

## 计算机视觉 课程实验报告

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实验题目: Harris 角点检测

实验内容:

实现 Harris 角点检测算法, 并与 OpenCV 的 cornerHarris 函数的结果进行比较。

实验过程中遇到和解决的问题:

### 1. cornerHarris 函数

\$ cornerHarris()

```

void cv::cornerHarris ( InputArray  src,
                        OutputArray dst,
                        int      blockSize,
                        int      ksize,
                        double    k,
                        int      borderType = BORDER_DEFAULT
                      )

```

**Python:**  

```

dst = cv.cornerHarris( src, blockSize, ksize, k[, dst[, borderType]] )

```

Harris corner detector.

The function runs the Harris corner detector on the image. Similarly to `cornerMinEigenVal` and `cornerEigenValsAndVecs`, for each pixel  $(x, y)$  it calculates a  $2 \times 2$  gradient covariance matrix  $M^{(x,y)}$  over a `blockSize`  $\times$  `blockSize` neighborhood. Then, it computes the following characteristic:

$$\text{dst}(x, y) = \det M^{(x,y)} - k \cdot \left( \text{tr} M^{(x,y)} \right)^2$$

Corners in the image can be found as the local maxima of this response map.

**Parameters**

<b>src</b>	Input single-channel 8-bit or floating-point image.
<b>dst</b>	Image to store the Harris detector responses. It has the type CV_32FC1 and the same size as src.
<b>blockSize</b>	Neighborhood size (see the details on <code>cornerEigenValsAndVecs</code> ).
<b>ksize</b>	Aperture parameter for the Sobel operator.
<b>k</b>	Harris detector free parameter. See the formula below.
<b>borderType</b>	Pixel extrapolation method. See <code>BorderTypes</code> .

### 2. 实现 Harris 角点检测算法

算法流程:

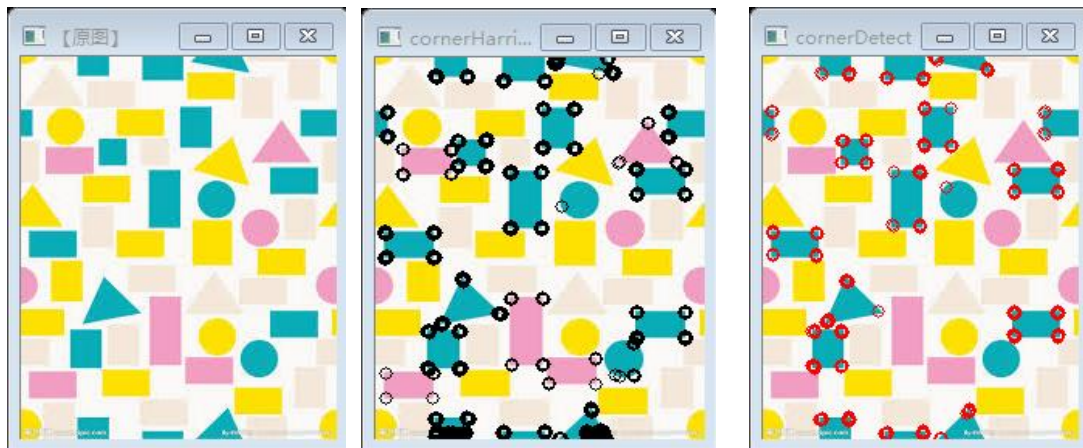
- 1) 读入待检测图片并转换为灰度图;
- 2) 对灰度图用 sobel 算子求得 x 及 y 方向梯度图  $I_x$ ,  $I_y$ ;
- 3) 对  $I_x$ ,  $I_y$  进一步处理得到  $I_x^2, I_y^2, I_x I_y$  ;
- 4) 对上一步得到的图片分别进行高斯滤波得到  $g(I_x^2), g(I_y^2), g(I_x I_y)$  ;

5) 由以下公式计算出角点响应:

$$R = \det[M(\sigma_I, \sigma_D)] - \alpha[\text{trace}(M(\sigma_I, \sigma_D))]^2$$
$$= g(I_x^2)g(I_y^2) - [g(I_x I_y)]^2 - \alpha[g(I_x^2) + g(I_y^2)]^2$$

6) 设置阈值 threshold, 小于阈值的点不视为角点。

阈值设为最大响应的一半, 原图及检测结果如下 (从左至右原图、cornerHarris 函数结果、自己实现结果):



结论分析与体会: