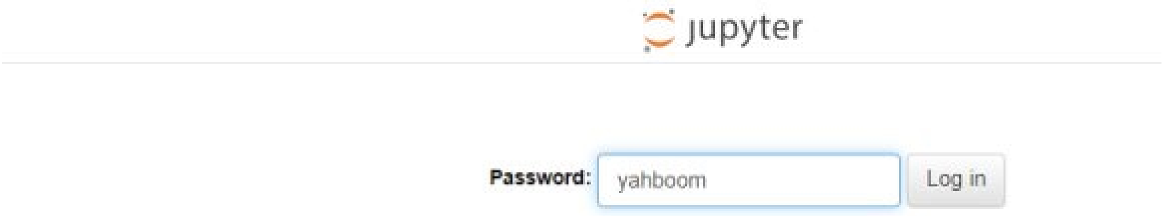
Human face mask

1. Purpose of the experiment

Drive the robot dog to recognize the human face and put a mask on the human face, and make corresponding movements according to the position of the human face on the screen

2. Experimental path source code

Enter the system of the robot dog, end the robot dog program, enter "ip (ip is the ip of the robot dog): 8888" in the browser, enter the password "yahboom"



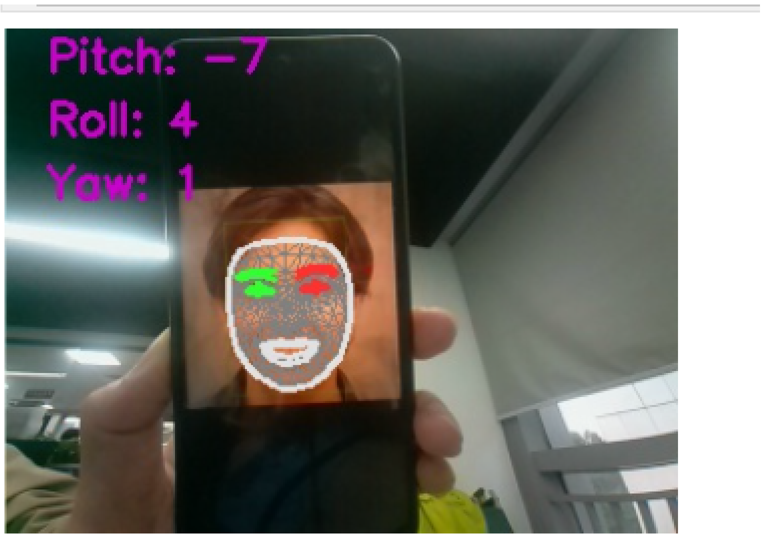
Password: yahboom

and log in. Enter the path of **cd ~/DOGZILLA_Lite_class/5.AI Visual Recognition Course/10. Facial Mask** and run **face_mask.ipynb** . You can also enter the command in the terminal to directly start the python script

```
python3 face_mask.py
```

3. Experimental Phenomenon

After running the source code, you can see that the robot dog can recognize human faces, put on masks for the faces, and perform corresponding movements.



