

# 5. Camera display

Code path: /home/pi/Yahboom\_Project/1.OpenCV Course/04 Advanced Tutorial/Camera.ipynb

Common API functions used by OpenCV:

## 1. cv2.VideoCapture() function:

```
cap = cv2.VideoCapture(0)
```

The parameter in VideoCapture() is 0, which means Raspberry Pi video0.

(Note: You can view the current camera through the command `ls /dev/`)

```
pi@yahboom4wd:~ $ ls /dev
autofs          loop7          raw            tty25          tty56          vcsa3
block           loop-control  rfkill         tty26          tty57          vcsa4
btrfs-control  mapper        rpivid-h264mem tty27          tty58          vcsa5
bus            media0        rpivid-hevcmem tty28          tty59          vcsa6
cachefiles     media1        rpivid-intcmem tty29          tty6           vcsa7
char           media2        rpivid-vp9mem  tty3           tty60          vcsu
console        mem           serial0        tty30          tty61          vcsu-cma
cpu_dma_latency mmcblk0       serial1        tty31          tty62          vcsu
cuse           mmcblk0p1    shm           tty32          tty63          vcsu1
disk           mmcblk0p2    snd           tty33          tty7           vcsu2
dma_heap       mqueue       spidev0.0     tty34          tty8           vcsu3
dri            net          spidev0.1     tty35          tty9           vcsu4
fb0            null         stderr        tty36          ttyAMA0        vcsu5
fd             port         stdin         tty37          ttyprintk      vcsu6
full           ppp          stdout        tty38          ttyS0          vcsu7
fuse           ptmx         tty           tty39          uhid           vga_arbiter
gpiochip0      pts          tty0          tty4           uinput        vchi
gpiochip1      ram0         tty1          tty40          urandom        video0
gpiomem        ram1         tty10         tty41          usb            video1
hidraw0        ram10        tty11         tty42          v4l            video10
hidraw1        ram11        tty12         tty43          vchiq          video11
hwrng          ram12        tty13         tty44          vcio           video12
i2c-1          ram13        tty14         tty45          vc-mem         video13
initctl        ram14        tty15         tty46          vcs            video14
input          ram15        tty16         tty47          vcs1           video15
kmsg           ram2         tty17         tty48          vcs2           video16
log            ram3         tty18         tty49          vcs3           watchdog
loop0          ram4         tty19         tty5           vcs4           watchdog0
loop1          ram5         tty2           tty50          vcs5           zero
loop2          ram6         tty20         tty51          vcs6
loop3          ram7         tty21         tty52          vcs7
loop4          ram8         tty22         tty53          vcsa
loop5          ram9         tty23         tty54          vcsa1
loop6          random       tty24         tty55          vcsa2
```

```
cap = cv2.VideoCapture("../1.avi")
```

VideoCapture("../1.avi") means that if the parameter is the video file path, the video will be opened.

## 2. cap.set() function

Set camera parameters. Do not modify them at will. Common configuration methods:

```
capture.set(CV_CAP_PROP_FRAME_WIDTH, 1920); #Width
```

```
capture.set(CV_CAP_PROP_FRAME_HEIGHT, 1080); #Height
```

```
capture.set(CV_CAP_PROP_FPS, 30); #Frame number
capture.set(CV_CAP_PROP_BRIGHTNESS, 1); #Brightness 1
capture.set(CV_CAP_PROP_CONTRAST,40); #Contrast 40
capture.set(CV_CAP_PROP_SATURATION, 50); #Saturation 50
capture.set(CV_CAP_PROP_HUE, 50); #Hue 50
capture.set(CV_CAP_PROP_EXPOSURE, 50); #Exposure 50
```

CV\_CAP\_PROP\_POS\_MSEC - current position of the video, get timestamp as milliseconds or video

CV\_CAP\_PROP\_POS\_FRAMES - Frame index that will be decompressed/acquired next, starting from 0

CV\_CAP\_PROP\_POS\_AVI\_RATIO - relative position of the video file (0 - start of video, 1 - end of video)

CV\_CAP\_PROP\_FRAME\_WIDTH - Frame width in the video stream

CV\_CAP\_PROP\_FRAME\_HEIGHT - Frame height in the video stream

CV\_CAP\_PROP\_FPS - frame rate

CV\_CAP\_PROP\_FOURCC - Four characters representing the codec

CV\_CAP\_PROP\_FRAME\_COUNT - Total number of frames in the video file

The function `cvGetCaptureProperty` obtains the specified properties of the camera or video file.

