# 8、Color recognition and object tracking


8、Color recognition and object tracking
- 8.1、Introduction
  - 8.1.1、Color recognition
  - 8.1.2、Object tracking
- 8.2、Steps
  - 8.2.1、Start up
  - 8.2.2、Identify
  - 8.2.3、Color calibration
- 8.3、C++ version KCF
  - 8.3.1、Instructions
  - 8.3.3、Node relationship graph


website：https://learnopencv.com/object-tracking-using-opencv-cpp-python/#opencv-tracking-api

## 8.1、Introduction

### 8.1.1、Color recognition

- **HSV**

H: 0 — 180

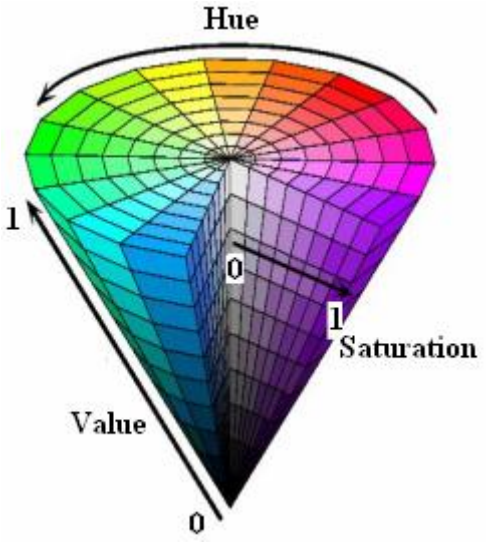
S: 0 — 255

V: 0 — 255

Part of the red is classified as the purple range here:

| | black | gray | white | red | | orange | yellow | green | verdant | blue | purple |
|---|---|---|---|---|---|---|---|---|---|---|---|
| hmin | 0 | 0 | 0 | 0 | 156 | 11 | 26 | 35 | 78 | 100 | 125 |
| hmax | 180 | 180 | 180 | 10 | 180 | 25 | 34 | 77 | 99 | 124 | 155 |
| smin | 0 | 0 | 0 | 43 | | 43 | 43 | 43 | 43 | 43 | 43 |
| smax | 255 | 43 | 30 | 255 | | 255 | 255 | 255 | 255 | 255 | 255 |
| vmin | 0 | 46 | 221 | 46 | | 46 | 46 | 46 | 46 | 46 | 46 |
| vmax | 46 | 220 | 255 | 255 | | 255 | 255 | 255 | 255 | 255 | 255 |

- **HSV**
  - **Hue H**
  - **Saturation S**
  - **Lightness V**




### 8.1.2、Object tracking

Object tracking is to locate an object in consecutive video frames.

- Comparison of OpenCV algorithms

| Algorithm | Speed | Accuracy | Description |
|---|---|---|---|
| BOOSTING | Slow | Low | It is the same as the machine learning algorithm behind Haar casades (AdaBoost), but it has been born for more than ten years, a veteran algorithm. |
| MIL | Slow | Low | It is more accurate than BOOSTING, but the failure rate is higher. |
| KCF | Fast | High | Faster than BOOSTING and MIL, but it is not effective when there is occlusion |
| TLD | Middle | Middle | There are a lot of erro |
| MEDIANFLOW | Middle+ | Middle | The model will fail for fast-jumping or fast-moving objects. |
| GOTURN | Middle | Middle | A deep learning-based object detector requires additional models to run. |
| MOSSE | Fastest | High | The speed is really fast, but not as high as the accuracy of CSRT and KCF. If you are looking for speed, you can choose it. |
| CSRT | Fast - | Higher | Slightly more accurate than KCF, but not as fast as KCF. |

