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| **Color Image Processing** | **HW1** | | **何柏昇** | **M11107309** |
| **第一題 影像邊緣偵測** | | | | |
| 1. 讀取附件的 8-bit 灰階影像。 2. 顯示輸入影像。 3. 將影像轉換成double格式，數值範圍在[0 1]之間。 4. 用雙層迴圈由左而右，由上而下讀取以(x, y)為中心的3\*3影像區域。 5. 將3\*3影像區域點對點乘上Sobel濾鏡數值矩陣後，將數值總和存入輸出影像的(x, y)位置。 6. 將濾波後的影像加上0.5，呈現浮雕影像。 7. 分別將濾波後的影像開絕對值，再二值化(門檻值自訂)，用bitor(bitwise or)或直接相加，產生輪廓影像。 8. 轉成8bit，儲存影像檔。 | | | | |
| Sobel 濾鏡 | | | | |
| 水平濾波 | | 垂直濾波 | | |
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| **Result** | | | | |
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| **Code** |
| import cv2 as cv  import numpy as np  from matplotlib import pyplot as plt  import os  # Read image  img = cv.imread("ntust\_gray.jpg",0)  # Show information of image  print(img.dtype)  print(img.shape)  # Turn to double type, and range in [0,1]  img = img.astype(float) / 255  # Sobel kernel  Gx = np.array([[-1, -2, -1],[0, 0, 0],[1, 2, 1]])  Gy = np.array([[-1, 0, 1],[-2, 0, 2],[-1, 0, 1]]) |
| # Convolution  rows, colums=img.shape  tmpx = np.zeros(img.shape)  tmpy = np.zeros(img.shape)  for row in range(rows):      for colum in range(colums):          if ((row-1 > 0)&(colum-1 > 0)&(row+1 < rows)&(colum+1 < colums)):              tmpx[row, colum] = np.sum(np.multiply(img[row-1:row+2,colum-1:colum+2],Gx))\*0.5              tmpy[row, colum] = np.sum(np.multiply(img[row-1:row+2,colum-1:colum+2],Gy))\*0.5 |

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| # Absolute  result = abs(tmpx) + abs(tmpy)  # Binarization  thresh = np.mean(result)  maxval = 255  result = (result > thresh) \* maxval |
| # Create folder to save image  if not os.path.exists('images'):      os.makedirs('images')  # Show all images  imgs = [img\*maxval, tmpx, tmpy, result]  titles = ['Input', 'Sobel-X', 'Sobel-Y', 'Result']  fig = plt.figure()  fig.set\_figwidth(15)  for i in range(4):      # Save image      #cv.imwrite('images/'+titles[i]+'.jpg', imgs[i])      # Plot image      plt.subplot(1,4,i+1)      plt.imshow(imgs[i], 'gray')      plt.title(titles[i])      plt.axis('off')      plt.colorbar()  print("Save the image of result to /images/ \n")  plt.savefig('images/All-Result-Sobel.jpg')  plt.show() |

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| **第二題 Unsharp Masking(USM)影像銳化** |
| 1. 輸入影像模糊參數（例如均值濾波的濾鏡尺寸n）。 2. 讀取附件的8-bit灰階影像。 3. 顯示輸入影像。 4. 將影像轉換成double格式，數值範圍在[0 1]之間。 5. 用雙層迴圈對n\*n濾鏡（均值濾鏡或高斯濾鏡）做影像模糊化，獲得模糊影像。 6. 利用原圖與模糊影像的差異，加上原圖，獲得銳利影像。 |
| n\*n均值濾波器 |
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| **Result** |
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| **Code** |
| import cv2 as cv  import numpy as np  from matplotlib import pyplot as plt  import os  # Read image  img = cv.imread("ntust\_gray.jpg",0)  # Show information of image  print(img.dtype)  print(img.shape)  # Turn to double type, and range in [0,1]  img = img.astype(float) / 255 |
| # Mean filter  def get\_input(s):      while True:          try:              n = int(input('Enter %s: ' % s))          except ValueError:              print('Error: Invalid Input.')          if n%2 == 0 :              raise ValueError('n=%d is a even value!' % n)          return n  # Enter the n of filter  n = get\_input('n of filter (odd)')  filter = np.ones([n,n])/(n\*\*2) |

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| # Convolution  rows, colums=img.shape  tmp = np.zeros(img.shape)  k=int((n-1)/2)  for row in range(rows):      for colum in range(colums):          if ((row-k > 0)&(colum-k > 0)&(row+k < rows)&(colum+k < colums)):              tmp[row, colum] = np.sum(np.multiply(img[row-k:row+k+1,colum-k:colum+k+1],filter))  # Unsharp Masking 0.8\*(a-b)+a  result = 0.8\*(img-tmp)+img  result = result\*255/np.max(result) |
| # Create folder  if not os.path.exists('images'):      os.makedirs('images')  # Show all images  imgs = [img\*255, tmp\*255, result]  titles = ['Input', 'Mean-filter', 'Unsharp']  fig = plt.figure()  fig.set\_figwidth(15)  for i in range(3):      # Save each image      #cv.imwrite('images/'+titles[i]+'.jpg', imgs[i])      # Plot image      plt.subplot(1,3,i+1)      plt.imshow(imgs[i], 'gray')      plt.title(titles[i])      plt.axis('off')      plt.colorbar()  print("Save the image of result to /images/ \n")  plt.savefig('images/All-Result-Unsharp.jpg')  plt.show() |