Face detection

1、Introduction

- MediaPipe is an open source data stream processing machine learning application development framework developed by Google. It is a graph-based data processing pipeline for building and using multiple forms of data sources, such as video, audio, sensor data, and any time series data. MediaPipe is cross-platform and can run on embedded platforms (Raspberry Pi, etc.), mobile devices (iOS and Android), workstations and servers, and supports mobile GPU acceleration.

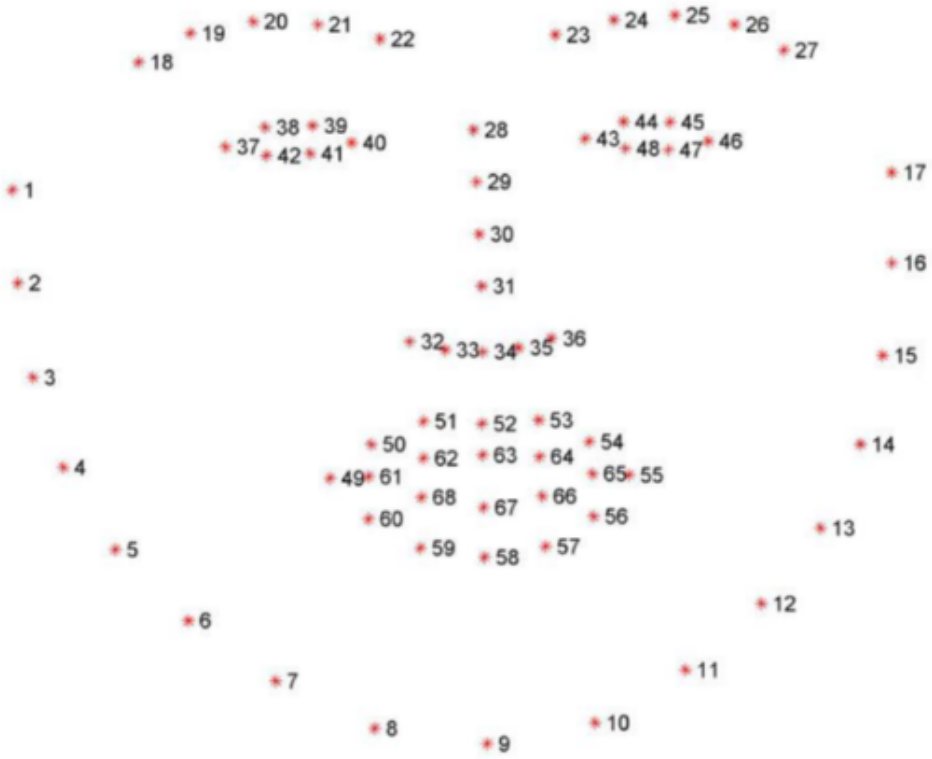
  MediaPipe provides cross-platform, customizable ML solutions for real-time and streaming media. The core framework of MediaPipe is implemented in C++ and provides support for languages such as Java and Objective C. The main concepts of MediaPipe include Packet, Stream, Calculator, Graph and Subgraph.

  Features of MediaPipe：

  - End-to-end acceleration: Built-in fast ML inference and processing accelerates even on commodity hardware.
  - Build once, deploy anywhere: Unified solutions for Android, iOS, desktop/cloud, web and IoT.
  - Ready-to-use solutions: Cutting-edge ML solutions that showcase the full capabilities of the framework.
  - Free and open source: frameworks and solutions under Apache2.0, fully extensible and customizable.

2、Dlib

DLIB is a modern C++toolkit that includes machine learning algorithms and tools for creating complex software in C++to solve real-world problems. It is widely applied in fields such as machines, embedded devices, mobile phones, and high-performance computing environments in the industry and academia. The dlib library uses 68 points to mark important parts of the face, such as the right eyebrow at 18-22 points and the mouth at 51-68 points. Get the dlib library_ Frontal_ Face_ The detector module detects a face, causing a shape_ Predictor_ 68_ Face_ Landmarks. dat feature data predicts facial feature values.

