Posture 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.

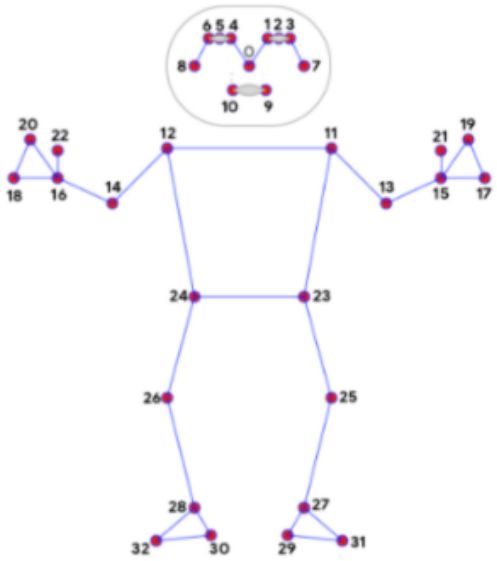
  Features of MediaPipe：

  - 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、MediaPipe Pose

MediaPipe Pose is an ML solution for body pose tracking with high fidelity. Through BlazePose research, 33 3D coordinates and full background segmentation masks are inferred from RGB video frames. This study also provides dynamic support for the ML Kit pose detection API.

The landmark model in the MediaPipe pose predicted the positions of 33 pose coordinates (see figure below).

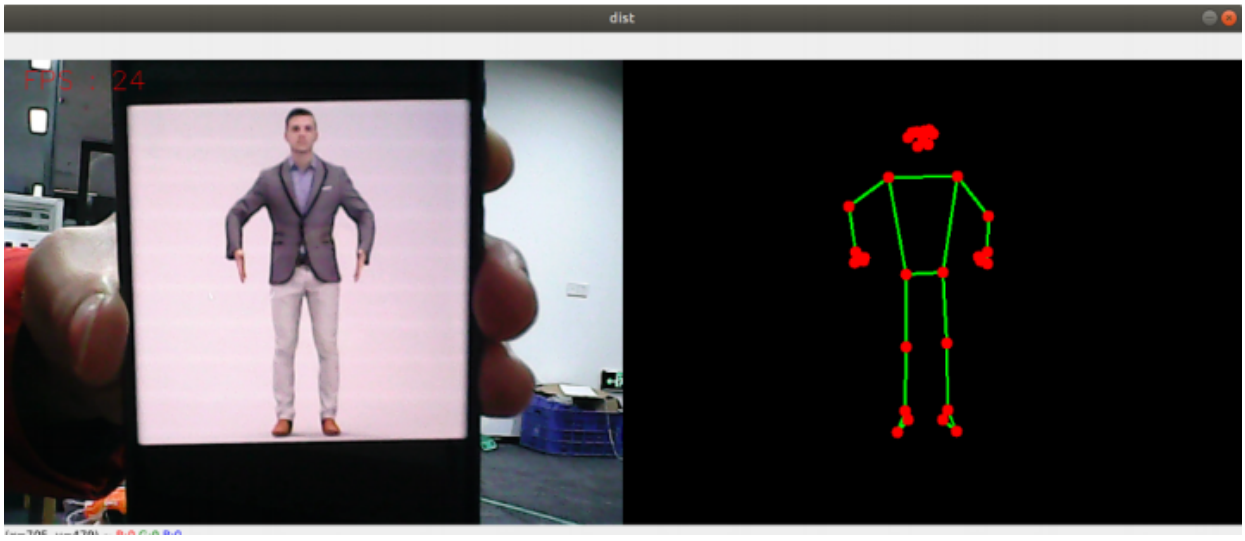


3、Posture detection

3.1、run code

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

```
ros2 run yahboomcar_mediapipe 02_PoseDetector
```



3.2、Code

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/02_PoseDetector.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 PoseDetector:
    def __init__(self, mode=False, smooth=True, detectionCon=0.5, trackCon=0.5):
        self.mpPose = mp.solutions.pose
        self.mpDraw = mp.solutions.drawing_utils
        self.pose = self.mpPose.Pose(
            static_image_mode=mode,
            smooth_landmarks=smooth,
            min_detection_confidence=detectionCon,
            min_tracking_confidence=trackCon )
        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=6)
        self.drawSpec = mp.solutions.drawing_utils.DrawingSpec(color=(0, 255, 0),
thickness=2, circle_radius=2)

    def pubPosePoint(self, frame, draw=True):
        pointArray = PointArray()
        img = np.zeros(frame.shape, np.uint8)
        img_RGB = cv.cvtColor(frame, cv.COLOR_BGR2RGB)
        self.results = self.pose.process(img_RGB)
        if self.results.pose_landmarks:
            if draw: self.mpDraw.draw_landmarks(frame, self.results.pose_landmarks,
self.mpPose.POSE_CONNECTIONS, self.lmDrawSpec, self.drawSpec)
            self.mpDraw.draw_landmarks(img, self.results.pose_landmarks,
self.mpPose.POSE_CONNECTIONS, self.lmDrawSpec, self.drawSpec)
            for id, lm in enumerate(self.results.pose_landmarks.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('PoseDetector', 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
    pose_detector = PoseDetector()
    index = 3
    while capture.isOpened():
        ret, frame = capture.read()
        # frame = cv.flip(frame, 1)
        frame, img = pose_detector.pubPosePoint(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)
        dist = pose_detector.frame_combine(frame, img)
        cv.imshow('dist', dist)
        # cv.imshow('frame', frame)
        # cv.imshow('img', img)
    capture.release()
    cv.destroyAllWindows()
```