

1 Notes

This homework has **80 points** in total.

Please submit your homework to blackboard with a zip file named as **DIP2023_ID_Name_hw3.zip**. The zip file should contain three things: **a folder named 'codes' storing your codes, a folder named 'images' storing the original images**, and **your report named as report_ID_Name_hw3.pdf**. The names of your codes should look like **'p1a.m'** (for (a) part of Problem 1), so that we can easily match your answer to the question. **Make sure all paths in your codes are relative path and we can get the result directly after running the code**. Please answer in English.

Please complete all the coding assignments using **MATLAB**. All core codes are required to be implemented **by yourself** (without using relevant built-in functions). Make sure your results in the report are the same with the results of your codes. Please explain with notes at least at the key steps of your code.

2 Policy on plagiarism

This is an individual homework. You can discuss the ideas and algorithms, but you can neither read, modify, and submit the codes of other students, nor allow other students to read, modify, and submit your codes. Do not directly copy ready-made or automatically generated codes, or your score will be seriously affected. We will check plagiarism using automated tools and any violations will result in a zero score for this assignment.

Problem 1 (30 pts)

- (a) Please implement the Basic global thresholding on "flower.tif". (start with $T = 0.001$) (10pts)
- (b) Please implement the Otsus method on "caster_stand.tif". (10 pts)
- (c) Please implement the edge tracking using Canny Edge Detector on "fingerprint.tif". (10 pts)

Solution:

Problem 2 (20 pts)

Figure 1 shows an image of some texts titled with an unknown angle. For better readability, the titling angle must be found and used to correct the orientation of the image. Hough transform is a good choice for this application. 'tilted.png' is one of the texts, your tasks are:

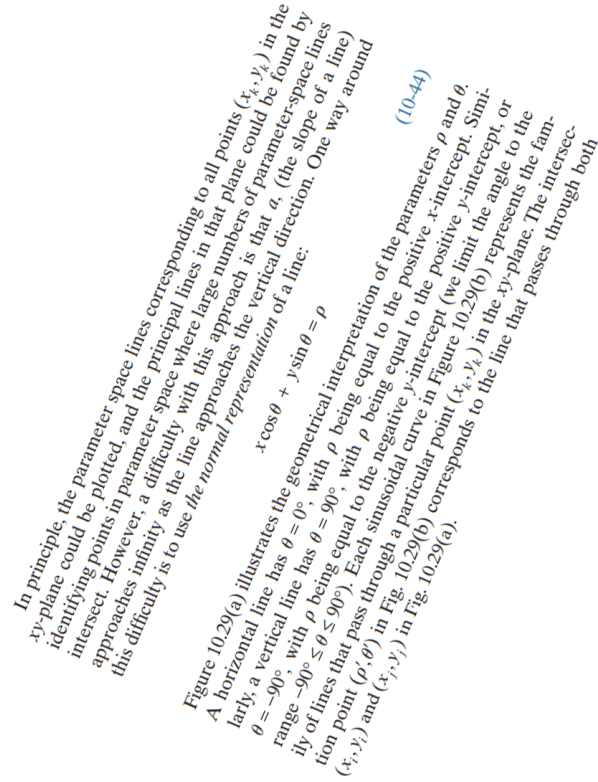


Figure 1: tilted text

- Implement Hough transform and perform it on 'tilted.png', show its $\rho\theta$ -plane image. The input of Hough transform is a binary image, so you should do some thresholding before performing Hough transform. (15 pts)
- Using result obtained by Hough transform, correct the tilt angle, show the corrected image. (5 pts)

Solution:

Problem 3 (30 pts)

Super pixel is a method that turns a pixel-level picture into district-level picture, which is an abstraction of basic information elements. A super pixel is a small area composed of a series of adjacent pixels with similar characteristics such as color, brightness, and texture. Most of these small areas retain effective information for further image segmentation, and generally do not destroy the boundary information of objects in the image.

In this problem, you need to turn 'sea house.jpg' to super pixel style using SLIC algorithm with 100, 500 and 1000 cluster centers (In practice, number of cluster center can be slightly different from these values) and show the result images.

Reference, doi:10.1109/TPAMI.2012.120

Algorithm 1 SLIC superpixel segmentation

/ Initialization */*

Initialize cluster centers $C_k = [l_k, a_k, b_k, x_k, y_k]^T$ by sampling pixels at regular grid steps S .

Move cluster centers to the lowest gradient position in a 3×3 neighborhood.

Set label $l(i) = -1$ for each pixel i .

Set distance $d(i) = \infty$ for each pixel i .

repeat

/ Assignment */*

for each cluster center C_k **do**

for each pixel i in a $2S \times 2S$ region around C_k **do**

 Compute the distance D between C_k and i .

if $D < d(i)$ **then**

 set $d(i) = D$

 set $l(i) = k$

end if

end for

end for

/ Update */*

 Compute new cluster centers.

 Compute residual error E .

until $E \leq \text{threshold}$

Figure 2: SLIC Algorithm



Figure 3: sea house.jpg

Solution: