NHAN DIEN NGUOI

May 14, 2022

[ ]:
```
# Sử dụng các thư viện sau để train mô hình
from sklearn.model_selection import train_test_split
import matplotlib.pyplot as plt
import numpy as np
import pandas as pd
import tensorflow as tf
from keras.utils import np_utils
from keras.models import Sequential
from keras.layers import Dense, Activation, Dropout, Conv2D, MaxPooling2D,␣
↪Flatten
from tensorflow.keras.optimizers import SGD, RMSprop, Adam
from keras.callbacks import EarlyStopping
from sklearn.utils import validation
from sklearn import preprocessing
from tensorflow.keras.utils import to_categorical
from tensorflow.keras.models import load_model
from tensorflow.keras.utils import load_img, img_to_array
from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

[ ]:
```
# Chuyển đến file Google Drive chứa bộ ảnh đã tải lên
%cd"/content/drive/MyDrive/Colab Notebooks/BT_AI/NHAN DIEN NGUOI/"
```

```
/content/drive/MyDrive/Colab Notebooks/BT_AI/NHAN DIEN NGUOI
```

[ ]:
```
# Tạo ra class ImageDataGenerator để chỉnh sửa ảnh
train_datagen=ImageDataGenerator(rescale=1./255, shear_range=0.2, zoom_range=0.
↪2, horizontal_flip=True)
```

[ ]:
```
# Tải bộ dữ liệu training set
training_set=train_datagen.flow_from_directory("/content/drive/MyDrive/Colab␣
↪Notebooks/BT_AI/NHAN DIEN NGUOI/Training_set",target_size=(150,150),␣
↪batch_size=32, class_mode='categorical')
```

```
Found 120 images belonging to 3 classes.
```

[ ]:
```
# Tải bộ dữ liệu validation
```

```
validation=train_datagen.flow_from_directory("/content/drive/MyDrive/Colab␣
↪Notebooks/BT_AI/NHAN DIEN NGUOI/Validation",target_size=(150,150),␣
↪batch_size=32, class_mode='categorical')
```

```
Found 18 images belonging to 3 classes.
```

[ ]:
```
# Xem các nhãn có trong bộ dữ liệu training set
training_set.class_indices
```

[ ]:
```
{'DUOC': 0, 'GIANG': 1, 'TRIEN': 2}
```

[ ]:
```
# Xem các nhãn có trong bộ dữ liệu validation
validation.class_indices
```

[ ]:
```
{'DUOC': 0, 'GIANG': 1, 'TRIEN': 2}
```

[ ]:
```
# Tạo mô hình
model=Sequential()
# Tích chập 32 lần với mỗi lần là 3 hàng 3 cột
model.add(Conv2D(32,(3,3), activation='relu', kernel_initializer='he_uniform',␣
↪padding='same',input_shape=(150,150,3)))
model.add(Conv2D(32,(3,3), activation='relu', kernel_initializer='he_uniform',␣
↪padding='same'))
# Lấy phần tử lớn nhất ở trong 2 hàng và 2 cột
model.add(MaxPooling2D(2,2))
# Tích chập 64 lần với mỗi lần là 3 hàng 3 cột
model.add(Conv2D(64,(3,3), activation='relu', kernel_initializer='he_uniform',␣
↪padding='same'))
model.add(Conv2D(64,(3,3), activation='relu', kernel_initializer='he_uniform',␣
↪padding='same'))
# Lấy phần tử lớn nhất ở trong 2 hàng và 2 cột
model.add(MaxPooling2D(2,2))
# Tích chập 128 lần với mỗi lần là 3 hàng 3 cột
model.add(Conv2D(128,(3,3), activation='relu', kernel_initializer='he_uniform',␣
↪padding='same'))
model.add(Conv2D(128,(3,3), activation='relu', kernel_initializer='he_uniform',␣
↪padding='same'))
# Lấy phần tử lớn nhất ở trong 2 hàng và 2 cột
model.add(MaxPooling2D(2,2))
# Duỗi thẳng dữ liệu
model.add(Flatten())
# Tạo lớp ẩn thứ nhất với 128 tín hiệu ra
model.add(Dense(128,activation='relu',kernel_initializer='he_uniform'))
model.add(Dropout(0.2))
# Tạo lớp ẩn thứ hai với 3 tín hiệu ra
model.add(Dense(3,activation='softmax'))
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d (Conv2D)             (None, 150, 150, 32)      896

 conv2d_1 (Conv2D)           (None, 150, 150, 32)      9248

 max_pooling2d (MaxPooling2D  (None, 75, 75, 32)       0
 )

 conv2d_2 (Conv2D)           (None, 75, 75, 64)        18496

 conv2d_3 (Conv2D)           (None, 75, 75, 64)        36928

 max_pooling2d_1 (MaxPooling  (None, 37, 37, 64)       0
 2D)

 conv2d_4 (Conv2D)           (None, 37, 37, 128)       73856

 conv2d_5 (Conv2D)           (None, 37, 37, 128)       147584

 max_pooling2d_2 (MaxPooling  (None, 18, 18, 128)      0
 2D)

 flatten (Flatten)           (None, 41472)             0

 dense (Dense)               (None, 128)               5308544

 dropout (Dropout)           (None, 128)               0

 dense_1 (Dense)             (None, 3)                 387

=================================================================
Total params: 5,595,939
Trainable params: 5,595,939
Non-trainable params: 0
_________________________________________________________________
```

[ ]:
```
# Biên dịch mô hình
model.
 ↪compile(optimizer='adam',loss='categorical_crossentropy',metrics=['accuracy'])
#Train mô hình với 100 lần học (epochs), mỗi lần học 50 dữ liệu (batch_size),␣
 ↪khi sai số không thay đổi trong 70 lần học thì sẽ␣ dừng việc train
history=model.fit(training_set,epochs=500,batch_size=50,verbose=1,␣
 ↪validation_data=validation, callbacks=[EarlyStopping(monitor='val_loss',␣
 ↪patience=70)])
```

