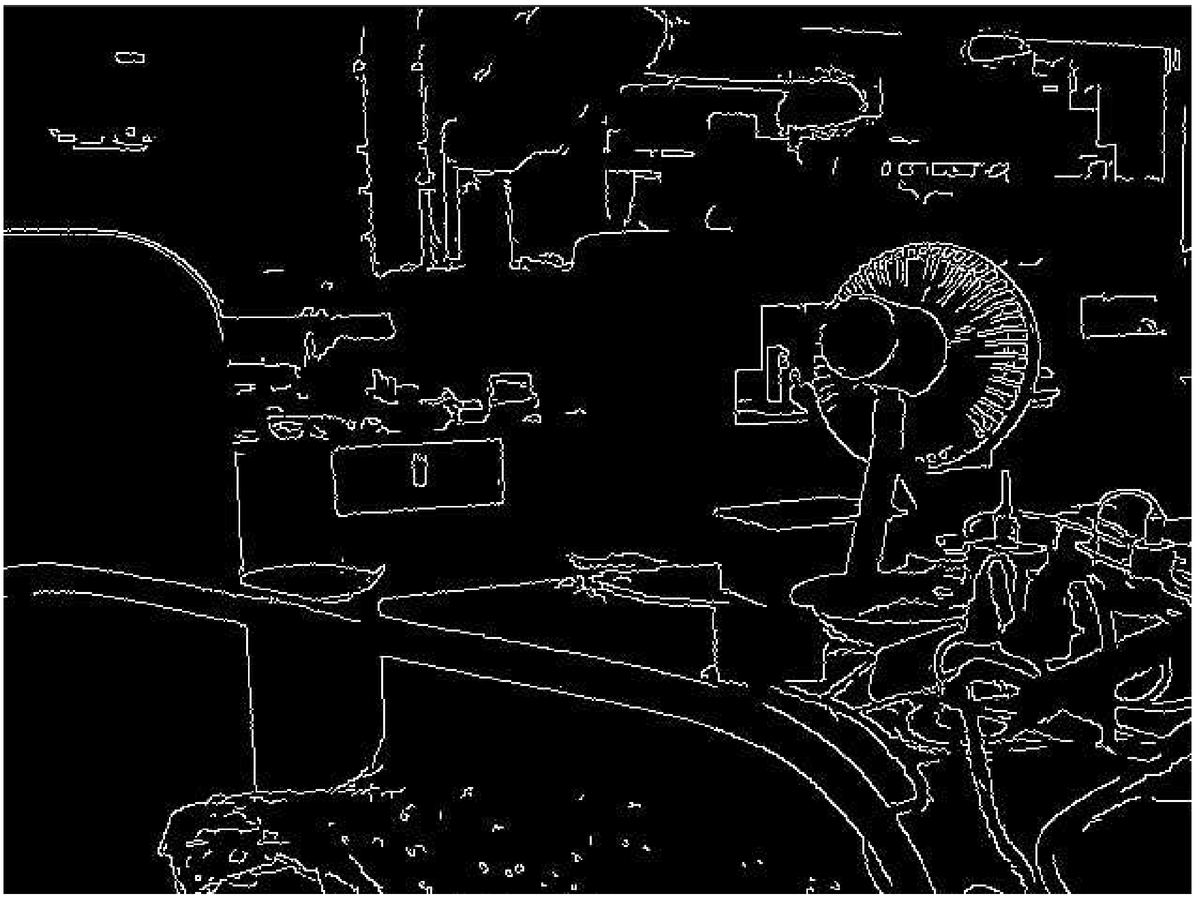
Edge Recognition - Color Image

Example Results

Run the example code in this section [Source Code/06.cv_lite/8.rgb888_find_edges.py]

In this section, we will use the `cv_lite` extension module to implement edge detection (Canny algorithm) in the RGB888 format on an embedded device.