## 8.2、Steps

### 8.2.1、Start up

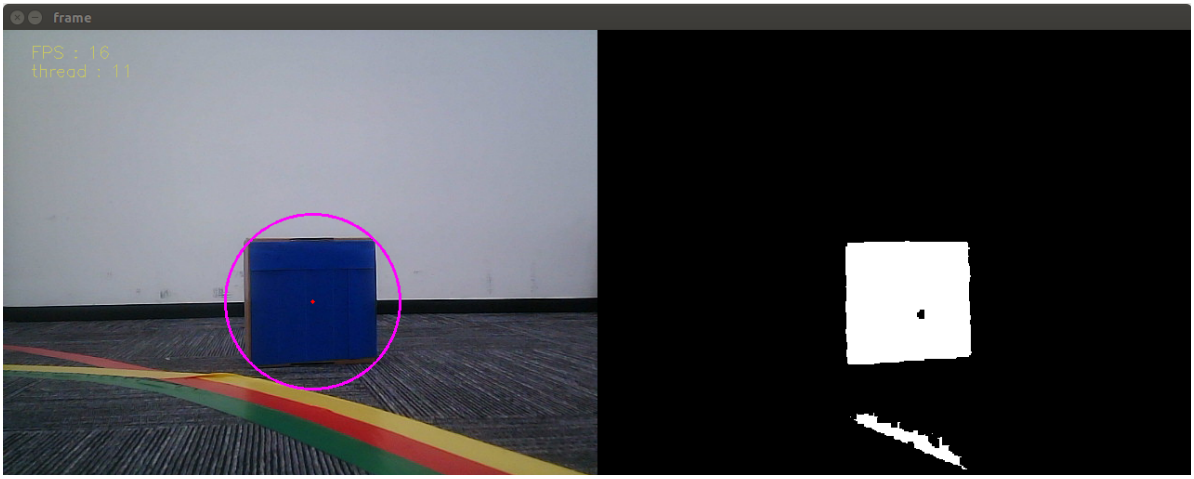
```
roslaunch astra_tracker AstraTracker.launch VideoSwitch:=false
tracker_type:=color
```

- VideoSwitch parameter: whether to use the astrapro.launch function package to start.
- tracker_type parameter： select the tracking algorithm ['BOOSTING','MIL','KCF','TLD','MEDIANFLOW','MOSSE','CSRT','color'], click the keyboard [F] key after startup Can be switched.

Set the parameters according to your needs, and you can also modify the launch file directly, so you don't need to attach parameters when you start.

### 8.2.2、Identify

After startup, the system defaults to [Target Detection Mode], as shown below.




Keyboard key control:

【r】： Color selection mode, the mouse can be used to select the area of the color to be recognized (cannot exceed the area range).

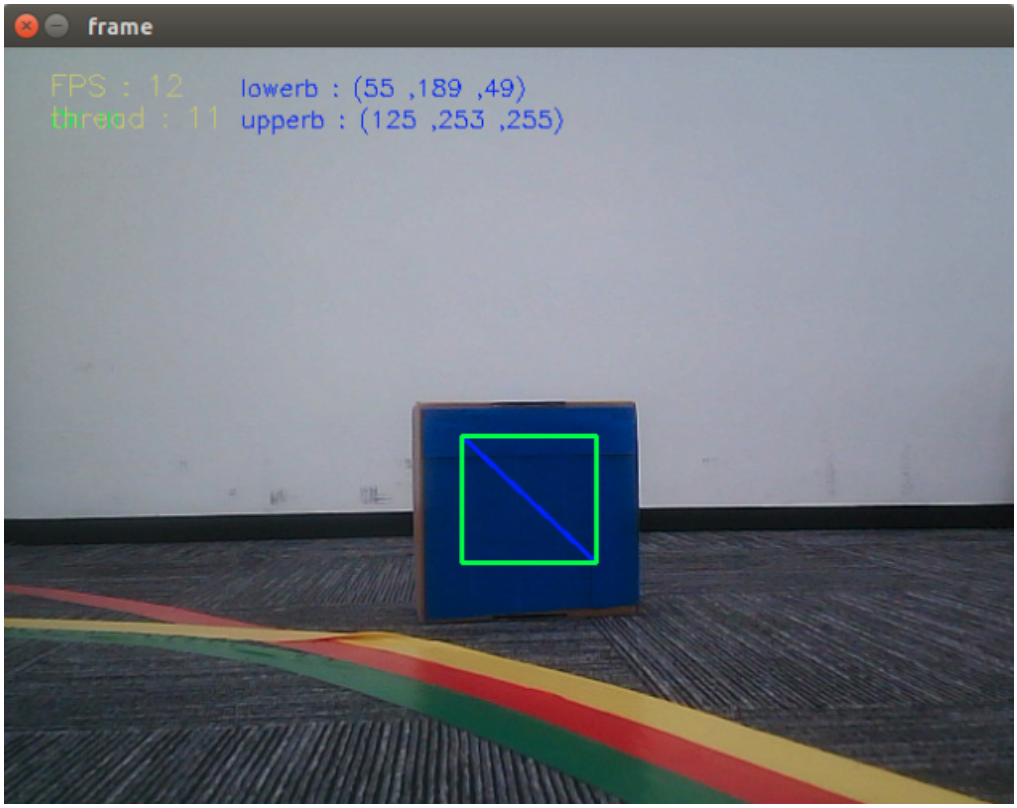
【i】: Target detection mode. Color map on the left (Color), binary map on the right (Binary).

【f】: Switching algorithm: ['BOOSTING','MIL','KCF','TLD','MEDIANFLOW','MOSSE','CSRT','color'].

【q】: Exit the program.

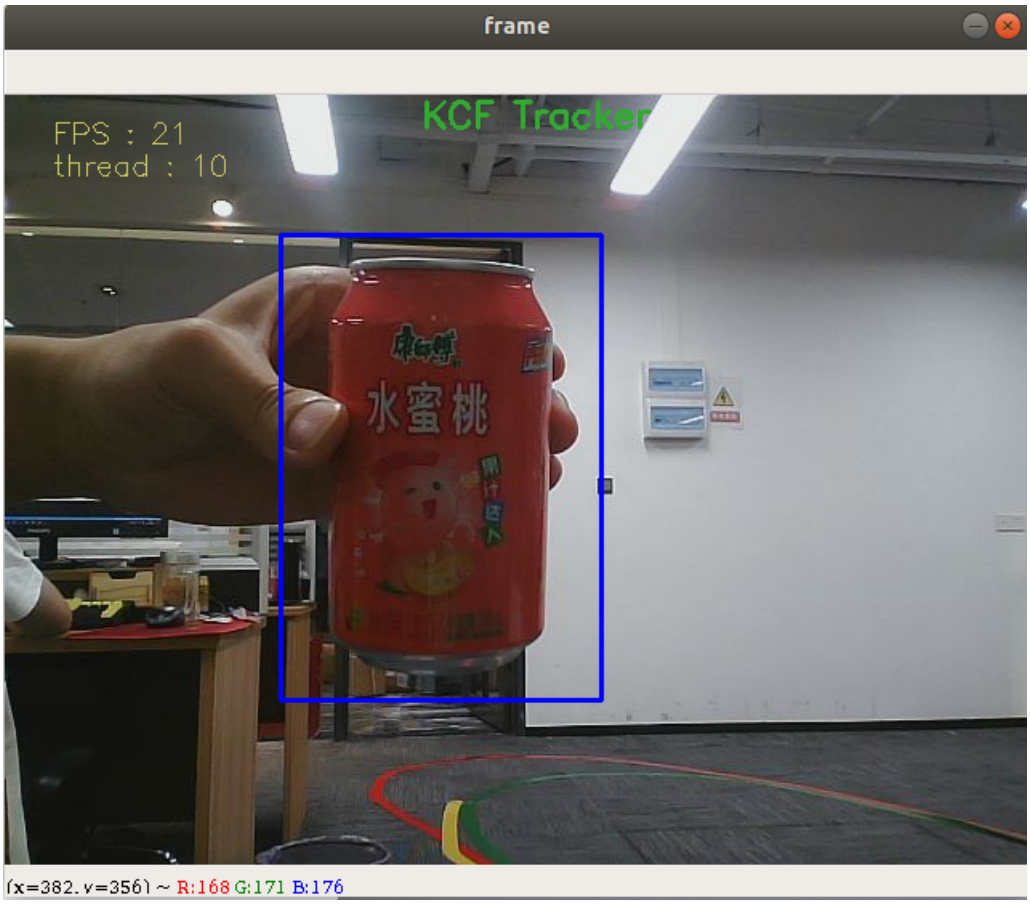
- Color recognition

In the color selection mode, use the mouse to select the location of the colored object, as shown in the figure below, release it to start recognition.




