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## LAMPIRAN

## LAMPIRAN 1 : Facial Expression Recognition

```

from __future__ import print_function
import argparse
import os
import cv2
import pandas as pd
import numpy as np
import torch
from torchvision import transforms
from PIL import Image
from torch.utils.data import DataLoader, Dataset
import torch.nn.functional as F
from deep_emotion import Deep_Emotion
from data_loaders import Plain_Dataset, eval_data_dataloader
import smbus
import os
from time import sleep

device = torch.device("cuda:0" if torch.cuda.is_available() else
"cpu")

transformation =
transforms.Compose([transforms.ToTensor(),transforms.Normalize((0.5,)
,(0.5,))])
dataset = Plain_Dataset(csv_file='data'+ '/'+'train.csv',img_dir =
'data'+ '/'+'test/',datatype = 'finaltest',transform = transformation)
test_loader = DataLoader(dataset,batch_size=64,num_workers=0)

net = Deep_Emotion()
print("Deep Emotion:-", net)
model = 'deep_emotion1-2-128-0.005.pt'
net.load_state_dict(torch.load(model))
net.to(device)
net.eval()

#Model Evaluation on test data
classes = ('Angry', 'Angry', 'Angry' 'Happy','Sad', 'Happy' , 'Sad')
total = []
test_acc = False
if test_acc:
    with torch.no_grad():
        for data, labels in test_loader:
            data, labels = data.to(device), labels.to(device)
            outputs = net(data)
            pred = F.softmax(outputs,dim=1)
            classs = torch.argmax(pred,1)
            wrong = torch.where(classs !=
labels,torch.tensor([1.]).cuda(),torch.tensor([0.]).cuda())
            acc = 1- (torch.sum(wrong) / 64)
            total.append(acc.item())

```

```

    print('Accuracy of the network on the test images: %d %%' % (100
* np.mean(total)))

#helper_function for real time testing
def load_img(path):
    img = Image.open(path)
    img = transformation(img).float()
    img = torch.autograd.Variable(img,requires_grad = True)
    img = img.unsqueeze(0)
    return img.to(device)

cam = True
if cam:
    cap = os.system('libcamera-still -o /home/iascr/Downloads/Deep-
Emotion-master/imgs/oke.jpg -t 4000 --width 740 --height 780')
    while True:
        face_cascade =
cv2.CascadeClassifier('./cascade_model/haarcascade_frontalface_defaul
t.xml')
        # Read the frame
        img = cv2.imread("/home/iascr/Downloads/Deep-Emotion-
master/imgs/oke.jpg")
        # Convert to grayscale
        gray = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
        # Detect the faces
        faces = face_cascade.detectMultiScale(gray, 1.1, 4)
        # Draw the rectangle around each face
        #roi = cv2.resize(gray,(48,48))
        #cv2.imwrite("D:/Kuliah/Tugas-akhir/Realtime-Face-Emotion-
Recognition-main/oke.jpg", roi)
        facess = face_cascade.detectMultiScale(img)
        if len(facess) == 0:
            print("no face detected")
        else:
            imgg = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
            imgg = cv2.resize(imgg,(48,48))
            imgg = np.expand_dims(imgg, axis = 0)
            imgg = np.expand_dims(imgg, axis = 0)
            imgg = imgg/255.0
            data = torch.from_numpy(imgg)
            data = data.type(torch.FloatTensor)
            data = data.to(device)
            out = net(data)
            pred = F.softmax(out, dim = 1)
            classs = torch.argmax(pred,1)
            wrong = torch.where(classs !=
3,torch.tensor([1.]).cpu(),torch.tensor([0.]).cpu())
            classs = torch.argmax(pred,1)
            prediction = classes[classs.item()]
            print(prediction)

```

## LAMPIRAN 2 : Algoritma Genetika

<pre> %Mainmatroom clear clc besar_populasi=10; laju_mutasi = 0.05; total_generasi = 150; %cahayaT = 200; prev.gen = [0 0 0 0];  prev.fitness = 0; delay = 0; global s; s = serialport('COM3',9600); fopen(s); isLooping = true; data2 = zeros(total_generasi,9); data1 = zeros(total_generasi,8);  i = 1; for i = 1:1     i = i+1;  [ga,data,populasi_awal,cahayaT] = GMain(data1,data2, prev, besar_populasi,laju_mutasi, total_generasi); gen(1) = prev.gen(1)-ga.gen(1); gen(2) = prev.gen(2) - ga.gen(2); gen(3) = prev.gen(3) - ga.gen(3); gen(4) = prev.gen (4) - ga.gen(4); %fitness GAcalculateFitness (prev,ga.gen,suhuId,cahayaT, suDa,suLu,caDa,caLu); pause(delay); serialWrite(gen,s) end clear s </pre>	<pre> %calculate nilai fitness function [Euclidean_distanse , Euclidean_distanse_cahaya, Euclidean_distanse_Suhu, luxTambahan, luxKiraan]= GAcalculateFitness(prev,gen,suhuId, cahayaT,suDa,suLu,caDa,caLu)      lampu1      = gen(1);     kipas       = gen(2);     jendela     = gen(3);     lampu2      = gen(4);     suhuTarget  = suhuId;     luxTambahan = luxLampu(lampu1,lampu2,jendela);     %disp(luxTambahan)     %luxSebelum = luxLampu(prev.gen(1),prev.gen(4),prev.gen(3))+ luxJendela(caLu, prev.gen(3));     luxKiraan   = abs(caDa + luxTambahan);      if suDa &lt; suLu &amp;&amp; suDa &lt; suhuTarget         suhuKiraan = suDa + suhu(kipas,jendela);     elseif suDa &gt; suLu &amp;&amp; suDa &gt; suhuTarget         suhuKiraan = suDa - suhu(kipas,jendela);      elseif suDa &lt;= suLu &amp;&amp; suDa &gt;= suhuTarget         suhuKiraan = suDa + suhu(kipas,jendela);     elseif suDa &gt;= suLu &amp;&amp; suDa &lt;= suhuTarget         suhuKiraan = suDa - suhu(kipas,jendela);     end      Euclidean_distanse_Suhu      =suhuId - suhuKiraan;     Euclidean_distanse_cahaya   = abs(cahayaT - luxKiraan);     Euclidean_distanse          = abs(cahayaT - luxKiraan);  end </pre>
--	---

## GAMain

```

function [mutant1, data, populasi_awal, cahayaT] = GAMain(data, data2,
prev, besar_populasi, laju_mutasi, total_generasi)
clear s
global s
[populasi, cahayaT, suhuId] = GAcreeatePopulation(prev, besar_populasi);
populasi_awal = populasi;
isLooping = true;
generasi = 0;
check = 0;
ED=0;
ulang = true;
solusi = struct();
while isLooping
    if ulang == true
        [parent1, parent2] = GAselection(populasi);
        [child1, child2] = GAcrossover(parent1, parent2);
        disp("Crossover selesai");
        mutant1 = GAmutation(child1, laju_mutasi);
        mutant2 = GAmutation(child2, laju_mutasi);
        %disp(mutant1)
        %disp(mutant2)
        %disp("Mutasi selesai")
        [~, suDa, suLu, caDa, caLu, ~] = serialRead(s);
        [mutant1.Euclidean_distanse, mutant1.Euclidean_distanseCahaya,
mutant1.Euclidean_distanseSuhu, mutant1.luxlampu,
mutant1.lumencapaianindividu] =
GAcalculateFitness(prev, mutant1.gen, suhuId, cahayaT, suDa, suLu, caDa, caLu
);
        [mutant2.Euclidean_distanse, mutant2.Euclidean_distanseCahaya,
mutant2.Euclidean_distanseSuhu, mutant2.luxlampu,
mutant2.lumencapaianindividu] =
GAcalculateFitness(prev, mutant2.gen, suhuId, cahayaT, suDa, suLu, caDa, caLu
);
        disp("Mengirim inidvidu baru");
        %populasi = GAregeneration(children, populasi);
        for p = 1 : length(populasi)
            ED = ED + populasi(p).Euclidean_distanse;
        end
        ED1 = ED + mutant1.Euclidean_distanse +
mutant2.Euclidean_distanse;
        mutant1.fitness = 1 - (mutant1.Euclidean_distanse/ED1);
        mutant2.fitness = 1 - (mutant2.Euclidean_distanse/ED1);
        [solusi1, ~] = GAselection1(populasi);
        ulang = false;
        coba1 = [mutant1.gen(1), mutant1.gen(4),
mutant1.gen(2), mutant1.gen(3)];
        coba2 = [mutant2.gen(1), mutant2.gen(4),
mutant2.gen(2), mutant2.gen(3)];
        end
        if generasi >= 2
            LX = ismember(coba1, data(1:generasi, 2:5), "rows");

