Open in Colab

Tugas Akhir - Pembelajaran Mesin Lanjut

Pengenalan Wajah dengan DeepFace

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Langkah 1. Persiapan Library

Load library yang dibutuhkan untuk memroses data serta pengenalan wajah dari suatu data citra. Apakah termasuk anggota kelas atau bukan?

```
# Library untuk pengaksesan media penyimpanan
import os
import shutil
import numpy as np
from google.colab import drive

# Library untuk persiapan data image
import matplotlib.pyplot as plt
from keras.preprocessing.image import load_img
from keras.preprocessing.image import img_to_array

# Library untuk pemrosesan data image untuk data augmentation
import random
from scipy import ndarray
import skimage as sk
from skimage import transform
from skimage import img_as_ubyte
from skimage import util
```

```
from skimage import io
from skimage import exposure

# Library yang digunakan untuk memanfaatkan fasilitas DeepFace
!pip install deepface
from deepface import DeepFace
from scipy import stats

# Library untuk mengukur kualitas model
from sklearn.metrics import confusion_matrix
from sklearn.metrics import accuracy_score, f1_score

# Library untuk melakukan plotting
import matplotlib.pyplot as plt
```

```
Requirement already satisfied: numpy>=1.14.0 in /usr/local/lib/python3.7/dist-packages (from deepface) (1.21.6)
Requirement already satisfied: mtcnn>=0.1.0 in /usr/local/lib/python3.7/dist-packages (from deepface) (0.1.1)
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Requirement already satisfied: gdown>=3.10.1 in /usr/local/lib/python3.7/dist-packages (from deepface) (4.4.0)
Requirement already satisfied: Pillow>=5.2.0 in /usr/local/lib/python3.7/dist-packages (from deepface) (7.1.2)
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Requirement already satisfied: tf-estimator-nightly==2.8.0.dev2021122109 in /usr/local/lib/python3.7/dist-packages (from tensorflow>=1.9.0->deepface) (2.8.0.dev2021
```

```
Requirement already satisfied: wrapt>=1.11.0 in /usr/local/lib/python3.7/dist-packages (from tensorflow>=1.9.0->deepface) (1.14.1)
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Requirement already satisfied: idna<3,>=2.5 in /usr/local/lib/python3.7/dist-packages (from requests[socks]->gdown>=3.10.1->deepface) (2.10)
Requirement already satisfied: oauthlib>=3.0.0 in /usr/local/lib/python3.7/dist-packages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<0.5,>=0.4.1->tensorboa
Requirement already satisfied: PySocks!=1.5.7,>=1.5.6 in /usr/local/lib/python3.7/dist-packages (from requests[socks]->gdown>=3.10.1->deepface) (1.7.1)
```

Langkah 2. Data Loading

Memuat data wajah dari anggota kelas yang sudah dipersiapkan dan disimpan pada google drive.

```
# Memastikan bahwa belum ada folder dan membuat folder baru untuk
# menyimpan data citra wajah anggota kelas
!rm -rf '/content/db_wajah_anggota'
os.mkdir("/content/db_wajah_anggota/")
```

```
# Proses memindahkan data citra wajah anggota kelas ke dalam folder yang telah disiapkan
list_label = []
drive.mount('/content/drive')
path_db = '/content/drive/MyDrive/Colab Notebooks/Tugas DeepFace/DB Wajah Anggota Kelas/'
for path, subdirs, files in os.walk(path_db):
```

```
  for name in files:
    sourcepath_file = path_db+name
    destpath_file = '/content/db_wajah_anggota/'+name
    shutil.copyfile(sourcepath_file, destpath_file)

    temp = name.split(".")
    list_label.append(temp[0])

list_label.append("Non Anggota Kelas")
list_label.sort()
```

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

Langkah 3. Data Augmentation

Memproses satu gambar wajah dari suatu anggota kelas untuk dibentuk data citra yang memberikan varian informasi seperti perbedaan rotasi, noise, dan lainnya.

```
# Pendefinisian beberapa fungsi transformasi data image

def random_rotation(image_array: ndarray):
··#·Mengambil·secara·random·derajat·rotasi·antara·25%·pada·kiri·dan·25%·pada·kanan
··random_degree·=·random.uniform(-25,·25)
··return·transform.rotate(image_array,·random_degree)

def random_noise(image_array: ndarray):
  # Menambahkan noise pada data image
  return util.random_noise(image_array)

def horizontal_flip(image_array: ndarray):
  # Proses hanya melakukan flip data array dari pixel image
  return image_array[:, ::-1]

def brightness_change(image_array: ndarray):
  # Proses pengubahan brightness dengan menggunakan pengaturan nilai gamma
  gain = np.random.uniform(0.25, 1)
  gamma = np.random.uniform(0.25, 1)
  return exposure.adjust_gamma(image_array, gamma, gain)
```

```
# Memastikan bahwa belum ada folder untuk menyimpan data augmentation dan membuat folder baru
!rm -rf '/content/db_aug_proses'
os.mkdir("/content/db_aug_proses/")


# Proses pembuatan data sintetis sebanyak lima dengan varian rotasi, noise, flip horizontal, dan tingkat brightness
banyak_data_augmentation = 5

path_db = '/content/drive/MyDrive/Colab Notebooks/Tugas DeepFace/DB Wajah Anggota Kelas/'
for path, subdirs, files in os.walk(path_db):
  for name in files:
    nama_anggota = name.split(".")
    path_save = "/content/db_aug_proses/"+nama_anggota[0]+"-"
    image_path = path_db+name
    image_to_transform = io.imread(image_path)

    for i in range(0, banyak_data_augmentation):
      transformed_image = random_rotation(image_to_transform)
      if (random.uniform(0, 1) > 0.5):
        transformed_image = random_noise(transformed_image)
      if (random.uniform(0, 1) > 0.5):
        transformed_image = horizontal_flip(transformed_image)
      if (random.uniform(0, 1) > 0.5):
        transformed_image = brightness_change(transformed_image)

      file_name = "DataAug%s.jpg" % (i)
      new_file = path_save + file_name
      io.imsave(new_file,img_as_ubyte(transformed_image))

    file_name = "DataAug%s.jpg" % (i+1)
    new_file = path_save + file_name
    image_dasar = io.imread(image_path)
    io.imsave(new_file,img_as_ubyte(image_dasar))
```

