Computer Vision

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Assignment –2

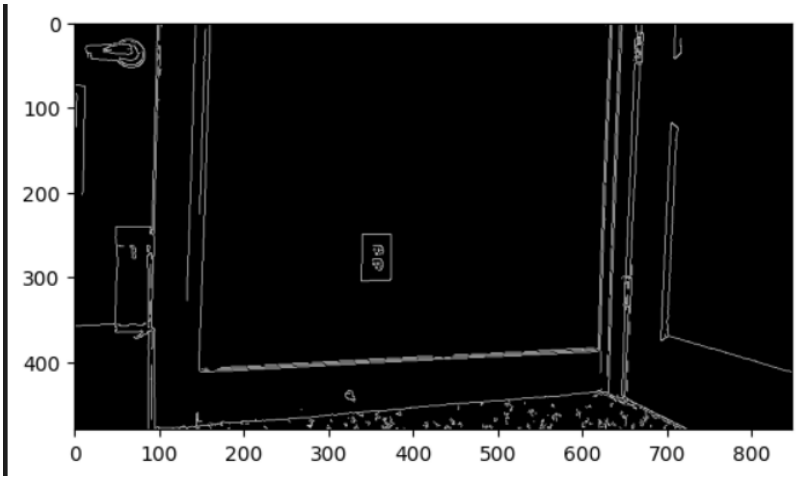
1.Capture a 10 sec video footage using a camera of your choice. The footage should be taken with the camera in hand, and you need to pan the camera slightly from left-right or right-left during the 10 sec duration. For all the images, operate at grayscale.

```
import cv2 as cv
vidcap = cv.VideoCapture(r'C:\Users\padar\Desktop\CV-2\m1.mp4')
check,image = vidcap.read()
count = 0
inc=0
while check:
    check,image = vidcap.read()
    if count%30==0 : #As i have taken a video in 30fps so i am storing one image from each frame.
      inc+=1
      image=cv.flip(image,1)
      cv.imwrite(r'C:\Users\padar\Desktop\CV-2\frame%d.jpg' % inc, image)
    count += 1
```

a)Harris corner and Canny edge detection function.

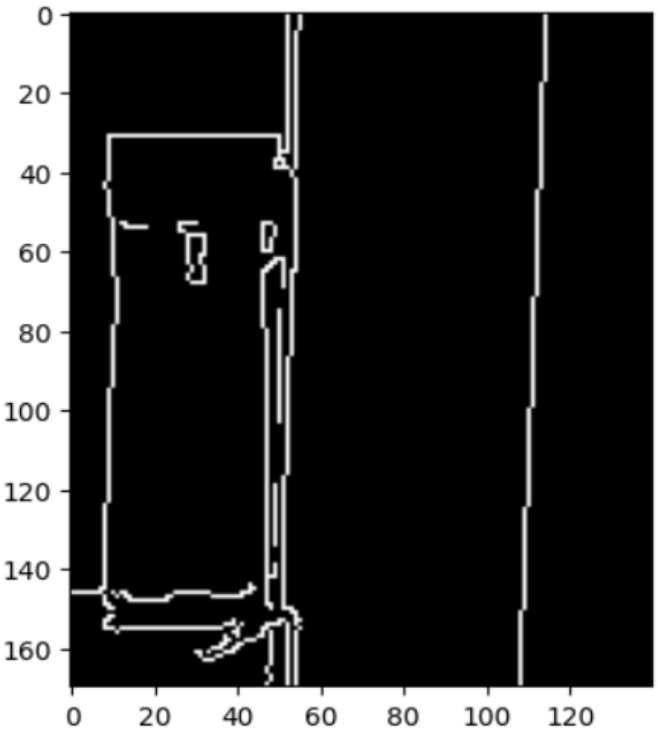
```
import numpy as np
import cv2 as cv
from matplotlib import pyplot as plt
img = cv.imread(r'C:\Users\padar\Desktop\CV-2\frame4.jpg',0)
edges = cv.Canny(img,100,200)
plt.imshow(edges,cmap='gray')
```

Output:



```
import numpy as np
import cv2 as cv
from matplotlib import pyplot as plt
img = cv.imread(r'C:\Users\padar\Desktop\CV-2\frame4.jpg',0)
img1=img[210:380,40:180]
edges = cv.Canny(img1,100,200)
plt.imshow(edges,cmap='gray')
```

Output:



