from keras.models import Sequential
import pathlib
from google.colab import drive
import os
import matplotlib.pyplot as plt
import zipfile, os
import shutil
```

Mengekstrak folder tujuan dari Google Drive serta Membaca Folder Konten (folder tujuan) yang ada di Google Drive

In [2]:
```
drive.mount('/content/drive')
```
```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

In [3]:
```
# ekstrak

local_zip = '/content/drive/MyDrive/DATAMINING/datasets.zip'
zip_ref = zipfile.ZipFile(local_zip, 'r')
zip_ref.extractall('/content')
zip_ref.close()
```

Membaca data path folder dan file tujuan kedalam var base_dir (base directory)

In [4]:
```
base_dir = '/content/datasets'
```

Membaca path directory dari var sebelumnya menggunakan syntax pathlib dan dimasukkan kedalam var data_dir (data directory)

In [5]:
```
data_dir = pathlib.Path(base_dir)
```

Menghitung banyaknya gambar berekstensi jpg pada folder datasets

In [6]:
```
image_count = len(list(data_dir.glob('*/*.jpg')))
print(image_count)
```
```
3000
```

Mengklasifikasikan berbagai kelas yang terdapat pada folder datasets

In [7]:
```
list_dir = [os.path.basename(x) for x in data_dir.iterdir() if x.is_dir()]
print("Jumlah class: {} ".format(len(list_dir)))
print("Jumlah instance per class")
for x in list_dir:
 print("{} = {} ".format(x,len(list(data_dir.glob('{}/*.jpg'.format(x))))))
```
```
Jumlah class: 6
Jumlah instance per class
Ruby = 500
Fake_Emerald = 500
Emerald = 500
Fake_Ruby = 500
Fake_Turquoise = 500
Turquoise = 500
```

Menampilkan data dalam bentuk image pada indeks pertama[0]

In [8]:
```
visual_img = list(data_dir.glob('Ruby/*'))
PIL.Image.open(str(visual_img[0]))
```

Out[8]:

Menentukan Ukuran tinggi dan lebar gambar serta ukuran batch

In [9]:
```
batch_size = 34
img_height = 200
img_width = 200
# 32 - 180 34 200 36 220
```

Menyiapkan data training dengan mengambil 0.7 atau 70% dari data asli

In [10]:
```
train_ds = tf.keras.utils.image_dataset_from_directory(
 data_dir,
 validation_split=0.7,
 subset="training",
 seed=123,
 image_size=(img_height, img_width),
 batch_size=batch_size)
```
```
Found 3000 files belonging to 6 classes.
Using 900 files for training.
```

Menyiapkan data validasi dengan mengambil 0.1 atau 10% dari data validasi

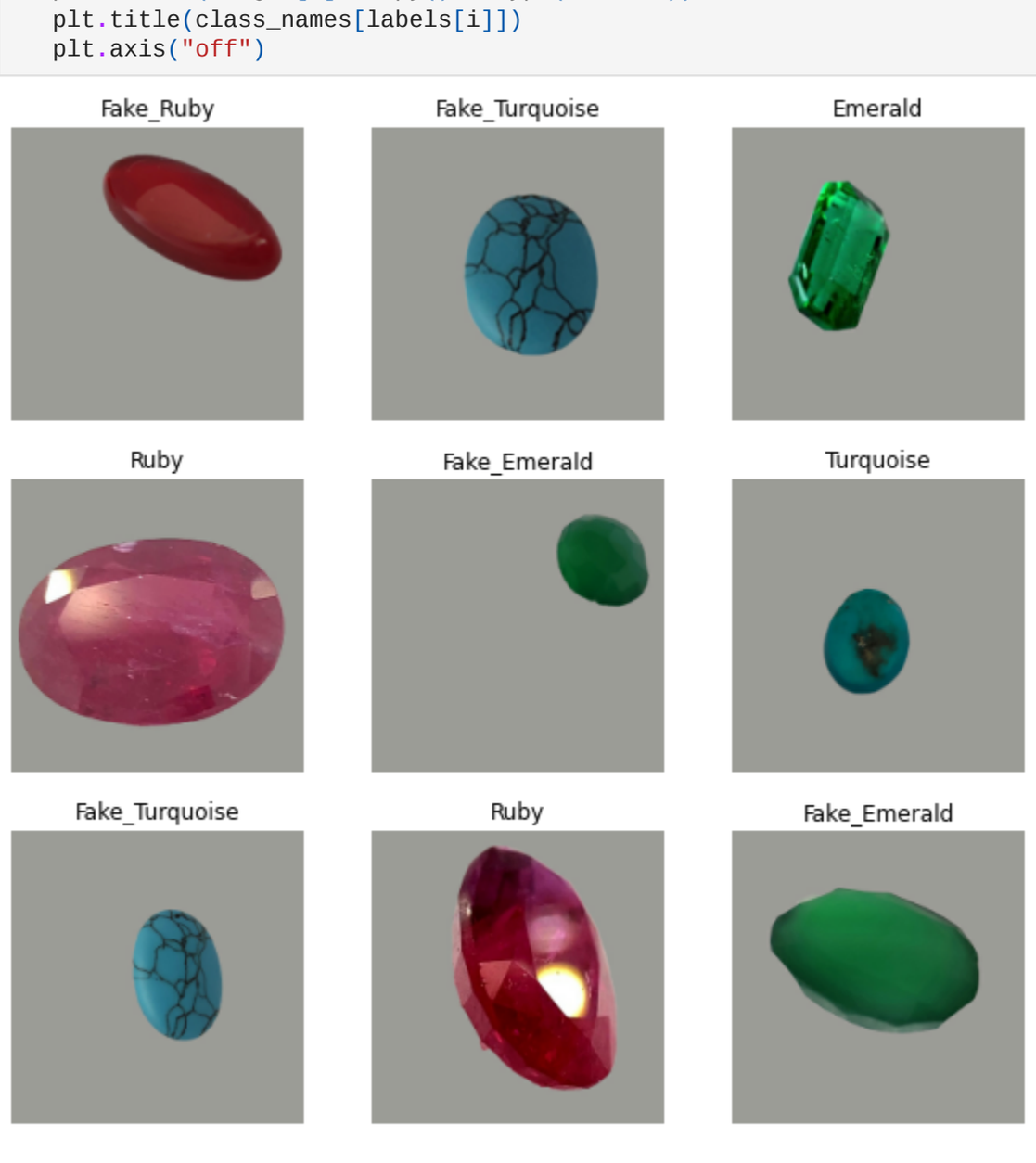
In [11]:
```
val_ds = tf.keras.utils.image_dataset_from_directory(
 data_dir,
 validation_split=0.2,
 subset="validation",
 seed=123,
 image_size=(img_height, img_width),
 batch_size=batch_size)
```
```
Found 3000 files belonging to 6 classes.
Using 600 files for validation.
```

Memasukkan nama - nama kelas kedalam var serta Menampilkan nama nama kelas

In [12]:
```
class_names = train_ds.class_names
print(class_names)
```
```
['Emerald', 'Fake_Emerald', 'Fake_Ruby', 'Fake_Turquoise', 'Ruby', 'Turquoise']
```

Menampilkan preview dataset training

In [13]:
```
# lihat dataset training

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) # 3 baris, 3 kolom
   plt.imshow(images[i].numpy().astype("uint8"))
   plt.title(class_names[labels[i]])
   plt.axis("off")
```



Memperlihatkan shape untuk data train

In [14]:
```
for image_batch, labels_batch in train_ds:
 print(image_batch.shape)
 print(labels_batch.shape)
 break
```
```
(34, 200, 200, 3)
(34,)
```

Set cache buffer untuk meningkatkan efisiensi training

In [15]:
```
AUTOTUNE = tf.data.AUTOTUNE

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

Normalisasi nilai rgb dari 0-255 menjadi 0-1

In [16]:
```
# normalisasi nilai RGB
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]
# nilai dari [0 sd 255] menjadi [0 sd 1]
print(np.min(first_image), np.max(first_image))
```
```
0.0 1.0
```

Membuat arsitektur deep learning

In [17]:
```
num_classes = len(class_names)

model = Sequential([
 layers.Rescaling(1./255, input_shape=(img_height, img_width, 3)),
 layers.Conv2D(16, 3, padding='same', activation='relu'),
 layers.MaxPooling2D(),
 layers.Conv2D(32, 3, padding='same', activation='relu'),
 layers.MaxPooling2D(),
 layers.Conv2D(64, 3, padding='same', activation='relu'),
 layers.MaxPooling2D(),
 layers.Flatten(),
 layers.Dense(128, activation='relu'),
 layers.Dense(num_classes)
])
```

Compile model

In [18]:
```
model.compile(optimizer='adam',
          loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),
           metrics=['accuracy'])
```

Memperlihatkan arsitektur neural network

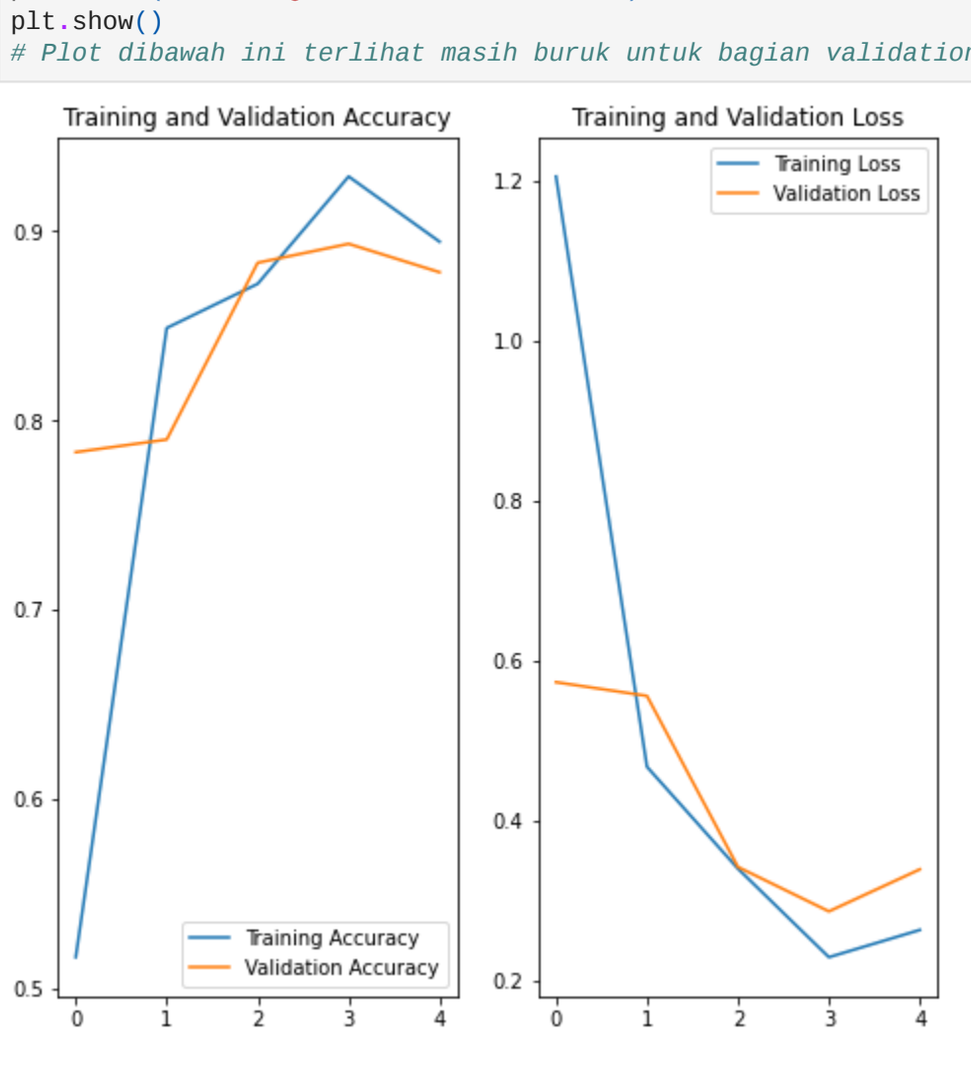
In [19]:
```
model.summary()
```
```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 rescaling_1 (Rescaling)     (None, 200, 200, 3)       0

