```
import numpy as np
import os

from keras.models import Sequential
from keras.layers import Dense, Conv2D
from keras.layers import Dropout
from keras.layers import Flatten
from keras.constraints import maxnorm
from tensorflow.keras.optimizers import Adam

from keras.layers.convolutional import Convolution2D
from keras.layers.convolutional import MaxPooling2D
from keras.callbacks import ModelCheckpoint, LearningRateScheduler
from keras.callbacks import ReduceLROnPlateau
from keras.callbacks import EarlyStopping


from keras.utils import np_utils
import matplotlib.pyplot as plt
from keras.preprocessing.image import ImageDataGenerator


from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.m
```

```
x_train= '/content/drive/MyDrive/nhandienkhuongmat/x_train'
x_test= '/content/drive/MyDrive/nhandienkhuongmat/x_test'
```

```
x_train = ImageDataGenerator(rescale=1/255)
x_test = ImageDataGenerator(rescale=1/255)
```

```
x_train_data = x_train.flow_from_directory(
    directory=r"/content/drive/MyDrive/nhandienkhuongmat/x_train",
    target_size=(224, 224),
    batch_size=3,
    class_mode='categorical',
    )
x_test_data = x_test.flow_from_directory(
    directory=r"/content/drive/MyDrive/nhandienkhuongmat/x_test",
    target_size=(224, 224),
    batch_size=3,
    class_mode= "categorical",
    )
```

```
Found 27 images belonging to 3 classes.
```

```
Found 11 images belonging to 3 classes.
```

```
x_train_data.class_indices
```

```
{'son': 0, 'thai': 1, 'trang': 2}
```

```
model = Sequential()

model.add(Conv2D(32,(3,3),input_shape=(224,224,3),padding='same',activation='relu'))
model.add(Dropout(0.2))

model.add(Conv2D(32,(3,3),activation='relu',padding='same'))
model.add(MaxPooling2D(pool_size=(2,2)))

model.add(Conv2D(64,(3,3),activation='relu',padding='same'))
model.add(Dropout(0.2))

model.add(Conv2D(64,(3,3),activation='relu',padding='same'))
model.add(MaxPooling2D(pool_size=(2,2)))

model.add(Conv2D(128,(3,3),activation='relu',padding='same'))
model.add(Dropout(0.2))

model.add(Conv2D(128,(3,3),activation='relu',padding='same'))
model.add(MaxPooling2D(pool_size=(2,2)))

model.add(Flatten())
model.add(Dropout(0.2))

model.add(Dense(512,activation='relu'))
model.add(Dropout(0.2))

model.add(Dense(218,activation='relu'))
model.add(Dropout(0.2))

model.add(Dense(3,activation='softmax'))
model.summary()
```

```
Model: "sequential_5"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_30 (Conv2D)          (None, 224, 224, 32)      896

 dropout_31 (Dropout)        (None, 224, 224, 32)      0

 conv2d_31 (Conv2D)          (None, 224, 224, 32)      9248

 max_pooling2d_15 (MaxPoolin  (None, 112, 112, 32)     0
 g2D)

 conv2d_32 (Conv2D)          (None, 112, 112, 64)      18496

 dropout_32 (Dropout)        (None, 112, 112, 64)      0
```

```
 conv2d_33 (Conv2D)          (None, 112, 112, 64)      36928

 max_pooling2d_16 (MaxPoolin  (None, 56, 56, 64)       0
 g2D)

 conv2d_34 (Conv2D)          (None, 56, 56, 128)       73856

 dropout_33 (Dropout)        (None, 56, 56, 128)       0

 conv2d_35 (Conv2D)          (None, 56, 56, 128)       147584

 max_pooling2d_17 (MaxPoolin  (None, 28, 28, 128)      0
 g2D)

 flatten_5 (Flatten)         (None, 100352)            0

 dropout_34 (Dropout)        (None, 100352)            0

 dense_16 (Dense)            (None, 512)               51380736

 dropout_35 (Dropout)        (None, 512)               0

 dense_17 (Dense)            (None, 218)               111834

 dropout_36 (Dropout)        (None, 218)               0

 dense_18 (Dense)            (None, 3)                 657

=================================================================
Total params: 51,780,235
Trainable params: 51,780,235
Non-trainable params: 0
_________________________________________________________________
```

```
from tensorflow.keras.optimizers import SGD
#opt = SGD(lr = 0.01, momentum= 0.9)
model.compile(optimizer=Adam(learning_rate=0.0005), loss='categorical_crossentropy', metri
history=model.fit(x_train_data,
                  epochs=5,
                  batch_size=10,
                  verbose=1,
                  validation_data= x_test_data)
```

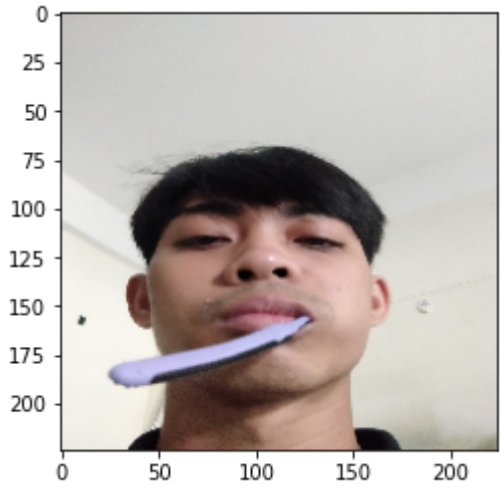
```
Epoch 1/5
9/9 [==============================] - 3s 276ms/step - loss: 0.5234 - accuracy: 0.851
Epoch 2/5
9/9 [==============================] - 2s 237ms/step - loss: 0.2695 - accuracy: 0.925
Epoch 3/5
9/9 [==============================] - 2s 249ms/step - loss: 0.1423 - accuracy: 1.000
Epoch 4/5
9/9 [==============================] - 2s 238ms/step - loss: 0.0408 - accuracy: 1.000
Epoch 5/5
9/9 [==============================] - 2s 239ms/step - loss: 0.0021 - accuracy: 1.000
```

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

```
from keras.models import load_model
nhandangmat = load_model('nhandangmat.h5')
```

```
from keras.preprocessing.image import load_img, img_to_array
img = load_img('/content/drive/MyDrive/nhandienkhuongmat/x_test/son/z3432747691879_d290fbd
plt.imshow(img)
img = img_to_array(img)
img = img.reshape(1,224,224,3)
img = img.astype('float32')
img = img/255
img.shape
```

```
(1, 224, 224, 3)
```




```
np.argmax(nhandangmat.predict(img),axis= 1)
```

```
array([0])
```

{'son': 0, 'trang': 2,'thai':1}