Activity: Nhận diện giới tính

Tải data vào colab

In [79]:

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

```
Drive already mounted at /content/gdrive; to attempt to forcibly remount, call drive.moun
t("/content/gdrive", force_remount=True).
```

In [80]:

```
!unzip /content/gdrive/Shareddrives/nhan_dien_dac_diem_khuon_mat/gender_data.zip -d "/co
ntent"
```

```
Archive:  /content/gdrive/Shareddrives/nhan_dien_dac_diem_khuon_mat/gender_data.zip
replace /content/Training/female/131422.jpg.jpg? [y]es, [n]o, [A]ll, [N]one, [r]ename: N
```

Import thư viện

In [81]:

```
import os
import cv2
import numpy as np
import pandas as pd
from matplotlib import pyplot as plt
import glob
import seaborn as sn
from tensorflow.keras.datasets import mnist
import tensorflow
from tensorflow.keras.models import Model
from tensorflow.keras.layers import Dense, Dropout, Flatten, Input, Reshape
from tensorflow.keras.layers import Conv2D, MaxPooling2D
```

Chia 2 thư mục train và test

In [82]:

```
train_dir = '/content/Training'
test_dir = '/content/Validation'
categories = ["female", "male"]
img_size = 50
```

In [83]:

```
X_train_label = []
X_train_list = []
X_test_label = []
X_test_list = []
```

Load data và preprocessing

In [84]:

```
female_train_list = glob.glob(train_dir+"/"+categories[0]+"/*")
male_train_list = glob.glob(train_dir+"/"+categories[1]+"/*")
for name in female_train_list:
  X_train_label.append(0)
  img = cv2.imread(name)
  img = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
  img = cv2.resize(img,(img_size,img_size))
  X_train_list.append((img))
for name in male_train_list:
  X_train_label.append(1)
  img = cv2.imread(name)
  img = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
  img = cv2.resize(img,(img_size,img_size))
  X_train_list.append((img))
```

In [85]:

```
female_test_list = glob.glob(test_dir+"/"+categories[0]+"/*")
male_test_list = glob.glob(test_dir+"/"+categories[1]+"/*")
for name in female_test_list:
  X_test_label.append(0)
  img = cv2.imread(name)
  img = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
  img = cv2.resize(img,(img_size,img_size))
  X_test_list.append((img))
for name in male_test_list:
  X_test_label.append(1)
  img = cv2.imread(name)
  img = cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
  img = cv2.resize(img,(img_size,img_size))
  X_test_list.append((img))
```

In [104]:

```
X_train = np.array(X_train_list)
y_train = np.array(X_train_label)
X_test = np.array(X_test_list)
y_test = np.array(X_test_label)
```

Duỗi vector, chuẩn hoá input, output

In [87]:

```
X_train_scaled = np.array(X_train)/255.
X_test_scaled = np.array(X_test)/255.
# OnehotVector output
from sklearn.preprocessing import OneHotEncoder
encoder = OneHotEncoder()
encoder.fit(y_train.reshape(-1,1))
y_train = encoder.transform(y_train.reshape(-1,1)).toarray()
y_test = encoder.transform(y_test.reshape(-1,1)).toarray()
print(y_train.shape)
```

```
(47009, 2)
```

Xây dựng mô hình CNN

In [88]:

```
from tensorflow.keras.layers import BatchNormalization

inp = Input(shape = (50, 50, 1))

cnn = Conv2D(filters = 32, kernel_size = 3, activation = 'relu', padding = 'same')(inp)
# Thêm padding
cnn = BatchNormalization()(cnn)
cnn = Conv2D(filters = 32, kernel_size = 3, activation = 'relu', padding = 'same')(cnn)
cnn = BatchNormalization()(cnn)
pooling = MaxPooling2D(pool_size = (2, 2))(cnn)

cnn = Conv2D(filters = 64, kernel_size = 3, activation = 'relu', padding = 'same')(pooling)
cnn = BatchNormalization()(cnn)
cnn = Conv2D(filters = 64, kernel_size = 3, activation = 'relu', padding = 'same')(cnn)
cnn = BatchNormalization()(cnn)
pooling = MaxPooling2D(pool_size = (2, 2))(cnn)
```

```
cnn = Conv2D(filters = 128, kernel_size = 3, activation = 'relu', padding = 'same')(pool
ing)
cnn = BatchNormalization()(cnn)
cnn = Conv2D(filters = 128, kernel_size = 3, activation = 'relu', padding = 'same')(cnn)
cnn = BatchNormalization()(cnn)
pooling = MaxPooling2D(pool_size = (2, 2))(cnn)

cnn = Conv2D(filters = 256, kernel_size = 3, activation = 'relu', padding = 'same')(pool
ing)
cnn = BatchNormalization()(cnn)
cnn = Conv2D(filters = 256, kernel_size = 3, activation = 'relu', padding = 'same')(cnn)
cnn = BatchNormalization()(cnn)
pooling = MaxPooling2D(pool_size = (2, 2))(cnn)

f = Flatten()(pooling)

fc1 = Dense(units = 512, activation = 'relu') (f)
drop = Dropout(0.2)(fc1)
fc2 = Dense(units = 256, activation = 'relu') (drop)
fc3 = Dense(units = 128, activation = 'relu') (fc2)
fc4 = Dense(units = 64, activation = 'relu') (fc3)
fc5 = Dense(units = 32, activation = 'relu') (fc4)
out = Dense(units = 2, activation = 'sigmoid') (fc5)

model = Model(inputs=inp, outputs=out)
model.summary()
```

```
Model: "model_8"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   
=================================================================
 input_10 (InputLayer)       [(None, 50, 50, 1)]       0         
                                                                 
 conv2d_45 (Conv2D)          (None, 50, 50, 32)        320       
                                                                 
 batch_normalization_32 (Bat  (None, 50, 50, 32)       128       
 chNormalization)                                                
                                                                 
 conv2d_46 (Conv2D)          (None, 50, 50, 32)        9248      
                                                                 
 batch_normalization_33 (Bat  (None, 50, 50, 32)       128       
 chNormalization)                                                
                                                                 
 max_pooling2d_28 (MaxPoolin  (None, 25, 25, 32)       0         
 g2D)                                                            
                                                                 
 conv2d_47 (Conv2D)          (None, 25, 25, 64)        18496     
                                                                 
 batch_normalization_34 (Bat  (None, 25, 25, 64)       256       
 chNormalization)                                                
                                                                 
 conv2d_48 (Conv2D)          (None, 25, 25, 64)        36928     
                                                                 
 batch_normalization_35 (Bat  (None, 25, 25, 64)       256       
 chNormalization)                                                
                                                                 
 max_pooling2d_29 (MaxPoolin  (None, 12, 12, 64)       0         
 g2D)                                                            
                                                                 
 conv2d_49 (Conv2D)          (None, 12, 12, 128)       73856     
                                                                 
 batch_normalization_36 (Bat  (None, 12, 12, 128)      512       
 chNormalization)                                                
                                                                 
 conv2d_50 (Conv2D)          (None, 12, 12, 128)       147584    
                                                                 
 batch_normalization_37 (Bat  (None, 12, 12, 128)      512       
 chNormalization)                                                
                                                                 
 max_pooling2d_30 (MaxPoolin  (None, 6, 6, 128)        0         
 g2D)                                                            
 conv2d_51 (Conv2D)          (None, 6, 6, 256)         295168
                                                                 
 batch_normalization_38 (Bat  (None, 6, 6, 256)        1024
 chNormalization)                                                
                                                                 
 conv2d_52 (Conv2D)          (None, 6, 6, 256)         590080
                                                                 
 batch_normalization_39 (Bat  (None, 6, 6, 256)        1024
 chNormalization)                                                
                                                                 
 max_pooling2d_31 (MaxPoolin  (None, 3, 3, 256)        0
 g2D)                                                            
                                                                 
 flatten_8 (Flatten)         (None, 2304)              0
                                                                 
 dense_36 (Dense)            (None, 512)               1180160
                                                                 
 dropout_12 (Dropout)        (None, 512)               0
                                                                 
 dense_37 (Dense)            (None, 256)               131328
                                                                 
 dense_38 (Dense)            (None, 128)               32896
                                                                 
 dense_39 (Dense)            (None, 64)                8256
                                                                 
 dense_40 (Dense)            (None, 32)                2080
                                                                 
 dense_41 (Dense)            (None, 2)                 66
                                                                 
=================================================================
Total params: 2,530,306
Trainable params: 2,528,386
Non-trainable params: 1,920
_________________________________________________________________
```

Huấn luyện mô hình

In [89]:

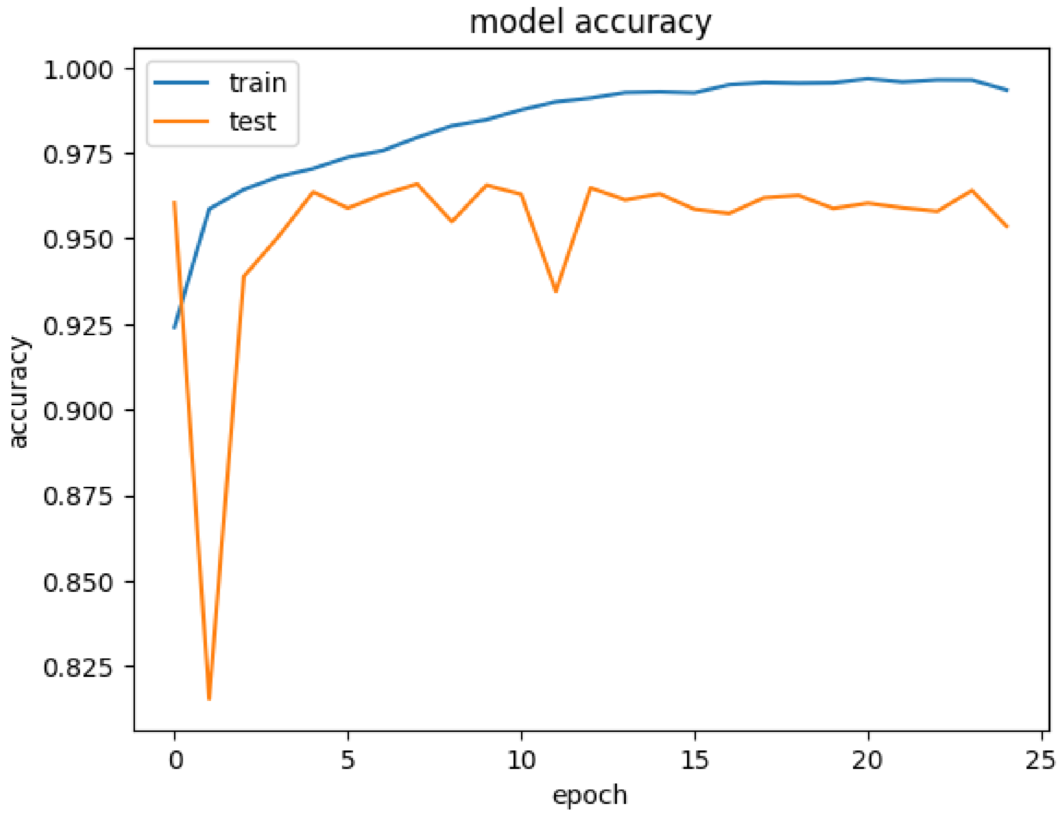
```
optimizer1 = tensorflow.keras.optimizers.Adam(learning_rate = 0.001)
model.compile(optimizer = optimizer1, loss='categorical_crossentropy',metrics = ['accura
cy'])

history = model.fit(X_train_scaled,y_train,batch_size=64,
                    epochs = 25, validation_data = (X_test_scaled, y_test))
```