 conv2d (Conv2D)             (None, 200, 200, 16)      448

 max_pooling2d (MaxPooling2D  (None, 100, 100, 16)     0
 )

 conv2d_1 (Conv2D)           (None, 100, 100, 32)      4640

 max_pooling2d_1 (MaxPooling  (None, 50, 50, 32)       0
 2D)

 conv2d_2 (Conv2D)           (None, 50, 50, 64)        18496

 max_pooling2d_2 (MaxPooling  (None, 25, 25, 64)       0
 2D)

 flatten (Flatten)           (None, 40000)             0

 dense (Dense)               (None, 128)               5120128

 dense_1 (Dense)             (None, 6)                 774

=================================================================
Total params: 5,144,486
Trainable params: 5,144,486
Non-trainable params: 0
_________________________________________________________________
```

Memproses data train

In [20]:
```
# Memproses data train yang sudah kita model sebelumnya
epochs= 5
history = model.fit(
 train_ds,
 validation_data=val_ds,
 epochs=epochs
)
```
```
Epoch 1/5
27/27 [==============================] - 8s 93ms/step - loss: 1.2054 - accuracy: 0.5167 - val_loss: 0.5726 - val_accuracy: 0.7833
Epoch 2/5
27/27 [==============================] - 1s 37ms/step - loss: 0.4667 - accuracy: 0.8489 - val_loss: 0.5554 - val_accuracy: 0.7900
Epoch 3/5
27/27 [==============================] - 1s 35ms/step - loss: 0.3392 - accuracy: 0.8722 - val_loss: 0.3413 - val_accuracy: 0.8833
Epoch 4/5
27/27 [==============================] - 1s 35ms/step - loss: 0.2284 - accuracy: 0.9289 - val_loss: 0.2858 - val_accuracy: 0.8933
Epoch 5/5
27/27 [==============================] - 1s 36ms/step - loss: 0.2625 - accuracy: 0.8944 - val_loss: 0.3384 - val_accuracy: 0.8783
```

