clc;

close all;

I=imread('D:\Softwares\Matlab 2019\bin\YS7.jpeg');

figure

subplot(3,5,1),imshow(I)

title('Original Image')

gmag = imgradient(I);

%gradient of image is obtained with the help of edge detection, sobel

%operator is used by default

subplot(3,5,2),imshow(gmag,[])

title('Gradient Magnitude')

se = strel('disk',20);

%creates structuring element for morphological operations of opening and

%closing which is in a shape of disk, 20 is the radius in pixels

Io = imopen(I,se);

%pixels are added to blur the image

subplot(3,5,3)

imshow(Io)

title('Opening')

Ie = imerode(I,se);

%the pixels are removed from the image

Iobr = imreconstruct(Ie,I);

%the final aim of this opening,closing opeing closing operation is to

%smoothen the image

subplot(3,5,4)

imshow(Iobr)

title('Opening-by-Reconstruction')

Ioc = imclose(Io,se);

subplot(3,5,5)

imshow(Ioc)

title('Opening-Closing')

Iobrd = imdilate(Iobr,se);

Iobrcbr = imreconstruct(imcomplement(Iobrd),imcomplement(Iobr));

Iobrcbr = imcomplement(Iobrcbr);

%image complement

subplot(3,5,6)

imshow(Iobrcbr)

title('Opening-Closing by Reconstruction')

fgm = imregionalmax(Iobrcbr);

%returns the maxima in an image

subplot(3,5,7)

imshow(fgm)

title('Regional Maxima')

I2 = labeloverlay(I,fgm);

%imposes one image over other using labeloverlay function

subplot(3,5,8)

imshow(I2)

title('Regional Maxima Superimposed')

se2 = strel(ones(3,3));

%strel is a structuring element, here we create a matrix of ones, 3\*3

%matrix

fgm2 = imclose(fgm,se2);

fgm3 = imerode(fgm2,se2);

fgm4 = bwareaopen(fgm3,20);

I3 = labeloverlay(I,fgm4);

%regional image is smoothened

subplot(3,5,9)

imshow(I3)

title('Modified Regional Maxima')

bw = imbinarize(Iobrcbr,'adaptive','ForegroundPolarity','dark','Sensitivity',0.4);

%thresholding of the image to obtain the maxima and minima of the image

subplot(3,5,10)

imshow(bw)

title('Thresholded Opening-Closing')

D = bwdist(bw);

%distance transform is taken to reverse the image maxima and minima

DL = watershed(D);

bgm = DL == 0;

%subplot(3,5,10)

%imshow(bgm)

%title('Watershed Ridge Lines')

gmag2 = imimposemin(gmag,bgm | fgm4);

%here we obtain the regional minima of our requiered area which is to be

%segmentated, imimposemin overlays the minima

L = watershed(gmag2);

labels = imdilate(L==0,ones(3,3)) + 2\*bgm + 3\*fgm4;

I4 = labeloverlay(I,labels);

subplot(3,5,11)

imshow(I4)

title('Markers and Object Boundaries Superimposed')

Lrgb = label2rgb(L,'jet','w','shuffle');

subplot(3,5,13)

imshow(Lrgb)

title('Colored Watershed Label Matrix')

subplot(3,5,15)

imshow(I)

hold on

himage = imshow(Lrgb);

himage.AlphaData = 0.3;

title('Colored Labels Superimposed Transparently')