PS4-REPORT

Taking 1 late day

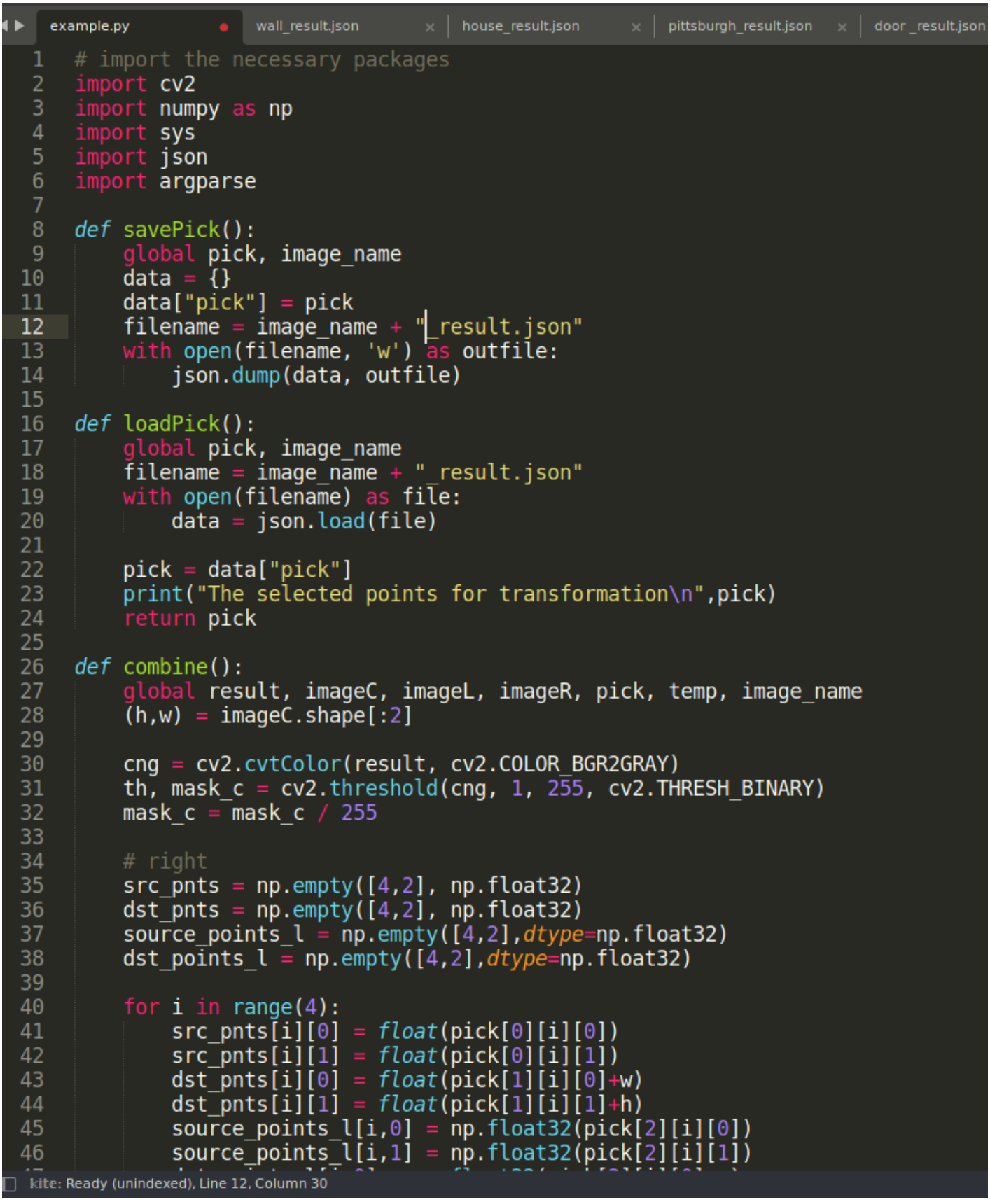
INDEX

Submitted by:
Akshay Antony
PS-4
CMU

ALGORITHM:

1. Reading the 3 images: image-center, image-left, image-right
2. Creating an image called **result**, with size 3*w and 3*h to hold the stitched image
3. Select if you want to use the selected points from the .json file or select new images
    a. If using the saved points load the points from the .json file
    b. If selecting new points on the images call the function: ***mousePick()***
    c. After the 16 points have been selected (4 right, 4 center-right, 4-left, 4 center-left), the member function ***combine()*** is called.
4. The weights are saved to the .json file
5. The ***combine()*** function finds the transformation matrix M_r and M_l.Then uses those transformation matrices to transform the left image and right image.
6. Calculate the three masks**(**$m_{r,}$ $m_{l'}$ m**)** using the three images
7. Calculate the coefficients of the alpha blending matrix
8. Multiplying the **result** matrix with the alpha blending matrix
9. Displaying and saving the image

CODE Screenshots:



example.py | wall_result.json | house_result.json | pittsburgh_result.json | door _result.json

```
            dst_pnts[i][0] = float(pick[1][i][0]+w)
            dst_pnts[i][1] = float(pick[1][i][1]+h)
            source_points_l[i,0] = np.float32(pick[2][i][0])
            source_points_l[i,1] = np.float32(pick[2][i][1])
            dst_points_l[i,0] = np.float32(pick[3][i][0]+w)
            dst_points_l[i,1] = np.float32(pick[3][i][1]+h)

        M = cv2.getPerspectiveTransform(src_pnts, dst_pnts)
        rn = cv2.warpPerspective(imageR, M, (w*3,h*3))
        rng = cv2.cvtColor(rn, cv2.COLOR_BGR2GRAY)
        th, mask_r = cv2.threshold(rng, 1, 255, cv2.THRESH_BINARY)
        #cv2.imwrite("mask_r.png", mask_r)
        mask_r = mask_r / 255

        # left image appears upper left corner, but it still works in blending.
        M = cv2.getPerspectiveTransform(source_points_l,dst_points_l)
        ln = cv2.warpPerspective(imageL, M, (w*3,h*3))
        lng = cv2.cvtColor(ln, cv2.COLOR_BGR2GRAY)
        th, mask_l = cv2.threshold(lng, 1, 255, cv2.THRESH_BINARY)
        mask_l = mask_l / 255
        #cv2.imwrite("mask_l.png", mask_l)
        # alpha blending
        # mask element: number of pictures at that coordinate
        mask = np.array(mask_c + mask_l + mask_r, float)

        # alpha blending weight
        ag = np.full(mask.shape, 0.0, dtype=float)
        # weight: 1.0 / (num of picture)
        ag = 1.0 / np.maximum(1,mask) # avoid 0 division

        # generate result image from 3 images + alpha weight
        result[:,:,0] = result[:,:,0]*ag[:,:] + ln[:,:,0]*ag[:,:] + rn[:,:,0]*ag[:,:]
        result[:,:,1] = result[:,:,1]*ag[:,:] + ln[:,:,1]*ag[:,:] + rn[:,:,1]*ag[:,:]
        result[:,:,2] = result[:,:,2]*ag[:,:] + ln[:,:,2]*ag[:,:] + rn[:,:,2]*ag[:,:]
        filename = image_name + "-stitched.jpg"
        if cv2.imwrite(filename, result):
            print("image written successfully")
        cv2.imshow("result", result)

'''
pick 4 points from right image (red point)
'''
def right_click(event, x, y, flags, param):
    if event == cv2.EVENT_LBUTTONUP:
        mousePick(x, y, 0)

```

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example.py | wall_result.json | house_result.json | pittsburgh_result.json | door _result.json

```
85  def right_click(event, x, y, flags, param):
86      if event == cv2.EVENT_LBUTTONUP:
87          mousePick(x, y, 0)
88
89  '''
90  pick 4 points from center (correspond to right, red point)
91  '''
92  def center_click_r(event, x, y, flags, param):
93      if event == cv2.EVENT_LBUTTONUP:
94          mousePick(x, y, 1)
95
96  '''
97  pick 4 points from left (blue point)
98  '''
99  def left_click(event, x, y, flags, param):
100     if event == cv2.EVENT_LBUTTONUP:
101         # add your code to select 4 points
102         mousePick(x, y, 2)
103
104 '''
105 pick 4 points from center (correspond to left, blue point)
106 '''
107 def center_click_l(event, x, y, flags, param):
108     if event == cv2.EVENT_LBUTTONUP:
109         # add your code to select 4 points
110         mousePick(x, y, 3)
111
112 '''
113 idea: handle mouse pick
114 idx
115 0: right
116 1: center (correspond to right)
117 2: left
118 3: center (correspond to left)
119
120 you can also create your own function for left + center selection
121 '''
122 def mousePick(x, y, idx):
123     global rn, cn, ln, imageR, imageC, imageL, pick, image_name
124     if idx == 0:
125         src = imageR
126         dst = rn
127         wn = "right"
128     elif idx == 1:
129         src = imageC
130         dst = cn
```

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example.py | wall_result.json | house_result.json | pittsburgh_result.json | door _result.json

```
130             dst = cn
131             wn = "center"
132         elif idx == 2:
133             src = imageL
134             dst = ln
135             wn = "left"
136         elif idx == 3:
137             src = imageC
138             dst = cn
139             wn = "center"
140         # you need to add idx 2, 3 cases
141
142         #print(idx, x, y)
143         pick[idx].append((x,y))
144         dst = src.copy()
145         # red BGR color in OpenCV, you need to set to blue on left side
146         if idx == 3:
147             col = (255,0,0)
148         else:
149             col = (0, 0, 255)
150         # place circle on the picked point and text its serial (0-3)
151         for i in range(len(pick[idx])):
152             dst = cv2.circle(dst, pick[idx][i], 5, col, 2)
153             dst = cv2.putText(dst, str(i), (pick[idx][i][0]+10, pick[idx][i][1]-10),
154                               cv2.FONT_HERSHEY_SIMPLEX,1, col, 1)
155         # please make sure when idx == 3, you need to show red color circle in dst
156         # this example erases red circle
157
158         cv2.imshow(wn, dst)
159         # to make sure image is updated
160         cv2.waitKey(1)
161         if len(pick[idx]) >= 4:
162             print('Is it OK? (y/n)')
163             i = input()
164             if i == 'y' or i == 'Y':
165                 if idx >= 3:
166                     savePick()
167                     combine()
168                 elif idx == 0:
169                     print('center 4 points')
170                     cv2.setMouseCallback("center", center_click_r)
171                 elif idx == 1:
172                     # only taking care of right and center, you need to replace 2 lines to start
173                     # picking left and center correspondence
174                     print("\nplease select 4 points on the left image")
175                     cv2.setMouseCallback("left",left_click)
```

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example.py | wall_result.json | house_result.json | pittsburgh_result.json | door _result.json

```
                # only taking care of right and center, you need to replace 2 lines to start
                # picking left and center correspondence
                print("\nplease select 4 points on the left image")
                cv2.setMouseCallback("left",left_click)
                # you need to add pick code
                #print('left 4 points')
                #cv2.setMouseCallback("left", left_click)
            elif idx == 2:
                print("\nplease select 4 points on the  center image")
                cv2.setMouseCallback("center",center_click_l)
        else:
            pick[idx] = []
            dst = src.copy()
            cv2.imshow(wn, dst)


parser = argparse.ArgumentParser(description='Combine 3 images')
parser.add_argument('-d', '--data', type=int, help='Dataset index', default=1)
args = parser.parse_args()
dataset = args.data
temp = dataset
if dataset == 0:
    imageL = cv2.imread("ps4-images/wall-left.png")
    imageC = cv2.imread("ps4-images/wall-center.png")
    imageR = cv2.imread("ps4-images/wall-right.png")
    image_name = "wall"

elif dataset == 1:
    imageL = cv2.imread("ps4-images/door-left.jpg")
    imageC = cv2.imread("ps4-images/door-center.jpg")
    imageR = cv2.imread("ps4-images/door-right.jpg")
    image_name = "door"

elif dataset == 2:
    imageL = cv2.imread("ps4-images/house-left.jpg")
    imageC = cv2.imread("ps4-images/house-center.jpg")
    imageR = cv2.imread("ps4-images/house-right.jpg")
    image_name = "house"

else:
    imageL = cv2.imread("ps4-images/pittsburgh-left.jpg")
    imageC = cv2.imread("ps4-images/pittsburgh-center.jpg")
    imageR = cv2.imread("ps4-images/pittsburgh-right.jpg")
    image_name = "pittsburgh"

result = cv2.copyMakeBorder(imageC,imageC.shape[0],imageC.shape[0],imageC.shape[1],imageC.shape[1],
```

