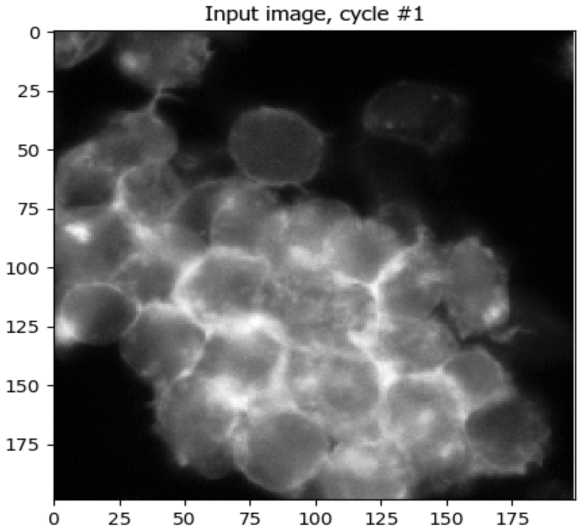
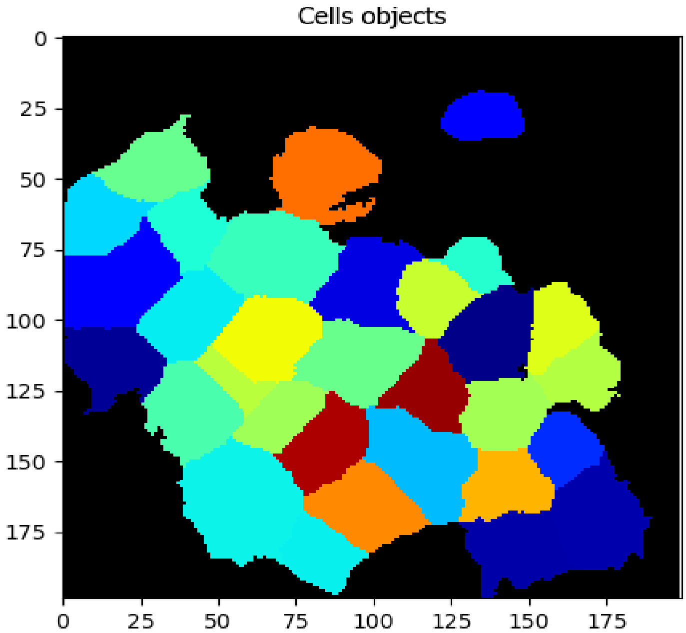
Software Name- Cellprofiler

