

CV HW9

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Pictures



Roberts Lena



Prewitts Lena



Sobel's Lena



Frei and Chen's Lena



Kirsch's Lena



Robinsons Lena



Nevatia-Babu 5×5 Lena

Code details

```
def padding(img, pad):
    w, h = img.size
    new_img = Image.new('L', (w + 2 * pad, h + 2 * pad))
    new_img.paste(img, (pad, pad))

    top = img.crop((0, 0, w, 1))
    bottom = img.crop((0, h - 1, w, h))
    left = new_img.crop((pad, 0, pad + 1, h + 2 * pad))
    right = new_img.crop((w + pad - 1, 0, w + pad, h + 2 * pad))

    new_img.paste(top, (pad, 0))
    new_img.paste(bottom, (pad, h + pad))
    new_img.paste(left, (pad, pad - 1))
    new_img.paste(right, (pad, h + 2 * pad - 1))
    new_img.paste(left, (0, 0))
    new_img.paste(right, (w + pad, 0))
    new_img.paste(left, (pad - 1, 0))
    new_img.paste(right, (w + 2 * pad - 1, 0))

    return new_img
```

padding

```
def apply_kernel(img, thresholds, kernel1, kernel2):
    width, height = img.size
    new_image = Image.new('1', img.size)
    padding_pixel = round(kernel1.shape[0] / 2)
    img = padding(img, padding_pixel)

    for x in range(width):
        for y in range(height):
            kernel_list = [[img.getpixel((x + i + padding_pixel, y + j + padding_pixel))
                            for i in range(kernel1.shape[1])
                            for j in range(kernel1.shape[0])]]

            gradient_magnitude = int(math.sqrt(np.sum(np.multiply(kernel_list, kernel1))**2 +
                                                       np.sum(np.multiply(kernel_list, kernel2))**2))

            if gradient_magnitude >= thresholds:
                new_image.putpixel((x, y), 0)
            else:
                new_image.putpixel((x, y), 1)

    return new_image
```

apply kernel

```
def compass_operator(img, thresholds, k_list, padding_pixel):
    width, height = img.size
    new_image = Image.new('1', img.size)
    img = padding(img, padding_pixel)

    for x in range(width):
        for y in range(height):
            kernel_list = [[img.getpixel((x + i, y + j))
                            for i in range(-padding_pixel, padding_pixel + 1)]
                            for j in range(-padding_pixel, padding_pixel + 1)]

            gradient_magnitude = max(np.sum(np.multiply(kernel_list, k)) for k in k_list)

            new_image.putpixel((x, y), 0 if gradient_magnitude >= thresholds else 1)

    return new_image
```

compass operator

- For Roberts, Prewitts, Sobels and Frei and Chen's, use the specified kernel to `apply_kernel`.
- For Kirschs, Robinsons, and Nevatia Babu, use the specified k-list to `compass_operator`.