```
Epoch 1/500
4/4 [==============================] - 49s 10s/step - loss: 9.5841 - accuracy:
0.3417 - val_loss: 1.0349 - val_accuracy: 0.3333
Epoch 2/500
4/4 [==============================] - 3s 824ms/step - loss: 1.0482 - accuracy:
0.4000 - val_loss: 0.8978 - val_accuracy: 0.5556
Epoch 3/500
4/4 [==============================] - 3s 821ms/step - loss: 0.8057 - accuracy:
0.6250 - val_loss: 0.6096 - val_accuracy: 0.7778
Epoch 4/500
4/4 [==============================] - 3s 819ms/step - loss: 0.5387 - accuracy:
0.7583 - val_loss: 0.6315 - val_accuracy: 0.7778
Epoch 5/500
4/4 [==============================] - 3s 817ms/step - loss: 0.2423 - accuracy:
0.9333 - val_loss: 0.3073 - val_accuracy: 0.9444
Epoch 6/500
4/4 [==============================] - 3s 810ms/step - loss: 0.1199 - accuracy:
0.9667 - val_loss: 0.5202 - val_accuracy: 0.8889
Epoch 7/500
4/4 [==============================] - 3s 817ms/step - loss: 0.1303 - accuracy:
0.9583 - val_loss: 0.2891 - val_accuracy: 0.8889
Epoch 8/500
4/4 [==============================] - 3s 812ms/step - loss: 0.0763 - accuracy:
0.9833 - val_loss: 0.2223 - val_accuracy: 0.9444
Epoch 9/500
4/4 [==============================] - 3s 814ms/step - loss: 0.0474 - accuracy:
0.9917 - val_loss: 0.2098 - val_accuracy: 0.9444
Epoch 10/500
4/4 [==============================] - 3s 898ms/step - loss: 0.0418 - accuracy:
0.9833 - val_loss: 0.1330 - val_accuracy: 0.9444
Epoch 11/500
4/4 [==============================] - 3s 827ms/step - loss: 0.0288 - accuracy:
0.9833 - val_loss: 0.0753 - val_accuracy: 0.9444
Epoch 12/500
4/4 [==============================] - 3s 869ms/step - loss: 0.0454 - accuracy:
0.9750 - val_loss: 0.1005 - val_accuracy: 0.9444
Epoch 13/500
4/4 [==============================] - 3s 883ms/step - loss: 0.0267 - accuracy:
0.9917 - val_loss: 0.2709 - val_accuracy: 0.8889
Epoch 14/500
4/4 [==============================] - 3s 818ms/step - loss: 0.0104 - accuracy:
1.0000 - val_loss: 0.1374 - val_accuracy: 0.9444
Epoch 15/500
4/4 [==============================] - 3s 872ms/step - loss: 0.0063 - accuracy:
1.0000 - val_loss: 0.0984 - val_accuracy: 0.9444
Epoch 16/500
4/4 [==============================] - 3s 889ms/step - loss: 0.0207 - accuracy:
0.9917 - val_loss: 0.0695 - val_accuracy: 0.9444
```

```
Epoch 17/500
4/4 [==============================] - 3s 807ms/step - loss: 0.0081 - accuracy:
1.0000 - val_loss: 0.1124 - val_accuracy: 0.9444
Epoch 18/500
4/4 [==============================] - 3s 816ms/step - loss: 0.0033 - accuracy:
1.0000 - val_loss: 0.0746 - val_accuracy: 0.9444
Epoch 19/500
4/4 [==============================] - 3s 811ms/step - loss: 2.8018e-04 -
accuracy: 1.0000 - val_loss: 0.0170 - val_accuracy: 1.0000
Epoch 20/500
4/4 [==============================] - 3s 813ms/step - loss: 4.0767e-04 -
accuracy: 1.0000 - val_loss: 0.0144 - val_accuracy: 1.0000
Epoch 21/500
4/4 [==============================] - 3s 791ms/step - loss: 0.0438 - accuracy:
0.9833 - val_loss: 0.6166 - val_accuracy: 0.8889
Epoch 22/500
4/4 [==============================] - 3s 798ms/step - loss: 0.0165 - accuracy:
0.9917 - val_loss: 0.1135 - val_accuracy: 0.9444
Epoch 23/500
4/4 [==============================] - 3s 878ms/step - loss: 0.1535 - accuracy:
0.9750 - val_loss: 0.2592 - val_accuracy: 0.8889
Epoch 24/500
4/4 [==============================] - 3s 811ms/step - loss: 0.0576 - accuracy:
0.9833 - val_loss: 0.2158 - val_accuracy: 0.8889
Epoch 25/500
4/4 [==============================] - 3s 823ms/step - loss: 0.0070 - accuracy:
1.0000 - val_loss: 0.3083 - val_accuracy: 0.8889
Epoch 26/500
4/4 [==============================] - 3s 866ms/step - loss: 0.0139 - accuracy:
0.9917 - val_loss: 0.0377 - val_accuracy: 1.0000
Epoch 27/500
4/4 [==============================] - 3s 879ms/step - loss: 0.0040 - accuracy:
1.0000 - val_loss: 0.2242 - val_accuracy: 0.9444
Epoch 28/500
4/4 [==============================] - 3s 818ms/step - loss: 0.0082 - accuracy:
0.9917 - val_loss: 0.0541 - val_accuracy: 0.9444
Epoch 29/500
4/4 [==============================] - 3s 867ms/step - loss: 0.0667 - accuracy:
0.9750 - val_loss: 0.0038 - val_accuracy: 1.0000
Epoch 30/500
4/4 [==============================] - 3s 816ms/step - loss: 0.0490 - accuracy:
0.9750 - val_loss: 0.3983 - val_accuracy: 0.8889
Epoch 31/500
4/4 [==============================] - 3s 799ms/step - loss: 0.0224 - accuracy:
0.9917 - val_loss: 0.4612 - val_accuracy: 0.8889
Epoch 32/500
4/4 [==============================] - 3s 872ms/step - loss: 0.0127 - accuracy:
0.9917 - val_loss: 0.0543 - val_accuracy: 1.0000
```