Membuat plot dari hasil proses train sebelumnya, untuk memperjelas

In [21]:
```
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()
# Plot dibawah ini terlihat masih buruk untuk bagian validation
```

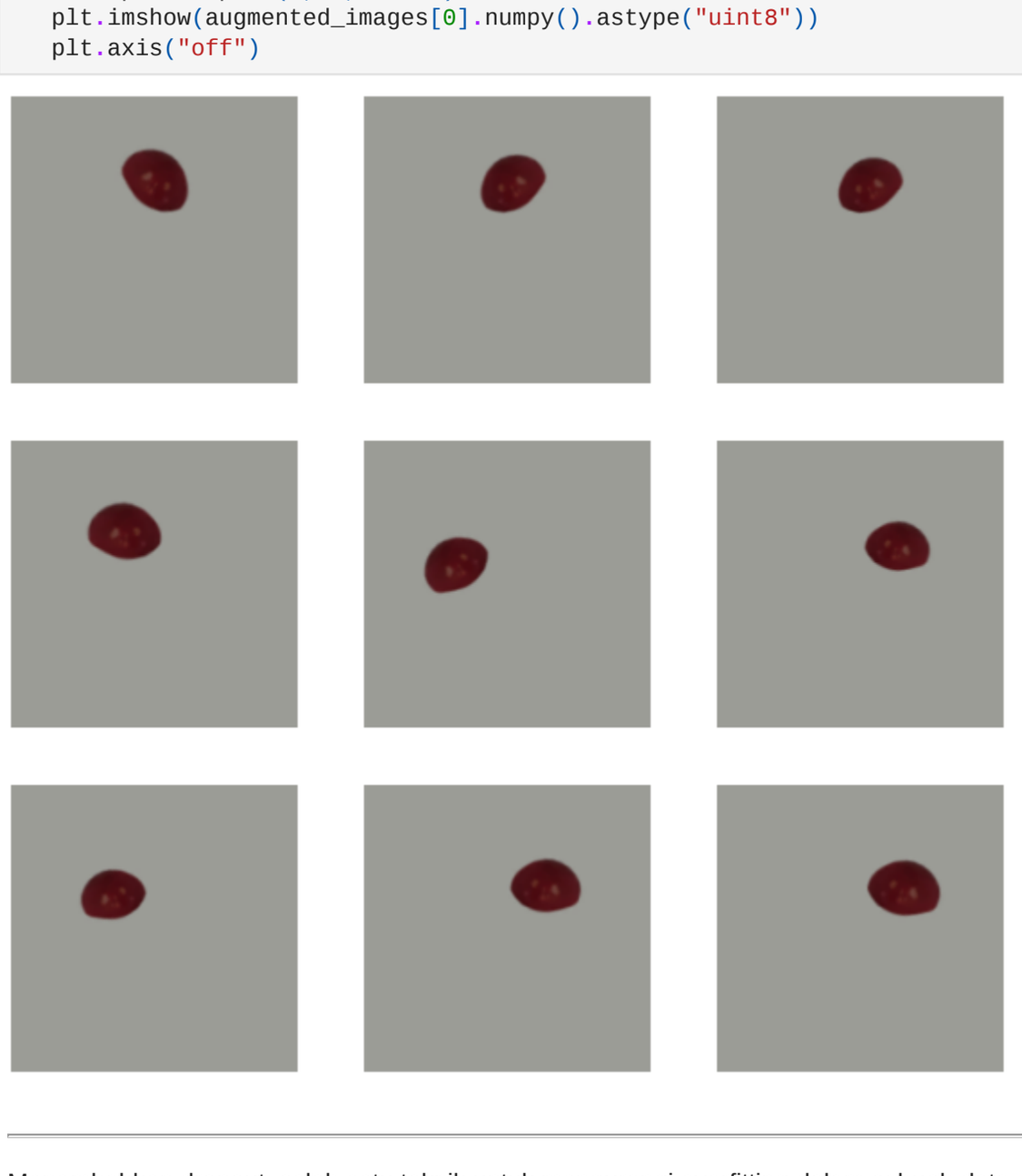


Mengatasi data overfitting yaitu dengan mengaugmentasi data training

In [22]:
```
data_augmentation = keras.Sequential(
 [
   layers.RandomFlip("horizontal",
                     input_shape=(img_height,
                                  img_width,
                                  3)),
   layers.RandomRotation(0.1),
   layers.RandomZoom(0.1),
 ]
)
```

Test data sebelumnya berupa visual gambar

In [23]:
```
plt.figure(figsize=(10, 10))
for images, _ in train_ds.take(1):
 for i in range(9):
   augmented_images = data_augmentation(images)
   ax = plt.subplot(3, 3, i + 1)
   plt.imshow(augmented_images[0].numpy().astype("uint8"))
   plt.axis("off")
```



Menambahkan dropout, salah satu teknik untuk mengurangi overfitting dalam sebuah data

In [24]:
```
model = Sequential([
 data_augmentation,
 layers.Rescaling(1./255),
 layers.Conv2D(16, 3, padding='same', activation='relu'),
 layers.MaxPooling2D(),
 layers.Conv2D(32, 3, padding='same', activation='relu'),
 layers.MaxPooling2D(),
 layers.Conv2D(64, 3, padding='same', activation='relu'),
 layers.MaxPooling2D(),
 layers.Dropout(0.2),
 layers.Flatten(),
 layers.Dense(128, activation='relu'),
 layers.Dense(num_classes, name="outputs")
])
```

Compile kembali model Arsitektur CNN yang sudah dibuat

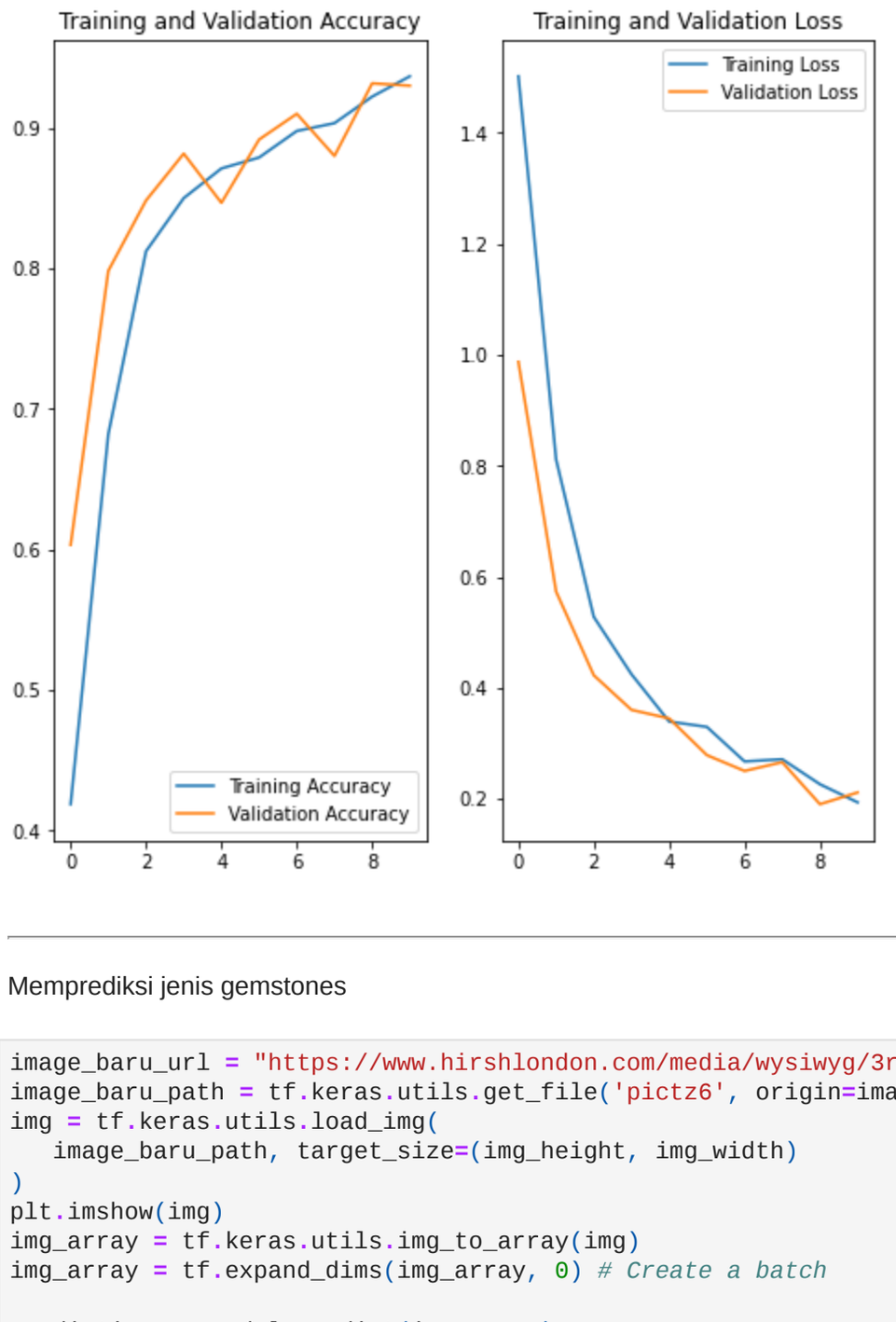
In [25]:
```
model.compile(optimizer='adam',
           loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),
           metrics=['accuracy'])
```

Lakukan kembali proses train

In [26]:
```
epochs = 10
history = model.fit(
 train_ds,
 validation_data=val_ds,
 epochs=epochs
)
```
```
Epoch 1/10
27/27 [==============================] - 3s 61ms/step - loss: 1.5016 - accuracy: 0.4189 - val_loss: 0.9873 - val_accuracy: 0.6033
Epoch 2/10
27/27 [==============================] - 1s 54ms/step - loss: 0.8112 - accuracy: 0.6822 - val_loss: 0.5733 - val_accuracy: 0.7983
Epoch 3/10
27/27 [==============================] - 1s 53ms/step - loss: 0.5277 - accuracy: 0.8122 - val_loss: 0.4226 - val_accuracy: 0.8483
Epoch 4/10
27/27 [==============================] - 1s 51ms/step - loss: 0.4244 - accuracy: 0.8500 - val_loss: 0.3602 - val_accuracy: 0.8817
Epoch 5/10
27/27 [==============================] - 1s 53ms/step - loss: 0.3392 - accuracy: 0.8711 - val_loss: 0.3449 - val_accuracy: 0.8467
Epoch 6/10
27/27 [==============================] - 1s 53ms/step - loss: 0.3296 - accuracy: 0.8789 - val_loss: 0.2787 - val_accuracy: 0.8917
Epoch 7/10
27/27 [==============================] - 1s 52ms/step - loss: 0.2674 - accuracy: 0.8978 - val_loss: 0.2502 - val_accuracy: 0.9100
Epoch 8/10
27/27 [==============================] - 1s 54ms/step - loss: 0.2713 - accuracy: 0.9033 - val_loss: 0.2660 - val_accuracy: 0.8800
Epoch 9/10
27/27 [==============================] - 1s 54ms/step - loss: 0.2263 - accuracy: 0.9222 - val_loss: 0.1904 - val_accuracy: 0.9317
Epoch 10/10
27/27 [==============================] - 1s 54ms/step - loss: 0.1936 - accuracy: 0.9367 - val_loss: 0.2115 - val_accuracy: 0.9300
```

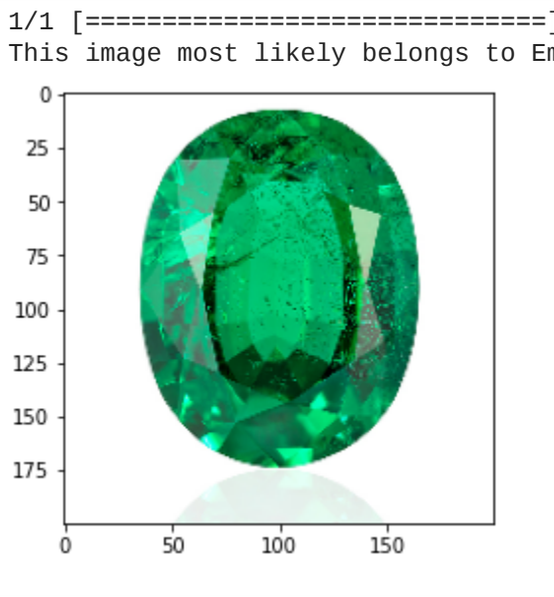
Tampilkan kembali plot dari hasil proses train sebelumnya untuk mengetahui perbedaan dari model awal dan model sekarang

In [27]:
```
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()
```



Memprediksi jenis gemstones

In [28]:
```
image_baru_url = "https://www.hirshlondon.com/media/wysiwyg/3reasons/emerald-largercopy.jpg"
image_baru_path = tf.keras.utils.get_file('pictz6', origin=image_baru_url)
img = tf.keras.utils.load_img(
   image_baru_path, target_size=(img_height, img_width)
)
plt.imshow(img)
img_array = tf.keras.utils.img_to_array(img)
img_array = tf.expand_dims(img_array, 0) # Create a batch

predictions = model.predict(img_array)
score = tf.nn.softmax(predictions[0])

print(
   "This image most likely belongs to {} with a {:.2f} percent confidence."
   .format(class_names[np.argmax(score)], 100 * np.max(score))
)
```
```
1/1 [==============================] - 0s 136ms/step
This image most likely belongs to Emerald with a 100.00 percent confidence.
```



In [29]:
```
image_baru_url = "
image_baru_path = tf.keras.utils.get_file('pictr1', origin=image_baru_url)
img = tf.keras.utils.load_img(
   image_baru_path, target_size=(img_height, img_width)
)
plt.imshow(img)
img_array = tf.keras.utils.img_to_array(img)
img_array = tf.expand_dims(img_array, 0) # Create a batch

predictions = model.predict(img_array)
score = tf.nn.softmax(predictions[0])

print(
   "This image most likely belongs to {} with a {:.2f} percent confidence."
   .format(class_names[np.argmax(score)], 100 * np.max(score))
)
```
```
1/1 [==============================] - 0s 16ms/step
This image most likely belongs to Ruby with a 100.00 percent confidence.
```