```



```

disp(LX);
disp("masukmi");
if LX == 1
    LX2 = ismember(coba2,data(1:generasi,2:5),"rows");
    if LX2 == 1
        ulang = true;
        disp("masukmi2");
    else
        solusi = mutant2;
        generasi = generasi + 1;
        disp("Generasi sekarang");
        disp(generasi);
        data(generasi,:) = [generasi,
solusi.gen(1),solusi.gen(4), solusi.gen(2), solusi.gen(3),
solusi.Euclidean_distanse, solusi.luxlampu,
solusi.lumencapaianindividu];
    end
    else
        solusi = mutant1;
        generasi = generasi + 1;
        disp("Generasi sekarang");
        disp(generasi);
        data(generasi,:) = [generasi,
solusi.gen(1),solusi.gen(4), solusi.gen(2), solusi.gen(3),
solusi.Euclidean_distanse, solusi.luxlampu,
solusi.lumencapaianindividu];
    end
    else
        solusi = mutant1;
        generasi = generasi + 1;
        disp("Generasi sekarang");
        disp(generasi);
        data(generasi,:) = [generasi, solusi.gen(1),solusi.gen(4),
solusi.gen(2), solusi.gen(3), solusi.Euclidean_distanse,
solusi.luxlampu, solusi.lumencapaianindividu];
    end
    children = [solusi mutant2];
    populasi = GAregeneration(children,populasi);
    if generasi == total_generasi
        isLooping = false;
        disp("masukmi3");
    else
        ulang= true;
        disp(solusi);
    end
end
end
end

```

#### GACreatePopulation

```

function[ populasi,cahayaT,suhuId] = GACreatePopulation(prev,
besar_populasi)

```

```

clear s
populasi = struct();
ED = 0;
fitness = 0;
gensekarang = 0;
prev.gen = [0 0 0 0];
global s;
for k=1:besar_populasi
    creategen = true;
    while creategen
        gen = GAcreeateGen();
        populasi(k).gen = gen;
        %a = serialport('COM3',9600);
        gen = populasi(k).gen;
        [emotion, suDa, suLu, caDa, caLu, ~] = serialRead(s);
        emosi = [700 700 700];
        suhuId = 23;
        cahayaT= emosi(emotion);
        [Euclidean_distanse, Euclidean_distanseCahaya,
Euclidean_distanseSuhu, luxlampu, lumencapaianindividu] =
GAcalculateFitness(prev,gen,suhuId,cahayaT,suDa,suLu,caDa,caLu);
        ED = ED + Euclidean_distanse;
        populasi(k).Euclidean_distanse = Euclidean_distanse;
        populasi(k).Euclidean_distanseCahaya =
Euclidean_distanseCahaya;
        populasi(k).Euclidean_distanseSuhu =
Euclidean_distanseSuhu;
        populasi(k).luxlampu = luxlampu;
        populasi(k).lumencapaianindividu = lumencapaianindividu;
        disp(Euclidean_distanse);
        creategen = false;
        if Euclidean_distanse > 50
            creategen = true;
        else
            creategen = false;
        end
    end
    gensekarang = gensekarang + 1;
    disp("gensekarang");
    disp(gensekarang);
end
    for i = 1:besar_populasi
        Euclidean_distanse = populasi(i).Euclidean_distanse;
        fitness = 1 - (Euclidean_distanse./ED);
        populasi(i).fitness = fitness;
        % populasi(i).luxSebelum = luxSebelum;
    end
clear s
end

```

<pre> serialWrite function [] = serialWrite(ga,s) a = int2str(ga(1)); b = int2str(ga(2)); c = int2str(ga(3)); d = int2str(ga(4));  fwrite(s,a); pause(15); fwrite(s,b); pause(15); fwrite(s,c); pause(15); fwrite(s,d); pause(15); end </pre>	<pre> luxLampu function luxLampu = luxLampu(lampu1,lampu2,jendela)  m1 = 1.70436367920813; m2 = 1.58152272466225; m3 = -0.630000000000001; c = 267.908933713251;  luxLampu = ( (m1*(lampu1)) + (m2*(lampu2)) + (jendela*(m3)) + c); end </pre>
---	--

<pre> function [child1,child2] = GAcrossover(parent1,parent2) child1 = parent1; child2 = parent2;  CP = (1:(length((parent1.gen)/2)));  child1.gen(1:CP) = parent2.gen(1:CP); child2.gen(1:CP) = parent1.gen(1:CP); end </pre>	<pre> function [gen] = GAcreeateGen() gen = zeros(1,4); gen(1) = randi([0,255]); gen(2) = randi([1,3]); gen(3) = randi([0,100]); gen(4) = randi([0,255]); end </pre>
--	--

