

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

Equipe Visão

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1. 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.

2. 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 tecla "Esc".

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

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

3. CÓDIGO DO RECONHECIMENTO DE GESTOS

Code adapted from Passos, Biana (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__':
```

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