Langkah 4. Pemastian Basisdata Wajah Anggota

Proses untuk memasukkan keseluruhan data, baik data asli dan data augmentasi ke dalam variabel numpy dan ditampilkan beberapa data secara random, sebelum siap digunakan untuk proses pengenalan wajah dengan DeepFace

```
# Mengambil data citra dari folder hasil augmentasi serta menyamakan dimensi
# data menjadi 120x100 dan dimasukkan ke variabel numpy
```

```
db_wajah_anggota = np.empty([1, 120, 100, 3])
db_nama_anggota = ['None']

path_folder = '/content/db_aug_proses/'
for path, subdirs, files in os.walk(path_folder):
  for namefile in files:
    sourcepath_file = path_folder+namefile
    image = load_img(sourcepath_file, target_size=(120, 100))
    array_image = img_to_array(image)
    array_image = array_image.reshape(1, array_image.shape[0], array_image.shape[1], array_image.shape[2])
    db_wajah_anggota = np.append(db_wajah_anggota, array_image, axis=0)

    nama_anggota = namefile.split("-")
    db_nama_anggota.append(nama_anggota[0])


# Memastikan data telah berhasil termuat dan tersimpan pada variabel numpy
db_wajah_anggota_process = (np.expand_dims(db_wajah_anggota, axis=-1)/255.).astype(np.float32)

plt.figure(figsize=(10,7))
random_inds = np.random.choice(len(db_nama_anggota),8)
for i in range(8):
    plt.subplot(2,4,i+1)
    plt.xticks([])
    plt.yticks([])
    plt.grid(False)
    image_ind = random_inds[i]
    plt.imshow(np.squeeze(db_wajah_anggota_process[image_ind]), cmap=plt.cm.binary)
    plt.xlabel(db_nama_anggota[image_ind])
```


Ahmad Luky Ramdani


Rahman Indra Kesuma


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Arief Ichwani

Langkah 5. Persiapan Dataset untuk Pengujian Model

Proses untuk memasukkan keseluruhan test set yang telah disiapkan di media penyimpanan google drive ke dalam folder yang disediakan.
Yang mana, nantinya folder tersebut akan digunakan untuk proses pengujian model pengenalan wajah dengan DeepFace.

```
# Memastikan bahwa belum ada folder dan membuat folder baru untuk
# menyimpan data citra wajah untuk proses pengujian model
!rm -rf '/content/db_wajah_test'
os.mkdir("/content/db_wajah_test/")


# Proses memindahkan test set (data citra) ke dalam folder yang telah disiapkan
drive.mount('/content/drive')
path_db = '/content/drive/MyDrive/Colab Notebooks/Tugas DeepFace/Testing Data/'
for path, subdirs, files in os.walk(path_db):
  for name in files:
    sourcepath_file = path_db+name
    destpath_file = '/content/db_wajah_test/'+name
    shutil.copyfile(sourcepath_file, destpath_file)
```

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

```
# Deskripsi dari jumlah data pada Database Wajah Anggota Kelas dan Data Testing
jumData_Wajah_Anggota = 0
jumData_Testing_Anggota = 0
jumData_Testing_NonAnggota = 0

path_db = '/content/db_wajah_anggota'
for path, subdirs, files in os.walk(path_db):
  for name in files :
    jumData_Wajah_Anggota = jumData_Wajah_Anggota + 1
```

```
path_db = '/content/db_wajah_test'
for path, subdirs, files in os.walk(path_db):
  for name in files :
    subname = name.split("-")
    if subname[1] == 'AA' :
      jumData_Testing_Anggota = jumData_Testing_Anggota + 1
    else :
      jumData_Testing_NonAnggota = jumData_Testing_NonAnggota + 1

print("Jumlah Database Wajah Anggota Kelas -> ", jumData_Wajah_Anggota)
print("Jumlah Data Testing - Anggota Kelas -> ", jumData_Testing_Anggota)
print("Jumlah Data Testing - Non Anggota Kelas -> ", jumData_Testing_NonAnggota)
```

```
Jumlah Database Wajah Anggota Kelas ->  30
Jumlah Data Testing - Anggota Kelas ->  49
Jumlah Data Testing - Non Anggota Kelas ->  49
```

Double-click (or enter) to edit

Langkah 6. Percobaan Library DeepFace

Proses percobaan untuk penggunaan library deepface dengan default setting untuk tujuan pengenalan wajah dalam test set ke database wajah hasil augmentation.

```
test_image = "/content/db_wajah_test/D26-NA-Johnny Depp.jpeg"
hasil_deepface = DeepFace.find(img_path = test_image, db_path = "/content/db_aug_proses", enforce_detection=False, prog_bar=True)
```

```
vgg_face_weights.h5 will be downloaded...
Downloading...
From: https://github.com/serengil/deepface_models/releases/download/v1.0/vgg_face_weights.h5
To: /root/.deepface/weights/vgg_face_weights.h5

  0%|          | 0.00/580M [00:00<?, ?B/s]
  2%|▏         | 11.0M/580M [00:00<00:05, 108MB/s]
  6%|▌         | 33.0M/580M [00:00<00:03, 172MB/s]
  9%|▉         | 51.4M/580M [00:00<00:03, 171MB/s]
 13%|█▎        | 76.0M/580M [00:00<00:02, 200MB/s]
 17%|█▋        | 96.5M/580M [00:00<00:03, 159MB/s]
```

```
 20%|██          | 114M/580M [00:00<00:02, 162MB/s]
 23%|██          | 132M/580M [00:00<00:02, 166MB/s]
 26%|██          | 154M/580M [00:00<00:02, 180MB/s]
 31%|███         | 178M/580M [00:00<00:02, 199MB/s]
 34%|███         | 199M/580M [00:01<00:02, 190MB/s]
 38%|███         | 222M/580M [00:01<00:01, 200MB/s]
 42%|████        | 244M/580M [00:01<00:01, 205MB/s]
 46%|████        | 265M/580M [00:01<00:01, 174MB/s]
 50%|████        | 288M/580M [00:01<00:01, 189MB/s]
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 59%|█████       | 345M/580M [00:01<00:01, 153MB/s]
 62%|██████      | 361M/580M [00:02<00:01, 141MB/s]
 65%|██████      | 376M/580M [00:02<00:01, 138MB/s]
 67%|██████      | 390M/580M [00:02<00:01, 125MB/s]
 71%|███████     | 415M/580M [00:02<00:01, 153MB/s]
 76%|███████     | 439M/580M [00:02<00:00, 177MB/s]
 80%|████████    | 465M/580M [00:02<00:00, 197MB/s]
 84%|████████    | 487M/580M [00:02<00:00, 205MB/s]
 88%|████████    | 509M/580M [00:02<00:00, 206MB/s]
 92%|█████████   | 533M/580M [00:02<00:00, 216MB/s]
 96%|█████████   | 556M/580M [00:03<00:00, 221MB/s]
100%|██████████  | 580M/580M [00:03<00:00, 181MB/s]
 70%|███████     | 407M/580M [00:19<00:04, 37.1MB/s]Representations stored in  /content/db_aug_proses / representations_vgg_face.pkl  file. Please delete this file when
find function lasts  59.64272880554199  seconds
```

```
print("Daftar Data Wajah yang Dianggap Memiliki Kemiripan")

data_wajah_test = io.imread(test_image)
plot_wajah_test = (np.expand_dims(data_wajah_test, axis=-1)/255.).astype(np.float32)
plt.figure(figsize=(2,4))
plt.imshow(np.squeeze(plot_wajah_test), cmap=plt.cm.binary)

if hasil_deepface['identity'].count() > 0:
  index = 1
  lebar = hasil_deepface['identity'].count() / 5
  plt.figure(figsize=(10,4*lebar))
  for hasil_path,dist_value in zip(hasil_deepface.iloc[:, 0],hasil_deepface.iloc[:, 1]) :
    data_wajah_hasil = io.imread(hasil_path)
    plot_wajah_hasil = (np.expand_dims(data_wajah_hasil, axis=-1)/255.).astype(np.float32)
    plt.subplot(lebar+1,5,index)
    plt.xticks([])
    plt.yticks([])
```

```
    plt.grid(False)
    plt.imshow(np.squeeze(plot_wajah_hasil), cmap=plt.cm.binary)
    plt.xlabel("Dist = {:.4f}".format(dist_value))
    index = index + 1
else :
  print("Tidak ada wajah yang dianggap mirip dengan Database Anggota Kelas")
```


```
# Pengecekan label Anggota Kelas (Nama Anggota) dan Non Anggota Kelas dengan menggunakan
# threshold dari nilai distance sebesar 0.2

dist_threshold = 0.2
label_find = []
for hasil_path,dist_value in zip(hasil_deepface.iloc[:, 0],hasil_deepface.iloc[:, 1]) :
  if dist_value < dist_threshold :
    nama_file = hasil_path.split("/")
    nama_anggota = nama_file[3].split("-")
    label_find.append(nama_anggota[0])
```

```
print(label_find)

if len(label_find) > 0 :
  label_final = stats.mode(label_find)[0][0]
else :
  label_final = "Non Anggota Kelas"

nama_file_actual = test_image.split("/")
nama_anggota_actual = nama_file_actual[3].split("-")
if nama_anggota_actual[1] == "AA" :
  temp = nama_anggota_actual[2].split(".")
  label_actual = temp[0]
else :
  label_actual = "Non Anggota Kelas"

print("\nActual Label : ", label_actual)
print("Predicted Label : ", label_final)
```

```
[]

Actual Label :  Non Anggota Kelas
Predicted Label :  Non Anggota Kelas
```

Langkah 7. Persiapan Eksperimen dengan DeepFace

Proses pendefinisian beberapa fungsi yang nantinya akan digunakan untuk proses eksplorasi dan pencarian setting model terbaik untuk pengenalan wajah dari anggota kelas.

```
# Fungsi eksplorasi didesain untuk mencari setting dari model_name, distance_metric, dan detector_backend terbaik
def deepface_apply(nama_model, matriks_jarak, detector):
  hasil_eksperimen = []
··label_actual·=·[]
··label_predict·=·[]

··path_db·=·'/content/db_wajah_test/'
  for path, subdirs, files in os.walk(path_db):
    for name in files :
      test_image = path_db+name
      hasil_deepface = DeepFace.find(img_path = test_image, db_path = "/content/db_aug_proses", enforce_detection=False, prog_bar=True, model_name=nama_model, di
```

```
      dist_threshold = 0.2
      label_find = []
      for hasil_path,dist_value in zip(hasil_deepface.iloc[:, 0],hasil_deepface.iloc[:, 1]) :
        if dist_value < dist_threshold :
          nama_file = hasil_path.split("/")
          nama_anggota = nama_file[3].split("-")
          label_find.append(nama_anggota[0])

      if len(label_find) > 0 :
        label_predict.append(stats.mode(label_find)[0][0])
      else :
        label_predict.append("Non Anggota Kelas")

      nama_file_actual = test_image.split("/")
      nama_anggota_actual = nama_file_actual[3].split("-")
      if nama_anggota_actual[1] == "AA" :
        temp = nama_anggota_actual[2].split(".")
        label_actual.append(temp[0])
      else :
        label_actual.append("Non Anggota Kelas")

  hasil_eksperimen.append(confusion_matrix(label_actual, label_predict, labels=list_label))
  hasil_eksperimen.append(accuracy_score(label_actual, label_predict))
  hasil_eksperimen.append(f1_score(label_actual, label_predict, average='macro'))
  return hasil_eksperimen


hasil = deepface_apply("Facenet512", "cosine", "opencv")
print("\nAkurasi : {:.4f}".format(hasil[1]))
print("Macro F1-Score : {:.4f}".format(hasil[2]))
```

```
    find function lasts  0.2776215076446533  seconds
    WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
    There are  180  representations found in  representations_facenet512.pkl
    find function lasts  0.5123002529144287  seconds
    WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
    There are  180  representations found in  representations_facenet512.pkl
    find function lasts  0.4424405097961426  seconds
    WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
    There are  180  representations found in  representations_facenet512.pkl
    find function lasts  0.8574731349945068  seconds
    WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
    There are  180  representations found in  representations_facenet512.pkl
    find function lasts  0.18692541122436523  seconds
    WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
```

```
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.14565682411193848  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.30380916595458984  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.31710147857666016  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.24920344352722168  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.29031896591186523  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.3285384178161621  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.3018369674682617  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.29404497146606445  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.2640492916107178  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.3214597702026367  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.19689488410949707  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.30031847953796387  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  5.579078197479248  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  2.1654019355773926  seconds

Akurasi : 0.7959
Macro F1-Score : 0.7578
```

Langkah 8. Percobaan Pertama dari Strategi Eksperimen dengan DeepFace

Proses percobaan pertama dilakukan dengan fokus pencarian model terbaik yang bisa digunakan dalam arsitektur DeepFace. Yang mana berdasarkan panduan penggunaan library DeepFace terdapat beberapa state-of-the-art dari model pengenalan wajah seperti VGG-Face, Google FaceNet, OpenFace, Facebook DeepFace, DeepID, ArcFace dan Dlib.

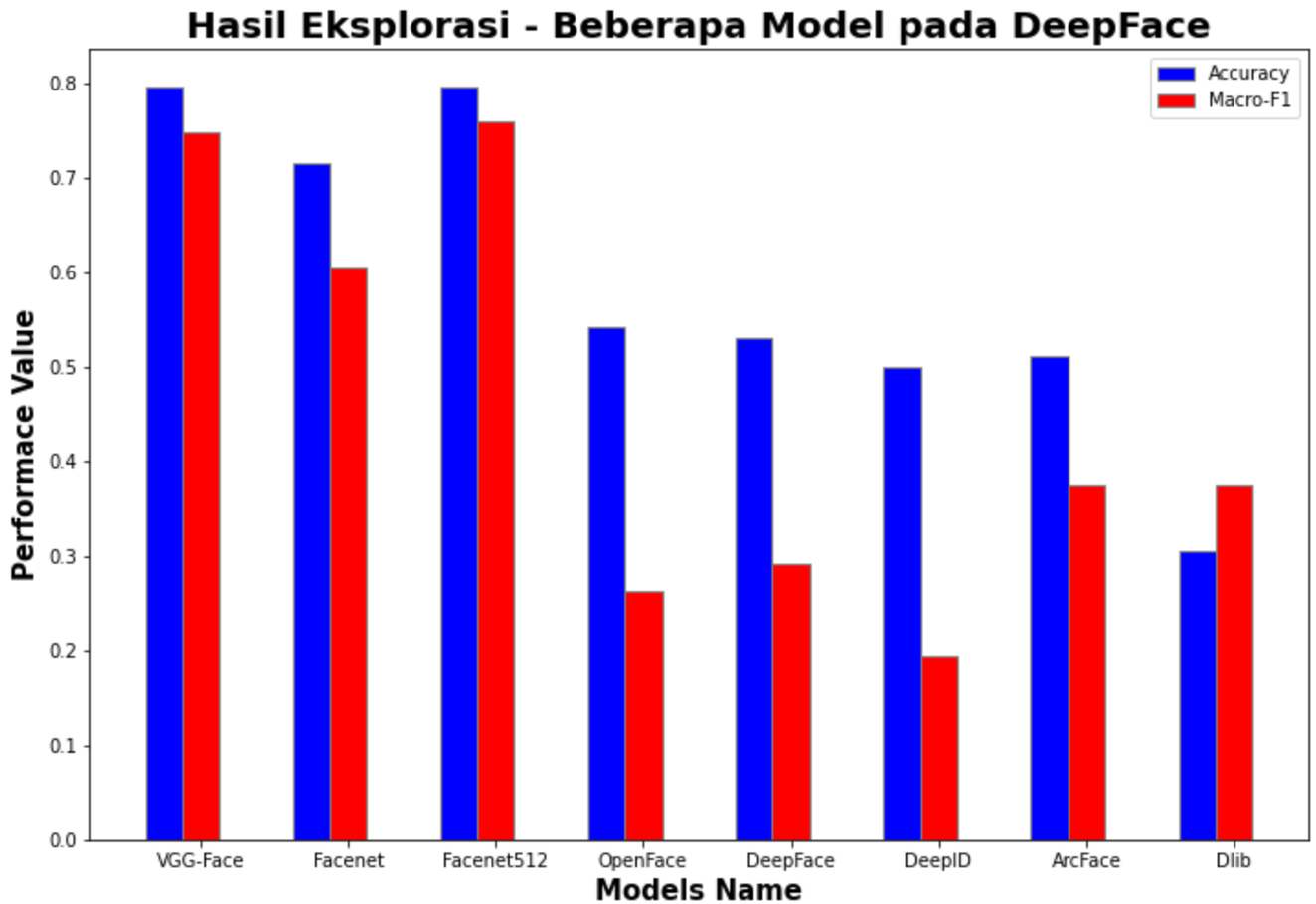
```
# Setting distance_metric : cosine
# Setting detector_backend : opencv
list_models = ["VGG-Face", "Facenet", "Facenet512", "OpenFace", "DeepFace", "DeepID", "ArcFace", "Dlib"]
hasil_recognition = []

for nama_model in list_models:
  hasil = deepface_apply(nama_model, "cosine", "opencv")
  hasil_recognition.append(hasil)
```

```
find function lasts  0.26260948181152344  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.18050003051757812  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.3936307430267334  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.33623313903808594  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.7585146427154541  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.0919497013092041  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.046865224838256836  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.19113492965698242  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.2089829444885254  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.13455438613891602  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
```

```
find function lasts  0.21011734008789062  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.18779230117797852  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.20279669761657715  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.20469141006469727  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.1364445686340332  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.20647811889648438  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.09321427345275879  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  0.2147824764251709  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
find function lasts  4.744105577468872  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_dlib.pkl . If you added new instances after this f
There are  180  representations found in  representations_dlib.pkl
```

```
# Pengaturan lebar dari bar chart
barWidth = 0.25
fig = plt.subplots(figsize =(12, 8))

# Pengaturan dari nilai akurasi dan macro f1 yang akan ditampilkan
index = 0
acc = []
macro_f1 = []
for nama_model in list_models:
  acc.append(hasil_recognition[index][1])
  macro_f1.append(hasil_recognition[index][2])
  index = index + 1

# Pengaturan posisi dari setiap bar pada sumbu X
br1 = np.arange(len(acc))
```

```
br2 = [x + barWidth for x in br1]

# Membuat plot
plt.bar(br1, acc, color ='b', width = barWidth, edgecolor ='grey', label ='Accuracy')
plt.bar(br2, macro_f1, color ='r', width = barWidth, edgecolor ='grey', label ='Macro-F1')

# Penambahan informasi pada setiap sumbu
plt.xlabel('Models Name', fontweight ='bold', fontsize = 15)
plt.ylabel('Performace Value', fontweight ='bold', fontsize = 15)
plt.xticks([r + barWidth for r in range(len(acc))], list_models)

plt.legend()
plt.title("Hasil Eksplorasi - Beberapa Model pada DeepFace", fontweight ='bold', fontsize = 20)
plt.show()
```



Langkah 9. Percobaan Kedua dari Strategi Eksperimen dengan DeepFace

Proses percobaan kedua dilakukan dengan fokus pencarian teknik perhitungan jarak (distance_matrice) terbaik yang bisa digunakan dalam arsitektur DeepFace. Yang mana berdasarkan panduan penggunaan library DeepFace terdapat beberapa teknik pengukuran similaritas ataupun jarak data seperti Cosine Similarity, Euclidean Distance dan Euclidean Distance dengan penerapan L2.