<pre> function [parent1,parent2] = GAselection(populasi)  fitness_data = zeros(1,length(populasi));  for i=1:length(populasi) fitness_data(i) = populasi(i).fitness; %fitness_data(i) = populasi(i).Euclidean_distanse; end  [~,index] =max(fitness_data); parent1 = populasi(index);  populasi(index) = []; </pre>	<pre> function mutant = GAmutation(child,laju_mutasi) mutant = child; if rand &lt;= laju_mutasi mutant.gen(1) = randi([0,224]); end if rand &lt;= laju_mutasi mutant.gen(2) = randi([1,3]); end if rand &lt;= laju_mutasi mutant.gen(3) = randi([0,100]); end if rand &lt;= laju_mutasi </pre>
---	--

<pre> fitness_data(index) = [];  [~,index] = max(fitness_data); parent2 = populasi(index); end </pre>	<pre> mutant.gen(4) = randi([0,255]);     end end </pre>
---	--

### LAMPIRAN 3. Hasil pengujian Facial Expression Recognition

```

geany_run_script_V9RA91.sh
File Edit Tabs Help
[0:34:17.167840130] [2714] INFO Camera camera.cpp:1026 configuring streams: (0) 740x780
-YUV420 (1) 2592x1944-SGBRG10_CSI2P
[0:34:17.170643364] [2715] INFO RPI raspberrypi.cpp:805 Sensor: /base/soc/i2c0mux/i2c@1
/ov5647@36 - Selected sensor format: 2592x1944-SGBRG10_1X10 - Selected unicam format: 25
92x1944-pGAA
Still capture image received
/usr/local/lib/python3.9/dist-packages/torch/nn/functional.py:4289: UserWarning: Default
grid_sample and affine_grid behavior has changed to align_corners=False since 1.3.0. Pl
ease specify align_corners=True if the old behavior is desired. See the documentation of
grid_sample for details.
  warnings.warn(
/usr/local/lib/python3.9/dist-packages/torch/nn/functional.py:4227: UserWarning: Default
grid_sample and affine_grid behavior has changed to align_corners=False since 1.3.0. Pl
ease specify align_corners=True if the old behavior is desired. See the documentation of
grid_sample for details.
  warnings.warn(
Happy
Accuracy of the images: 98 %

```

```

geany_run_script_H8TA91.sh
File Edit Tabs Help
922x972-YUV420
[0:16:04.597824370] [1399] INFO RPI raspberrypi.cpp:805 Sensor: /base/soc/i2c0m
ux/i2c@1/ov5647@36 - Selected sensor format: 1296x972-SGBRG10_1X10 - Selected un
icam format: 1296x972-pGAA
[0:16:08.797765306] [1398] INFO Camera camera.cpp:1026 configuring streams: (0)
740x780-YUV420 (1) 2592x1944-SGBRG10_CSI2P
[0:16:08.799012285] [1399] INFO RPI raspberrypi.cpp:805 Sensor: /base/soc/i2c0m
ux/i2c@1/ov5647@36 - Selected sensor format: 2592x1944-SGBRG10_1X10 - Selected u
nicam format: 2592x1944-pGAA
Still capture image received
/usr/local/lib/python3.9/dist-packages/torch/nn/functional.py:4289: UserWarning:
Default grid_sample and affine_grid behavior has changed to align_corners=False
since 1.3.0. Please specify align_corners=True if the old behavior is desired.
See the documentation of grid_sample for details.
  warnings.warn(
/usr/local/lib/python3.9/dist-packages/torch/nn/functional.py:4227: UserWarning:
Default grid_sample and affine_grid behavior has changed to align_corners=False
since 1.3.0. Please specify align_corners=True if the old behavior is desired.
See the documentation of grid_sample for details.
  warnings.warn(
Sad
Accuracy of the images: 95 %