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example.py | wall_result.json | house_result.json | pittsburgh_result.json | door _result.json

```
217 result = cv2.copyMakeBorder(imageC,imageC.shape[0],imageC.shape[0],imageC.shape[1],imageC.shape[1],
218                             borderType=cv2.BORDER_CONSTANT,value=[0,0,0])
219
220 #print(imageL.shape,imageC.shape,imageR.shape, result.shape)
221
222 cv2.namedWindow("left",cv2.WINDOW_NORMAL)
223 cv2.namedWindow("center",cv2.WINDOW_NORMAL)
224 cv2.namedWindow("right",cv2.WINDOW_NORMAL)
225 cv2.namedWindow("result",cv2.WINDOW_NORMAL)
226
227 ln = imageL.copy()
228 cn = imageC.copy()
229 rn = imageR.copy()
230
231 cv2.imshow("left", ln)
232 cv2.imshow("center", cn)
233 cv2.imshow("right", rn)
234 cv2.imshow("result", result)
235
236 pick = []
237 pick.append([])
238 pick.append([])
239 pick.append([])
240 pick.append([])
241
242 print('use saved points? (y/n)')
243 i = input()
244 if i == 'y' or i == 'Y':
245     loadPick()
246     combine()
247 else:
248     print("right 4 points")
249     cv2.setMouseCallback("right", right_click)
250
251 cv2.waitKey(0)
252
253 # close all open windows
254 cv2.destroyAllWindows()
255
256
257
258
259
```