Website reference- https://cellprofiler.org/

Input image -



Output image-



Explanation - It uses the watershed algorithm for cells separate from each other

o Input: image

o convert I into inverted grey: $\omega I = L - grey(I)$

compute the negative distance transform of ωI

o non-max suppression over shallow minima

o fill basins & get watersheds

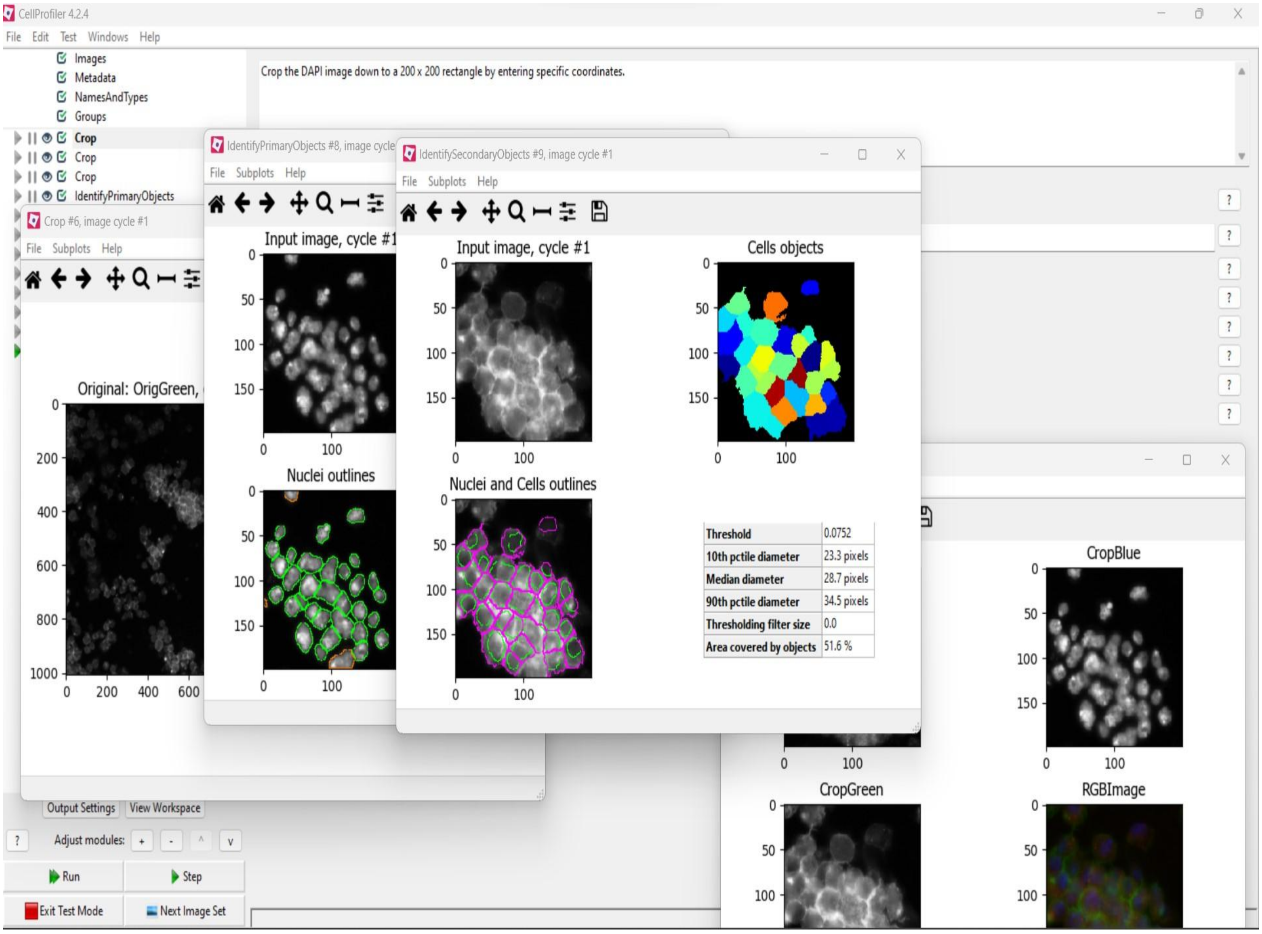
o update each segmented mask with watersheds