```

```

geany_run_script_LV8U91.sh
File Edit Tabs Help
[0:19:46.947453921] [1603] INFO Camera camera.cpp:1026 configuring streams: (0)
922x972-YUV420
[0:19:46.947971785] [1604] INFO RPI raspberrypi.cpp:805 Sensor: /base/soc/i2c0m
ux/i2c@1/ov5647@36 - Selected sensor format: 1296x972-SGBRG10_1X10 - Selected un
icam format: 1296x972-pGAA
[0:19:51.122781732] [1603] INFO Camera camera.cpp:1026 configuring streams: (0)
740x780-YUV420 (1) 2592x1944-SGBRG10_CSI2P
[0:19:51.124692565] [1604] INFO RPI raspberrypi.cpp:805 Sensor: /base/soc/i2c0m
ux/i2c@1/ov5647@36 - Selected sensor format: 2592x1944-SGBRG10_1X10 - Selected u
nicam format: 2592x1944-pGAA
Still capture image received
/usr/local/lib/python3.9/dist-packages/torch/nn/functional.py:4289: UserWarning:
Default grid_sample and affine_grid behavior has changed to align_corners=False
since 1.3.0. Please specify align_corners=True if the old behavior is desired.
See the documentation of grid_sample for details.
  warnings.warn(
/usr/local/lib/python3.9/dist-packages/torch/nn/functional.py:4227: UserWarning:
Default grid_sample and affine_grid behavior has changed to align_corners=False
since 1.3.0. Please specify align_corners=True if the old behavior is desired.
See the documentation of grid_sample for details.
  warnings.warn(
Angry
Accuracy of the images: 73 %

```

```

geany_run_script_HPOP91.sh
File Edit Tabs Help
[0:18:49.889898161] [1542] INFO Camera camera.cpp:1026 configuring streams: (0)
922x972-YUV420
[0:18:49.890645661] [1543] INFO RPI raspberrypi.cpp:805 Sensor: /base/soc/i2c0m
ux/i2c@1/ov5647@36 - Selected sensor format: 1296x972-SGBRG10_1X10 - Selected un
icam format: 1296x972-pGAA
[0:18:54.072726597] [1542] INFO Camera camera.cpp:1026 configuring streams: (0)
740x780-YUV420 (1) 2592x1944-SGBRG10_CSI2P
[0:18:54.076114201] [1543] INFO RPI raspberrypi.cpp:805 Sensor: /base/soc/i2c0m
ux/i2c@1/ov5647@36 - Selected sensor format: 2592x1944-SGBRG10_1X10 - Selected u
nicam format: 2592x1944-pGAA
Still capture image received
/usr/local/lib/python3.9/dist-packages/torch/nn/functional.py:4289: UserWarning:
Default grid_sample and affine_grid behavior has changed to align_corners=False
since 1.3.0. Please specify align_corners=True if the old behavior is desired.
See the documentation of grid_sample for details.
  warnings.warn(
/usr/local/lib/python3.9/dist-packages/torch/nn/functional.py:4227: UserWarning:
Default grid_sample and affine_grid behavior has changed to align_corners=False
since 1.3.0. Please specify align_corners=True if the old behavior is desired.
See the documentation of grid_sample for details.
  warnings.warn(
Angry
Accuracy of the images: 70 %

```

```
geany_run_script_8EKA91.sh
File Edit Tabs Help
[0:17:10.194627783] [1467] INFO Camera camera.cpp:1026 configuring streams: (0)
922x972-YUV420
[0:17:10.195515856] [1468] INFO RPI raspberrypi.cpp:805 Sensor: /base/soc/i2c0m
ux/i2c@1/ov5647@36 - Selected sensor format: 1296x972-SGBRG10_1X10 - Selected un
icam format: 1296x972-pGAA
[0:17:14.397818823] [1467] INFO Camera camera.cpp:1026 configuring streams: (0)
740x780-YUV420 (1) 2592x1944-SGBRG10_CSI2P
[0:17:14.401735698] [1468] INFO RPI raspberrypi.cpp:805 Sensor: /base/soc/i2c0m
ux/i2c@1/ov5647@36 - Selected sensor format: 2592x1944-SGBRG10_1X10 - Selected u
nicam format: 2592x1944-pGAA
Still capture image received
/usr/local/lib/python3.9/dist-packages/torch/nn/functional.py:4289: UserWarning:
Default grid_sample and affine_grid behavior has changed to align_corners=False
since 1.3.0. Please specify align_corners=True if the old behavior is desired.
See the documentation of grid_sample for details.
  warnings.warn(
/usr/local/lib/python3.9/dist-packages/torch/nn/functional.py:4227: UserWarning:
Default grid_sample and affine_grid behavior has changed to align_corners=False
since 1.3.0. Please specify align_corners=True if the old behavior is desired.
See the documentation of grid_sample for details.
  warnings.warn(
Sad
Accuracy of the images: 60 %
```