ET3112 Assignment 02 on Fitting

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1. Your task is to use image processing techniques to estimate the slope of a crop field, represented by angle θ. The image of the crop field is provided in Fig. 1a, with the crop slope marked in Fig. 1b. To simplify the processing, a cropped section of the image (Fig. 1c) is utilized to estimate the crop slope θ.

   To begin, apply the Canny edge detector algorithm to the image provided in Fig. 1c. This can be done using the "cv.Canny(img, minVal, maxVal)" function available in the OpenCV toolbox. For this particular task, set the values of minVal and maxVal to 550 and 690, respectively. More information about the OpenCV canny edge detector function can be found in opencv canny documentation. Using the "imshow" function from the matplotlib library, plot both the original image and the edge image that displays the extracted edges. You may get an image similar to the Fig. 2b.

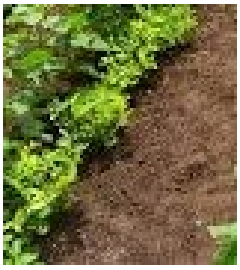
   We will now use the coordinates of the extracted edges to estimate the slope of the crop field.

   - Assign the extracted features positions to x and y coordinates, which can be done using the following code.

```
edges = cv.Canny( img, 550 ,690)
indices = np.where( edges != [ 0 ] )
x=indices [1]
y=indices [0]
```

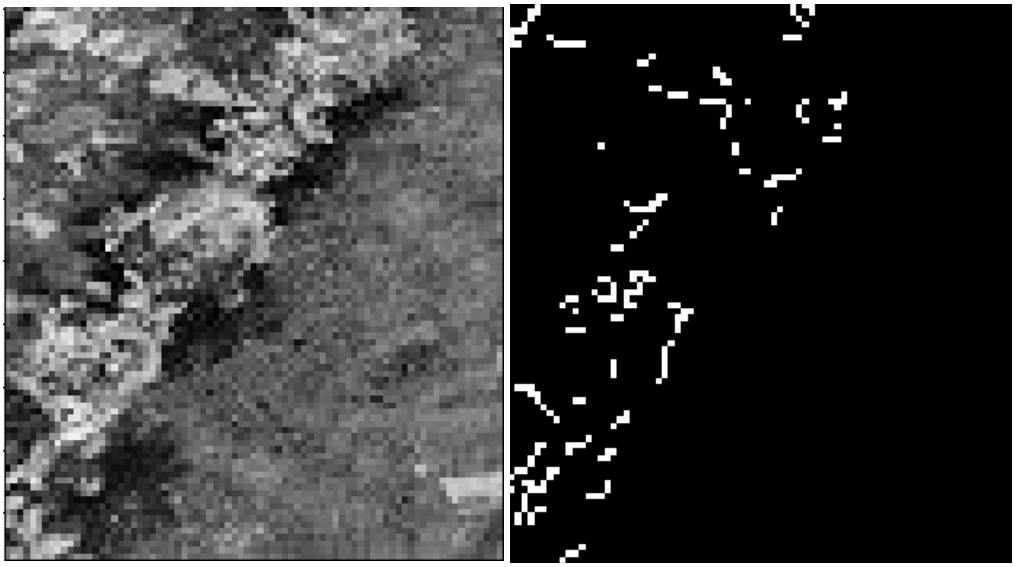
(a) Image of the crop field.

(b) Image of the crop field with slop shown as θ.



(c) Cropped segment of the image.

Figure 1: Image of the crop field.



(a) Original image. (b) Output of Canny edge detector.

Figure 2: Images of the crop field before and after feature extraction.

2. Plot the x and y in a scatter plot.
3. Use all the points $(x,\ y)$ to find the least-squares-fit line and show the line graphically in the a scatter plot with x and y points.
4. What is the estimated value of the crop field angle based on the least-squares-fit ?
5. Do you think the estimation is correct? if not explain reason for this error.
6. Use all the points $(x,\ y)$ to find the total least-squares-fit line and show the line graphically in the a scatter plot with x and y points.
7. What is the estimated value of the crop field angle based on the total least-squares-fit?
8. Do you think the estimation is correct? if not explain reason for this error.
9. Propose a better algorithm than the least-squares-fit and total least-squares-fit for this scenario.
10. Estimate the line using your proposed algorithm and show the line graphically in the a scatter plot with x and y points.
11. What is the estimated value of the crop field angle based on the your proposed algorithm?
12. Explain, why your proposed approach is performing better than the least-squares-fit and total least-squares-fit

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 2 marks per page.
- An extra penalty of 10% is applied for late submission.
- Pay careful attention to formatting such as font size, spacing, and margins.
- Include a title page with necessary information (e.g., title, author, date, index no).
- Use consistent and professional formatting throughout the document.
- Plagiarism will be checked and in cases of plagiarism, an extra penalty of 50% will be applied. In case of copying from each other, both parties involved will receive a grade of zero for the assignment. Academic integrity is of utmost importance, and any form of plagiarism1 or cheating will not be tolerated.