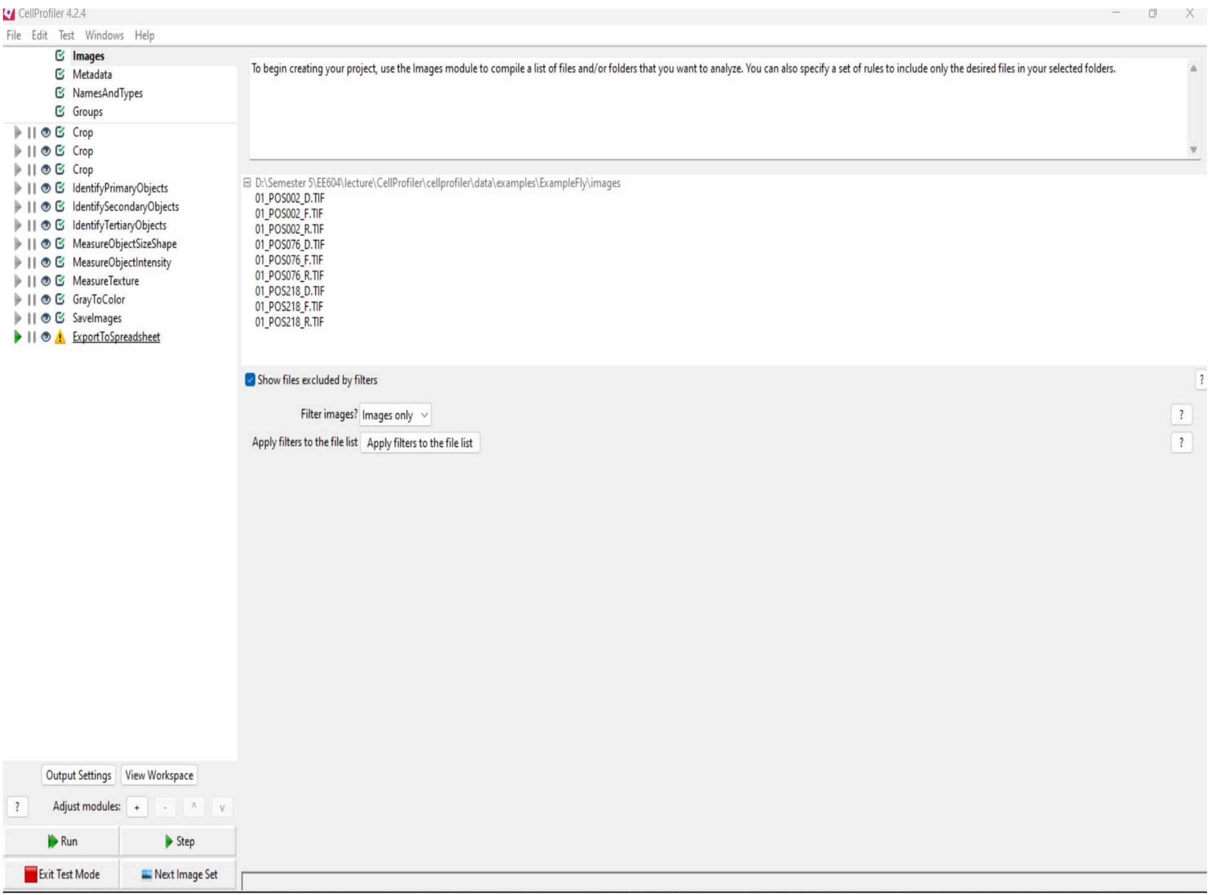
o Initialize:
A *grey I* having:[Hmin ,Hmax]
Minima points: M1, ..., MR
Thresholded set: Th = {pe II(p) ≤ h}, where p is a pixel in I and h is some intensity level.
Let's define the Influence set

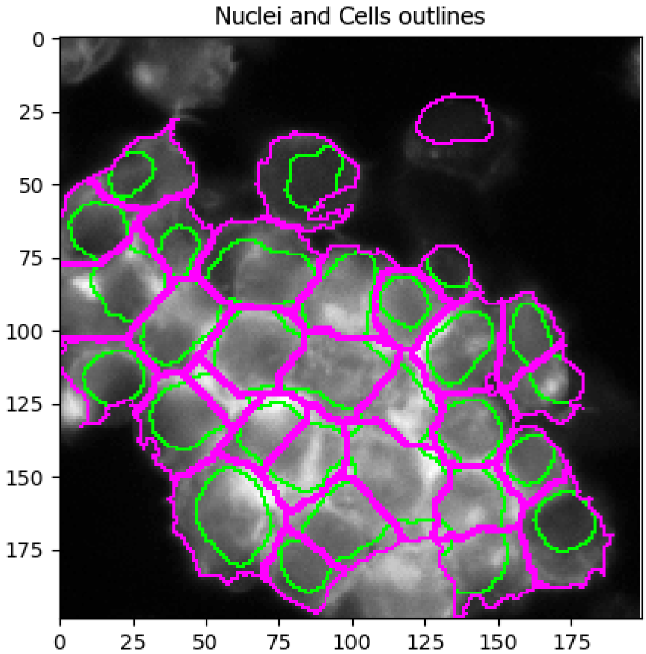
C(M) = cluster associated with M
IZh+1(Mi) = {p Th+1|d(p, C(M;)) < d(p, C(M;))}
Vj, I #j

Run:

