2110431 Introduction to Digital Imaging
2147329 Digital Image Processing and Vision Systems
Homework #3

Deadline: November 21, 2023 @23:59

Submissions: (1) PDF version of this file ONLY problem 1 and 3 will be graded.

Submissions: (1) PDF version of this file
(2) .ipynb file; template in this link

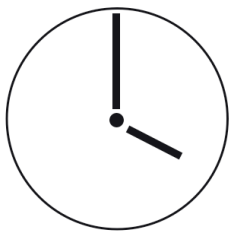
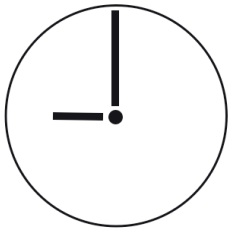
All images are in the hw3 folder.

IMPORTANT! (1) Before submitting the python file, please make sure it can be successfully compiled and correctly in its format name

(2) The scores will be 0 for all students whose source codes are very similar to each other.

1. (10 points) Reading a (very) simple clock

Use image processing to read a simple clock provided below and write a program using python library to provide output in the format displayed “HH:MM”, such as “04:00” for the most left clock, “10:00” for the second clock, and so on. (HH in the range [01,12], MM in [00,59])

			
04:00	10:00	09:00	09:10

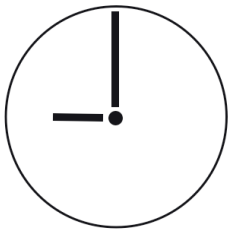
Note: your algorithm does not have to be 100% accurate; you should explain your results.

1.1) Describe steps of your algorithm

Steps	Description and purposes

1	Create masks that filter minute hand and hour hand.
2	Filter only minute hand that calculate the minute by using angle.
3	Calculate hour hand but this filter will give us both hour and minute hand. So, I will skill the angle that same as minute hand.
4	For negative angle, we need to adjust the number by +12 or +60

1.2) Write down the results from your program:

			
04:00	04:00	09:00	09:08

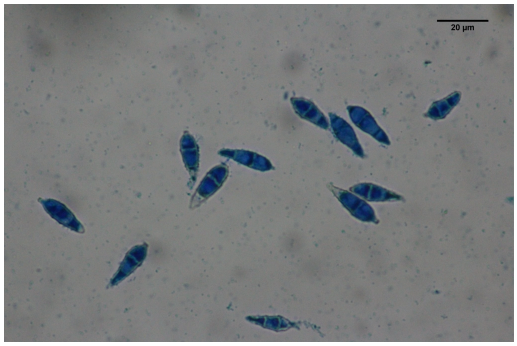
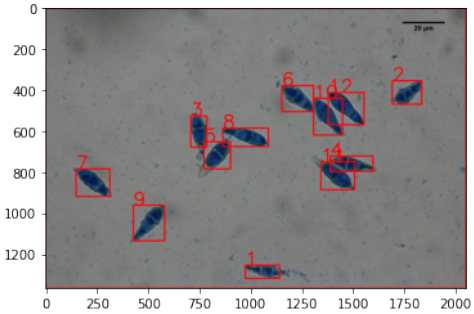
1.3) Analyze the results.

Hint: in terms of how accurate is your technique, any further improvement can be done?

In the second image (10:00), I think my algorithm know correct the angle but it's need more information to compute. e.g. in 90 degree, it can be 2 possible time -> 15 minute or 45 minute.

So, we can add more factor such average intensity in each quarter to compute the correct time.

2. (Optional – for practice) Pyricularia Oryzae, rice blast fungus can cause rice blast disease. To identify the possibility of the occurrence of rice blast disease, the density of the spores of Pyricularia Oryzae can be calculated. Plant pathologist knows that you studied image processing, so they have asked you to help them automatically count the number of spores using image processing. They have provided two image samples below for you to develop an algorithm to count them. You should provide your results in terms of `num_count` and `resulted_image` (labeled count) (you can use cv2.rectangle(…) and cv2.putText(…) functions) as the example shown below **Note:** your algorithm does not have to be 100% accurate; you should explain your results.

