In [56]:
```
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.preprocessing import image
from tensorflow.keras.optimizers import SGD, RMSprop
from tensorflow.keras.utils import to_categorical
import matplotlib.pyplot as plt
from tensorflow.keras.models import load_model
import tensorflow as  tf
import numpy as np
import cv2
import os
from keras.utils import np_utils
from tensorflow.keras.callbacks import EarlyStopping, ModelCheckpoint, ReduceL
ROnPlateau
from keras.models import Sequential
from keras.layers import Dense,Flatten, Dropout
from tensorflow.keras.utils import load_img
from tensorflow.keras.utils import img_to_array
from keras.layers import Conv2D, MaxPooling2D
```

In [57]:
```
train = ImageDataGenerator(rescale = 1./255,
                                    shear_range = 0.2,
                                    zoom_range = 0.2,
                                    horizontal_flip = True)
validation = ImageDataGenerator(rescale = 1./255)
```

In [58]:
```
train_set=train.flow_from_directory('/content/drive/MyDrive/FRUIT1/train1',tar
get_size = (64,64),batch_size = 12,class_mode = 'categorical')
test_set=validation.flow_from_directory('/content/drive/MyDrive/FRUIT1/test1',
target_size = (64,64),batch_size = 12,class_mode = 'categorical')
```

```
Found 699 images belonging to 10 classes.
Found 272 images belonging to 10 classes.
```

In [59]:
```
train_set.class_indices
```

Out[59]:
```
{'chuối': 0,
 'dâu tây': 1,
 'dưa hấu': 2,
 'dừa': 3,
 'dứa': 4,
 'khế': 5,
 'măng cụt': 6,
 'ổi': 7,
 'táo': 8,
 'xoài': 9}
```

In [ ]:

In [63]:
```
model = tf.keras.models.Sequential(
    [ tf.keras.layers.Conv2D(32,(3,3),activation = 'relu',kernel_initializer=
'he_uniform',padding='same',input_shape =(64,64,3)),
      tf.keras.layers.Conv2D(32,(3,3),activation = 'relu',kernel_initializer=
'he_uniform',padding='same'),
      tf.keras.layers.MaxPool2D(2,2),

      tf.keras.layers.Conv2D(32,(3,3),activation = 'relu',kernel_initializer=
'he_uniform',padding='same'),
      tf.keras.layers.Conv2D(32,(3,3),activation = 'relu',kernel_initializer=
'he_uniform',padding='same'),
      tf.keras.layers.MaxPool2D(2,2),

      tf.keras.layers.Conv2D(64,(3,3),activation = 'relu',kernel_initializer=
'he_uniform',padding='same'),
      tf.keras.layers.Conv2D(64,(3,3),activation = 'relu',kernel_initializer=
'he_uniform',padding='same'),
      tf.keras.layers.MaxPool2D(2,2),

      tf.keras.layers.Conv2D(128,(3,3),activation = 'relu',kernel_initializer=
'he_uniform',padding='same'),
      tf.keras.layers.Conv2D(128,(3,3),activation = 'relu',kernel_initializer=
'he_uniform',padding='same'),
      tf.keras.layers.MaxPool2D(2,2),

      tf.keras.layers.Flatten(),
      tf.keras.layers.Dense(256,activation = 'relu',kernel_initializer='he_uni
form'),
      tf.keras.layers.Dense(10,activation='softmax')])
model.summary()
```

```
Model: "sequential_4"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_32 (Conv2D)          (None, 64, 64, 32)        896

 conv2d_33 (Conv2D)          (None, 64, 64, 32)        9248

 max_pooling2d_16 (MaxPoolin  (None, 32, 32, 32)       0
 g2D)

 conv2d_34 (Conv2D)          (None, 32, 32, 32)        9248

 conv2d_35 (Conv2D)          (None, 32, 32, 32)        9248

 max_pooling2d_17 (MaxPoolin  (None, 16, 16, 32)       0
 g2D)

 conv2d_36 (Conv2D)          (None, 16, 16, 64)        18496

 conv2d_37 (Conv2D)          (None, 16, 16, 64)        36928

 max_pooling2d_18 (MaxPoolin  (None, 8, 8, 64)         0
 g2D)

 conv2d_38 (Conv2D)          (None, 8, 8, 128)         73856

 conv2d_39 (Conv2D)          (None, 8, 8, 128)         147584

 max_pooling2d_19 (MaxPoolin  (None, 4, 4, 128)        0
 g2D)

 flatten_4 (Flatten)         (None, 2048)              0

 dense_8 (Dense)             (None, 256)               524544

 dense_9 (Dense)             (None, 10)                2570

=================================================================
Total params: 832,618
Trainable params: 832,618
Non-trainable params: 0
_________________________________________________________________
```