Pitch: -7
Roll: 4
Yaw: 1

4. Main source code analysis

```
# For webcam input:
drawing_spec = mp_drawing.DrawingSpec(thickness=1, circle_radius=1)
cap=cv2.VideoCapture(0)
cap.set(3,320)
cap.set(4,240)
with mp_face_mesh.FaceMesh(
    max_num_faces=1,
    refine_landmarks=True,
    min_detection_confidence=0.5,
    min_tracking_confidence=0.5) as face_mesh:
  while cap.isOpened():
    face_coordination_in_real_world = np.array([
        [285, 528, 200],
        [285, 371, 152],
        [197, 574, 128],
        [173, 425, 108],
        [360, 574, 128],
        [391, 425, 108]
    ], dtype=np.float64)

    h=240
    w=320
    face_coordination_in_image = []
    text=''
    success, image = cap.read()
    if not success:
      print("Ignoring empty camera frame.")
      # If loading a video, use 'break' instead of 'continue'.
      continue

    # To improve performance, optionally mark the image as not writeable to
    # pass by reference.
    image.flags.writeable = False
    image = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
    results = face_mesh.process(image)

    # Draw the face mesh annotations on the image.
    image.flags.writeable = True
    image = cv2.cvtColor(image, cv2.COLOR_RGB2BGR)
    direction=0
    if results.multi_face_landmarks:
      for face_landmarks in results.multi_face_landmarks:
        mp_drawing.draw_landmarks(
            image=image,
            landmark_list=face_landmarks,
            connections=mp_face_mesh.FACEMESH_TESSELATION,
            landmark_drawing_spec=None,
            connection_drawing_spec=mp_drawing_styles
            .get_default_face_mesh_tesselation_style())
        mp_drawing.draw_landmarks(
            image=image,
            landmark_list=face_landmarks,
            connections=mp_face_mesh.FACEMESH_CONTOURS,
            landmark_drawing_spec=None,
            connection_drawing_spec=mp_drawing_styles
            .get_default_face_mesh_contours_style())
        mp_drawing.draw_landmarks(
            image=image,
            landmark_list=face_landmarks,
            connections=mp_face_mesh.FACEMESH_IRISES,
            landmark_drawing_spec=None,
            connection_drawing_spec=mp_drawing_styles
            .get_default_face_mesh_iris_connections_style())

        for idx, lm in enumerate(face_landmarks.landmark):
          if idx in [1, 9, 57, 130, 287, 359]:
            x, y = int(lm.x * w), int(lm.y * h)
            face_coordination_in_image.append([x, y])
        face_coordination_in_image = 
np.array(face_coordination_in_image,dtype=np.float64)
        # The camera matrix
        focal_length = 1 * w
        cam_matrix = np.array([[focal_length, 0, w / 2],
                               [0, focal_length, h / 2],
                               [0, 0, 1]])
        # The Distance Matrix
        dist_matrix = np.zeros((4, 1), dtype=np.float64)
        success, rotation_vec, transition_vec = 
cv2.solvePnP(face_coordination_in_real_world,
face_coordination_in_image,cam_matrix, dist_matrix)
        # Use Rodrigues function to convert rotation vector to matrix
        rotation_matrix, jacobian = cv2.Rodrigues(rotation_vec)
        result = rotation_matrix_to_angles(rotation_matrix)
        print(result)
        pitch=round(-result[0]/100*20)
        yaw=round(result[1]/80*15)
        roll=round(result[2]/80*15)
        if abs(yaw)<= 4:
            if abs(pitch)<3:
                pitch = round( pitch * 7 )
                print("pitch11",pitch)
                if pitch < -7:
                    print("hello")
                    pitch = -3
                    print("pitch",pitch)
                elif pitch > 7:
                    pitch = 3
                    print("picth",pitch)
            else:
                pitch = pitch
                print("pitch",pitch)
                yaw = 0
                roll = 0
        else:
            pitch = -3
            yaw = yaw
            if abs(roll) >29:
                roll = round(roll/6)
            else:
                roll = roll
        print("pitch,yaw,roll",pitch,yaw,roll)
        if car_type!="R":
          car.attitude(['p','y','r'],[pitch,yaw,roll])
        else:
          print('rider')
          car.attitude(['p','y','r'],[pitch,yaw,roll])
          #car.attitude(['p','y','r'],[int(pitch/4),int(yaw/4),int(roll/4)])
        time.sleep(0.1)
    else:
      pass
    # Flip the image horizontally for a selfie-view mydisplay.
    b,g,r = cv2.split(image)
    image = cv2.merge((r,g,b))
    image = cv2.flip(image, 1)
    try:
      for i, info in enumerate(zip(('Pitch', 'Roll', 'Yaw'), result)):
        k, v = info
        text = f'{k}: {int(v)}'
        cv2.putText(image, text, (20, i*30 + 20),cv2.FONT_HERSHEY_SIMPLEX, 0.7,
(200, 0, 200), 2)
    except:
      pass
    imgok = Image.fromarray(image)
    mydisplay.ShowImage(imgok)

    #把结果显示到屏幕上  Display the results on the screen
    r,g,b = cv2.split(image)
    image1 = cv2.merge((b,g,r))
    image_widget.value = bgr8_to_jpeg(image1)
    # cv2.imshow("image",image1)

    if cv2.waitKey(5) & 0xFF == 27:
      break
    if button.press_b():
      break
```

The main function turns on the camera and covers the face recognized by the camera with a mask, and performs corresponding movements based on the IMU data and the position of the face on the screen.