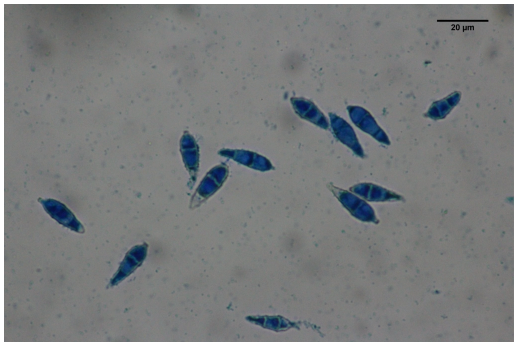
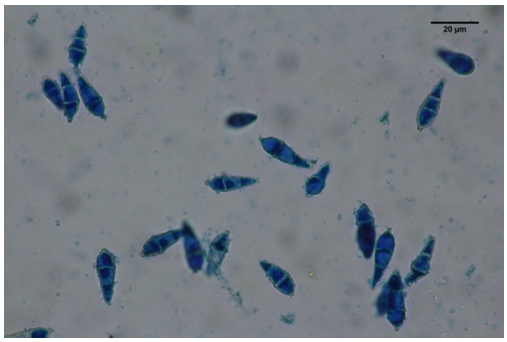
Original image	Your results / number of counted spores
 pyri02.png	**EXAMPLE**  **num_count = 12**

2.1) Describe steps of your algorithm

Steps	Description and purposes
1	
2	

3	

2.2) Results

Original image	Your results / number of counted spores
 pyri02.png	
 pyri02.png	

2.3) Analyze the results.

Hint: in terms of how accurate is your technique, any further improvement can be done?

3. (10 points) Separate and segment the oil in the beaker by distinguishing between solid (darker) and liquid oil. The container has a width and height, as shown in Figure 3.1. The equation for volume is $\pi r^2 h$, where r represents the radius and h is the height of the beaker, respectively.