```
Epoch 33/500
4/4 [==============================] - 3s 806ms/step - loss: 0.0020 - accuracy:
1.0000 - val_loss: 0.0028 - val_accuracy: 1.0000
Epoch 34/500
4/4 [==============================] - 3s 804ms/step - loss: 0.0061 - accuracy:
1.0000 - val_loss: 0.0187 - val_accuracy: 1.0000
Epoch 35/500
4/4 [==============================] - 3s 805ms/step - loss: 0.0019 - accuracy:
1.0000 - val_loss: 0.0090 - val_accuracy: 1.0000
Epoch 36/500
4/4 [==============================] - 3s 796ms/step - loss: 0.0026 - accuracy:
1.0000 - val_loss: 0.1771 - val_accuracy: 0.9444
Epoch 37/500
4/4 [==============================] - 3s 798ms/step - loss: 0.0024 - accuracy:
1.0000 - val_loss: 0.0525 - val_accuracy: 0.9444
Epoch 38/500
4/4 [==============================] - 3s 796ms/step - loss: 2.0562e-04 -
accuracy: 1.0000 - val_loss: 0.1917 - val_accuracy: 0.9444
Epoch 39/500
4/4 [==============================] - 3s 821ms/step - loss: 1.9179e-04 -
accuracy: 1.0000 - val_loss: 0.0393 - val_accuracy: 0.9444
Epoch 40/500
4/4 [==============================] - 3s 800ms/step - loss: 1.1046e-04 -
accuracy: 1.0000 - val_loss: 1.6600e-04 - val_accuracy: 1.0000
Epoch 41/500
4/4 [==============================] - 3s 799ms/step - loss: 1.1412e-04 -
accuracy: 1.0000 - val_loss: 5.6217e-04 - val_accuracy: 1.0000
Epoch 42/500
4/4 [==============================] - 3s 817ms/step - loss: 1.6413e-05 -
accuracy: 1.0000 - val_loss: 2.2651e-04 - val_accuracy: 1.0000
Epoch 43/500
4/4 [==============================] - 3s 811ms/step - loss: 2.5798e-05 -
accuracy: 1.0000 - val_loss: 0.0287 - val_accuracy: 1.0000
Epoch 44/500
4/4 [==============================] - 3s 805ms/step - loss: 5.1364e-06 -
accuracy: 1.0000 - val_loss: 2.6498e-04 - val_accuracy: 1.0000
Epoch 45/500
4/4 [==============================] - 3s 808ms/step - loss: 3.5781e-05 -
accuracy: 1.0000 - val_loss: 0.1520 - val_accuracy: 0.9444
Epoch 46/500
4/4 [==============================] - 3s 807ms/step - loss: 3.3779e-05 -
accuracy: 1.0000 - val_loss: 2.2514e-04 - val_accuracy: 1.0000
Epoch 47/500
4/4 [==============================] - 3s 902ms/step - loss: 1.6809e-05 -
accuracy: 1.0000 - val_loss: 1.9621e-04 - val_accuracy: 1.0000
Epoch 48/500
4/4 [==============================] - 3s 884ms/step - loss: 2.3096e-05 -
accuracy: 1.0000 - val_loss: 0.0015 - val_accuracy: 1.0000
```

```
Epoch 49/500
4/4 [==============================] - 3s 820ms/step - loss: 0.0092 - accuracy:
0.9917 - val_loss: 0.0014 - val_accuracy: 1.0000
Epoch 50/500
4/4 [==============================] - 3s 816ms/step - loss: 0.0028 - accuracy:
1.0000 - val_loss: 0.5138 - val_accuracy: 0.9444
Epoch 51/500
4/4 [==============================] - 3s 812ms/step - loss: 0.0360 - accuracy:
0.9667 - val_loss: 0.0084 - val_accuracy: 1.0000
Epoch 52/500
4/4 [==============================] - 3s 818ms/step - loss: 0.0033 - accuracy:
1.0000 - val_loss: 0.1161 - val_accuracy: 0.9444
Epoch 53/500
4/4 [==============================] - 3s 812ms/step - loss: 0.0280 - accuracy:
0.9833 - val_loss: 0.0990 - val_accuracy: 0.9444
Epoch 54/500
4/4 [==============================] - 3s 875ms/step - loss: 0.0048 - accuracy:
1.0000 - val_loss: 0.0283 - val_accuracy: 1.0000
Epoch 55/500
4/4 [==============================] - 3s 870ms/step - loss: 9.9329e-04 -
accuracy: 1.0000 - val_loss: 0.0054 - val_accuracy: 1.0000
Epoch 56/500
4/4 [==============================] - 3s 815ms/step - loss: 0.0022 - accuracy:
1.0000 - val_loss: 0.0672 - val_accuracy: 0.9444
Epoch 57/500
4/4 [==============================] - 3s 869ms/step - loss: 0.0054 - accuracy:
1.0000 - val_loss: 0.0149 - val_accuracy: 1.0000
Epoch 58/500
4/4 [==============================] - 3s 811ms/step - loss: 0.0019 - accuracy:
1.0000 - val_loss: 0.1433 - val_accuracy: 0.9444
Epoch 59/500
4/4 [==============================] - 3s 889ms/step - loss: 7.5553e-04 -
accuracy: 1.0000 - val_loss: 0.0563 - val_accuracy: 0.9444
Epoch 60/500
4/4 [==============================] - 3s 818ms/step - loss: 4.5218e-05 -
accuracy: 1.0000 - val_loss: 0.0052 - val_accuracy: 1.0000
Epoch 61/500
4/4 [==============================] - 3s 813ms/step - loss: 4.1851e-04 -
accuracy: 1.0000 - val_loss: 0.1324 - val_accuracy: 0.9444
Epoch 62/500
4/4 [==============================] - 3s 818ms/step - loss: 5.2588e-04 -
accuracy: 1.0000 - val_loss: 0.0341 - val_accuracy: 1.0000
Epoch 63/500
4/4 [==============================] - 3s 876ms/step - loss: 0.0010 - accuracy:
1.0000 - val_loss: 0.0037 - val_accuracy: 1.0000
Epoch 64/500
4/4 [==============================] - 3s 812ms/step - loss: 1.5767e-04 -
accuracy: 1.0000 - val_loss: 0.1316 - val_accuracy: 0.9444
```

