Image and Video Processing Lab (CSC18205) **Session: Winter 2020-21**
VIII Dual Degree (CSE) **Date: 28.01.2021**

Assignment-3 (Image Enhancement in Spatial Domain-II)

1. An application processes large size images. The application enhances some objects that are important for the viewers and leaves other parts as it is in the image. Suppose you are given an image *I* which contains a flower. The entire image is corrupted with *salt and pepper* noise. So, this application does not remove noise from the entire image but it selects the flower region and removes the noise. To implement the functionality of this application, you need to perform following tasks:

   i. Write a function $BW = gray\_to\_binary(I, th)$ that converts the given gray-scale image I to binary image BW by performing following operation for each pixel value $p \in I$

   $$p = 1, \quad if\ p \geq th$$
   $$p = 0, \quad otherwise$$

   where, th is a threshold value taken from the user.

   ii. Find the largest connected component from the binary image *BW*. Place the largest connected region in a bounding box or rectangle.

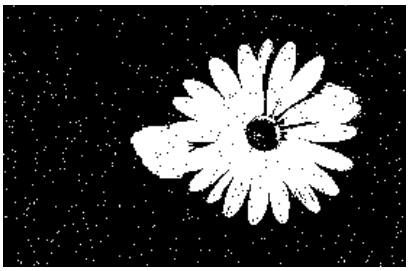
   iii. Write a function $medfilt(I)$ that applies a median filter over an image. Apply the median filter on the pixels in the bounding box of the input image I.

Sample Input:

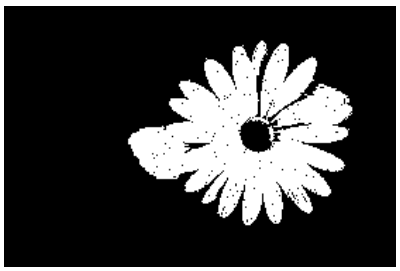
Input image

$\boldsymbol{Enter\ threshold\ (th) = 170}$

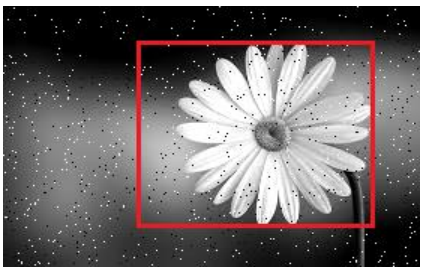
Sample Output:



Binary image



Largest connected component



Bounding box

Output for $\mathbf{3 \times 3}$ filter

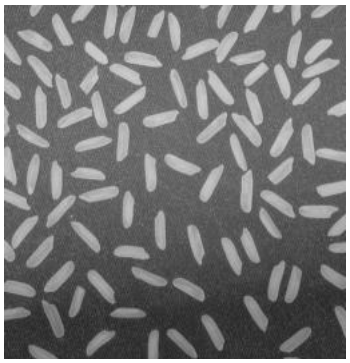
Output for $\mathbf{5 \times 5}$ filter

Output for $\mathbf{7 \times 7}$ filter

2. You have given an image $\boldsymbol{I(x,y)}$, your task is to enhance the image by sharpening. You need to implement an image sharpening method that consists of following three steps:

   i. Apply a mean filter on the input image $\boldsymbol{I(x,y)}$ and obtain image $\boldsymbol{\bar{I}(x,y)}$.
   ii. Find the mask image as: $\boldsymbol{I_{mask}(x,y) = I(x,y) - \bar{I}(x,y)}$.
   iii. Add mask image to the input image and obtain the output image as follows: $\boldsymbol{O(x,y) = I(x,y) + k \times I_{mask}(x,y)}$, where $\boldsymbol{k}$ $(\boldsymbol{k \geq 0})$ is a constant.

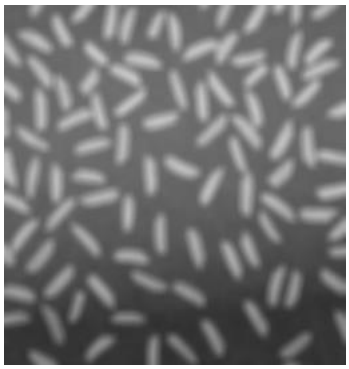
   Sample Input:



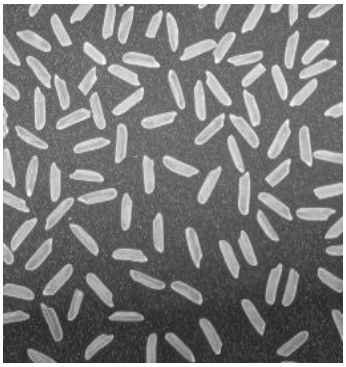
Input image

Sample Output:

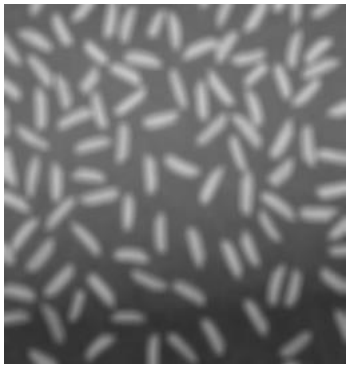
For $\boldsymbol{k = 1}$,


Mean filtered image $\overline{\boldsymbol{I}}(\boldsymbol{x}, \boldsymbol{y})$

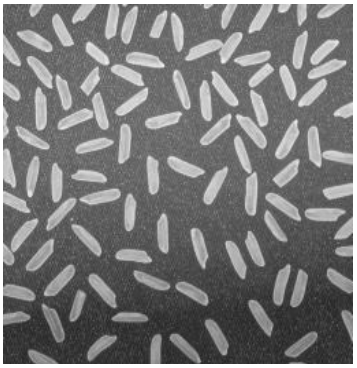

Mask image $\boldsymbol{I_{mask}}(\boldsymbol{x}, \boldsymbol{y})$


Output image

For $\boldsymbol{k = 0.75}$,


Mean filtered image $\overline{\boldsymbol{I}}(\boldsymbol{x}, \boldsymbol{y})$


Mask image $\boldsymbol{I_{mask}}(\boldsymbol{x}, \boldsymbol{y})$


Output image