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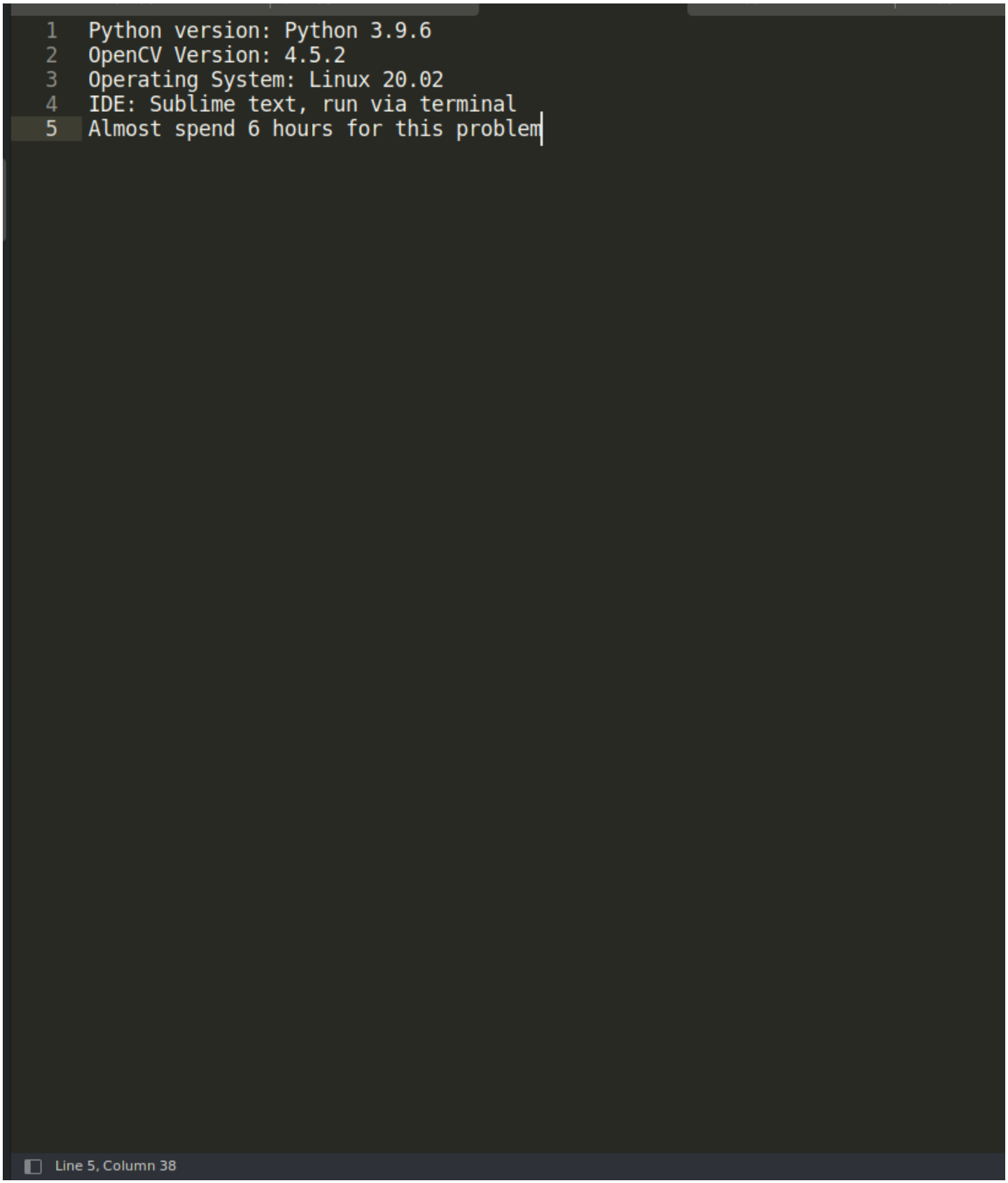
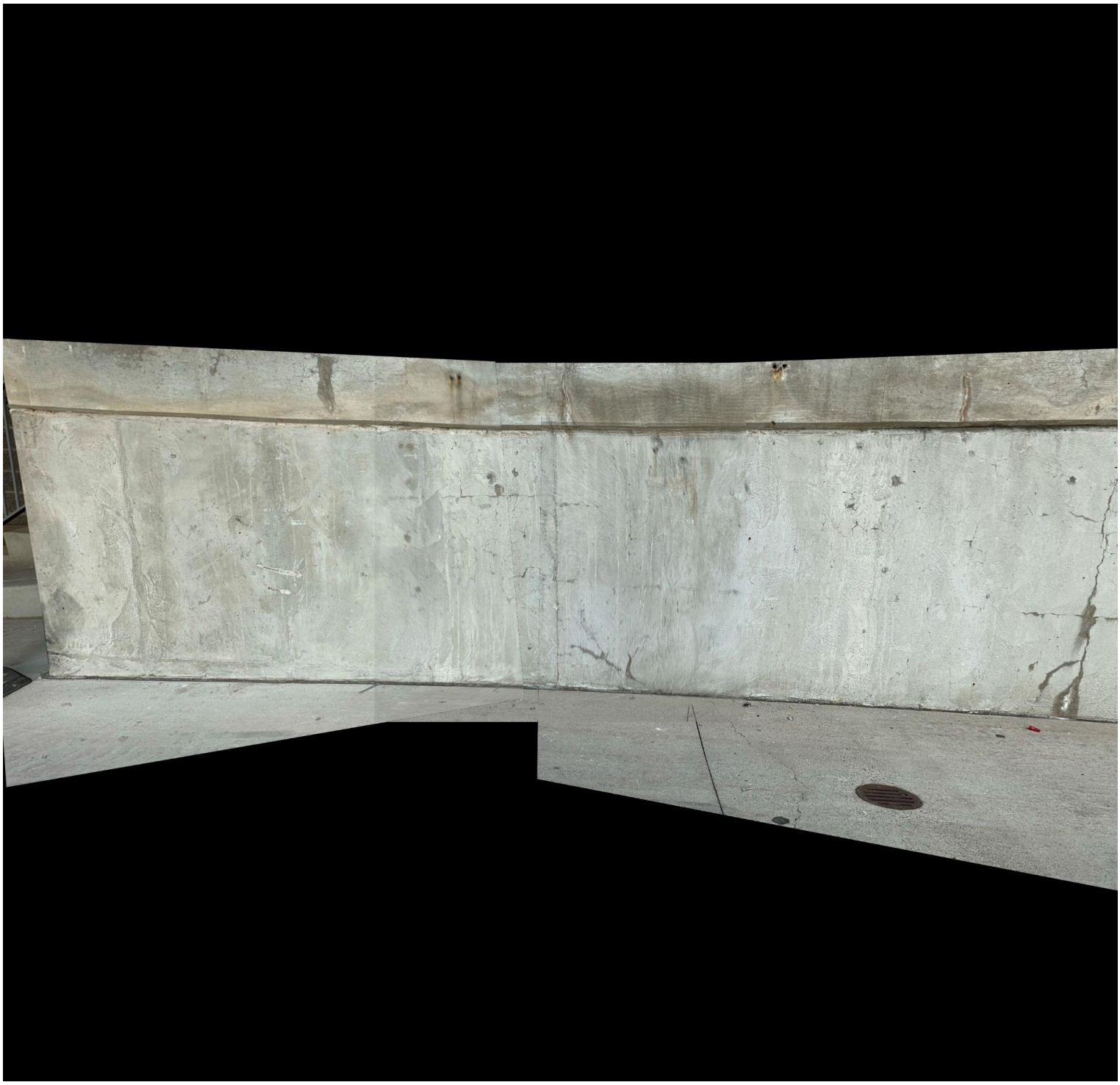
README.TXT