**The following are detailed parameters:**

```
#define CV_CAP_PROP_POS_MSEC 0 //Current position in milliseconds
#define CV_CAP_PROP_POS_FRAMES 1 //Calculate the current position in frames
#define CV_CAP_PROP_POS_AVI_RATIO 2 //The relative position of the video, from 0 to 1. The first
three parameters should be related to video playback and reading related dynamic information.
#define CV_CAP_PROP_FRAME_WIDTH 3 //Frame width
#define CV_CAP_PROP_FRAME_HEIGHT 4 //Frame height
#define CV_CAP_PROP_FPS 5 //Frame rate
#define CV_CAP_PROP_FOURCC 6 //4 character encoding method
#define CV_CAP_PROP_FRAME_COUNT 7 //Video frame number
#define CV_CAP_PROP_FORMAT 8 //Video format
#define CV_CAP_PROP_MODE 9 //Backend specific value indicating the current capture mode.
#define CV_CAP_PROP_BRIGHTNESS 10 //Brightness
#define CV_CAP_PROP_CONTRAST 11 //Contrast
#define CV_CAP_PROP_SATURATION 12 //Saturation
#define CV_CAP_PROP_HUE 13 //Hue
```

```
#define CV_CAP_PROP_GAIN 14 //Gain

#define CV_CAP_PROP_EXPOSURE 15 //Exposure

#define CV_CAP_PROP_CONVERT_RGB 16 //Boolean flag whether the image should be converted
to RGB.

#define CV_CAP_PROP_WHITE_BALANCE 17 //White balance

#define CV_CAP_PROP_RECTIFICATION 18 //Stereo camera correction flag (note: only supports
DC1394 v2. x end currently)
```

### 3, **cap.isOpened() function:**

Return true to indicate success, false to indicate unsuccessful

### 4 **ret,frame = cap.read() function:**

cap.read() reads the video frame by frame. ret and frame are the two return values of the cap.read() method. where ret is a Boolean value. If the read frame is correct, it returns True. If the file is not read to the end, its return value is False.

Frame is the image of each frame, which is a three-dimensional matrix.

### 5. **cv2.waitKey() function:**

The parameter is 1, which means switching to the next image with a delay of 1ms. If the parameter is too large, such as cv2.waitKey(1000), it will cause lag due to too long delay.

The parameter is 0. For example, cv2.waitKey(0) only displays the current frame image, which is equivalent to pausing the video.

### 6. **cap.release() and destroyAllWindows() functions:**

cap.release() releases the video and calls destroyAllWindows() to close all image windows.

### **Code implementation process**

Since our entire tutorial runs in JupyterLab, we must understand the various components inside. Here we need to use the image display component.

1. Import library:

```
import ipywidgets.widgets as widgets
```

2. Set up the Image component:

```
image_widget = widgets.Image(format='jpeg', width=600, height=500)
```

I format: display format.

I width: width.

I height: height.

3. Display the Image component:

```
display(image_widget)
```

4. Turn on the camera and read the image:

```
image = cv2.VideoCapture(0) #Open the camera
```

```
ret, frame = image.read() #Read camera data
```

5. Assign values to components

```
#Convert the image to jpeg and assign it to the video display component
```

```
image_widget.value = bgr8_to_jpeg(frame)
```

Code content:

```
import cv2

import ipywidgets.widgets as widgets

import threading

import time

#Set camera display component

image_widget = widgets.Image(format='jpeg', width=500, height=400)

display(image_widget) #Display camera component
```

```
#bgr8 to jpeg format

import enum

import cv2

def bgr8_to_jpeg(value, quality=75):

    return bytes(cv2.imencode('.jpg', value)[1])
```

```
image = cv2.VideoCapture(0) #Open the camera

# width=1280

# height=960

# cap.set(cv2.CAP_PROP_FRAME_WIDTH,width)#Set image width

# cap.set(cv2.CAP_PROP_FRAME_HEIGHT,height)#Set the image height
```

```
image.set(3,600)

image.set(4,500)

image.set(5, 30) #Set frame rate

image.set(cv2.CAP_PROP_FOURCC, cv2.VideoWriter.fourcc('M', 'J', 'P', 'G'))

image.set(cv2.CAP_PROP_BRIGHTNESS, 40) #Set brightness -64 - 64 0.0

image.set(cv2.CAP_PROP_CONTRAST, 50) #Set contrast -64 - 64 2.0

image.set(cv2.CAP_PROP_EXPOSURE, 156) #Set exposure value 1.0 - 5000 156.0


ret, frame = image.read() #Read camera data

image_widget.value = bgr8_to_jpeg(frame)
```

```
try:
    while 1:

        ret, frame = image.read()

        image_widget.value = bgr8_to_jpeg(frame)

        time.sleep(0.010)
except KeyboardInterrupt:
    image.release() #Capture ctrl +c to release the camera
```

If we want to end the program, we can press this icon on jupyterlab to release the camera