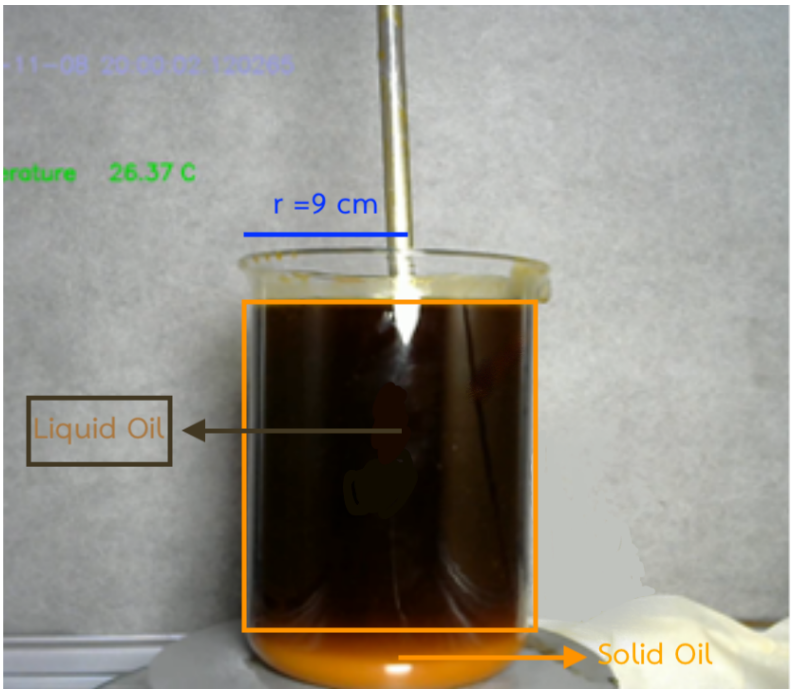
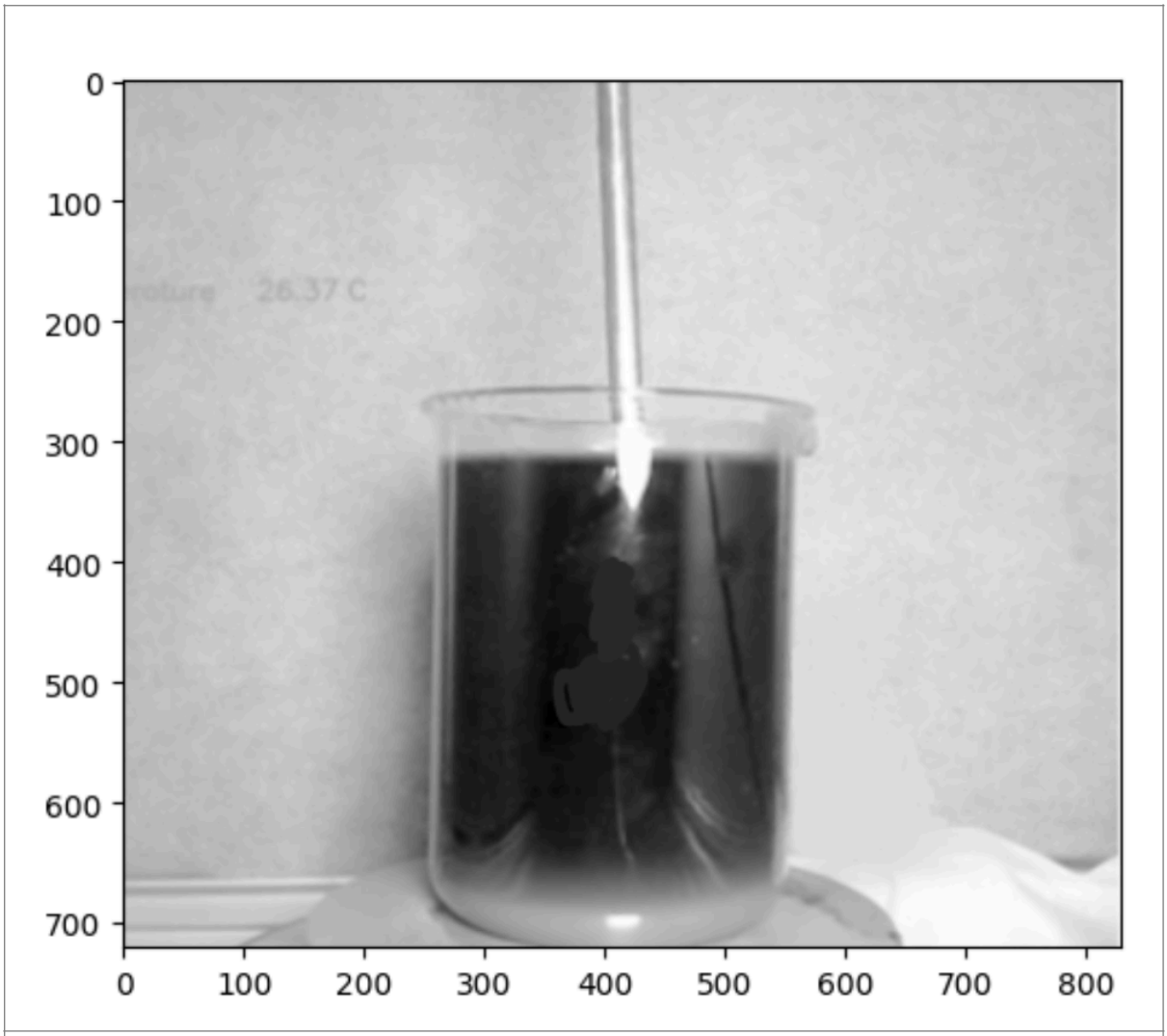


