Potato Disease Classification - CNN

In [4]:
```
import tensorflow as tf
from tensorflow import keras
from tensorflow.keras import models, layers
import matplotlib.pyplot as plt
```

In [5]:
```
Image_Size = 256
Batch_size = 32
```

In [6]:
```
dataset = tf.keras.preprocessing.image_dataset_from_directory(
    "./dataset/PlantVillage",
    shuffle=True,
    image_size=(Image_Size,Image_Size),
    batch_size=Batch_size
)
```

```
Found 2152 files belonging to 3 classes.
```

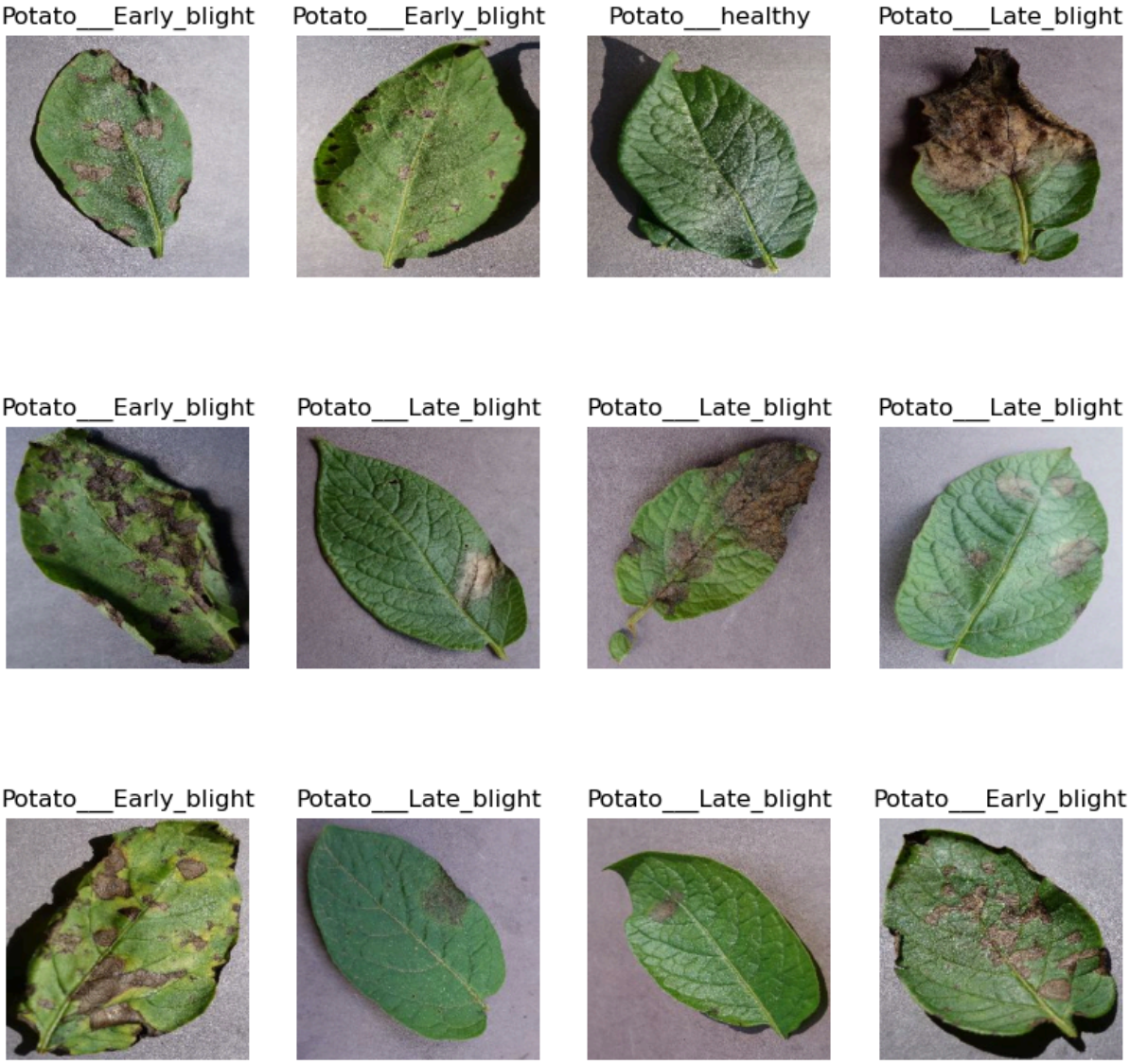
In [7]:
```
class_names = dataset.class_names
class_names
```