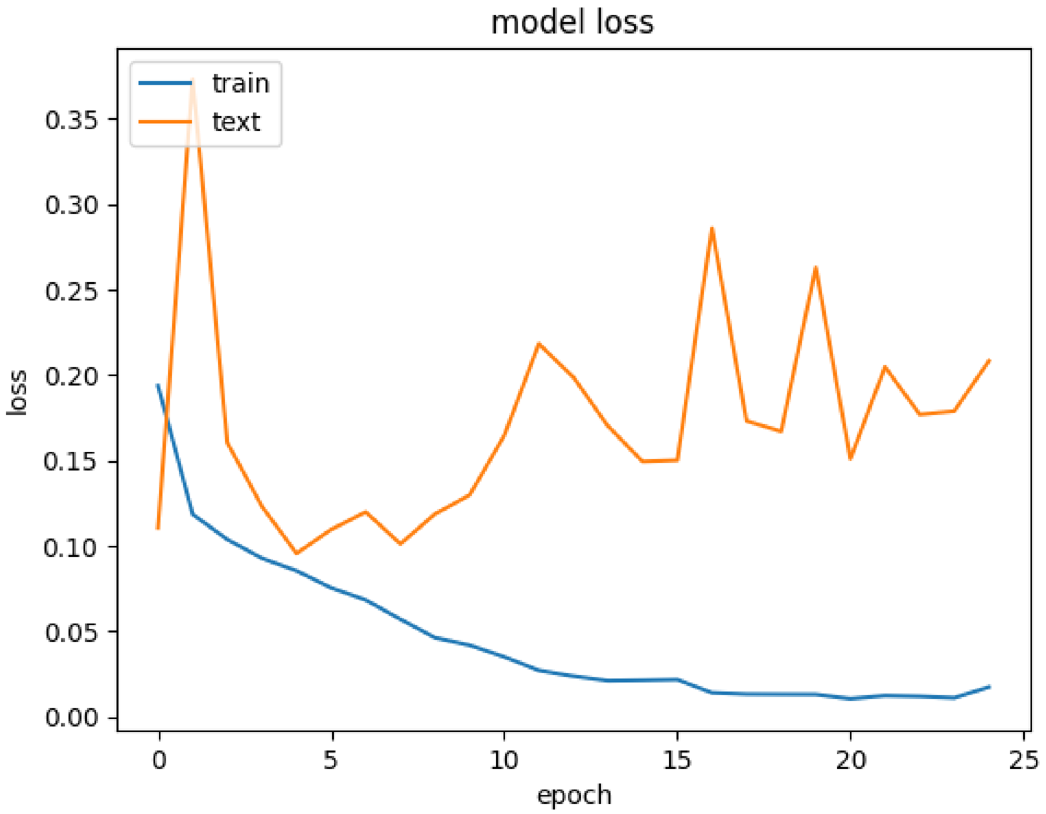
```
Epoch 1/25
735/735 [==============================] - 26s 25ms/step - loss: 0.1935 - accuracy: 0.924
0 - val_loss: 0.1105 - val_accuracy: 0.9604
Epoch 2/25
735/735 [==============================] - 19s 25ms/step - loss: 0.1184 - accuracy: 0.958
6 - val_loss: 0.3729 - val_accuracy: 0.8154
Epoch 3/25
735/735 [==============================] - 18s 25ms/step - loss: 0.1037 - accuracy: 0.964
3 - val_loss: 0.1604 - val_accuracy: 0.9389
Epoch 4/25
735/735 [==============================] - 19s 26ms/step - loss: 0.0927 - accuracy: 0.968
0 - val_loss: 0.1230 - val_accuracy: 0.9506
Epoch 5/25
735/735 [==============================] - 18s 25ms/step - loss: 0.0853 - accuracy: 0.970
4 - val_loss: 0.0955 - val_accuracy: 0.9636
Epoch 6/25
735/735 [==============================] - 18s 24ms/step - loss: 0.0754 - accuracy: 0.973
8 - val_loss: 0.1095 - val_accuracy: 0.9589
Epoch 7/25
735/735 [==============================] - 18s 25ms/step - loss: 0.0683 - accuracy: 0.975
7 - val_loss: 0.1197 - val_accuracy: 0.9628
Epoch 8/25
735/735 [==============================] - 18s 25ms/step - loss: 0.0570 - accuracy: 0.979
5 - val_loss: 0.1011 - val_accuracy: 0.9659
Epoch 9/25
Epoch 9/25
735/735 [==============================] - 18s 25ms/step - loss: 0.0462 - accuracy: 0.982
9 - val_loss: 0.1186 - val_accuracy: 0.9549
Epoch 10/25
735/735 [==============================] - 18s 25ms/step - loss: 0.0419 - accuracy: 0.984
7 - val_loss: 0.1296 - val_accuracy: 0.9656
Epoch 11/25
735/735 [==============================] - 20s 27ms/step - loss: 0.0350 - accuracy: 0.987
6 - val_loss: 0.1644 - val_accuracy: 0.9629
Epoch 12/25
735/735 [==============================] - 18s 25ms/step - loss: 0.0271 - accuracy: 0.990
0 - val_loss: 0.2181 - val_accuracy: 0.9346
Epoch 13/25
