1122 Digital Image Processing Assignment #7

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主題:**Image Segmentation and Object Detection** 影像分割及物件偵測

專案目標:

偵測出附件2張視訊照片中的所有書桌的桌面區域。

1. 標示出每張桌子的桌面的矩形邊界框(Bounding box)
2. 標示出偵測到桌子的桌角

開發環境:

- 用的作業系統:Windows
- 開發環境:VScode
- 用的套件:OpenCV version: 4.9.0, numpy
- 程式語言:Python 3.12.0

程式架構與功能說明:

- 讀取及預處理圖片
  - 將影像放入向量
  - 轉成 hsv
- 進行顏色範圍檢測桌面，建立 mask

```
hsv = cv2.cvtColor(image, cv2.COLOR_BGR2HSV)

# define the range of color
lower_color = np.array([0, 25, 110])
upper_color = np.array([25, 130, 255])
mask = cv2.inRange(hsv, lower_color, upper_color)
```

- 二值化:使用 Otsu 閥值法

```
# Use Otsu's method to automatically select the threshold
_, binary = cv2.threshold(mask, 0, 255, cv2.THRESH_BINARY + cv2.THRESH_OTSU)
```

- 計算邊緣密度，調整形態學合適的 kernal
- 形態學處理(閉操作)
  - 先進行膨脹，再進行侵蝕。用來填補物體的間隙或小洞，尤其是在物體邊緣附近。

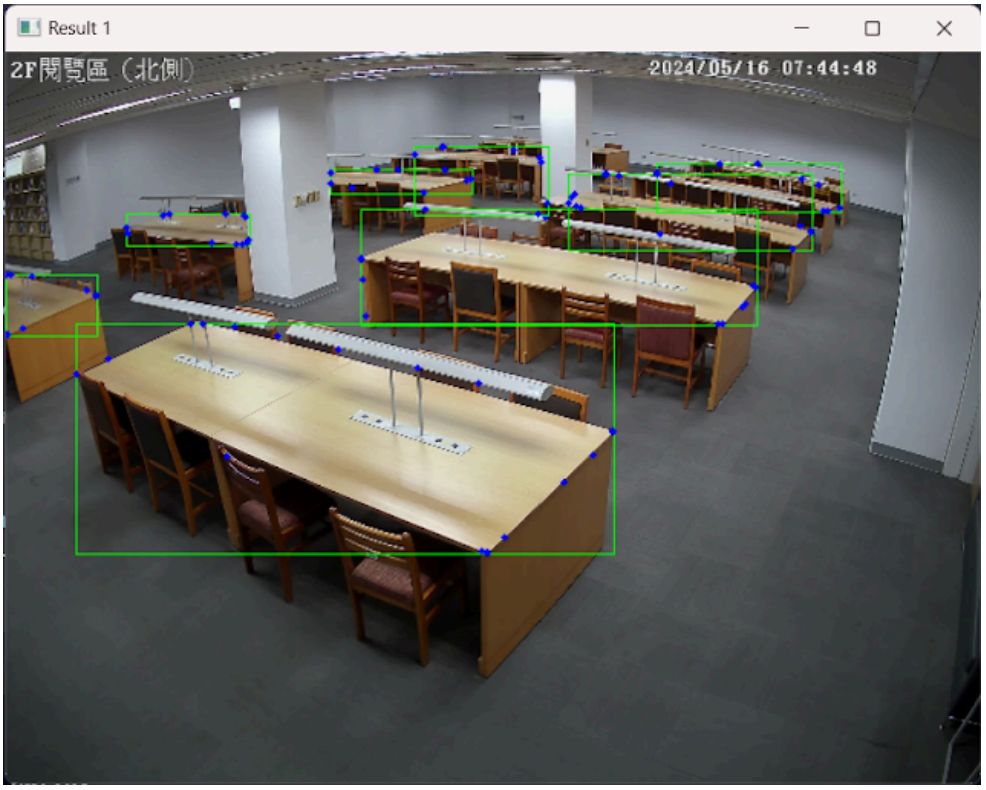
```
# compute the edge density
edge_density = np.sum(binary) / (binary.shape[0] * binary.shape[1] * 255)

# choose the kernel size for edge density
if edge_density > 0.1:
    kernel_size = 3
else:
    kernel_size = 7

# morphological operation
kernel = np.ones((kernel_size, kernel_size), np.uint8)
closed = cv2.morphologyEx(binary, cv2.MORPH_CLOSE, kernel)
```