Out[7]:
```
['Potato___Early_blight', 'Potato___Late_blight', 'Potato___healthy']
```

In [8]:
```
len(dataset)
```

Out[8]:
```
68
```

In [9]:
```
plt.figure(figsize=(10,10))
for image_batch,label in dataset.take(1).as_numpy_iterator():
    for i in range(12):
        plt.subplot(3,4,i+1)
        plt.imshow(image_batch[i].astype('uint8'))
        plt.axis("off")
        plt.title(class_names[int(label[i])])
```



In [10]:
```
len(dataset)
```

Out[10]: 68

In [11]:
```
train_size = len(dataset)*0.8
train_size
```

Out[11]: 54.400000000000006

In [12]:
```
train_ds = dataset.take(54)
test_ds = dataset.skip(54)
```

In [13]:
```
len(train_ds)
```

Out[13]: 54

In [14]:
```
len(test_ds)
```

Out[14]: 14

In [15]:
```
val_size = 0.1
len(dataset)*val_size
```

Out[15]:
```
6.800000000000001
```

In [16]:
```
val_ds = test_ds.take(6)
test_ds = test_ds.skip(6)
```

In [17]:
```
len(val_ds)
```

Out[17]:
```
6
```

In [18]:
```
len(dataset) == len(val_ds) + len(train_ds) + len(test_ds)
```

Out[18]:
```
True
```

In [19]:
```
import math
```

In [20]:
```
def get_data_Partitions(ds, train_split=0.8,test_split=0.1,val_split=0.1,shuffle =

    if shuffle == True:
        ds = ds.shuffle(shuffle_size, seed=12)

    train_size = math.floor(len(ds)*train_split)
    train_ds = ds.take(train_size)
    test_ds = ds.skip(train_size)
    val_size = math.floor(len(ds)*val_split)
    val_ds = test_ds.take(val_size)
    test_ds = test_ds.skip(val_size)



    return train_ds, test_ds,val_ds
```

In [21]:
```
train_ds, test_ds,val_ds = get_data_Partitions(dataset)
```

In [22]:
```
len(dataset) == len(train_ds)+ len(test_ds)+len(val_ds)
```

Out[22]:
```
True
```

In [23]:
```
len(train_ds)
```

Out[23]:
```
54
```

In [24]:
```
len(test_ds)
```

Out[24]:
```
8
```

In [25]:
```
len(val_ds)
```

Out[25]:
```
6
```

In [26]:
```
train_ds=train_ds.cache().shuffle(1000).prefetch(buffer_size=tf.data.AUTOTUNE)
test_ds=test_ds.cache().shuffle(1000).prefetch(buffer_size=tf.data.AUTOTUNE)
val_ds=val_ds.cache().shuffle(1000).prefetch(buffer_size=tf.data.AUTOTUNE)
```

In [27]:
```
resize_and_rescale = tf.keras.Sequential([
    layers.Resizing(Batch_size,Image_Size,Image_Size,3),
    layers.Rescaling(1.0/255),
])
```

In [28]:
```
data_augmentation = resize_and_rescale = tf.keras.Sequential([
    layers.RandomFlip("horizontal_and_vertical"),
    layers.RandomRotation(0.2),
])
```