Selain itu, juga digunakan model terbaik dari hasil percobaan pertama yang mana diperoleh dua model yang dianggap lebih unggul dari pada model lainnya, yaitu VGG-Face dan Facenet512.

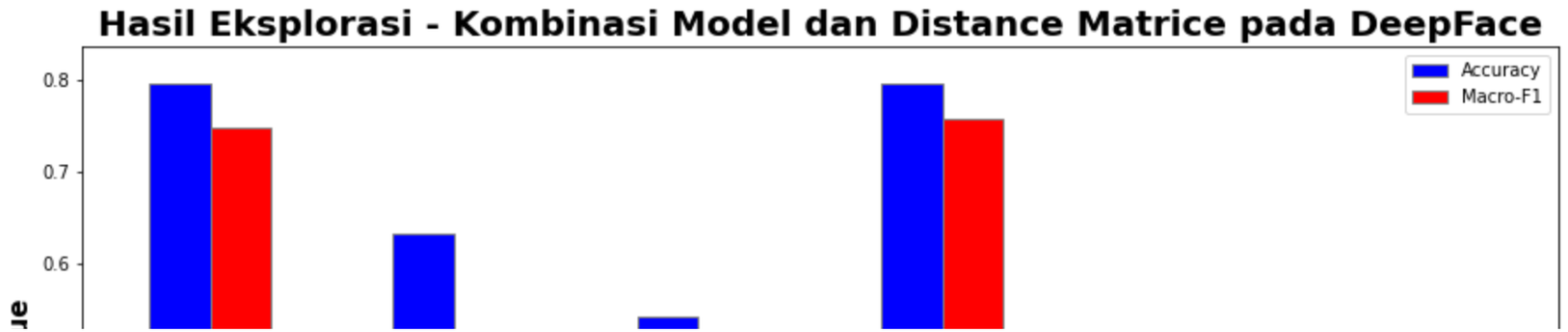
```
# Setting detector_backend : opencv
list_models = ["VGG-Face", "Facenet512"]
matriks_jarak = ["cosine", "euclidean", "euclidean_l2"]
hasil_recognition2 = []

for nama_model in list_models:
  for nama_matrik in matriks_jarak:
    hasil = deepface_apply(nama_model, nama_matrik, "opencv")
    hasil_recognition2.append(hasil)
```

```
find function lasts  0.3606898784637451  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.2793765068054199  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.5129241943359375  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.4295036792755127  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.859743595123291  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.19822192192077637  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.1609644889831543  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.3087446689605713  seconds
```

```
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.3164079189300537  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.2692387104034424  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.310833215713501  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.29383301734924316  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.2977466583251953  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.30915164947509766  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.24230527877807617  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.3104515075683594  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.19608640670776367  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.3228175640106201  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  4.8191657066345215  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  2.1797235012054443  seconds
```

```
# Pengaturan dari label sumbu x, nilai akurasi dan macro f1 yang akan ditampilkan
index = 0
acc = []
macro_f1 = []
label_x = []
for nama_model in list_models:
  for nama_matrik in matriks_jarak:
    label_x.append(nama_model+" - "+nama_matrik)
```

```
    acc.append(hasil_recognition2[index][1])
    macro_f1.append(hasil_recognition2[index][2])
    index = index + 1

# Pengaturan lebar dari bar chart
barWidth = 0.25
fig = plt.subplots(figsize =(15, 8))

# Pengaturan posisi dari setiap bar pada sumbu X
br1 = np.arange(len(acc))
br2 = [x + barWidth for x in br1]

# Membuat plot
plt.bar(br1, acc, color ='b', width = barWidth, edgecolor ='grey', label ='Accuracy')
plt.bar(br2, macro_f1, color ='r', width = barWidth, edgecolor ='grey', label ='Macro-F1')

# Penambahan informasi pada setiap sumbu
plt.xlabel('Models dan Matrice Name', fontweight ='bold', fontsize = 15)
plt.ylabel('Performace Value', fontweight ='bold', fontsize = 15)
plt.xticks([r + barWidth for r in range(len(acc))], label_x)

plt.legend()
plt.title("Hasil Eksplorasi - Kombinasi Model dan Distance Matrice pada DeepFace", fontweight ='bold', fontsize = 20)
plt.show()
```



Langkah 10. Percobaan Ketiga dari Strategi Eksperimen dengan DeepFace

Proses percobaan ketiga dilakukan dengan fokus pencarian pada detector backend terbaik yang bisa digunakan dalam arsitektur DeepFace. Yang mana berdasarkan panduan penggunaan library DeepFace terdapat beberapa detector backend yang bisa digunakan seperti OpenCV, SSD, Dlib, MTCNN, RetinaFace, dan MediaPipe.

Selain itu, juga digunakan model terbaik dari hasil percobaan kedua yang mana diperoleh dua kombinasi yang dianggap lebih unggul dari pada kombinasi lainnya, yaitu VGG-Face+Cosine dan Facenet512+Cosine.

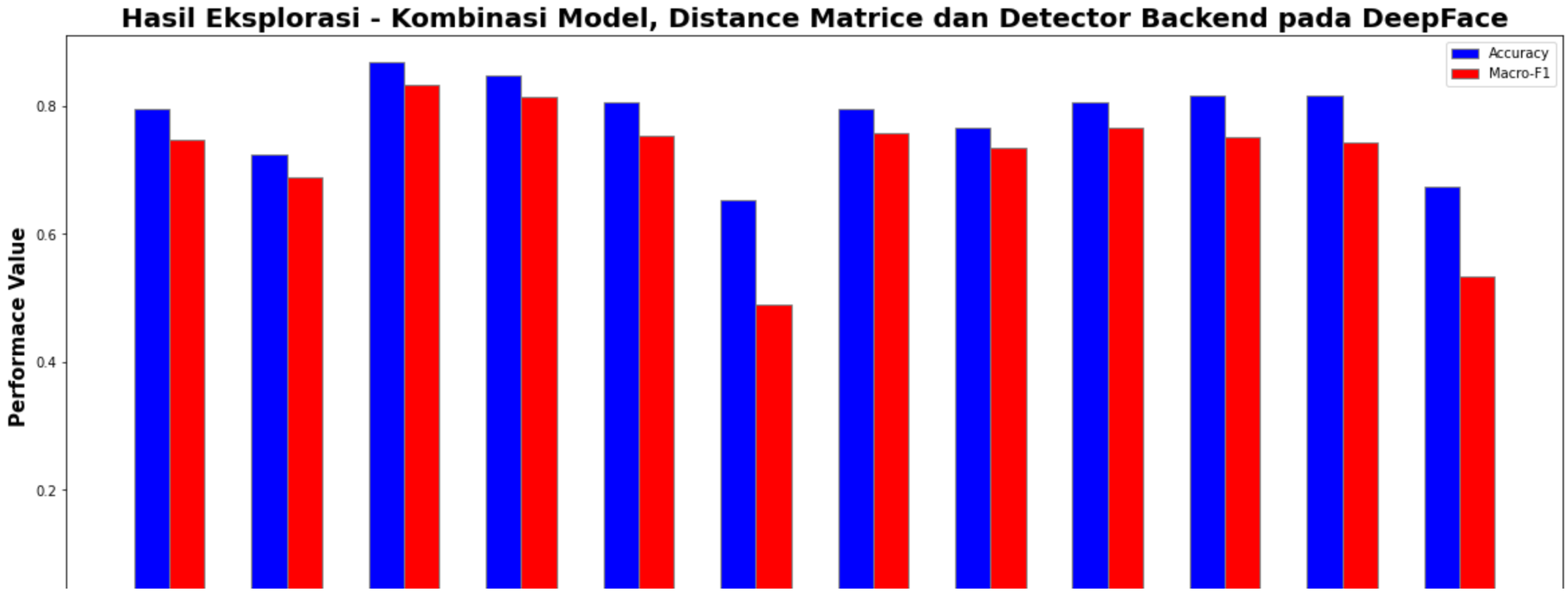
```
!pip install mediapipe==0.8.9.1
import mediapipe

# Setting matriks_jarak : cosine
list_models = ["VGG-Face", "Facenet512"]
list_backends = ['opencv', 'ssd', 'dlib', 'mtcnn', 'retinaface', 'mediapipe']
hasil_recognition3 = []

for nama_model in list_models:
  for nama_backend in list_backends:
    hasil = deepface_apply(nama_model, "cosine", nama_backend)
    hasil_recognition3.append(hasil)
```

```
find function lasts  0.1510157585144043  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.18273115158081055  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.1735095977783203  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
```

```
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.15304946899414062  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.17717957496643066  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.1371464729309082  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.1558833122253418  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.18351459503173828  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.1710212230682373  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.14025378227233887  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.1427006721496582  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.14995670318603516  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.19144225120544434  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.14313054084777832  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.1586449146270752  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.18648195266723633  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.14605951309204102  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.1504993438720703  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.5592367649078369  seconds
```

```
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_facenet512.pkl . If you added new instances after
There are  180  representations found in  representations_facenet512.pkl
find function lasts  0.26897382736206055  seconds
```

```
# Pengaturan dari label sumbu x, nilai akurasi dan macro f1 yang akan ditampilkan
index = 0
acc = []
macro_f1 = []
label_x = []
for nama_model in list_models:
  for nama_backend in list_backends:
    label_x.append(nama_model+"\ncosine\n"+nama_backend)
    acc.append(hasil_recognition3[index][1])
    macro_f1.append(hasil_recognition3[index][2])
    index = index + 1

# Pengaturan lebar dari bar chart
barWidth = 0.3
fig = plt.subplots(figsize =(20, 8))

# Pengaturan posisi dari setiap bar pada sumbu X
br1 = np.arange(len(acc))
br2 = [x + barWidth for x in br1]

# Membuat plot
plt.bar(br1, acc, color ='b', width = barWidth, edgecolor ='grey', label ='Accuracy')
plt.bar(br2, macro_f1, color ='r', width = barWidth, edgecolor ='grey', label ='Macro-F1')

# Penambahan informasi pada setiap sumbu
plt.xlabel('Models, Distance Matrice, dan Detector Backend', fontweight ='bold', fontsize = 15)
plt.ylabel('Performace Value', fontweight ='bold', fontsize = 15)
plt.xticks([r + barWidth for r in range(len(acc))], label_x)

plt.legend()
plt.title("Hasil Eksplorasi - Kombinasi Model, Distance Matrice dan Detector Backend pada DeepFace", fontweight ='bold', fontsize = 20)
plt.show()
```



Langkah 11. Percobaan Keempat dari Strategi Eksperimen dengan DeepFace

Percobaan dengan beberapa nilai distance threshold yang berbeda, dengan setting parameter DeepFace yaitu: (i) Model = VGG-Face; (ii) distance_matrice = cosine; dan (iii) detector_backend = dlib. Selain itu, akan dicoba nilai distance threshold dari rencang 0,05 hingga 0,3.

```
# Fungsi eksplorasi untuk mencari nilai distance threshold terbaik
def deepface_applyThreshold(nama_model, matriks_jarak, detector, threshold_value):
  hasil_eksperimen = []
  label_actual = []
  label_predict = []

  path_db = '/content/db_wajah_test/'
  for path, subdirs, files in os.walk(path_db):
    for name in files :
      test_image = path_db+name
      hasil_deepface = DeepFace.find(img_path = test_image, db_path = "/content/db_aug_proses", enforce_detection=False, prog_bar=True, model_name=nama_model, distance_metr
```

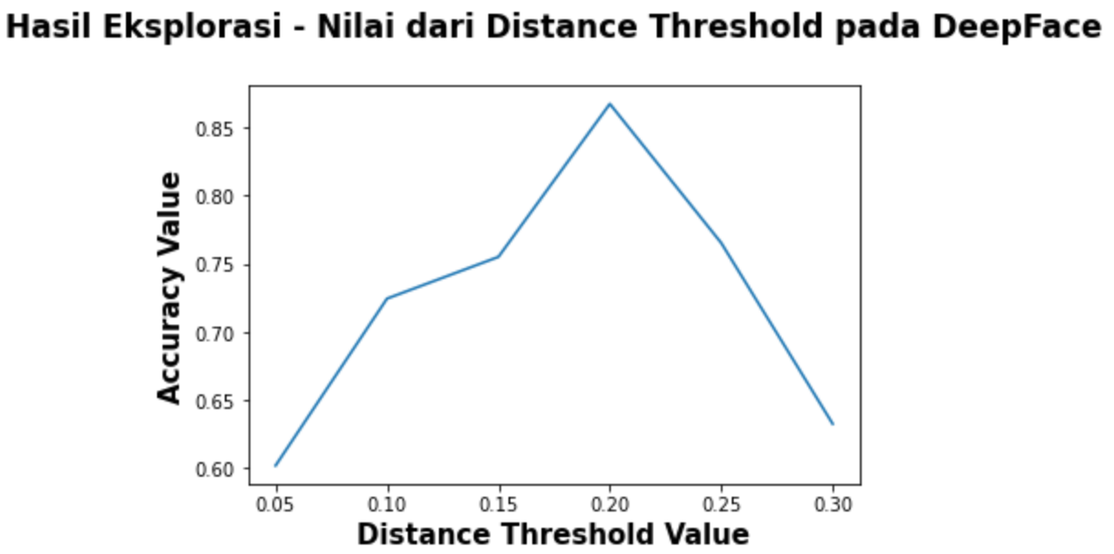
```
      dist_threshold = threshold_value
      label_find = []
      for hasil_path,dist_value in zip(hasil_deepface.iloc[:, 0],hasil_deepface.iloc[:, 1]) :
        if dist_value < dist_threshold :
          nama_file = hasil_path.split("/")
          nama_anggota = nama_file[3].split("-")
          label_find.append(nama_anggota[0])

      if len(label_find) > 0 :
        label_predict.append(stats.mode(label_find)[0][0])
      else :
        label_predict.append("Non Anggota Kelas")

      nama_file_actual = test_image.split("/")
      nama_anggota_actual = nama_file_actual[3].split("-")
      if nama_anggota_actual[1] == "AA" :
        temp = nama_anggota_actual[2].split(".")
        label_actual.append(temp[0])
      else :
        label_actual.append("Non Anggota Kelas")

  hasil_eksperimen.append(confusion_matrix(label_actual, label_predict, labels=list_label))
  hasil_eksperimen.append(accuracy_score(label_actual, label_predict))
  hasil_eksperimen.append(f1_score(label_actual, label_predict, average='macro'))
  return hasil_eksperimen

# Setting model : VGG-Face
# Setting matriks_jarak : cosine
# Setting detector_backend : dlib
threshold_list = [0.05, 0.1, 0.15, 0.2, 0.25, 0.3]
hasil_recognition4 = []

for threshold_value in threshold_list:
  hasil = deepface_applyThreshold("VGG-Face", "cosine", "dlib", threshold_value)
  hasil_recognition4.append(hasil)
```

```
find function lasts  0.6944468021392822  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5269098281860352  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  1.0069842338562012  seconds
```

```
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.8882250785827637  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  1.630117654800415  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.39942240715026855  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.34732770919799805  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.4769279956817627  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5281162261962891  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.49495482444763184  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5196893215179443  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5751118659973145  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5292127132415771  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5284137725830078  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.4729928970336914  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5132050514221191  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.40262603759765625  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5783045291900635  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
```

```
find function lasts  15.946640491485596  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  4.964871883392334  seconds
```

```
# Pengaturan dari nilai akurasi yang akan ditampilkan berdasarkan suatu nilai distance threshold
index = 0
acc = []
for threshold_value in threshold_list:
  acc.append(hasil_recognition4[index][1])
  index = index + 1

# Menampilkan hasil perhitungan accuracy pada setiap percobaan nilai distance threshold
plt.plot(threshold_list, acc)
plt.title("Hasil Eksplorasi - Nilai dari Distance Threshold pada DeepFace\n", fontweight ='bold', fontsize = 17)
plt.xlabel('Distance Threshold Value', fontweight ='bold', fontsize = 15)
plt.ylabel('Accuracy Value', fontweight ='bold', fontsize = 15)
plt.show()
```



Langkah 12. Penampilan Data yang Berhasil dan Gagal Diklasifikasikan

Pada bagian ini akan ditampilkan beberapa contoh data yang berhasil diklasifikasikan dengan benar dan yang gagal diklasifikasi.

```
hasil_eksperimen = []
file_identity = []
label_actual = []
label_predict = []

path_db = '/content/db_wajah_test/'
for path, subdirs, files in os.walk(path_db):
  for name in files :
    test_image = path_db+name
    hasil_deepface = DeepFace.find(img_path = test_image, db_path = "/content/db_aug_proses", enforce_detection=False, prog_bar=True, model_name='VGG-Face', dist
    file_identity.append(test_image)

    dist_threshold = 0.2
    label_find = []
    for hasil_path,dist_value in zip(hasil_deepface.iloc[:, 0],hasil_deepface.iloc[:, 1]) :
      if dist_value < dist_threshold :
        nama_file = hasil_path.split("/")
        nama_anggota = nama_file[3].split("-")
        label_find.append(nama_anggota[0])

    if len(label_find) > 0 :
      label_predict.append(stats.mode(label_find)[0][0])
    else :
      label_predict.append("Non Anggota Kelas")

    nama_file_actual = test_image.split("/")
    nama_anggota_actual = nama_file_actual[3].split("-")
    if nama_anggota_actual[1] == "AA" :
      temp = nama_anggota_actual[2].split(".")
      label_actual.append(temp[0])
    else :
      label_actual.append("Non Anggota Kelas")

hasil_eksperimen.append(confusion_matrix(label_actual, label_predict, labels=list_label))
hasil_eksperimen.append(accuracy_score(label_actual, label_predict))
hasil_eksperimen.append(f1_score(label_actual, label_predict, average='macro'))
```

```
find function lasts  0.7246582258480713  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5422673225402832  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.9773139953613281  seconds
```

```
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.8624413013458252  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  1.6194462776184082  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.40535593032836914  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.37174344062805176  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.4646427631378174  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5264303684234619  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.514338493347168  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5221188068389893  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.6161074638366699  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.529742956161499  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5419025421142578  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5053036212921143  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.5350344181060791  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.4031250476837158  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  0.6076819896697998  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
```

```
find function lasts  16.720128536224365  seconds
WARNING: Representations for images in  /content/db_aug_proses  folder were previously stored in  representations_vgg_face.pkl . If you added new instances after th
There are  180  representations found in  representations_vgg_face.pkl
find function lasts  5.153869867324829  seconds
```

```
print("Nilai Akurasi  -> ", hasil_eksperimen[1])
print("Nilai Macro F1 -> ", hasil_eksperimen[2])
```

```
Nilai Akurasi  ->  0.8673469387755102
Nilai Macro F1 ->  0.8324437467294611
```