- 檢測及篩選輪廓
- 畫出凸點及方形

```
# find contours
contours, _ = cv2.findContours(closed, cv2.RETR_EXTERNAL, cv2.CHAIN_APPROX_SIMPLE)

for contour in contours:
    # select the contour with a certain area
    if cv2.contourArea(contour) > 300:
        # draw bounding box
        x, y, w, h = cv2.boundingRect(contour)
        cv2.rectangle(image, (x, y), (x + w, y + h), (0, 255, 0), 1)

        # find convex hull
        hull = cv2.convexHull(contour)

        # draw convex hull
        for point in hull:
            cv2.circle(image, tuple(point[0]), 2, (255, 0, 0), -1)
```

- 顯示結果

成果展示與討論:


Result 1
2F閱覽區（北側）
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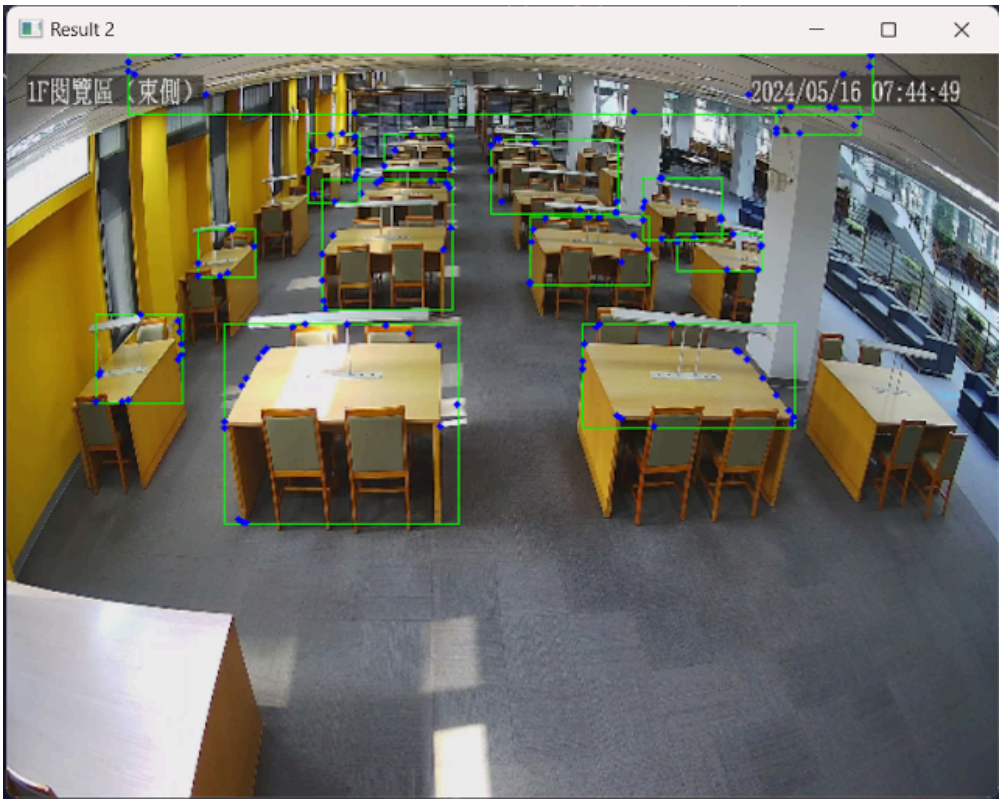
Result 2
1F閱覽區（東側）
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