CNN Model

In [29]:
```
input_shape = (Batch_size,Image_Size,Image_Size,3)
model = keras.Sequential(
    [
    resize_and_rescale,
    data_augmentation,
    layers.Conv2D(32, (3,3), activation='relu', input_shape=input_shape),
    layers.MaxPooling2D((2,2)),
    layers.Conv2D(64, kernel_size=(3,3), activation='relu'),
    layers.MaxPooling2D((2,2)),
    layers.Conv2D(64, kernel_size=(3,3), activation='relu'),
    layers.MaxPooling2D((2,2)),
    layers.Conv2D(64, kernel_size=(3,3), activation='relu'),
    layers.MaxPooling2D((2,2)),
    layers.Conv2D(64, kernel_size=(3,3), activation='relu'),
    layers.MaxPooling2D((2,2)),
    layers.Conv2D(64, kernel_size=(3,3), activation='relu'),
    layers.MaxPooling2D((2,2)),
    layers.Flatten(),
    layers.Dense(64,activation='relu'),
    layers.Dense(3,activation='softmax'),
]
)
```

```
C:\Anaconda3\Lib\site-packages\keras\src\layers\convolutional\base_conv.py:113: User
Warning: Do not pass an `input_shape`/`input_dim` argument to a layer. When using Se
quential models, prefer using an `Input(shape)` object as the first layer in the mod
el instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
```

In [30]:
```
model.build(input_shape=input_shape)
```

In [31]:
```
model.summary()
```

Model: "sequential_2"

Layer (type)	Output Shape	Param #
sequential_1 (Sequential)	(32, 256, 256, 3)	0
sequential_1 (Sequential)	(32, 256, 256, 3)	0
conv2d (Conv2D)	(32, 254, 254, 32)	896
max_pooling2d (MaxPooling2D)	(32, 127, 127, 32)	0
conv2d_1 (Conv2D)	(32, 125, 125, 64)	18,496
max_pooling2d_1 (MaxPooling2D)	(32, 62, 62, 64)	0
conv2d_2 (Conv2D)	(32, 60, 60, 64)	36,928
max_pooling2d_2 (MaxPooling2D)	(32, 30, 30, 64)	0
conv2d_3 (Conv2D)	(32, 28, 28, 64)	36,928
max_pooling2d_3 (MaxPooling2D)	(32, 14, 14, 64)	0
conv2d_4 (Conv2D)	(32, 12, 12, 64)	36,928
max_pooling2d_4 (MaxPooling2D)	(32, 6, 6, 64)	0
conv2d_5 (Conv2D)	(32, 4, 4, 64)	36,928
max_pooling2d_5 (MaxPooling2D)	(32, 2, 2, 64)	0
flatten (Flatten)	(32, 256)	0
dense (Dense)	(32, 64)	16,448
dense_1 (Dense)	(32, 3)	195

Total params: 183,747 (717.76 KB)

Trainable params: 183,747 (717.76 KB)

Non-trainable params: 0 (0.00 B)

In [32]:
```
model.compile(
    optimizer='adam',
    loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=False),
    metrics=['accuracy']
)
```

In [34]:
```
history = model.fit(train_ds,epochs=20,batch_size=Batch_size,verbose=1,validation_d
```

```
Epoch 1/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 24s 435ms/step - accuracy: 0.7311 - loss: 0.6226 - val_ac
curacy: 0.8177 - val_loss: 0.3969
Epoch 2/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 28s 513ms/step - accuracy: 0.8178 - loss: 0.4308 - val_ac
curacy: 0.7656 - val_loss: 0.6190
Epoch 3/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 25s 464ms/step - accuracy: 0.8603 - loss: 0.3387 - val_ac
curacy: 0.8177 - val_loss: 0.5231
Epoch 4/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 24s 443ms/step - accuracy: 0.9099 - loss: 0.2151 - val_ac
curacy: 0.8333 - val_loss: 0.4226
Epoch 5/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 24s 446ms/step - accuracy: 0.8786 - loss: 0.2926 - val_ac
curacy: 0.8646 - val_loss: 0.3842
Epoch 6/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 23s 431ms/step - accuracy: 0.9374 - loss: 0.1706 - val_ac
curacy: 0.9427 - val_loss: 0.1784
Epoch 7/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 24s 447ms/step - accuracy: 0.9132 - loss: 0.2241 - val_ac
curacy: 0.9219 - val_loss: 0.1845
Epoch 8/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 23s 428ms/step - accuracy: 0.9385 - loss: 0.1630 - val_ac
curacy: 0.9219 - val_loss: 0.1713
Epoch 9/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 22s 404ms/step - accuracy: 0.9331 - loss: 0.1757 - val_ac
curacy: 0.9583 - val_loss: 0.1234
Epoch 10/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 22s 416ms/step - accuracy: 0.9400 - loss: 0.1633 - val_ac
curacy: 0.9010 - val_loss: 0.2751
Epoch 11/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 22s 409ms/step - accuracy: 0.9276 - loss: 0.2140 - val_ac
curacy: 0.8958 - val_loss: 0.3610
Epoch 12/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 22s 411ms/step - accuracy: 0.9573 - loss: 0.1182 - val_ac
curacy: 0.9531 - val_loss: 0.1833
Epoch 13/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 22s 411ms/step - accuracy: 0.9394 - loss: 0.1435 - val_ac
curacy: 0.9479 - val_loss: 0.1299
Epoch 14/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 22s 408ms/step - accuracy: 0.9647 - loss: 0.1043 - val_ac
curacy: 0.9844 - val_loss: 0.0649
Epoch 15/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 22s 405ms/step - accuracy: 0.9608 - loss: 0.1023 - val_ac
curacy: 0.9062 - val_loss: 0.3076
Epoch 16/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 22s 401ms/step - accuracy: 0.9609 - loss: 0.1053 - val_ac
curacy: 0.9219 - val_loss: 0.2890
Epoch 17/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 22s 406ms/step - accuracy: 0.9740 - loss: 0.0819 - val_ac
curacy: 0.9479 - val_loss: 0.1874
Epoch 18/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 22s 410ms/step - accuracy: 0.9674 - loss: 0.0817 - val_ac
curacy: 0.9219 - val_loss: 0.3039
Epoch 19/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 22s 405ms/step - accuracy: 0.9663 - loss: 0.0813 - val_ac
```

```
curacy: 0.9531 - val_loss: 0.1383
Epoch 20/20
54/54 ━━━━━━━━━━━━━━━━━━━━ 24s 451ms/step - accuracy: 0.9820 - loss: 0.0532 - val_ac
curacy: 0.9323 - val_loss: 0.1534
```

In [35]:
```
model.evaluate(test_ds)
```

```
8/8 ━━━━━━━━━━━━━━━━━━━━ 2s 86ms/step - accuracy: 0.9038 - loss: 0.2415
```

Out[35]:
```
[0.2003180980682373, 0.92578125]
```

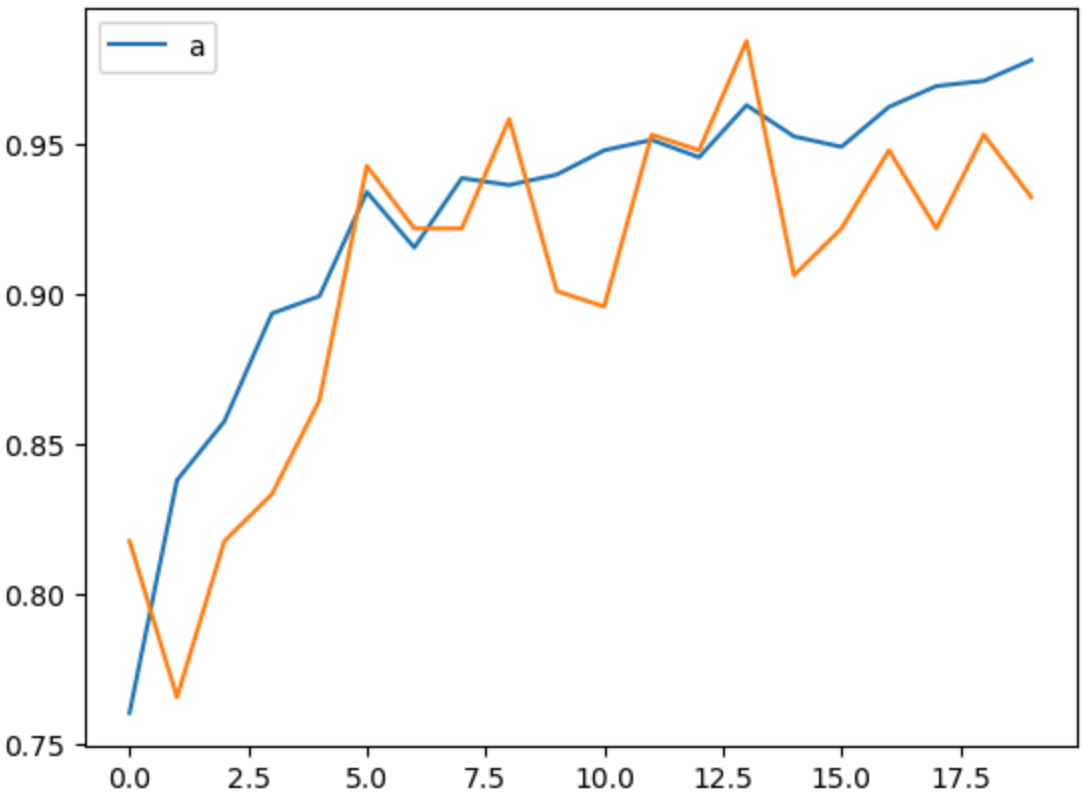
In [36]:
```
history.params
```

Out[36]:
```
{'verbose': 1, 'epochs': 20, 'steps': 54}
```

In [37]:
```
history.history.keys()
```

Out[37]:
```
dict_keys(['accuracy', 'loss', 'val_accuracy', 'val_loss'])
```

In [38]:
```
plt.plot(history.history['accuracy'])
plt.legend('accuracy')
plt.plot(history.history['val_accuracy'])
plt.show()
```