In [64]:
```
opt = SGD(lr=0.001, momentum=0.9)
model.compile(optimizer=opt, loss='categorical_crossentropy', metrics = ['accu
racy'])
```

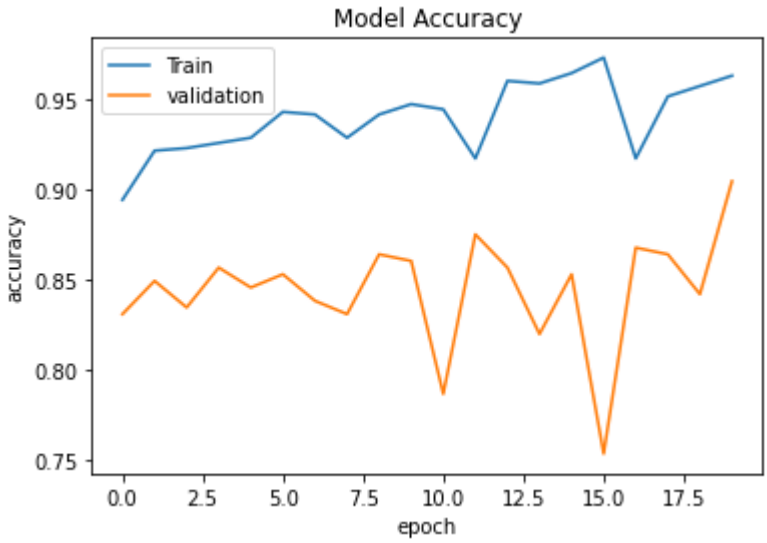
```
/usr/local/lib/python3.7/dist-packages/keras/optimizer_v2/gradient_descent.p
y:102: UserWarning: The `lr` argument is deprecated, use `learning_rate` inst
ead.
  super(SGD, self).__init__(name, **kwargs)
```