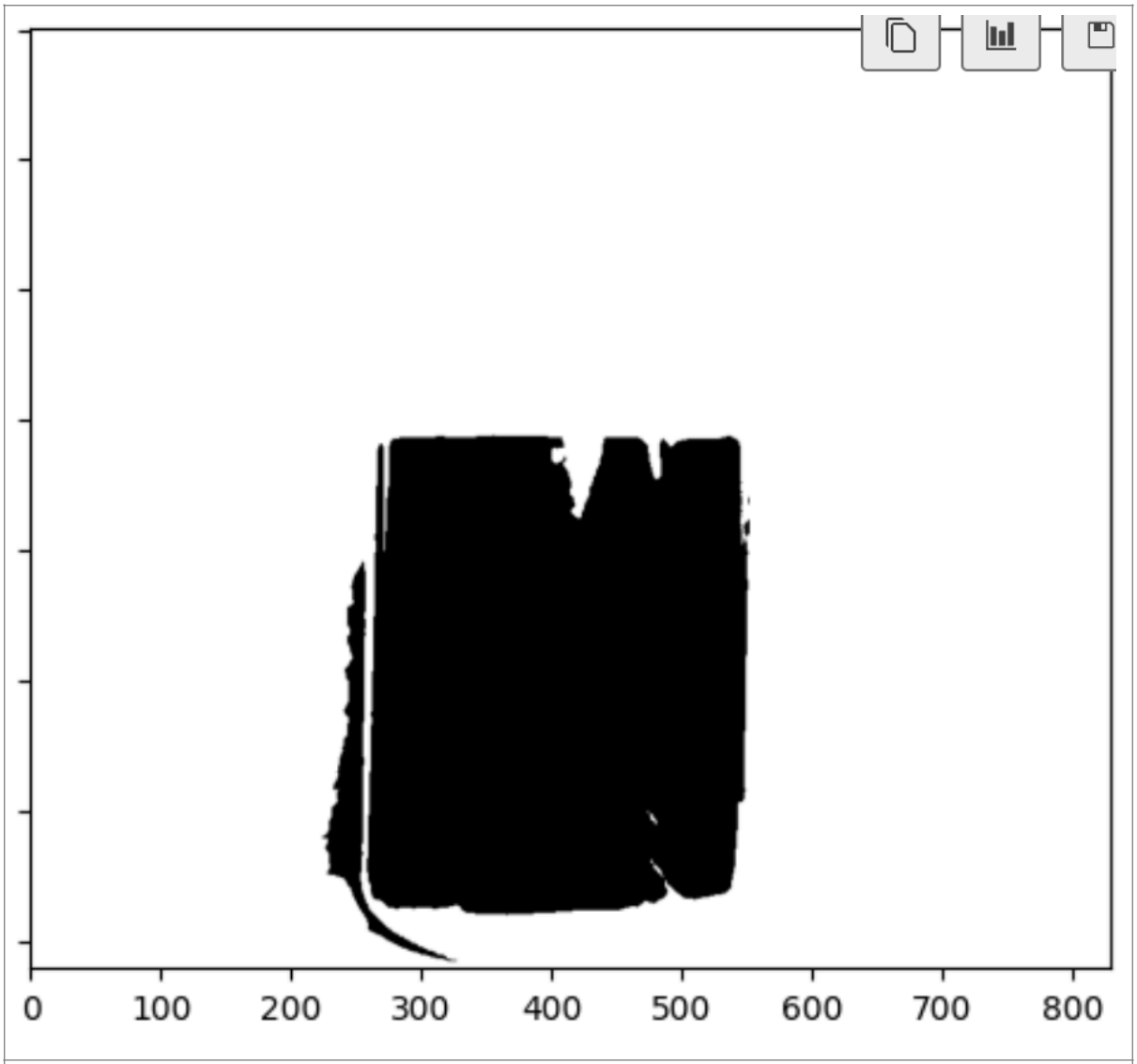
Fig 3.1 Crude oil (Oil.png)

3.1 Find the volume of the oil in the liquid state. Please use image enhancement, such as, Log transform, Power Law before apply segmentation. Then, you can use Otsu's, Adaptive Thresholding, Region Growing, and Manual Threshold to find the volume. Put your image results in the blank areas below.