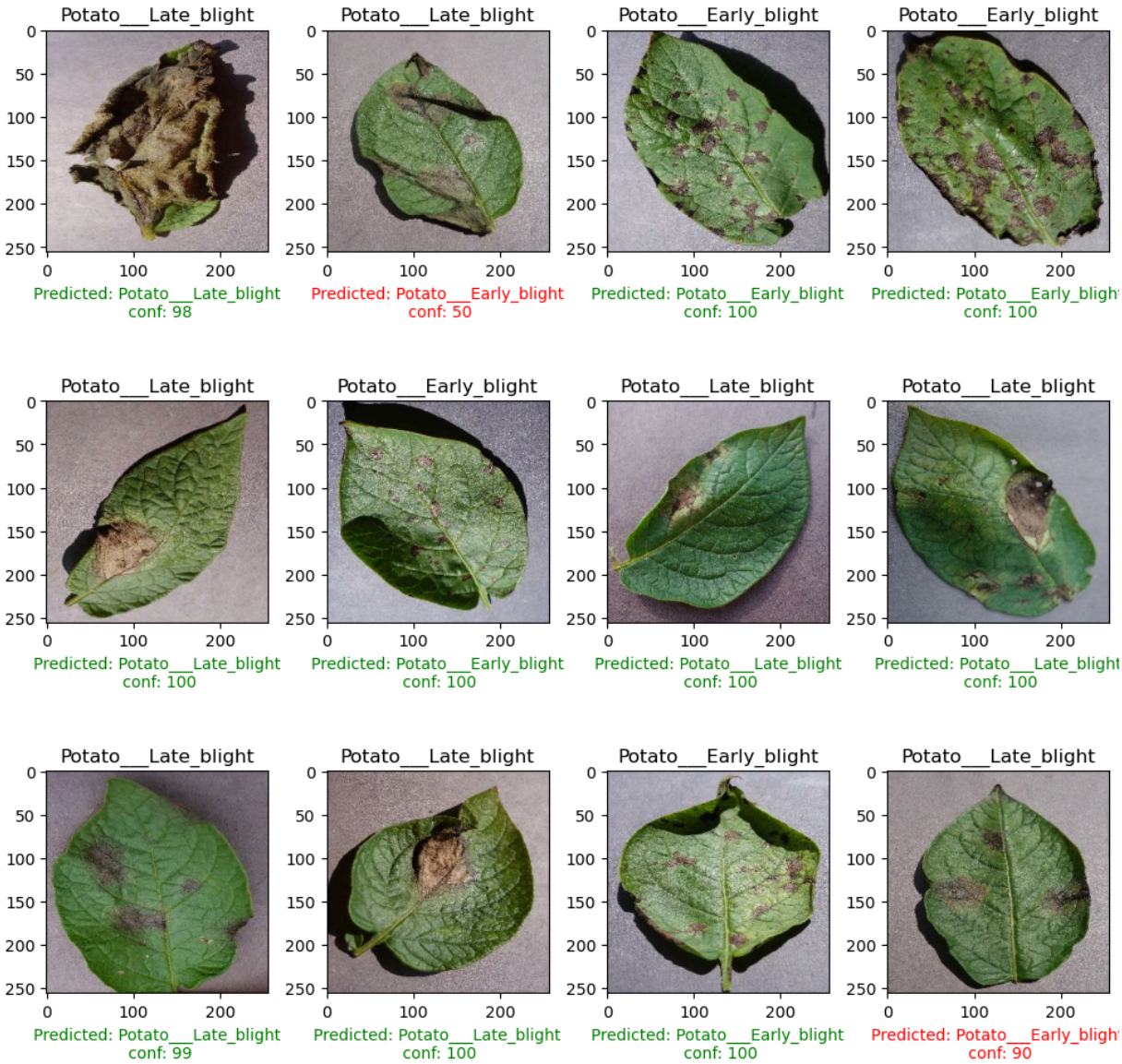
In [39]:
```
import numpy as np
```

In [40]:
```
plt.figure(figsize=(10,10))
for image,label in test_ds.take(1).as_numpy_iterator():
    preds = model.predict(image)
    pred_classes = [np.argmax(i) for i in preds]
    for i in range(12):
```

```
        plt.subplot(3,4,i+1)
        plt.title(class_names[label[i]] )
        plt.imshow(image[i].astype('uint8'))
        if label[i]==pred_classes[i]:
            color = "Green"
        else:
            color = "Red"

        plt.xlabel("Predicted: "+class_names[pred_classes[i]]+"\n conf: "+str(round
    plt.tight_layout()
```

```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 241ms/step
```



In [ ]:
```
model_version = 3
model.save(f"../models/{model_version}.h5")
```

In [44]:
```
model1 = tf.keras.models.load_model("../models/1.h5")
model2 = tf.keras.models.load_model("../models/2.h5")
model3= tf.keras.models.load_model("../models/3.h5")
```

```
WARNING:absl:Compiled the loaded model, but the compiled metrics have yet to be buil
t. `model.compile_metrics` will be empty until you train or evaluate the model.
WARNING:absl:Compiled the loaded model, but the compiled metrics have yet to be buil
t. `model.compile_metrics` will be empty until you train or evaluate the model.
WARNING:absl:Compiled the loaded model, but the compiled metrics have yet to be buil
t. `model.compile_metrics` will be empty until you train or evaluate the model.
```

In [ ]:
```
# Export to TensorFlow Serving format
tf.saved_model.save(model1, "models/1/")
tf.saved_model.save(model2, "models/2/")
tf.saved_model.save(model3, "models/3/")
```

In [ ]:
```

```