Face detection

1. Content Description

This course implements color image acquisition and face detection using the MediaPipe framework.

This section requires entering commands in the terminal. The terminal you open depends on your motherboard type. This lesson uses the Raspberry Pi 5 as an example. For Raspberry Pi and Jetson-Nano boards, you need to open a terminal on the host computer and enter the command to enter the Docker container. Once inside the Docker container, enter the commands mentioned in this section in the terminal. For instructions on entering the Docker container from the host computer, refer to this product tutorial **[Configuration and Operation Guide]--[Enter the Docker (Jetson Nano and Raspberry Pi 5 users, see here)]**.

Simply open the terminal on the Orin motherboard and enter the commands mentioned in this section.

2. Program startup

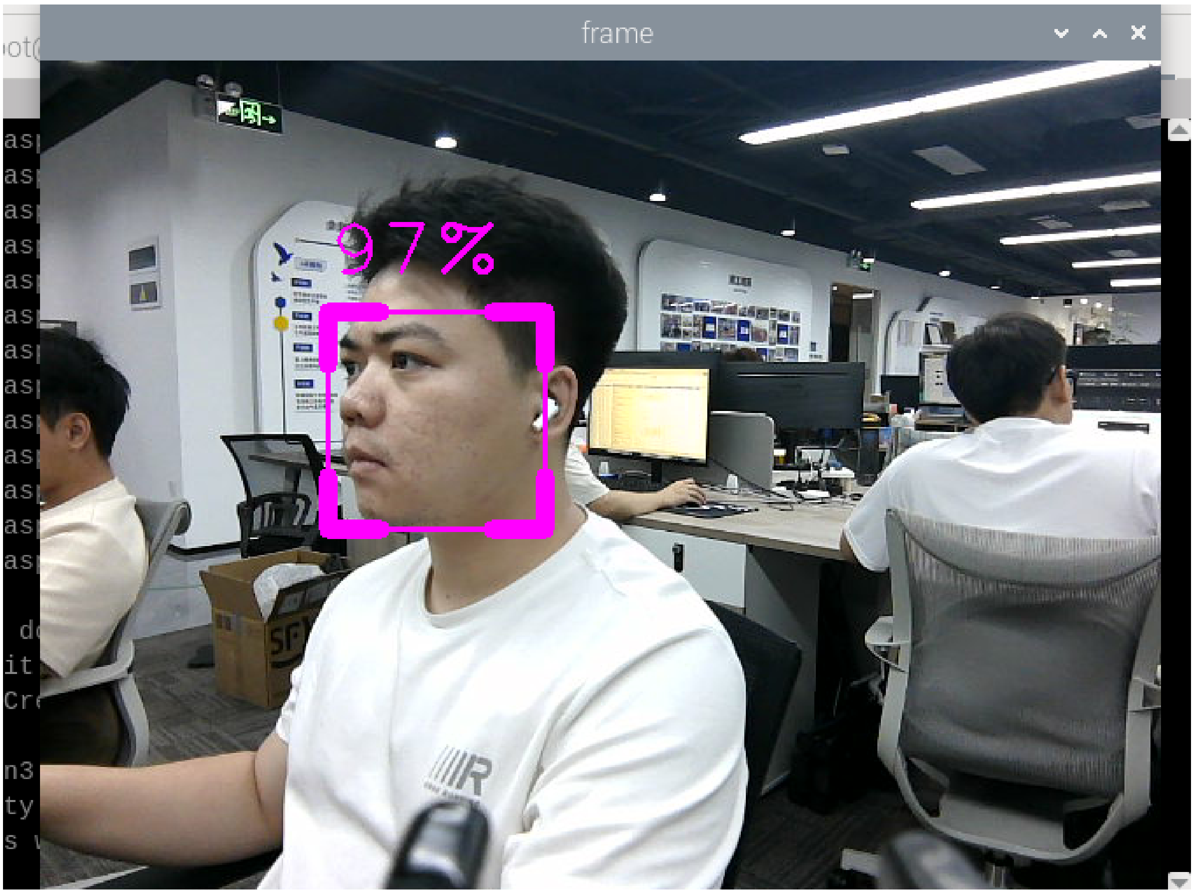
First, in the terminal, enter the following command to start the camera,

```
ros2 launch orbbec_camera dabai_dcw2.launch.py
```

After successfully starting the camera, open another terminal and enter the following command in the terminal to start the face detection program.

```
ros2 run yahboomcar_mediapipe 07_FaceDetection
```

After the program is run, as shown in the figure below, the detected face will be framed and the detection score will be displayed. The higher the score, the more accurate the face recognition is.