Corner Detection:

```
import numpy as np
import cv2 as cv
import matplotlib.pyplot as plt
filename = r'C:\Users\padar\Desktop\CV-2\frame4.jpg'
img = cv.imread(filename)
gray = cv.cvtColor(img,cv.COLOR_BGR2GRAY)
gray = np.float32(gray)
dst = cv.cornerHarris(gray,2,3,0.07)
#result is dilated for marking the corners, not important
dst = cv.dilate(dst,None)
# Threshold for an optimal value, it may vary depending on the image.
img[dst>0.01*dst.max()]=[0,0,255]
#cv.imshow('dst',img)
cv.imwrite(r'C:\Users\padar\Desktop\CV-2\output.jpg',img)
```

Output: True

b) Find the corresponding points between 2 points

```
import numpy as np
import cv2 as cv
from matplotlib import pyplot as plt
MIN_MATCH_COUNT = 10
img1 = cv.imread(r'C:\Users\padar\Desktop\CV-2\frame4.jpg',0)
img2 = cv.imread(r'C:\Users\padar\Desktop\CV-2\frame5.jpg',0)
sift = cv.SIFT_create()
kp1, des1 = sift.detectAndCompute(img1,None)
kp2, des2 = sift.detectAndCompute(img2,None)
FLANN_INDEX_KDTREE = 1
index_params = dict(algorithm = FLANN_INDEX_KDTREE, trees = 5)
search_params = dict(checks = 50)
flann = cv.FlannBasedMatcher(index_params, search_params)
matches = flann.knnMatch(des1,des2,k=2)
good = []
for m,n in matches:
    if m.distance < 0.7*n.distance:
        good.append(m)
```

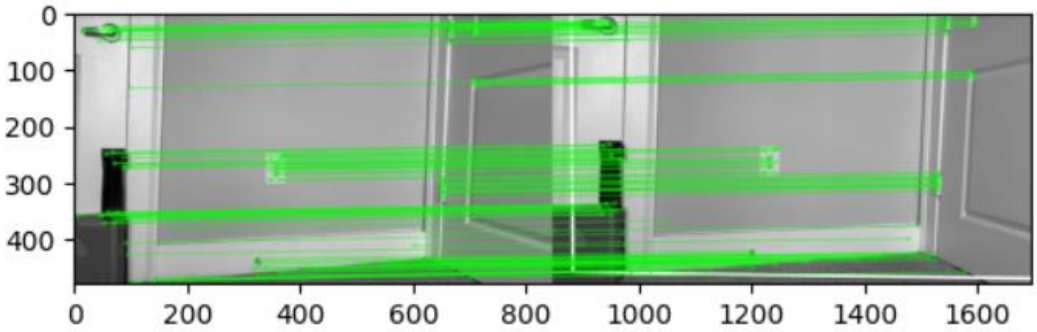
```
if len(good)>MIN_MATCH_COUNT:
    src_pts = np.float32([ kp1[m.queryIdx].pt for m in good ]).reshape(-1,1,2)
    dst_pts = np.float32([ kp2[m.trainIdx].pt for m in good ]).reshape(-1,1,2)
    M, mask = cv.findHomography(src_pts, dst_pts, cv.RANSAC,5.0)
    matchesMask = mask.ravel().tolist()
    h,w = img1.shape
    pts = np.float32([ [0,0],[0,h-1],[w-1,h-1],[w-1,0] ]).reshape(-1,1,2)
    dst = cv.perspectiveTransform(pts,M)
    img2 = cv.polylines(img2,[np.int32(dst)],True,255,3, cv.LINE_AA)
    print("Homography Matrix")
    print(M)
else:
    print( "Not enough matches are found - {}/{}".format(len(good), MIN_MATCH_COUNT) )
    matchesMask = None
```

Output:

Homography Matrix [[9.68573186e-01 7.17637107e-03 3.37017320e+01] [-6.40139643e-03 9.94722498e-01 -1.17304605e+01] [-4.24717812e-05 2.11939714e-05 1.00000000e+00]].

```
draw_params = dict(matchColor = (0,255,0),
                   singlePointColor = None,
                   matchesMask = matchesMask,
                   flags = 2)
img3 = cv.drawMatches(img1,kp1,img2,kp2,good,None,**draw_params)
cv.imwrite(r'C:\Users\padar\Desktop\CV-2\distance.jpg',img3)
plt.imshow(img3, 'gray')
#plt.show()
```

Output:



2. Implement the image stitching application in MATLAB (not necessary to be real-time). Test your application for any FIVE of a set of 3 image-set available in the gsu_building_database. That is, your stitching application should stitch 3 images. You must test the performance of your application for FIVE such sets.

```
import cv2
import matplotlib.pyplot as plt
import numpy as np
```

```
import cv2
def pan_stich(image_paths,output_loc):

    #image_paths=[r'E:\GSU\CV\Assignment_2\pics\classroom_south2.jpg',r'E:\GSU\CV\Assignment_2\pics\classroom_south3.jpg',r'E:\GSU\CV\Assignment_2\pics\classroom_south4.jpg']
    # initialized a list of images
    imgs = []

    for i in range(len(image_paths)):
        imgs.append(cv2.imread(image_paths[i]))
        imgs[i]=cv2.resize(imgs[i],(0,0),fx=0.4,fy=0.4)

    stitchy=cv2.Stitcher.create()
    (dummy,output)=stitchy.stitch(imgs)

    if dummy != cv2.STITCHER_OK:
        print("stitching ain't successful")
    else:
        print('Your Panorama is ready!!!')

    # final output
    cv2.imwrite(output_loc+'/out.jpg',output)
```

```
loc=r'C:\Users\padar\Desktop\CV-2'
image_paths=[r'C:\Users\padar\Desktop\CV-2\In3.jpeg',r'C:\Users\padar\Desktop\CV-2\In2.jpeg',r'C:\Users\padar\Desktop\CV-2\In1.jpeg']
image_dest=r'C:\Users\padar\Desktop\CV-2'
pan_stich(image_paths,image_dest)
```

Output:

Your Panorama is ready!!!

```
loc=r'C:\Users\padar\Desktop\CV-2'
image_paths=[r'C:\Users\padar\Desktop\CV-2\a1.jpg',r'C:\Users\padar\Desktop\CV-2\a2.jpg',r'C:\Users\padar\Desktop\CV-2\a3.jpg']
image_dest=r'C:\Users\padar\Desktop\CV-2'
pan_stich(image_paths,image_dest)
```

Output:

Your Panorama is ready!!!

```
loc=r'C:\Users\padar\Desktop\CV-2'
image_paths=[r'C:\Users\padar\Desktop\CV-2\cs1.jpg',r'C:\Users\padar\Desktop\CV-2\cs-2.jpg',r'C:\Users\padar\Desktop\CV-2\cs3.jpg']
image_dest=r'C:\Users\padar\Desktop\CV-2'
pan_stich(image_paths,image_dest)
```

Output:

Your Panorama is ready!!!

```
loc=r'C:\Users\padar\Desktop\CV-2'
image_paths=[r'C:\Users\padar\Desktop\CV-2\dahl1.jpg',r'C:\Users\padar\Desktop\CV-2\dahl2.jpg',r'C:\Users\padar\Desktop\CV-2\dahl3.jpg']
image_dest=r'C:\Users\padar\Desktop\CV-2'
pan_stich(image_paths,image_dest)
```

Output:

Your Panorama is ready!!!

```
loc=r'C:\Users\padar\Desktop\CV-2'
image_paths=[r'C:\Users\padar\Desktop\CV-2\b1.jpg',r'C:\Users\padar\Desktop\CV-2\b2.jpg',r'C:\Users\padar\Desktop\CV-2\b3.jpg]']
image_dest=r'C:\Users\padar\Desktop\CV-2'
pan_stich(image_paths,image_dest)
```

Output:

Your Panorama is ready!!!

3.Implement an application that will compute and display the INTEGRAL image feed along with the stereo and RGB feed.

```
import numpy as np
import cv2 as cv
import matplotlib.pyplot as plt
filename = r'C:\Users\padar\Desktop\CV-2\frame7.jpg'
img = cv.imread(filename)
gray = cv.cvtColor(img,cv.COLOR_BGR2GRAY)
gray = np.float32(gray)
dst = cv.cornerHarris(gray,2,3,0.07)
#result is dilated for marking the corners, not important
dst = cv.dilate(dst,None)
# Threshold for an optimal value, it may vary depending on the image.
img[dst>0.01*dst.max()]=[0,0,255]
#cv.imshow('dst',img)
cv.imwrite(r'C:\Users\padar\Desktop\CV-2\detect_corner.jpg',img)
```

Output:

True

detect_corner.jpg

```
import cv2
import depthai as dai
import numpy as np
from copy import deepcopy
```

```python
img = cv2.imread(r'C:\Users\padar\Desktop\CV-2\frame7.jpg')

img_bw = cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
# initialising to 0
intergal_img = [[0 for j in range(len(img_bw[0]))] for i in range(len(img_bw))]

# compying values form img array
for i in range(len(img_bw)):
    for j in range(len(img_bw[0])):
        intergal_img[i][j] = int(img_bw[i][j])

# calculating the integral img
for i in range(1, len(img_bw[0])):
    intergal_img[0][i] += intergal_img[0][i-1]

for j in range(1, len(img_bw)):
    intergal_img[j][0] += intergal_img[j-1][0]

for i in range(1, len(img_bw)):
    for j in range(1, len(img_bw[0])):
        intergal_img[i][j] = intergal_img[i-1][j] + intergal_img[i][j-1] - intergal_img[i-1][j-1] + img_bw[i][j]
```

```python
# saving integral image in file

a = np.array(intergal_img)
mat = np.matrix(a)

with open('integral_matrix.txt','wb') as f:
    for line in mat:
        np.savetxt(f, line, fmt="%d")
```

4. Implement the image stitching, for at least 1 pair of images. Use SIFT features. If using Depth AI API this should function in real-time. You can use built-in libraries/tools provided by the Depth AI API.

5. You can make assumptions as necessary, however, justify them in your answers/description.

```python
import cv2
import numpy as np
import sys

class Image_Stitching():
    def __init__(self,soro) :
        self.ratio=0.85
        self.min_match=10
        if soro=="SIFT":
          print("ok")
          self.soro=cv2.SIFT_create()
        else:
          self.soro=cv2.ORB_create()
        self.smoothing_window_size=800

    def registration(self,img1,img2):
        kp1, des1 = self.soro.detectAndCompute(img1, None)
        kp2, des2 = self.soro.detectAndCompute(img2, None)
        matcher = cv2.BFMatcher()
        raw_matches = matcher.knnMatch(des1, des2, k=2)
        good_points = []
        good_matches=[]
        for m1, m2 in raw_matches:
            if m1.distance < self.ratio * m2.distance:
                good_points.append((m1.trainIdx, m1.queryIdx))
                good_matches.append([m1])
        img3 = cv2.drawMatchesKnn(img1, kp1, img2, kp2, good_matches, None, flags=2)
        cv2.imwrite('matching.jpg', img3)
        if len(good_points) > self.min_match:
            image1_kp = np.float32(
                [kp1[i].pt for (_, i) in good_points])
            image2_kp = np.float32(
                [kp2[i].pt for (i, _) in good_points])
            H, status = cv2.findHomography(image2_kp, image1_kp, cv2.RANSAC,5.0)
```

```python
        return H

    def create_mask(self,img1,img2,version):
        height_img1 = img1.shape[0]
        width_img1 = img1.shape[1]
        width_img2 = img2.shape[1]
        height_panorama = height_img1
        width_panorama = width_img1 +width_img2
        offset = int(self.smoothing_window_size / 2)
        barrier = img1.shape[1] - int(self.smoothing_window_size / 2)
        mask = np.zeros((height_panorama, width_panorama))
        if version== 'left_image':
            mask[:, barrier - offset:barrier + offset ] = np.tile(np.linspace(1, 0, 2 * offset ).T, (height_panorama, 1))
            mask[:, :barrier - offset] = 1
        else:
            mask[:, barrier - offset :barrier + offset ] = np.tile(np.linspace(0, 1, 2 * offset ).T, (height_panorama, 1))
            mask[:, barrier + offset:] = 1
        return cv2.merge([mask, mask, mask])

    def blending(self,img1,img2):
        H = self.registration(img1,img2)
        height_img1 = img1.shape[0]
        width_img1 = img1.shape[1]
        width_img2 = img2.shape[1]
        height_panorama = height_img1
        width_panorama = width_img1 +width_img2

        panorama1 = np.zeros((height_panorama, width_panorama, 3))
        mask1 = self.create_mask(img1,img2,version='left_image')
        panorama1[0:img1.shape[0], 0:img1.shape[1], :] = img1
        panorama1 *= mask1
        mask2 = self.create_mask(img1,img2,version='right_image')
        panorama2 = cv2.warpPerspective(img2, H, (width_panorama, height_panorama))*mask2
```

```
result=panorama1+panorama2

rows, cols = np.where(result[:, :, 0] != 0)
min_row, max_row = min(rows), max(rows) + 1
min_col, max_col = min(cols), max(cols) + 1
final_result = result[min_row:max_row, min_col:max_col, :]
return final_result
```

```
img1 = cv2.imread(r'C:\Users\padar\Desktop\CV-2\a1.jpg')
img2 = cv2.imread(r'C:\Users\padar\Desktop\CV-2\a2.jpg')
final=Image_Stitching("SIFT").blending(img1,img2)
cv2.imwrite(r'C:\Users\padar\Desktop\CV-2\ans.jpg', final)
```

Output:

ok

True

ans.jp