Optional Enhancement image



Enhanced image



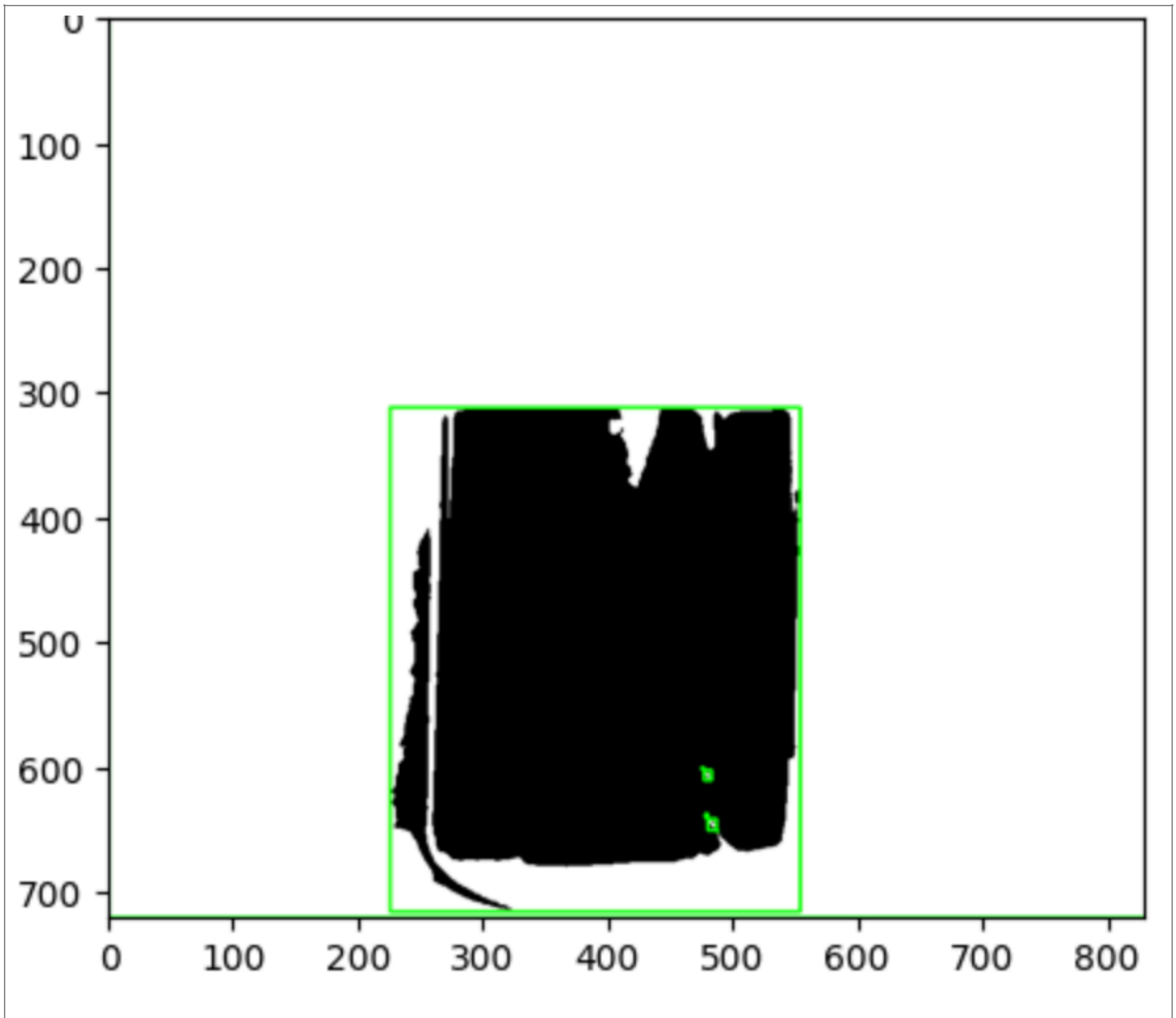
Segmented regions of the liquid oil and show width and height of the segmented image

Explain your steps and techniques used briefly:

1. Use power law image transformation with gamma = 0.5
2. Then use cv2.threshold to compute Otsu's thresholding.
3. Create a normal line which x=370, y=350 to compute the maximum and minimum dark point on each line.
4. After we know the pixel of width and real width is 18 cm, we can compute height.
5. Compute the volume of that cup !!!
6. `5970.933437360285 cm.^3`

3.2 Segment the liquid oil again using Connected-component-with-stats method and compare the segmented result and calculated volume with 3.1.

Hint: Don't forget to use image Enhancement and connectivity either 4 or 8



Segmented region of the liquid oil using Connected Component with stats method.

Explain your steps and techniques used briefly:

1. Use the same image enhancement technique as the previous one.
2. Fro image segmentation, Use connectivity = 4.
3. My image enhancement isn't good enough so the segmentation is not fit the real segment.

Result : `4580.442088933918 cm.^3`

Note: You will get full score if the calculated volume for both 3.1 and 3.2 are within 10% error from our reference volume.