3. Core code analysis

Program code path:

- Raspberry Pi 5 and Jetson-Nano board

  The program code is in the running docker. The path in docker is /root/yahboomcar_ws/src/yahboomcar_mediapipe/yahboomcar_mediapipe/07_FaceDetection.py

- Orin Motherboard

  The program code path is /home/jetson/yahboomcar_ws/src/yahboomcar_mediapipe/yahboomcar_mediapipe/07_FaceDetection.py

Import the library files used,

```
import time
import cv2 as cv
import numpy as np
import rclpy
from rclpy.node import Node
#Import mediapipe library
import mediapipe as mp
from cv_bridge import CvBridge
from sensor_msgs.msg import Image
from arm_msgs.msg import ArmJoints
import cv2
```

Initialize data and define publishers and subscribers,

```
def __init__(self, name):
    super().__init__(name)
    self.minDetectionCon=0.5
    #Use the class in the mediapipe library to define a face detection object
    self.mpFaceDetection = mp.solutions.face_detection
    self.mpDraw = mp.solutions.drawing_utils
    self.facedetection =
self.mpFaceDetection.FaceDetection(min_detection_confidence=self.minDetectionCon
)
    self.rgb_bridge = CvBridge()
    #Define the topic for controlling 6 servos and publish the detected posture
    self.TargetAngle_pub = self.create_publisher(ArmJoints, "arm6_joints", 10)
    self.init_joints = [90, 150, 10, 20, 90, 90]
    self.pubSix_Arm(self.init_joints)
    #Define subscribers for the color image topic
    self.sub_rgb =
self.create_subscription(Image,"/camera/color/image_raw",self.get_RGBImageCallBa
ck,100)
```

Color image callback function,

```
def get_RGBImageCallBack(self,msg):
    #Use CvBridge to convert color image message data into image data
    rgb_image = self.rgb_bridge.imgmsg_to_cv2(msg, "bgr8")
    #Put the obtained image into the defined findFaces function to perform face
detection program
    frame,_ = self.findFaces(rgb_image)
    key = cv2.waitKey(1)
    cv.imshow('frame', frame)
```

findFaces function,

```
def findFaces(self, frame):
    #Convert the color space of the incoming image from BGR to RGB to facilitate
subsequent image processing
    img_RGB = cv.cvtColor(frame, cv.COLOR_BGR2RGB)
    #Call the process function in the mediapipe library for image processing.
During init, the self.facedetection object is created and initialized.
    self.results = self.facedetection.process(img_RGB)
    bboxs = []
    #Judge whether self.results.detections exists, that is, whether a face is
recognized
    if self.results.detections:
        #Traverse the id and detection data
        for id, detection in enumerate(self.results.detections):
            #Get bounding box coordinates
            bboxC = detection.location_data.relative_bounding_box
            ih, iw, ic = frame.shape
            bbox = int(bboxC.xmin * iw), int(bboxC.ymin * ih), \
            int(bboxC.width * iw), int(bboxC.height * ih)
            #Store test results
            bboxs.append([id, bbox, detection.score])
            #Call fancyDraw function to draw the bounding box
            frame = self.fancyDraw(frame, bbox)
            #Display the face recognition score on the image
            cv.putText(frame, f'{int(detection.score[0] * 100)}%',(bbox[0],
bbox[1] - 20), cv.FONT_HERSHEY_PLAIN,3, (255, 0, 255), 2)
```

```
    return frame, bboxs
```

fancyDraw function draws the bounding box according to the value of the detection result bbox

```python
def fancyDraw(self, frame, bbox, l=30, t=10):
    x, y, w, h = bbox
    x1, y1 = x + w, y + h
    cv.rectangle(frame, (x, y),(x + w, y + h), (255, 0, 255), 2)
    # Top left x,y
    cv.line(frame, (x, y), (x + l, y), (255, 0, 255), t)
    cv.line(frame, (x, y), (x, y + l), (255, 0, 255), t)
    # Top right x1,y
    cv.line(frame, (x1, y), (x1 - l, y), (255, 0, 255), t)
    cv.line(frame, (x1, y), (x1, y + l), (255, 0, 255), t)
    # Bottom left x1,y1
    cv.line(frame, (x, y1), (x + l, y1), (255, 0, 255), t)
    cv.line(frame, (x, y1), (x, y1 - l), (255, 0, 255), t)
    # Bottom right x1,y1
    cv.line(frame, (x1, y1), (x1 - l, y1), (255, 0, 255), t)
    cv.line(frame, (x1, y1), (x1, y1 - l), (255, 0, 255), t)
    return frame
```