- Object tracking

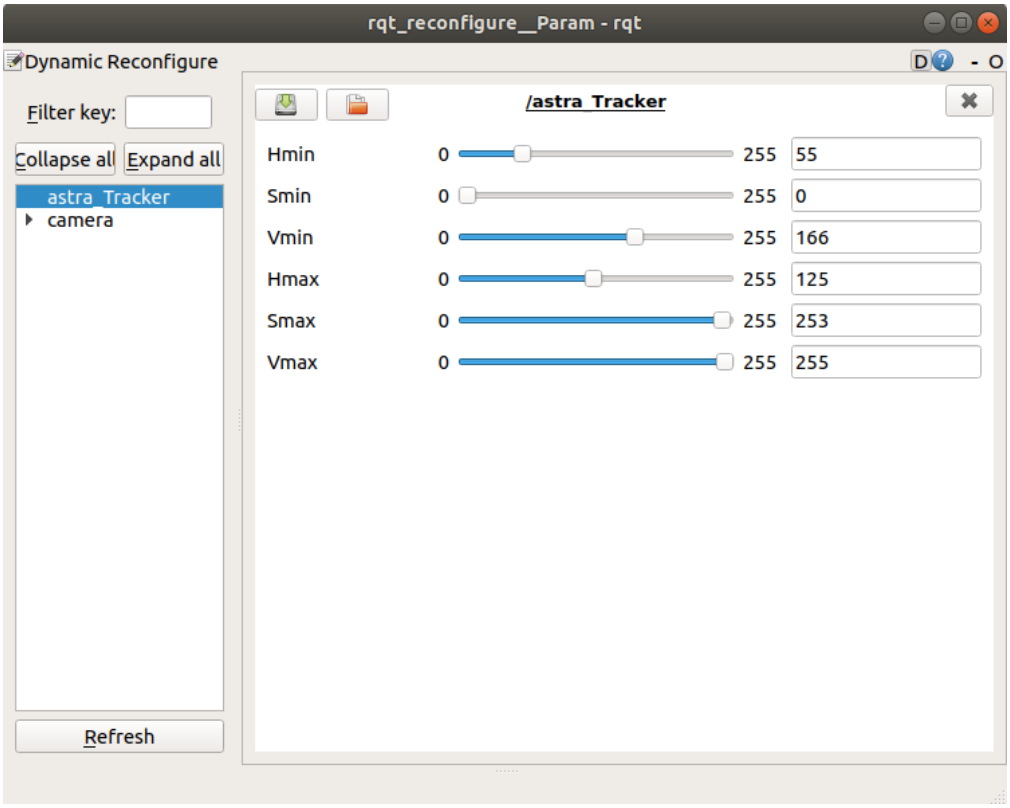
After starting, enter the selection mode, use the mouse to select the location of the object, as shown in the figure below, release it to start recognition.



