

7. 3D Object Recognition

7.1. 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 used to build data sources in various forms, 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 packets, streams, calculators, graphs, and subgraphs.

Features of MediaPipe:

- End-to-end acceleration: built-in fast ML inference and processing can be accelerated even on ordinary hardware.
- Build once, deploy anywhere anytime: unified solution for Android, iOS, desktop/cloud, web and IoT.
- Ready-to-use solution: cutting-edge ML solution that demonstrates the full functionality of the framework.
- Free and open source: framework and solution under Apache2.0, fully extensible and customizable.

7.2, 3D object recognition

3D object recognition: The recognizable objects are: ['Shoe', 'Chair', 'Cup', 'Camera'], a total of 4 categories; click [f key] to switch the recognition object.

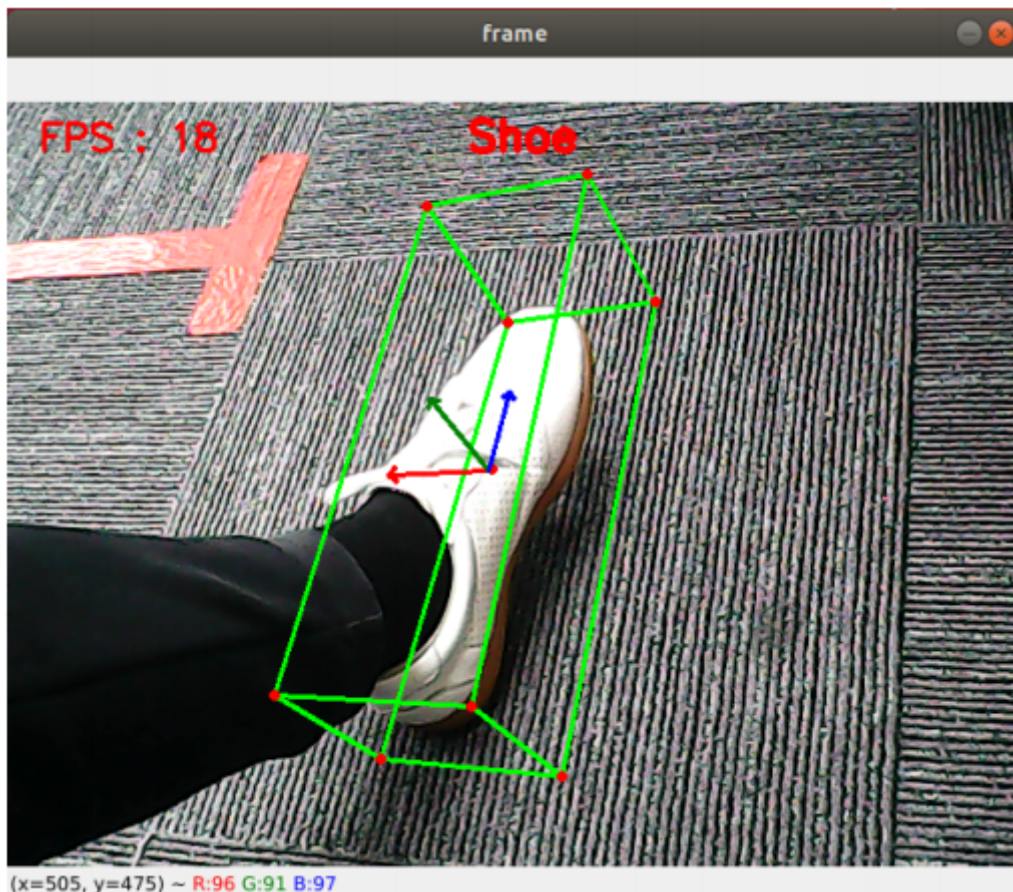
7.2.1, Startup

Terminal input,

Please do this step before running the program

```
sudo supervisorctl stop chassisServer #Stop the self-starting chassis service
#Indoor version of NAVROBO-astra_pro2 camera executes this command
/home/yahboom/YBAMR-COBOT-EDU-00001/start/OBColorViewer #Release color stream
video100
#[info][722318][Pipeline.cpp:251] Start streams done!
#[info][722318][Pipeline.cpp:234] Pipeline start done!
#[warning][722318][Pipeline.cpp:327] wait for frame timeout, you can try to
increase the wait time! current timeout=100
```

```
cd /home/yahboom/YBAMR-COBOT-EDU-00001/src/yahboom_navrobo_mediapipe/scripts #
Enter the source code directory
python3 08_Objectron.py # 3D object recognition
```



7.2.2, Source code

Source code location: /home/yahboom/YBAMR-COBOT-EDU-00001/src/yahboom_navrobo_mediapipe/scripts/08_Objectron.py

```
#!/usr/bin/env python3
# encoding: utf-8
import mediapipe as mp
import cv2 as cv
import time

class Objectron:
    def __init__(self, staticMode=False, maxObjects=5, minDetectionCon=0.5,
minTrackingCon=0.99):
        self.staticMode=staticMode
        self.maxObjects=maxObjects
        self.minDetectionCon=minDetectionCon
        self.minTrackingCon=minTrackingCon
        self.index=0
        self.modelNames = ['Shoe', 'Chair', 'Cup', 'Camera']
        self.mpObjectron = mp.solutions.objectron
        self.mpDraw = mp.solutions.drawing_utils
        self.mpobjectron = self.mpObjectron.Objectron(
            self.staticMode, self.maxObjects, self.minDetectionCon,
self.minTrackingCon, self.modelNames[self.index])

    def findObjectron(self, frame):
        cv.putText(frame, self.modelNames[self.index], (int(frame.shape[1] / 2)
- 30, 30),
                    cv.FONT_HERSHEY_SIMPLEX, 0.9, (0, 0, 255), 3)
        img_RGB = cv.cvtColor(frame, cv.COLOR_BGR2RGB)
```

```

        results = self.mpobjectron.process(img_RGB)
        if results.detected_objects:
            for id, detection in enumerate(results.detected_objects):
                self.mpDraw.draw_landmarks(frame, detection.landmarks_2d,
self.mpObjectron.BOX_CONNECTIONS)
                self.mpDraw.draw_axis(frame, detection.rotation,
detection.translation)
            return frame

    def configUP(self):
        self.index += 1
        if self.index>=4:self.index=0
        self.mpobjectron = self.mpObjectron.Objectron(
            self.staticMode, self.maxObjects, self.minDetectionCon,
self.minTrackingCon, self.modelNames[self.index])

if __name__ == '__main__':
    capture = cv.VideoCapture(6)
    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
    objectron = Objectron()
    while capture.isOpened():
        ret, frame = capture.read()
        # frame = cv.flip(frame, 1)
        action = cv.waitKey(1) & 0xFF
        if action == ord('q'): break
        if action == ord('f') or action == ord('F') : objectron.configUP()
        frame = objectron.findObjectron(frame)
        cTime = time.time()
        fps = 1 / (cTime - pTime)
        pTime = cTime
        text = "FPS : " + str(int(fps))
        cv.putText(frame, text, (20, 30), cv.FONT_HERSHEY_SIMPLEX, 0.8, (0, 0,
255), 2)
        cv.imshow('frame', frame)
    capture.release()
    cv.destroyAllWindows()

```