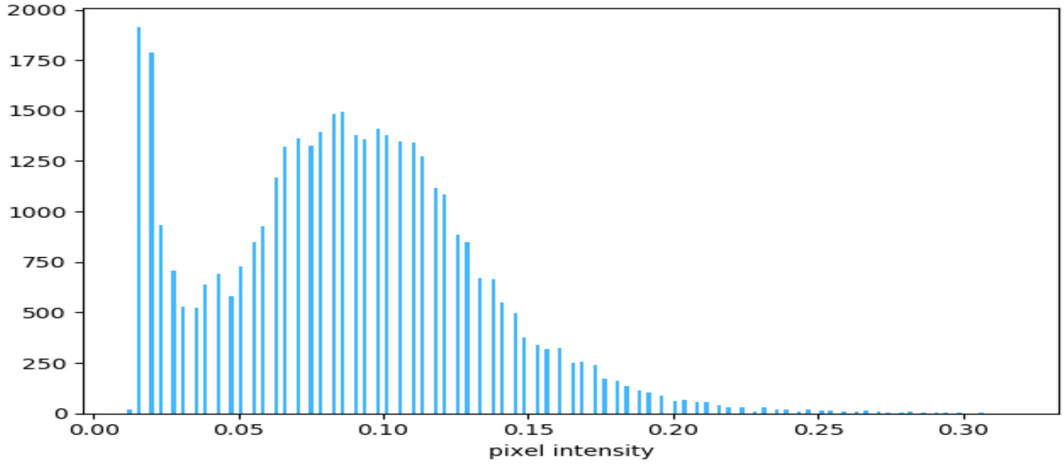
h = hmin
Immersed set: Xh = Xhmin = Thmin = {pЄ II(p) ≤ hmin}
Loop until Hmax
Xh+1 = XnUIZn+1 (M_1)... UJIZn+1(MR)
Influence set of minima M, at level h+1
Watershed (1) = Set of all pixels in I\Xmax


CellProfiler 4.2.4
File Edit Test Windows Help
Images
Metadata
NamesAndTypes
Groups
Crop
Crop
Crop
IdentifyPrimaryObjects
Crop the DAPI image down to a 200 x 200 rectangle by entering specific coordinates.
IdentifyPrimaryObjects #8, image cycle
IdentifySecondaryObjects #9, image cycle #1
Crop #6, image cycle #1
File Subplots Help
Original: OrigGreen,
Input image, cycle #1
Nuclei outlines
Cells objects
Nuclei and Cells outlines
Threshold 0.0752
10th pctile diameter 23.3 pixels
Median diameter 28.7 pixels
90th pctile diameter 34.5 pixels
Thresholding filter size 0.0
Area covered by objects 51.6 %
CropBlue
CropGreen
RGBImage
Output Settings
View Workspace
Adjust modules:
Run
Step
Exit Test Mode
Next Image Set

