**Código do Sistema de Captação dos Pontos de Referência da face via câmera**

**Equipe Visão**

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**CARAPICUÍBA – 2020**

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# INTRODUÇÃO

O presente artigo traz a o que é necessário para executar o programa de reconhecimento de gestos, incluindo o read me com as especificações do que será preciso para utilizar o programa, o código desenvolvido durante o projeto e por último todas as licenças do projeto.

# LEIA-ME

# Reconhecimento de Gestos

## Instalação

Requerimentos/Dependências:

\*\*- Sistema Operacional de arquitetura 64 bits\*\*

\*\*- Anaconda 3\*\*

\*\*- Compatibilidade ao Python 2.7 ou superior\*\*

\*\*- Bibliotecas numpy, opencv, math e time (Podem ser instaladas via conda ou pip)\*\*

- numpy:É um pacote para a linguagem Python que suporta arrays e matrizes multidimensionais, possuindo uma larga coleção de funções matemáticas para trabalhar com estas estruturas;

- OpenCV, originalmente, desenvolvida pela Intel, em 2000, é uma biblioteca multiplataforma, totalmente livre ao uso acadêmico e comercial, para o desenvolvimento de aplicativos na área de Visão computacional;

- math: Biblioteca para cálculos matemáticos;

- time: Este módulo provê várias funções relacionadas ao tempo (como a datetime).

# Execução/Instalação

## Instalação:

Após as configurações de ambiente do Anaconda, que há no arquivo README.md do diretório base (que já incluem as instalações de algumas das bibliotecas citadas).

Acesse a pasta referente aos arquivos de execução (No projeto é o HandGesture.py), no terminal:

cd Gestos

conda install -c conda-forge numpy -y

\*caso queira conferir se foram instalados com êxito, digite o comando \*\*conda list\*\*

## Execução:

Para executar, é necessário que você tenha uma webcam conectada a seu dispositivo de execução, ou você pode utilizar um aplicativo que simule em seu smartphone esta funcionalidade.

\*É recomendável que esteja em um local bem iluminado e que sua mão esteja totalmente no quadrante da câmera (sem ultrapassar as linhas).

Execute o seguinte comando no terminal dentro da pasta \*\*Fatequino\Visão\Gesto\*\*:

python HandGesture.py

Ao estender a mão no quadrante da câmera, no terminal irá aparecer "Olá aluno!"

Para finalizar a execução tecle "Esc".

Para mais informações a respeito do código, referências no link abaixo:

<https://github.com/biankatpas/Libras>

# CÓDIGO DO RECONHECIMENTO DE GESTOS

# Code adapted from Passos, Bianka (2019).

# Program to recognize alphabet signs from LIBRAS developed for PDI class.

# Retrieved from: https://github.com/biankatpas/Libras

# Adapted by: Group Fatequino

import cv2

import numpy as np

import math

import time

from \_datetime import datetime

# Define put text font

font = cv2.FONT\_HERSHEY\_SIMPLEX

# Define the codec and create VideoWriter object

fourcc = cv2.VideoWriter\_fourcc(\*'XVID')

record = cv2.VideoWriter('output/' + str(datetime.now()) + '.avi', fourcc, 20.0, (640, 480))

def main():

# Capture from webcam

cam = cv2.VideoCapture(0)

fgbg = cv2.createBackgroundSubtractorMOG2()

while True:

ret, frame = cam.read()

if ret is False:

return

# MOstrar retângulo de ROI

cv2.rectangle(frame, (20, 20), (300, 300), (255, 255, 2), 4) # retângulo mais externo

ROI = frame[20:300, 20:300]

# Segmentação da mão por movimento

# Subtração de fundo MOG2

fgmask = ROI

fgbg.setBackgroundRatio(0.005)

fgmask = fgbg.apply(ROI, fgmask)

# Remoção de ruído

kernel = np.ones((5, 5), np.uint8)

c1 = cv2.morphologyEx(fgmask, cv2.MORPH\_CLOSE, kernel)

c2 = cv2.morphologyEx(c1, cv2.MORPH\_CLOSE, kernel)

closing = cv2.morphologyEx(c2, cv2.MORPH\_CLOSE, kernel)

# Encontre contornos do quadro filtrado

contours, hierarchy = cv2.findContours(closing, cv2.RETR\_TREE, cv2.CHAIN\_APPROX\_SIMPLE)