```
Epoch 65/500
4/4 [==============================] - 3s 825ms/step - loss: 1.0414e-04 -
accuracy: 1.0000 - val_loss: 6.6374e-04 - val_accuracy: 1.0000
Epoch 66/500
4/4 [==============================] - 3s 802ms/step - loss: 4.7250e-04 -
accuracy: 1.0000 - val_loss: 0.0147 - val_accuracy: 1.0000
Epoch 67/500
4/4 [==============================] - 3s 817ms/step - loss: 7.5292e-05 -
accuracy: 1.0000 - val_loss: 6.1791e-04 - val_accuracy: 1.0000
Epoch 68/500
4/4 [==============================] - 3s 811ms/step - loss: 3.5288e-05 -
accuracy: 1.0000 - val_loss: 1.9992e-04 - val_accuracy: 1.0000
Epoch 69/500
4/4 [==============================] - 3s 800ms/step - loss: 6.0052e-05 -
accuracy: 1.0000 - val_loss: 0.0450 - val_accuracy: 0.9444
Epoch 70/500
4/4 [==============================] - 3s 877ms/step - loss: 5.7562e-06 -
accuracy: 1.0000 - val_loss: 1.4304e-04 - val_accuracy: 1.0000
Epoch 71/500
4/4 [==============================] - 3s 807ms/step - loss: 4.7825e-05 -
accuracy: 1.0000 - val_loss: 0.0022 - val_accuracy: 1.0000
Epoch 72/500
4/4 [==============================] - 3s 853ms/step - loss: 0.0014 - accuracy:
1.0000 - val_loss: 0.0725 - val_accuracy: 1.0000
Epoch 73/500
4/4 [==============================] - 3s 804ms/step - loss: 8.2541e-04 -
accuracy: 1.0000 - val_loss: 0.0938 - val_accuracy: 0.9444
Epoch 74/500
4/4 [==============================] - 3s 870ms/step - loss: 0.0020 - accuracy:
1.0000 - val_loss: 4.9517e-04 - val_accuracy: 1.0000
Epoch 75/500
4/4 [==============================] - 3s 810ms/step - loss: 3.3351e-05 -
accuracy: 1.0000 - val_loss: 0.2909 - val_accuracy: 0.9444
Epoch 76/500
4/4 [==============================] - 3s 807ms/step - loss: 9.8627e-06 -
accuracy: 1.0000 - val_loss: 0.2040 - val_accuracy: 0.9444
Epoch 77/500
4/4 [==============================] - 3s 820ms/step - loss: 3.3212e-04 -
accuracy: 1.0000 - val_loss: 0.0113 - val_accuracy: 1.0000
Epoch 78/500
4/4 [==============================] - 3s 874ms/step - loss: 6.8308e-05 -
accuracy: 1.0000 - val_loss: 0.0944 - val_accuracy: 0.9444
Epoch 79/500
4/4 [==============================] - 3s 868ms/step - loss: 0.0013 - accuracy:
1.0000 - val_loss: 1.4702e-06 - val_accuracy: 1.0000
Epoch 80/500
4/4 [==============================] - 3s 805ms/step - loss: 9.6757e-07 -
accuracy: 1.0000 - val_loss: 0.2314 - val_accuracy: 0.9444
```

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Epoch 81/500
4/4 [==============================] - 3s 878ms/step - loss: 0.0191 - accuracy:
0.9917 - val_loss: 4.8001e-05 - val_accuracy: 1.0000
Epoch 82/500
4/4 [==============================] - 3s 801ms/step - loss: 6.3079e-04 -
accuracy: 1.0000 - val_loss: 0.4359 - val_accuracy: 0.8889
Epoch 83/500
4/4 [==============================] - 3s 816ms/step - loss: 0.2974 - accuracy:
0.9667 - val_loss: 0.1011 - val_accuracy: 0.9444
Epoch 84/500
4/4 [==============================] - 3s 832ms/step - loss: 2.1551 - accuracy:
0.7750 - val_loss: 0.0013 - val_accuracy: 1.0000
Epoch 85/500
4/4 [==============================] - 3s 806ms/step - loss: 0.3329 - accuracy:
0.9500 - val_loss: 0.1940 - val_accuracy: 0.8889
Epoch 86/500
4/4 [==============================] - 3s 817ms/step - loss: 0.1488 - accuracy:
0.9667 - val_loss: 0.0570 - val_accuracy: 1.0000
Epoch 87/500
4/4 [==============================] - 3s 830ms/step - loss: 0.0516 - accuracy:
0.9750 - val_loss: 0.1202 - val_accuracy: 0.9444
Epoch 88/500
4/4 [==============================] - 3s 813ms/step - loss: 0.0335 - accuracy:
0.9833 - val_loss: 0.1781 - val_accuracy: 0.8889
Epoch 89/500
4/4 [==============================] - 3s 824ms/step - loss: 0.0419 - accuracy:
0.9917 - val_loss: 0.0850 - val_accuracy: 0.9444
Epoch 90/500
4/4 [==============================] - 3s 809ms/step - loss: 0.0280 - accuracy:
0.9833 - val_loss: 0.0637 - val_accuracy: 0.9444
Epoch 91/500
4/4 [==============================] - 3s 863ms/step - loss: 0.0027 - accuracy:
1.0000 - val_loss: 0.0606 - val_accuracy: 0.9444
Epoch 92/500
4/4 [==============================] - 3s 814ms/step - loss: 0.0018 - accuracy:
1.0000 - val_loss: 0.0091 - val_accuracy: 1.0000
Epoch 93/500
4/4 [==============================] - 3s 813ms/step - loss: 0.0070 - accuracy:
1.0000 - val_loss: 0.0052 - val_accuracy: 1.0000
Epoch 94/500
4/4 [==============================] - 3s 803ms/step - loss: 0.0094 - accuracy:
1.0000 - val_loss: 0.0262 - val_accuracy: 1.0000
Epoch 95/500
4/4 [==============================] - 3s 816ms/step - loss: 0.0306 - accuracy:
0.9833 - val_loss: 0.0028 - val_accuracy: 1.0000
Epoch 96/500
4/4 [==============================] - 3s 802ms/step - loss: 0.0147 - accuracy:
0.9917 - val_loss: 0.2648 - val_accuracy: 0.9444
```

```
Epoch 97/500
4/4 [==============================] - 3s 809ms/step - loss: 0.0051 - accuracy:
1.0000 - val_loss: 0.8357 - val_accuracy: 0.8889
Epoch 98/500
4/4 [==============================] - 3s 868ms/step - loss: 0.0218 - accuracy:
0.9917 - val_loss: 0.1141 - val_accuracy: 0.9444
Epoch 99/500
4/4 [==============================] - 3s 805ms/step - loss: 0.0978 - accuracy:
0.9917 - val_loss: 0.0796 - val_accuracy: 0.9444
Epoch 100/500
4/4 [==============================] - 3s 809ms/step - loss: 0.0159 - accuracy:
0.9917 - val_loss: 0.2835 - val_accuracy: 0.9444
Epoch 101/500
4/4 [==============================] - 3s 803ms/step - loss: 0.0035 - accuracy:
1.0000 - val_loss: 0.6152 - val_accuracy: 0.8889
Epoch 102/500
4/4 [==============================] - 3s 813ms/step - loss: 0.0035 - accuracy:
1.0000 - val_loss: 0.2964 - val_accuracy: 0.8889
Epoch 103/500
4/4 [==============================] - 3s 807ms/step - loss: 0.0050 - accuracy:
1.0000 - val_loss: 0.2632 - val_accuracy: 0.9444
Epoch 104/500
4/4 [==============================] - 3s 859ms/step - loss: 8.2262e-04 -
accuracy: 1.0000 - val_loss: 0.0175 - val_accuracy: 1.0000
Epoch 105/500