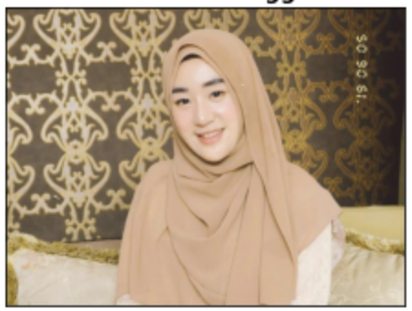
```
# Menampilkan seluruh data testing dengan status benar atau salah diklasifikasikan
index = 0
for nama_label in label_actual:
  data_wajah_test = io.imread(file_identity[index])
  plot_wajah_test = (np.expand_dims(data_wajah_test, axis=-1)/255.).astype(np.float32)
  plt.figure(figsize=(12,3))
  judul1 = "Label Actual : "+nama_label
  plt.subplot(1,2,1)
  plt.xticks([])
  plt.yticks([])
  plt.grid(False)
  plt.title(judul1, fontweight ='bold', fontsize = 12)
  plt.imshow(np.squeeze(plot_wajah_test), cmap=plt.cm.binary)

  status = "[BENAR]"
  if (nama_label != label_predict[index]) :
    status = "[SALAH]"

  if (label_predict[index] != "Non Anggota Kelas") :
    data_wajah_db = io.imread("/content/db_wajah_anggota/"+label_predict[index]+".jpeg")
    plot_wajah_db = (np.expand_dims(data_wajah_db, axis=-1)/255.).astype(np.float32)
    judul2 = "Label Predicted : "+label_predict[index]+" "+status
    plt.subplot(1,2,2)
    plt.xticks([])
    plt.yticks([])
    plt.grid(False)
    plt.title(judul2, fontweight ='bold', fontsize = 12)
    plt.imshow(np.squeeze(plot_wajah_db), cmap=plt.cm.binary)
  else :
    judul2 = "Label Predicted : "+label_predict[index]+" "+status
    plt.subplot(1,2,2)
```

```
    plt.xticks([])
    plt.yticks([])
    plt.grid(False)
    plt.title(judul2, fontweight ='bold', fontsize = 12)
    npArray = np.array([[[0, 0, 0, 0]]], dtype='uint8')
    plt.imshow(npArray, interpolation='nearest')

index = index + 1
```

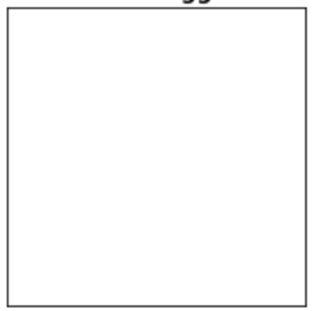
```
---------------------------------------------------------------------------
FileNotFoundError                         Traceback (most recent call last)
<ipython-input-48-9d2979ccbf15> in <module>()
     18
     19   if (label_predict[index] != "Non Anggota Kelas") :
---> 20     data_wajah_db = io.imread("/content/db_wajah_anggota/"+label_predict[index]+".jpeg")
     21     plot_wajah_db = (np.expand_dims(data_wajah_db, axis=-1)/255.).astype(np.float32)
     22     judul2 = "Label Predicted : "+label_predict[index]+" "+status

                                  6 frames

/usr/local/lib/python3.7/dist-packages/imageio/core/request.py in _parse_uri(self, uri)
    271                 # Reading: check that the file exists (but is allowed a dir)
    272                 if not os.path.exists(fn):
--> 273                     raise FileNotFoundError("No such file: '%s'" % fn)
    274             else:
    275                 # Writing: check that the directory to write to does exist

FileNotFoundError: No such file: '/content/db_wajah_anggota/Yaya Setiyadi.jpeg'
```

SEARCH STACK OVERFLOW

Label Actual : Non Anggota Kelas



Label Predicted : Non Anggota Kelas [BENAR]

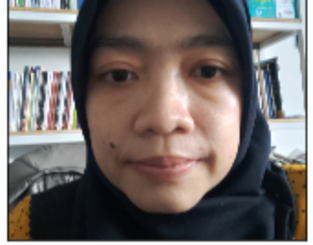


Label Actual : Adiyasa Nurfalah

Label Predicted : Adiyasa Nurfalah [BENAR]

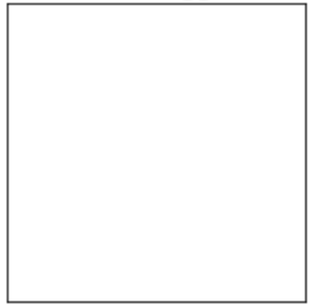
Label Actual : Mina Ismu Rahayu

Label Predicted : Mina Ismu Rahayu [BENAR]



Label Actual : Non Anggota Kelas

Label Predicted : Non Anggota Kelas [BENAR]



Label Actual : Reza Budiawan

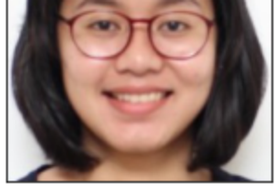
Label Predicted : Reza Budiawan [BENAR]

Label Actual : Adiyasa Nurfalah

Label Predicted : Adiyasa Nurfalah [BENAR]

Label Actual : Meredita Susanty

Label Predicted : Meredita Susanty [BENAR]



Label Actual : Non Anggota Kelas

Label Predicted : Non Anggota Kelas [BENAR]

Label Actual : Non Anggota Kelas

Label Predicted : Varuliantor Dear [SALAH]

Label Actual : Reza Budiawan

Label Predicted : Reza Budiawan [BENAR]

Label Actual : Hartanto Tantriawan

Label Predicted : Hartanto Tantriawan [BENAR]

Label Actual : Hartanto Tantriawan

Label Predicted : Non Anggota Kelas [SALAH]

Label Actual : Yaya Setiyadi