### 8.2.3、Color calibration

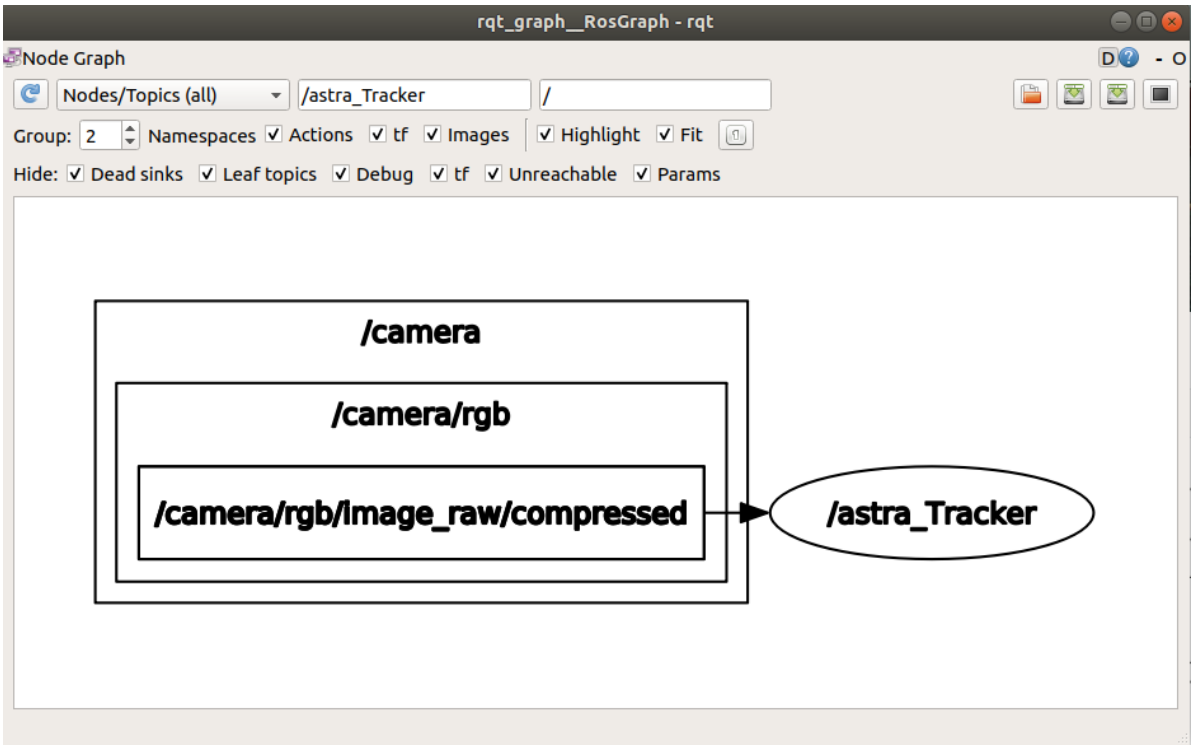
Dynamic parameter

```
rosrun rqt_reconfigure rqt_reconfigure
```




], [Hmax], these four parameters can be well identified.

The slider is always in the dragging state, and no data will be transferred to the system. Data will be transferred to the system when you release it.



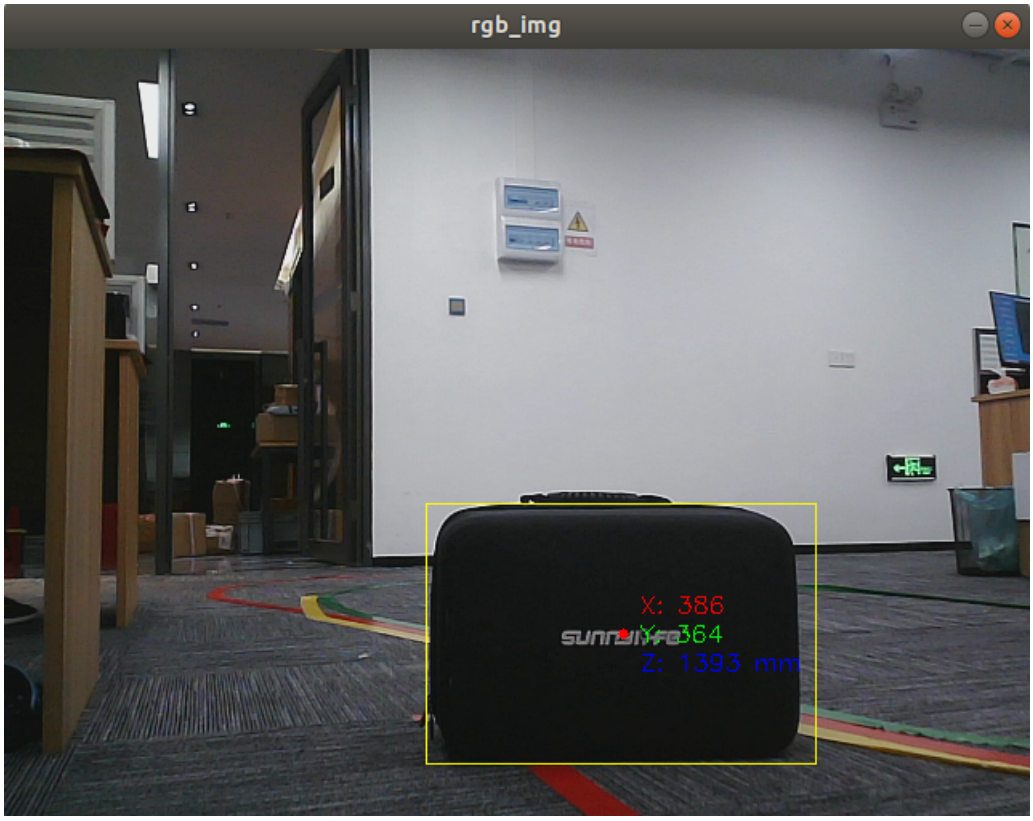
## 8.3、C++ version KCF

### 8.3.1、Instructions

Start up

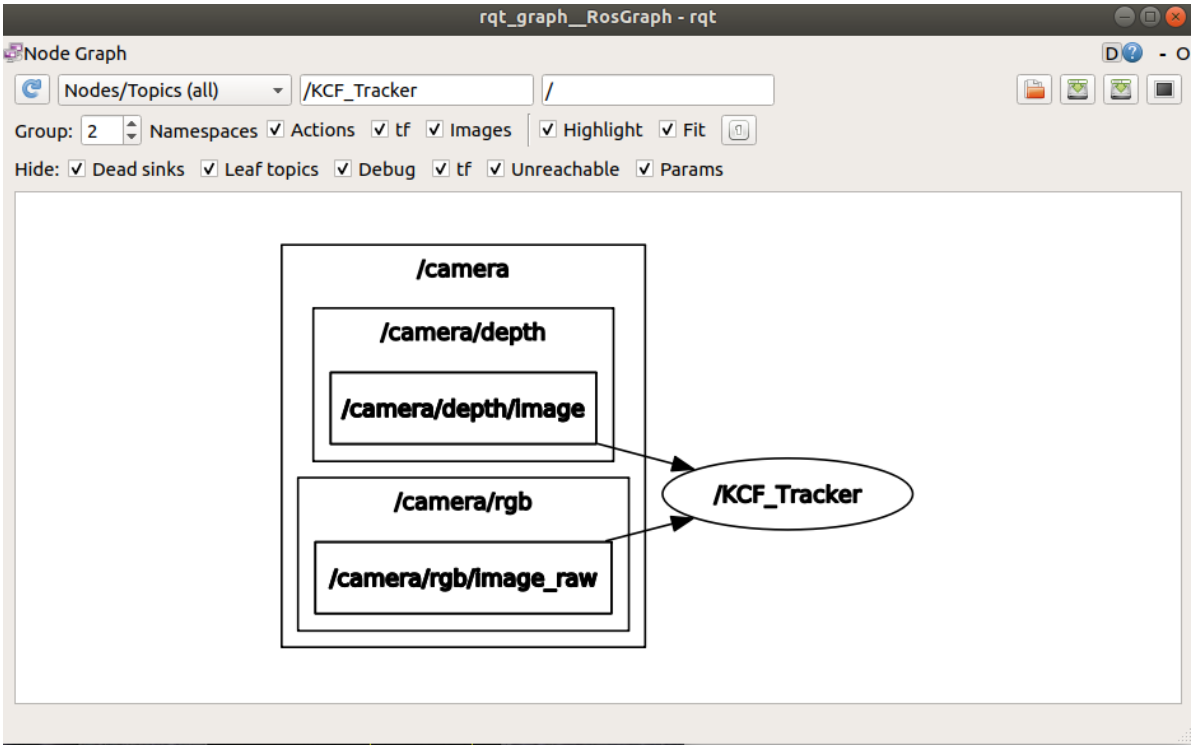
```
roslaunch astra_tracker KCFTracker.launch
```

After starting, enter the selection mode, use the mouse to select the location of the object, as shown in the figure below, release it to start recognition.




### 8.3.3、Node relationship graph

```
rqt_graph
```


rqt_graph__RosGraph - rqt
Node Graph
Nodes/Topics (all)
/KCF_Tracker
/
Group: 2
Namespaces
Actions
tf
Images
Highlight
Fit
Hide:
Dead sinks
Leaf topics
Debug
tf
Unreachable
Params
/camera
/camera/depth
/camera/depth/image
/camera/rgb
/camera/rgb/image_raw
/KCF_Tracker