4/4 [==============================] - 3s 800ms/step - loss: 0.0269 - accuracy:
0.9917 - val_loss: 0.4828 - val_accuracy: 0.9444
Epoch 106/500
4/4 [==============================] - 3s 885ms/step - loss: 0.1626 - accuracy:
0.9917 - val_loss: 0.0077 - val_accuracy: 1.0000
Epoch 107/500
4/4 [==============================] - 3s 803ms/step - loss: 0.0252 - accuracy:
0.9833 - val_loss: 0.0059 - val_accuracy: 1.0000
Epoch 108/500
4/4 [==============================] - 3s 797ms/step - loss: 0.0194 - accuracy:
0.9917 - val_loss: 0.0361 - val_accuracy: 1.0000
Epoch 109/500
4/4 [==============================] - 3s 808ms/step - loss: 0.0061 - accuracy:
1.0000 - val_loss: 0.0668 - val_accuracy: 0.9444
Epoch 110/500
4/4 [==============================] - 3s 799ms/step - loss: 0.0118 - accuracy:
1.0000 - val_loss: 0.0197 - val_accuracy: 1.0000
Epoch 111/500
4/4 [==============================] - 3s 803ms/step - loss: 0.0011 - accuracy:
1.0000 - val_loss: 0.0827 - val_accuracy: 0.9444
Epoch 112/500
4/4 [==============================] - 3s 805ms/step - loss: 8.9603e-04 -
accuracy: 1.0000 - val_loss: 8.5003e-04 - val_accuracy: 1.0000
```

```
Epoch 113/500
4/4 [==============================] - 3s 862ms/step - loss: 5.8740e-05 -
accuracy: 1.0000 - val_loss: 1.0255e-04 - val_accuracy: 1.0000
Epoch 114/500
4/4 [==============================] - 3s 801ms/step - loss: 8.3505e-04 -
accuracy: 1.0000 - val_loss: 2.4915e-04 - val_accuracy: 1.0000
Epoch 115/500
4/4 [==============================] - 3s 811ms/step - loss: 0.0127 - accuracy:
0.9917 - val_loss: 0.0147 - val_accuracy: 1.0000
Epoch 116/500
4/4 [==============================] - 3s 819ms/step - loss: 6.8556e-04 -
accuracy: 1.0000 - val_loss: 0.0017 - val_accuracy: 1.0000
Epoch 117/500
4/4 [==============================] - 3s 797ms/step - loss: 3.7433e-04 -
accuracy: 1.0000 - val_loss: 0.0048 - val_accuracy: 1.0000
Epoch 118/500
4/4 [==============================] - 3s 876ms/step - loss: 3.3961e-04 -
accuracy: 1.0000 - val_loss: 0.0030 - val_accuracy: 1.0000
Epoch 119/500
4/4 [==============================] - 3s 807ms/step - loss: 3.9029e-04 -
accuracy: 1.0000 - val_loss: 0.0012 - val_accuracy: 1.0000
Epoch 120/500
4/4 [==============================] - 3s 807ms/step - loss: 3.6425e-04 -
accuracy: 1.0000 - val_loss: 0.0021 - val_accuracy: 1.0000
Epoch 121/500
4/4 [==============================] - 3s 814ms/step - loss: 8.9153e-04 -
accuracy: 1.0000 - val_loss: 7.9630e-04 - val_accuracy: 1.0000
Epoch 122/500
4/4 [==============================] - 3s 810ms/step - loss: 2.6549e-04 -
accuracy: 1.0000 - val_loss: 0.0114 - val_accuracy: 1.0000
Epoch 123/500
4/4 [==============================] - 3s 798ms/step - loss: 3.5392e-04 -
accuracy: 1.0000 - val_loss: 0.0011 - val_accuracy: 1.0000
Epoch 124/500
4/4 [==============================] - 3s 806ms/step - loss: 1.5260e-04 -
accuracy: 1.0000 - val_loss: 4.8266e-04 - val_accuracy: 1.0000
Epoch 125/500
4/4 [==============================] - 3s 868ms/step - loss: 5.9919e-04 -
accuracy: 1.0000 - val_loss: 8.2175e-05 - val_accuracy: 1.0000
Epoch 126/500
4/4 [==============================] - 3s 785ms/step - loss: 1.8349e-04 -
accuracy: 1.0000 - val_loss: 0.0138 - val_accuracy: 1.0000
Epoch 127/500
4/4 [==============================] - 3s 861ms/step - loss: 1.1010e-04 -
accuracy: 1.0000 - val_loss: 0.0021 - val_accuracy: 1.0000
Epoch 128/500
4/4 [==============================] - 3s 804ms/step - loss: 2.0689e-05 -
accuracy: 1.0000 - val_loss: 1.2806e-04 - val_accuracy: 1.0000
```

```
Epoch 129/500
4/4 [==============================] - 3s 806ms/step - loss: 1.3858e-04 -
accuracy: 1.0000 - val_loss: 0.0014 - val_accuracy: 1.0000
Epoch 130/500
4/4 [==============================] - 3s 866ms/step - loss: 5.5066e-04 -
accuracy: 1.0000 - val_loss: 0.0028 - val_accuracy: 1.0000
Epoch 131/500
4/4 [==============================] - 3s 860ms/step - loss: 4.2275e-04 -
accuracy: 1.0000 - val_loss: 1.2819e-04 - val_accuracy: 1.0000
Epoch 132/500
4/4 [==============================] - 3s 809ms/step - loss: 2.3354e-05 -
accuracy: 1.0000 - val_loss: 0.0027 - val_accuracy: 1.0000
Epoch 133/500
4/4 [==============================] - 3s 868ms/step - loss: 1.1476e-04 -
accuracy: 1.0000 - val_loss: 8.5050e-04 - val_accuracy: 1.0000
Epoch 134/500
4/4 [==============================] - 3s 797ms/step - loss: 6.5698e-05 -
accuracy: 1.0000 - val_loss: 0.1241 - val_accuracy: 0.9444
Epoch 135/500
4/4 [==============================] - 3s 800ms/step - loss: 1.7796e-04 -
accuracy: 1.0000 - val_loss: 5.7137e-04 - val_accuracy: 1.0000
Epoch 136/500
4/4 [==============================] - 3s 811ms/step - loss: 3.8592e-05 -
accuracy: 1.0000 - val_loss: 3.5235e-04 - val_accuracy: 1.0000
Epoch 137/500
4/4 [==============================] - 3s 853ms/step - loss: 8.4676e-04 -
accuracy: 1.0000 - val_loss: 0.0303 - val_accuracy: 1.0000
Epoch 138/500
4/4 [==============================] - 3s 806ms/step - loss: 6.7666e-05 -
accuracy: 1.0000 - val_loss: 0.0083 - val_accuracy: 1.0000
Epoch 139/500
4/4 [==============================] - 3s 823ms/step - loss: 2.6106e-05 -
accuracy: 1.0000 - val_loss: 7.3015e-05 - val_accuracy: 1.0000
Epoch 140/500
4/4 [==============================] - 3s 794ms/step - loss: 1.1433e-04 -
accuracy: 1.0000 - val_loss: 0.0037 - val_accuracy: 1.0000
Epoch 141/500
4/4 [==============================] - 3s 821ms/step - loss: 9.3830e-05 -
accuracy: 1.0000 - val_loss: 4.4389e-05 - val_accuracy: 1.0000
Epoch 142/500
4/4 [==============================] - 3s 805ms/step - loss: 1.1898e-05 -
accuracy: 1.0000 - val_loss: 1.4831e-04 - val_accuracy: 1.0000
Epoch 143/500
4/4 [==============================] - 3s 809ms/step - loss: 6.7843e-06 -
accuracy: 1.0000 - val_loss: 0.0049 - val_accuracy: 1.0000
Epoch 144/500
4/4 [==============================] - 3s 876ms/step - loss: 1.5747e-05 -
accuracy: 1.0000 - val_loss: 4.7308e-04 - val_accuracy: 1.0000
```