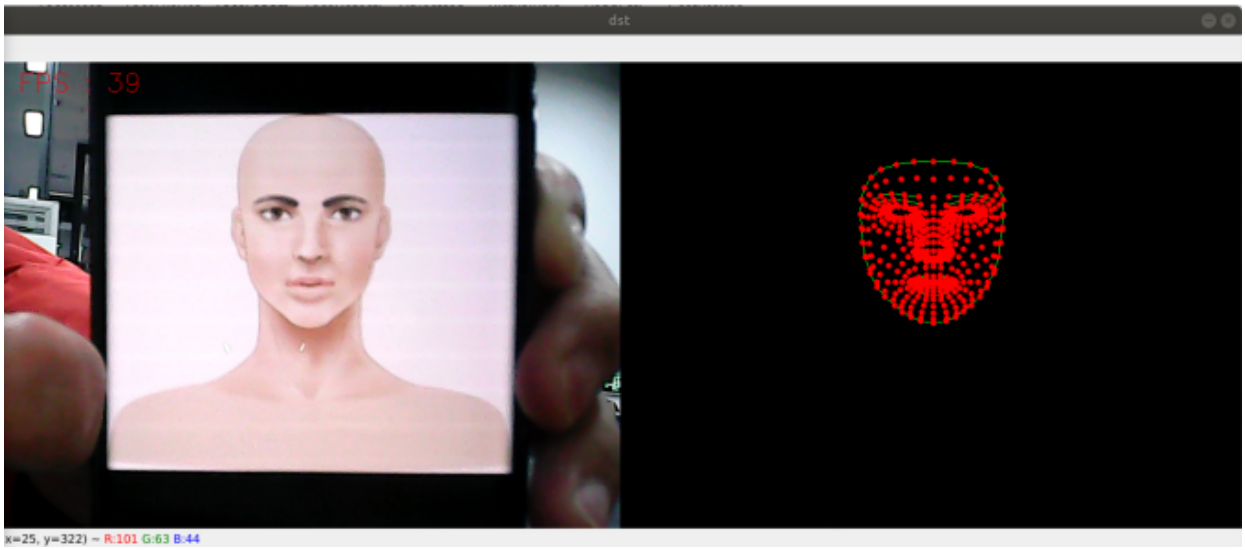


3、Face detection

3.1、Start

After entering the docker container, enter the following command in the terminal.

```
ros2 run yahboomcar_mediapipe 04_FaceMesh
```



3.2、Code analysis

After entering the docker container, the location of the source code of this function is as follows

```
/root/yahboomcar_ws/src/yahboomcar_mediapipe/yahboomcar_mediapipe/04_FaceMesh.py
```

```
#!/usr/bin/env python3
# encoding: utf-8
import time
import rospy
import cv2 as cv
import numpy as np
import mediapipe as mp
from geometry_msgs.msg import Point
from yahboomcar_msgs.msg import PointArray


class FaceMesh:
    def __init__(self, staticMode=False, maxFaces=2, minDetectionCon=0.5,
minTrackingCon=0.5):
        self.mpDraw = mp.solutions.drawing_utils
        self.mpFaceMesh = mp.solutions.face_mesh
        self.faceMesh = self.mpFaceMesh.FaceMesh(
            static_image_mode=staticMode,
            max_num_faces=maxFaces,
            min_detection_confidence=minDetectionCon,
            min_tracking_confidence=minTrackingCon )
        self.pub_point = rospy.Publisher('/mediapipe/points', PointArray,
queue_size=1000)
        self.lmDrawSpec = mp.solutions.drawing_utils.DrawingSpec(color=(0, 0, 255),
thickness=-1, circle_radius=3)
        self.drawSpec = self.mpDraw.DrawingSpec(color=(0, 255, 0), thickness=1,
circle_radius=1)

    def pubFaceMeshPoint(self, frame, draw=True):
        pointArray = PointArray()
        img = np.zeros(frame.shape, np.uint8)
        imgRGB = cv.cvtColor(frame, cv.COLOR_BGR2RGB)
        self.results = self.faceMesh.process(imgRGB)
        if self.results.multi_face_landmarks:
            for i in range(len(self.results.multi_face_landmarks)):
                if draw: self.mpDraw.draw_landmarks(frame,
self.results.multi_face_landmarks[i], self.mpFaceMesh.FACEMESH_CONTOURS,
self.lmDrawSpec, self.drawSpec)
                self.mpDraw.draw_landmarks(img,
self.results.multi_face_landmarks[i], self.mpFaceMesh.FACEMESH_CONTOURS,
self.lmDrawSpec, self.drawSpec)
                for id, lm in
enumerate(self.results.multi_face_landmarks[i].landmark):
                    point = Point()
                    point.x, point.y, point.z = lm.x, lm.y, lm.z
```

```
                        pointArray.points.append(point)
        self.pub_point.publish(pointArray)
        return frame, img

    def frame_combine(slef,frame, src):
        if len(frame.shape) == 3:
            frameH, frameW = frame.shape[:2]
            srcH, srcW = src.shape[:2]
            dst = np.zeros((max(frameH, srcH), frameW + srcW, 3), np.uint8)
            dst[:, :frameW] = frame[:, :]
            dst[:, frameW:] = src[:, :]
        else:
            src = cv.cvtColor(src, cv.COLOR_BGR2GRAY)
            frameH, frameW = frame.shape[:2]
            imgH, imgW = src.shape[:2]
            dst = np.zeros((frameH, frameW + imgW), np.uint8)
            dst[:, :frameW] = frame[:, :]
            dst[:, frameW:] = src[:, :]
        return dst


if __name__ == '__main__':
    rospy.init_node('FaceMesh', anonymous=True)
    capture = cv.VideoCapture(0)
    capture.set(6, cv.VideoWriter.fourcc('M', 'J', 'P', 'G'))
    capture.set(cv.CAP_PROP_FRAME_WIDTH, 640)
    capture.set(cv.CAP_PROP_FRAME_HEIGHT, 480)
    print("capture get FPS : ", capture.get(cv.CAP_PROP_FPS))
    pTime, cTime = 0, 0
    face_mesh = FaceMesh(maxFaces=2)
    while capture.isOpened():
        ret, frame = capture.read()
        # frame = cv.flip(frame, 1)
        frame, img = face_mesh.pubFaceMeshPoint(frame,draw=False)
        if cv.waitKey(1) & 0xFF == ord('q'): break
        cTime = time.time()
        fps = 1 / (cTime - pTime)
        pTime = cTime
        text = "FPS : " + str(int(fps))
        cv.putText(frame, text, (20, 30), cv.FONT_HERSHEY_SIMPLEX, 0.9, (0, 0, 255),
1)
        dst = face_mesh.frame_combine(frame, img)
        cv.imshow('dst', dst)
        # cv.imshow('frame', frame)
        # cv.imshow('img', img)
    capture.release()
    cv.destroyAllWindows()
```