# print(contours)

# Desenhar contornos

for cnt in contours:

color = [222, 222, 222] # contours color

cv2.drawContours(ROI, [cnt], -1, color, 3)

if contours:

cnt = contours[0]

# Encontre momentos do contorno

moments = cv2.moments(cnt)

cx = 0

cy = 0

# Massa central de momentos de primeira ordem

if moments['m00'] != 0:

cx = int(moments['m10'] / moments['m00']) # cx = M10/M00

cy = int(moments['m01'] / moments['m00']) # cy = M01/M00

center = (cx, cy)

# Desenhar massa central

cv2.circle(ROI, center, 15, [0, 0, 255], 2)

# Encontre o círculo que cobre completamente o objeto com a área mínima

(x, y), radius = cv2.minEnclosingCircle(cnt)

center = (int(x), int(y))

radius = int(radius)

cv2.circle(ROI, center, radius, (0, 0, 0), 3)

area\_of\_circle = math.pi \* radius \* radius

# Retângulo delimitador desenhado com área mínima, também considera a rotação

rect = cv2.minAreaRect(cnt)

box = cv2.boxPoints(rect)

box = np.int0(box)

cv2.drawContours(ROI, [box], 0, (0, 0, 255), 2)

# aproximar a forma

cnt = cv2.approxPolyDP(cnt, 0.01 \* cv2.arcLength(cnt, True), True)

# Encontrar defeitos convexos

hull = cv2.convexHull(cnt, returnPoints=False)

defects = cv2.convexityDefects(cnt, hull)

fingers = 0

# Obter pontos de defeito e desenhar na imagem original

if defects is not None:

# print('defects shape = ', defects.shape[0])

for i in range(defects.shape[0]):

s, e, f, d = defects[i, 0]

start = tuple(cnt[s][0])

end = tuple(cnt[e][0])

far = tuple(cnt[f][0])

cv2.line(ROI, start, end, [0, 255, 0], 3)

cv2.circle(ROI, far, 8, [211, 84, 0], -1)

# finger count

a = math.sqrt((end[0] - start[0]) \*\* 2 + (end[1] - start[1]) \*\* 2)

b = math.sqrt((far[0] - start[0]) \*\* 2 + (far[1] - start[1]) \*\* 2)

c = math.sqrt((end[0] - far[0]) \*\* 2 + (end[1] - far[1]) \*\* 2)

angle = math.acos((b \*\* 2 + c \*\* 2 - a \*\* 2) / (2 \* b \* c)) # teorema do cosseno

area = cv2.contourArea(cnt)

if angle <= math.pi / 2: # ângulo inferior a 90 graus, tratar como dedos

fingers += 1

cv2.circle(ROI, far, 1, [255, 0, 0], -1)

if len(cnt) >= 5:

(x\_centre, y\_centre), (minor\_axis, major\_axis), angle\_t = cv2.fitEllipse(cnt)

letter = ''

if area\_of\_circle - area < 5000:

# print('A')

letter = 'A'

elif angle\_t > 120:

letter = 'U'

elif area > 120000:

letter = 'B'

elif fingers == 1:

if 40 < angle\_t < 66:

# print('C')

letter = 'C'

elif 20 < angle\_t < 35:

letter = 'L'

else:

letter = 'V'

#print ('Olá aluno!')

elif fingers == 2:

if angle\_t > 100:

letter = 'F'

# print('W')

else:

letter = 'W'

elif fingers == 3:

# print('4')

letter = '4'

elif fingers == 4:

# print('Ola!')

letter = 'Ola!'

else:

if 169 < angle\_t < 180:

# print('I')

letter = 'I'

elif angle\_t < 168:

# print('J')

letter = 'J'

print ('Olá aluno!')

else:

# imprime mensagem: nenhuma mão detectada

cv2.putText(frame, "No hand detected", (45, 450), font, 2, np.random.randint(0, 255, 3).tolist(), 2)

# Mostrar imagens de saídas

cv2.imshow('frame', frame)

#cv2.imshow('blur', blur)

#cv2.imshow('hsv', hsv)

#cv2.imshow('thresh', thresh)

cv2.imshow('mog2', fgmask)

cv2.imshow('ROI', ROI)

record.write(frame)

# Verifica a tecla pressionada

if cv2.waitKey(100) == 27:

break # ESC para sair

cv2.destroyAllWindows()

if \_\_name\_\_ == '\_\_main\_\_':

# LICENÇAS

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Version 3, 29 June 2007

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