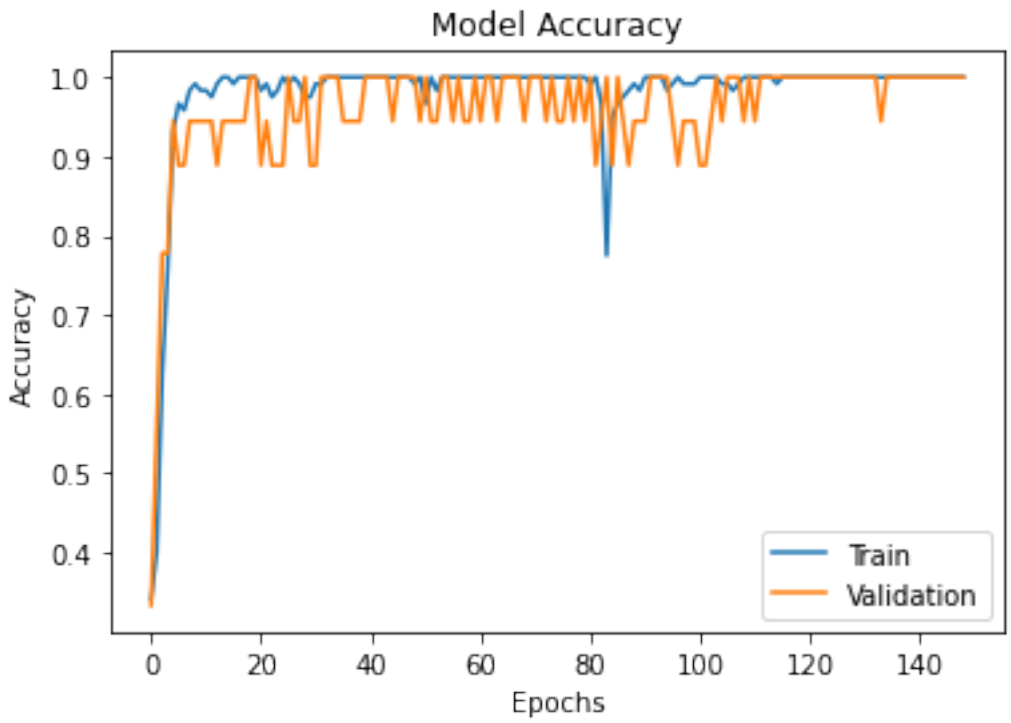
```
Epoch 145/500
4/4 [==============================] - 3s 804ms/step - loss: 3.1685e-05 -
accuracy: 1.0000 - val_loss: 0.0041 - val_accuracy: 1.0000
Epoch 146/500
4/4 [==============================] - 3s 799ms/step - loss: 1.2386e-05 -
accuracy: 1.0000 - val_loss: 1.0165e-04 - val_accuracy: 1.0000
Epoch 147/500
4/4 [==============================] - 3s 871ms/step - loss: 1.2327e-05 -
accuracy: 1.0000 - val_loss: 1.1872e-04 - val_accuracy: 1.0000
Epoch 148/500
4/4 [==============================] - 3s 863ms/step - loss: 8.8018e-06 -
accuracy: 1.0000 - val_loss: 9.8862e-04 - val_accuracy: 1.0000
Epoch 149/500
4/4 [==============================] - 3s 798ms/step - loss: 9.5811e-06 -
accuracy: 1.0000 - val_loss: 3.9504e-04 - val_accuracy: 1.0000
```

