IN4640 Assignment 2 on Fitting and Alignment

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1. Table 1 shows the first five lines of the dataset in the file `lines.csv`. It represents three points scatters conforming to three lines. The coordinates of the points are stored in columns x_1, x_2, x_3, y_1, y_2, and y_3.

   (a) Use total least squares to fit the lines to only using the data corresponding to the first line. Report the resulting parameters.

   (b) Now, use all the points as indicate in the code snippet below and fit three lines. Hint: Run RANSAC to find a line, mask the consensus and run again and so on to find the three lines

```
D = np.genfromtxt("lines.csv", delimiter=",", skip_header=1)
X_cols = D[:, :3]
Y_cols = D[:, 3:]
X_all = X_cols.flatten()
Y_all = Y_cols.flatten()
```

Table 1: First five rows of the dataset

x_1	x_2	x_3	y_1	y_2	y_3
-5.3055	-4.0601	-5.2613	-12.6663	-3.7962	3.6917
-5.5404	-5.0032	-3.9926	-11.0077	-3.9856	4.9000
-4.9821	-4.5845	-4.3312	-11.6973	-3.5893	5.0469
-4.4957	-5.0641	-4.7820	-11.9780	-3.5971	4.6359
-4.4422	-4.4114	-4.5675	-12.4150	-2.7995	4.7397

2. Fig. 1 shows an image ofa pair of earrings. Assume that a camera is mounted with the optical axis perpendicular to the imaging plane (where the flat earrings are kept). If the focal length of the camera is 8 mm, the pixel size is 2.2 μm × 2.2 μm, and the distance from the lens to the imaging plane is 720 mm, what are the sizes of the earrings?

3. Fig. 2 shows an image of a cricket turf. Listing 1 shows a code snippet that can be used to click and obtain the four corners. Superimpose the a country flag on the turf.

Listing 1: Code for clicking a quadrangle.

```
import cv2
import numpy as np

points = []

def mouse_callback(event, x, y, flags, param):
    global points, img_display

    if event == cv2.EVENT_LBUTTONDOWN:
```

Figure 1: Earrings.

Figure 2: Cricket turf.

```
        if len(points) < 4:
            points.append((x, y))
            print(f"Point {len(points)}: ({x}, {y})")

            cv2.circle(img_display, (x, y), 5, (0, 0, 255), -1)
            cv2.imshow("Image", img_display)

        if len(points) == 4:
            print("\nFour points selected:")
            for i, p in enumerate(points):
                print(f"P{i+1}: {p}")
            print("Press any key to exit.")


img = cv2.imread("turf.jpg")
if img is None:
    raise FileNotFoundError("Image not found.")

img_display = img.copy()

cv2.namedWindow("Image")
cv2.setMouseCallback("Image", mouse_callback)

cv2.imshow("Image", img_display)
cv2.waitKey(0)
cv2.destroyAllWindows()

points = np.array(points, dtype=np.float32)

print("\nFinal array of selected points:")
print(points)
```

GitHub Profile

You must include the link to your GitHub (or some other SVN) profile, so that I can see that you have worked on this assignment over a reasonable duration. Therefore, make commits regularly. However, I will use only the pdf for grading to save time.

Submission

Upload a report (eight pages or less) named as your_index_a02.pdf. Include the index number and the name *within the pdf* as well. The report must include important parts of code, image results, and comparison of results. The interpretation of results and the discussion are important in the report. Extra-page penalty is 20 marks per page.