1 Python version: Python 3.9.6
2 OpenCV Version: 4.5.2
3 Operating System: Linux 20.02
4 IDE: Sublime text, run via terminal
5 Almost spend 6 hours for this problem
Line 5, Column 38

OUTPUTS

1. **pittsburgh-stitched.png**

2. **wall-stitched.png**

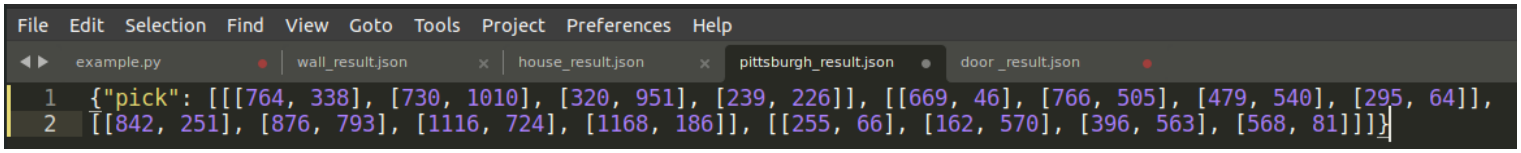


3. **house-stitched.jpg**

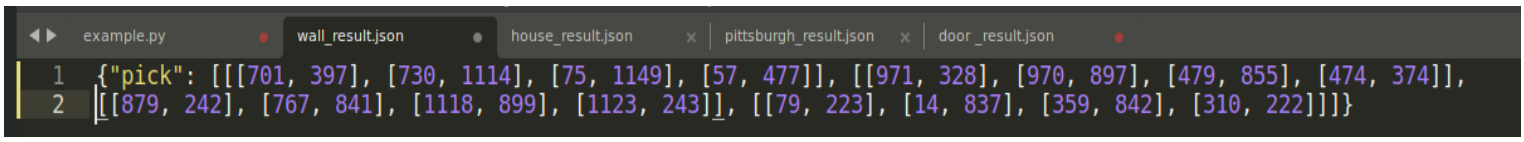
4. **door-stitched.jpg**

POINTS CHOSEN: .json FILE

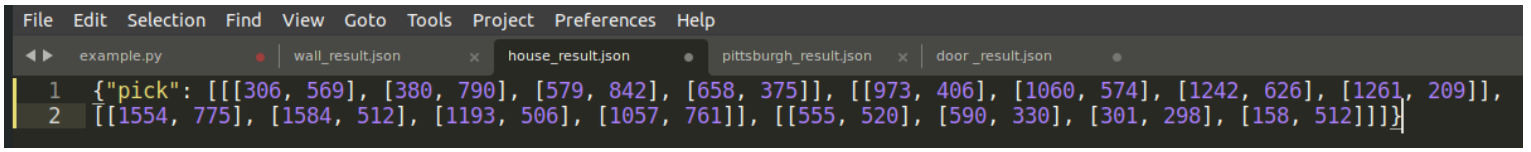
1. pittsburgh.jpg



2. wall.jpg



3. house.jpg



4. door.jpg