[ ]:
```
# Đánh giá độ chính xác của mô hình
Score=model.evaluate(training_set,verbose=0)
print('Train Loss', Score[0])
print('Train Accuracy', Score[1])
```

```
Train Loss 2.385093239354319e-06
Train Accuracy 1.0
```

[ ]:
```
# Vẽ đồ thị giữa số lần học (Epochs) và độ chính xác (Accuracy)
plt.plot(history.history['accuracy'])
plt.plot(history.history['val_accuracy'])
plt.title('Model Accuracy')
plt.ylabel('Accuracy')
plt.xlabel('Epochs')
plt.legend(['Train','Validation'])
plt.show
```

[ ]:
```
<function matplotlib.pyplot.show>
```



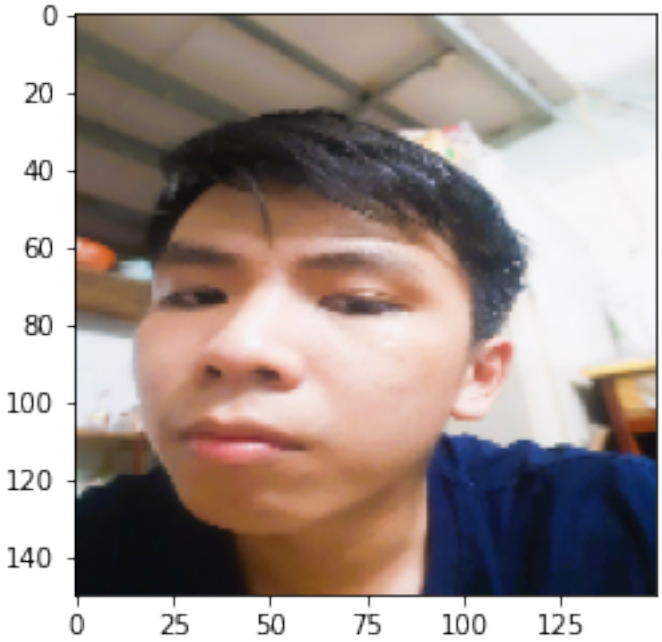
[ ]:
```
# Lưu lại
model.save("NHAN DIEN NGUOI.h5")
```

[ ]:
```
# Tải mô hình
model_CNN=load_model('NHAN DIEN NGUOI.h5')
```

[ ]:
```
# Kiểm tra hình của từng bạn với bộ dữ liệu test_set
```

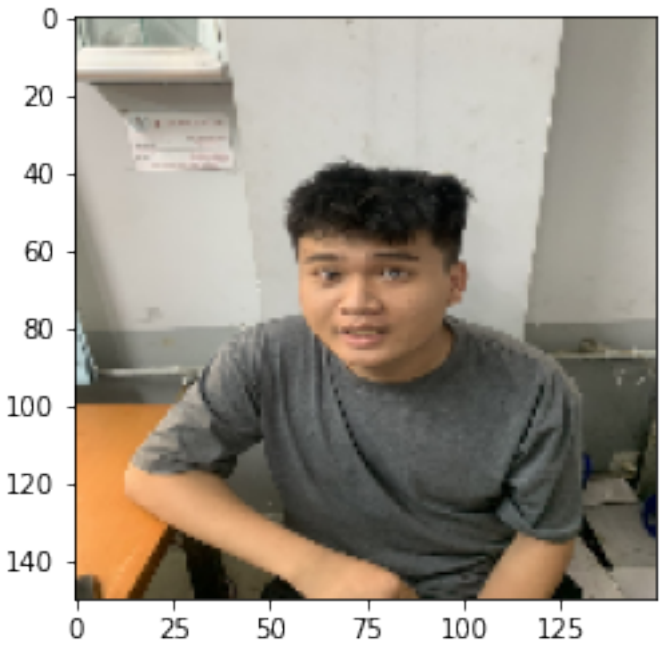
[ ]:
```
img=load_img("/content/drive/MyDrive/Colab Notebooks/BT_AI/NHAN DIEN NGUOI/
 ↪Test_set/DuocT2.jpg",target_size=(150,150))
plt.imshow(img)
img=img_to_array(img)
img=img.astype('float32')
img=img/255
img=np.expand_dims(img,axis=0)
result=model_CNN.predict(img)
if round(result[0][0])==1:
  prediction='DUOC'
if round(result[0][1])==1:
  prediction='GIANG'
if round(result[0][2])==1:
  prediction='TRIEN'
print(prediction)
```

DUOC



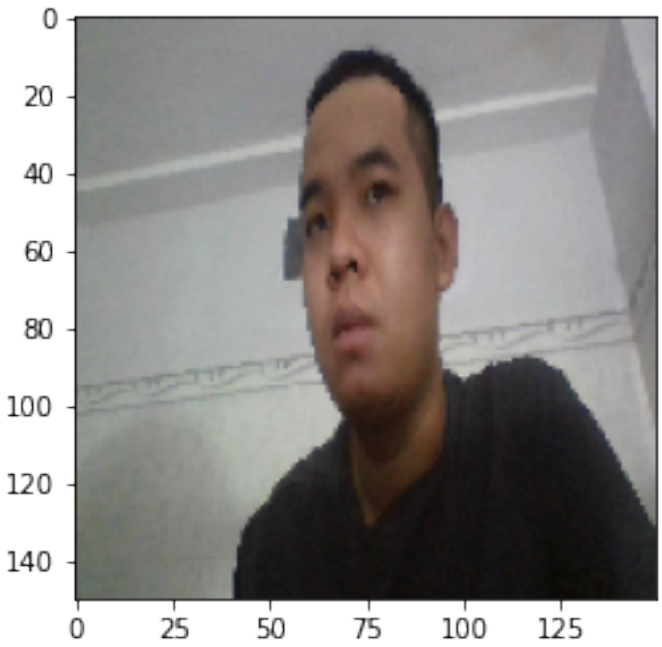
[ ]:
```
img=load_img("/content/drive/MyDrive/Colab Notebooks/BT_AI/NHAN DIEN NGUOI/
 ↪Test_set/GiangT1.jpg",target_size=(150,150))
plt.imshow(img)
img=img_to_array(img)
img=img.astype('float32')
img=img/255
img=np.expand_dims(img,axis=0)
result=model_CNN.predict(img)
if round(result[0][0])==1:
  prediction='DUOC'
if round(result[0][1])==1:
  prediction='GIANG'
if round(result[0][2])==1:
  prediction='TRIEN'
print(prediction)
```

GIANG



[ ]:
```
img=load_img("/content/drive/MyDrive/Colab Notebooks/BT_AI/NHAN DIEN NGUOI/
 ↪Test_set/TrienT3.jpg",target_size=(150,150))
plt.imshow(img)
img=img_to_array(img)
img=img.astype('float32')
img=img/255
img=np.expand_dims(img,axis=0)
result=model_CNN.predict(img)
if round(result[0][0])==1:
  prediction='DUOC'
if round(result[0][1])==1:
  prediction='GIANG'
if round(result[0][2])==1:
  prediction='TRIEN'
print(prediction)
```

```
TRIEN
```



[ ]:
```
# Chuyển sang pdf
from google.colab import drive
drive.mount('/content/drive')
!sudo apt-get install texlive-xetex texlive-fonts-recommended␣
 ↪texlive-generic-recommended
!wget -nc https://raw.githubusercontent.com/brpy/colab-pdf/master/colab_pdf.py
from colab_pdf import colab_pdf
colab_pdf('NHAN DIEN NGUOI.ipynb')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call
drive.mount("/content/drive", force_remount=True).
Reading package lists… Done
Building dependency tree
Reading state information… Done
The following packages were automatically installed and are no longer required:
  libnvidia-common-460 nsight-compute-2020.2.0
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  fonts-droid-fallback fonts-lato fonts-lmodern fonts-noto-mono fonts-texgyre
  javascript-common libcupsfilters1 libcupsimage2 libgs9 libgs9-common
  libijs-0.35 libjbig2dec0 libjs-jquery libkpathsea6 libpotrace0 libptexenc1
  libruby2.5 libsynctex1 libtexlua52 libtexluajit2 libzzip-0-13 lmodern
  poppler-data preview-latex-style rake ruby ruby-did-you-mean ruby-minitest
  ruby-net-telnet ruby-power-assert ruby-test-unit ruby2.5
  rubygems-integration t1utils tex-common tex-gyre texlive-base
```