735/735 [==============================] - 18s 24ms/step - loss: 0.0237 - accuracy: 0.991
1 - val_loss: 0.1985 - val_accuracy: 0.9648
Epoch 14/25
735/735 [==============================] - 19s 26ms/step - loss: 0.0211 - accuracy: 0.992
7 - val_loss: 0.1699 - val_accuracy: 0.9613
Epoch 15/25
735/735 [==============================] - 18s 24ms/step - loss: 0.0214 - accuracy: 0.992
9 - val_loss: 0.1492 - val_accuracy: 0.9630
Epoch 16/25
735/735 [==============================] - 18s 25ms/step - loss: 0.0217 - accuracy: 0.992
6 - val_loss: 0.1500 - val_accuracy: 0.9585
Epoch 17/25
735/735 [==============================] - 18s 24ms/step - loss: 0.0139 - accuracy: 0.995
0 - val_loss: 0.2858 - val_accuracy: 0.9573
Epoch 18/25
735/735 [==============================] - 18s 25ms/step - loss: 0.0132 - accuracy: 0.995
6 - val_loss: 0.1730 - val_accuracy: 0.9619
Epoch 19/25
735/735 [==============================] - 18s 25ms/step - loss: 0.0131 - accuracy: 0.995
4 - val_loss: 0.1669 - val_accuracy: 0.9626
Epoch 20/25
735/735 [==============================] - 18s 24ms/step - loss: 0.0130 - accuracy: 0.995
5 - val_loss: 0.2628 - val_accuracy: 0.9588
Epoch 21/25
735/735 [==============================] - 18s 25ms/step - loss: 0.0105 - accuracy: 0.996
7 - val_loss: 0.1507 - val_accuracy: 0.9603
Epoch 22/25
735/735 [==============================] - 18s 24ms/step - loss: 0.0123 - accuracy: 0.995
8 - val_loss: 0.2046 - val_accuracy: 0.9590
Epoch 23/25
735/735 [==============================] - 18s 25ms/step - loss: 0.0119 - accuracy: 0.996
4 - val_loss: 0.1768 - val_accuracy: 0.9579
Epoch 24/25
735/735 [==============================] - 20s 27ms/step - loss: 0.0110 - accuracy: 0.996
3 - val_loss: 0.1787 - val_accuracy: 0.9640
Epoch 25/25
735/735 [==============================] - 18s 25ms/step - loss: 0.0173 - accuracy: 0.993
4 - val_loss: 0.2081 - val_accuracy: 0.9536
```

Trực quan hóa kết quả Accuracy và Loss trên tập Train và Test

In [96]:

```python
plt.plot(history.history['accuracy'])
plt.plot(history.history['val_accuracy'])
plt.title('model accuracy')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.legend(['train','test'],loc = 'upper left')
plt.show()
# summarize history for loss
plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('model loss')
plt.ylabel('loss')
plt.xlabel('epoch')
plt.legend(['train','text'],loc='upper left')
plt.show()
```





Lưu mô hình, load mô hình đã lưu từ máy

In [97]:

```
model.save('model1.h5')
from tensorflow.keras.models import load_model
model1 = load_model('/content/model1.h5')
```

Tính y dự đoán từ mô hình đã lưu

In [105]:

```
y_hat = model1.predict(X_test_scaled)
```

```
365/365 [==============================] - 1s 4ms/step
```

Lấy argmax của y dự đoán và y test

In [107]:

```
# y_test = np.argmax(y_test, axis=1)
y_hat = np.argmax(y_hat, axis=1)
```

Sử dụng classification_report trong thư viện Sklearn đánh giá kết quả mô hình ban đầu dựa trên kết quả dự đoán tập test

In [108]:

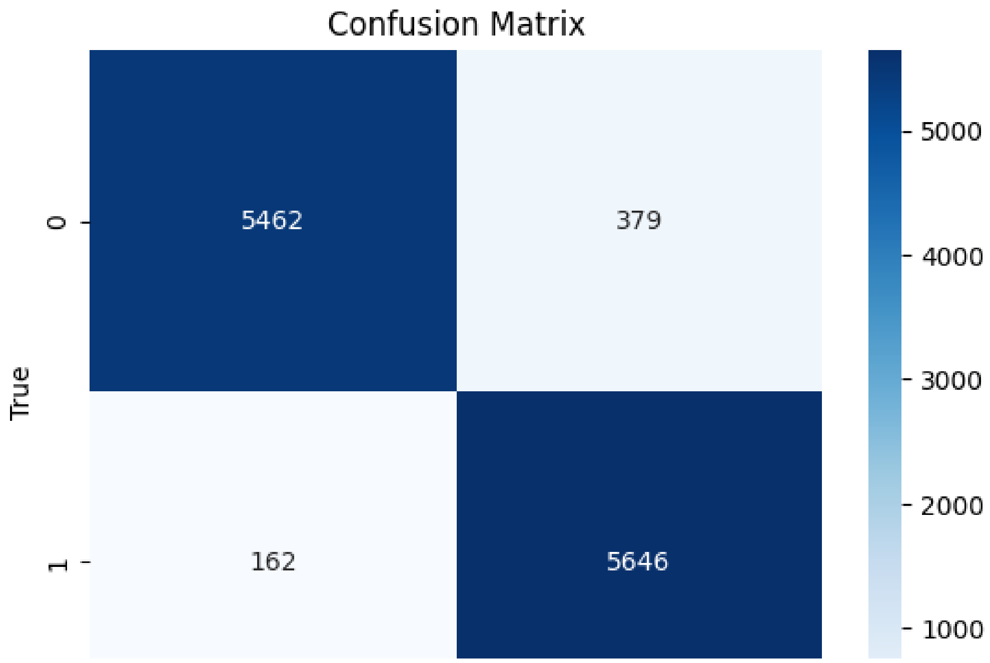
```
from sklearn.metrics import classification_report
target_names = ['female', 'male']
print(classification_report(y_test, y_hat,target_names=target_names))
```

```
              precision    recall  f1-score   support

      female       0.97      0.94      0.95      5841
        male       0.94      0.97      0.95      5808

    accuracy                           0.95     11649
   macro avg       0.95      0.95      0.95     11649
weighted avg       0.95      0.95      0.95     11649
```

Sử dụng Confusion_matrix trong thư viện Sklearn biểu diễn kết quả dự đoán trên tập test

In [109]:

```
import sklearn.metrics
import seaborn as sn

# Tạo confusion matrix
cm = sklearn.metrics.confusion_matrix(y_test, y_hat)

# Vẽ confusion matrix
plt.figure()
sn.heatmap(cm, annot=True, fmt='d', cmap='Blues')
plt.title('Confusion Matrix')
plt.xlabel('Predicted')
plt.ylabel('True')
plt.show()
```



0
1
Predicted