> Note: The implementation results in this section are the same as in the previous section, but the edge detection API used is different. The algorithm used in this section supports color images in RGB888 format.



Code Overview

Importing Modules

```
import time, os, sys, gc
from machine import Pin
from media.sensor import * # Import the camera interface
from media.display import * # Import the display interface
from media.media import * # Import the media manager
import _thread
import cv_lite # Import the cv_lite extension
import ulab.numpy as np # MicroPython NumPy library
```

Setting the Image Size

```
image_shape = [480, 640] # Height x Width
```

Define the image resolution as 480x640 (height x width). The camera and display module will be initialized based on this size later.

Initialize the camera (RGB888 format)

```
sensor = Sensor(id=2, width=1280, height=960, fps=90)
sensor.reset()
sensor.set_framesize(width=image_shape[1], height=image_shape[0])
sensor.set_pixformat(Sensor.RGB888) # Set RGB888 pixel format
```

- Initialize the camera, set the resolution to 1280x960 and the frame rate to 90 FPS.
- Resize the output frame to 640x480 and set it to RGB888 format (three-channel color image, suitable for edge detection in color images).

Initialize the display module

```
Display.init(Display.ST7701, width=image_shape[1], height=image_shape[0],
to_ide=True, quality=50)
```

Initialize the display module, using the ST7701 driver chip, with a resolution consistent with the image size. `to_ide=True` indicates that the image will be simultaneously transmitted to the IDE for virtual display, and `quality=50` sets the image transmission quality.

Initialize the media manager and start the camera

```
MediaManager.init()
sensor.run()
```

Initialize the media resource manager and start the camera to capture the image stream.

Set edge detection parameters

```
threshold1 = 50 # Lower threshold for Canny edge detection
threshold2 = 80 # Higher threshold for Canny edge detection
clock = time.clock() # Start FPS timer
```

- `threshold1`: Canny edge detection lower threshold, used to control the detection of weak edges.
- `threshold2`: Canny edge detection upper threshold, used to control the detection of strong edges. A larger value results in fewer edges being detected.
- `clock`: Used to calculate the frame rate.

Image processing and edge detection

```
while True:
    clock.tick()

    # Capture a frame
    img = sensor.snapshot()
    img_np = img.to_numpy_ref() # Get a reference to the RGB888 ndarray

    # Call the edge detection function extended by cv_lite and return a grayscale
edge map ndarray
    edge_np = cv_lite.rgb888_find_edges(image_shape, img_np, threshold1,
threshold2)

    # Construct a grayscale image object for display
    img_out = image.Image(image_shape[1], image_shape[0], image.GRAYSCALE,
alloc=image.ALLOC_REF, data=edge_np)

    # Display edge detection results
    Display.show_image(img_out)

    # Garbage collection
    gc.collect()

    # Print Current Frame Rate / Print FPS
    print("edges:", clock.fps())
```

- **Image Capture**: Capture an image frame using `sensor.snapshot()` and convert it to a NumPy array reference using `to_numpy_ref()`.
- **Edge Detection**: Call `cv_lite.rgb888_find_edges()` to perform Canny edge detection, returning a NumPy array of grayscale edge images.
- **Image Packaging and Display**: Pack the edge detection result into a grayscale image object and display it on the screen or in an IDE virtual window.
- **Memory Management and Frame Rate Output**: Call `gc.collect()` to clear memory and print the current frame rate using `clock.fps()`.

Resource release

```
sensor.stop()
Display.deinit()
os.exitpoint(os.EXITPOINT_ENABLE_SLEEP)
time.sleep_ms(100)
MediaManager.deinit()
```

Parameter adjustment instructions

- `threshold1`: Low threshold. A smaller value can detect more weak edges, but may introduce noise. It is recommended to start adjusting from 50.
- `threshold2`: High threshold. A larger value can detect fewer strong edges, which is suitable for noisy environments. Increasing this value can reduce false edges.