In [69]:
```
history = model.fit(train_set,batch_size=128,epochs=20,verbose=1,validation_da
ta=test_set)
```

```
Epoch 1/20
59/59 [==============================] - 24s 418ms/step - loss: 0.2940 - accu
racy: 0.8941 - val_loss: 0.5952 - val_accuracy: 0.8309
Epoch 2/20
59/59 [==============================] - 24s 411ms/step - loss: 0.2220 - accu
racy: 0.9213 - val_loss: 0.5534 - val_accuracy: 0.8493
Epoch 3/20
59/59 [==============================] - 24s 407ms/step - loss: 0.2492 - accu
racy: 0.9227 - val_loss: 0.5526 - val_accuracy: 0.8346
Epoch 4/20
59/59 [==============================] - 24s 407ms/step - loss: 0.1934 - accu
racy: 0.9256 - val_loss: 0.5470 - val_accuracy: 0.8566
Epoch 5/20
59/59 [==============================] - 24s 408ms/step - loss: 0.2005 - accu
racy: 0.9285 - val_loss: 0.6466 - val_accuracy: 0.8456
Epoch 6/20
59/59 [==============================] - 24s 412ms/step - loss: 0.1600 - accu
racy: 0.9428 - val_loss: 0.6851 - val_accuracy: 0.8529
Epoch 7/20
59/59 [==============================] - 24s 410ms/step - loss: 0.1763 - accu
racy: 0.9413 - val_loss: 0.5572 - val_accuracy: 0.8382
Epoch 8/20
59/59 [==============================] - 24s 408ms/step - loss: 0.2249 - accu
racy: 0.9285 - val_loss: 0.5356 - val_accuracy: 0.8309
Epoch 9/20
59/59 [==============================] - 24s 407ms/step - loss: 0.1552 - accu
racy: 0.9413 - val_loss: 0.4343 - val_accuracy: 0.8640
Epoch 10/20
59/59 [==============================] - 24s 414ms/step - loss: 0.1389 - accu
racy: 0.9471 - val_loss: 0.4805 - val_accuracy: 0.8603
Epoch 11/20
59/59 [==============================] - 24s 412ms/step - loss: 0.1649 - accu
racy: 0.9442 - val_loss: 0.7250 - val_accuracy: 0.7868
Epoch 12/20
59/59 [==============================] - 24s 408ms/step - loss: 0.2497 - accu
racy: 0.9170 - val_loss: 0.3942 - val_accuracy: 0.8750
Epoch 13/20
59/59 [==============================] - 24s 408ms/step - loss: 0.1303 - accu
racy: 0.9599 - val_loss: 0.5240 - val_accuracy: 0.8566
Epoch 14/20
59/59 [==============================] - 24s 413ms/step - loss: 0.1193 - accu
racy: 0.9585 - val_loss: 0.6464 - val_accuracy: 0.8199
Epoch 15/20
59/59 [==============================] - 24s 413ms/step - loss: 0.1072 - accu
racy: 0.9642 - val_loss: 0.5413 - val_accuracy: 0.8529
Epoch 16/20
59/59 [==============================] - 24s 413ms/step - loss: 0.0869 - accu
racy: 0.9728 - val_loss: 0.9938 - val_accuracy: 0.7537
Epoch 17/20
59/59 [==============================] - 24s 412ms/step - loss: 0.2338 - accu
racy: 0.9170 - val_loss: 0.4631 - val_accuracy: 0.8676
Epoch 18/20
59/59 [==============================] - 24s 407ms/step - loss: 0.1259 - accu
racy: 0.9514 - val_loss: 0.4911 - val_accuracy: 0.8640
Epoch 19/20
59/59 [==============================] - 24s 411ms/step - loss: 0.1137 - accu
racy: 0.9571 - val_loss: 0.6936 - val_accuracy: 0.8419
```

```
Epoch 20/20
59/59 [==============================] - 24s 408ms/step - loss: 0.1014 - accu
racy: 0.9628 - val_loss: 0.4798 - val_accuracy: 0.9044
```

In [70]:
```
plt.plot(history.history['accuracy'])
plt.plot(history.history['val_accuracy'])
plt.title('Model Accuracy')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.legend(['Train','validation'],loc='upper left')
plt.show()
```



In [71]:
```
score=model.evaluate(test_set,verbose=1)
print('Sai số: ',score[0])
print('Độ chính xác: ',score[1])
```

```
23/23 [==============================] - 3s 148ms/step - loss: 0.4798 - accur
acy: 0.9044
Sai số:  0.4797544479370117
Độ chính xác:  0.904411792755127
```

In [72]:
```
model.save('TraiCay.h5')
```

In [73]:
```
from tensorflow.keras.models import load_model
model1=load_model('TraiCay.h5')
```

In [74]:
```
test_img=load_img('/content/drive/MyDrive/FRUIT1/test1/chuối/Screen Shot 2018-06-12 at 9.38.04 PM.png',target_size=(64,64))
plt.imshow(test_img)
test_img= img_to_array(test_img)
test_img=test_img/255
test_img=np.expand_dims(test_img,axis=0)
result=model.predict(test_img)
if round(result[0][0])==1:
  prediction="Chuối"
elif round(result[0][1])==1:
  prediction="Dâu Tây"
elif round(result[0][2])==1:
  prediction="Dưa hấu"
elif round(result[0][3])==1:
  prediction="Dừa"
elif round(result[0][4])==1:
  prediction="Dứa"
elif round(result[0][5])==1:
  prediction="Khế"
elif round(result[0][6])==1:
  prediction="Măng cụt"
elif round(result[0][7])==1:
  prediction="Ổi"
elif round(result[0][8])==1:
  prediction="Táo"
elif round(result[0][9])==1:
  prediction="Xoài"
print('dự đoán:', prediction)
```

```
dự đoán: Chuối
```