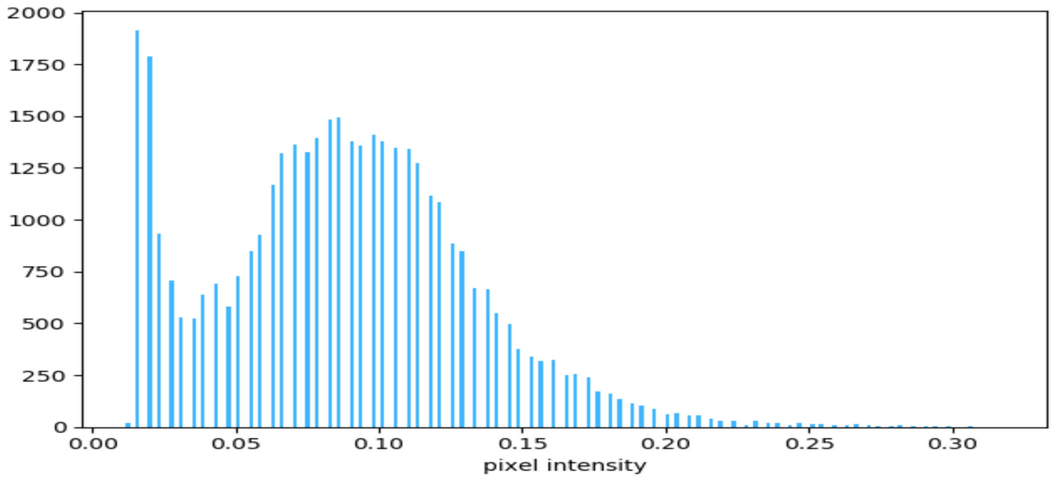

CellProfiler 4.2.4
File Edit Test Windows Help
Images
Metadata
NamesAndTypes
Groups
Crop
Crop
Crop
IdentifyPrimaryObjects
IdentifySecondaryObjects
IdentifyTertiaryObjects
MeasureObjectSizeShape
MeasureObjectIntensity
MeasureTexture
GrayToColor
SaveImages
ExportToSpreadsheet
To begin creating your project, use the Images module to compile a list of files and/or folders that you want to analyze. You can also specify a set of rules to include only the desired files in your selected folders.
D:\Semester 5\EE604\lecture\CellProfiler\cellprofiler\data\examples\ExampleFly\images
01_POS002_D.TIF
01_POS002_F.TIF
01_POS002_R.TIF
01_POS076_D.TIF
01_POS076_F.TIF
01_POS076_R.TIF
01_POS218_D.TIF
01_POS218_F.TIF
01_POS218_R.TIF
Show files excluded by filters
Filter images? Images only
Apply filters to the file list
Apply filters to the file list
Output Settings
View Workspace
Adjust modules:
Run
Step
Exit Test Mode
Next Image Set



Nuclei and Cells outlines
0
25
50
75
100
125
150
175



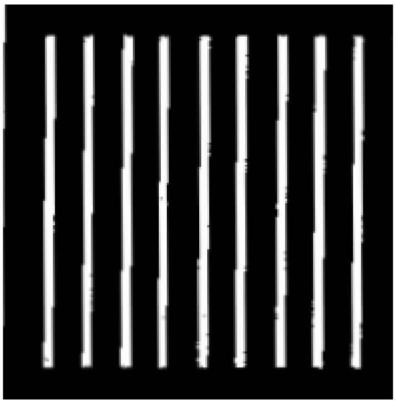
2000
1750
1500
1250
1000
750
500
250
0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
pixel intensity



2000
1750
1500
1250
1000
750
500
250
0
0.00
0.05
0.10
0.15
0.20
0.25
0.30
pixel intensity

2-

(i) The white bars in the test pattern shown are 7 pixels wide and 210 pixels high. The separation between bars is 17 pixels What would this image look like after the application of



1-

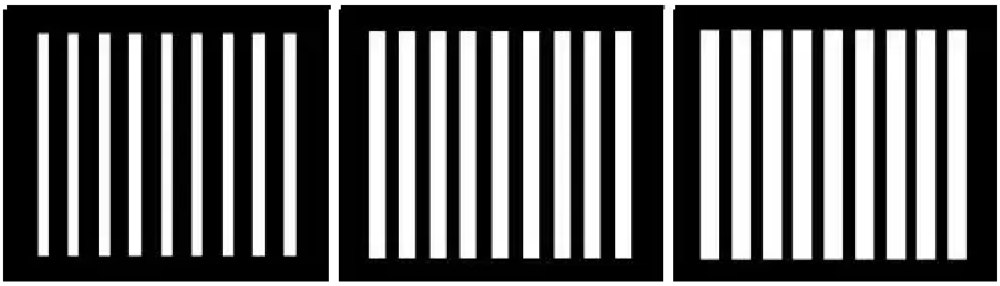
(a) 3×3 Harmonic mean filter
(b) 5×5 Harmonic mean filter
(c) 9×9 Harmonic mean filter

2-Repeat 1 for Cantraharmonic mean filter with Q = -1.5

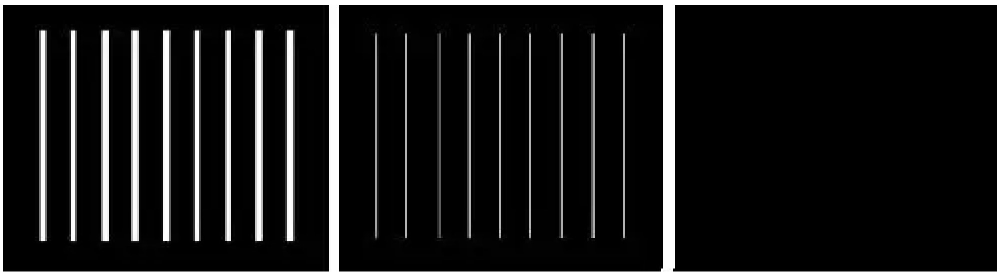
3-Repeat 2 for Max filter

Sol-1-

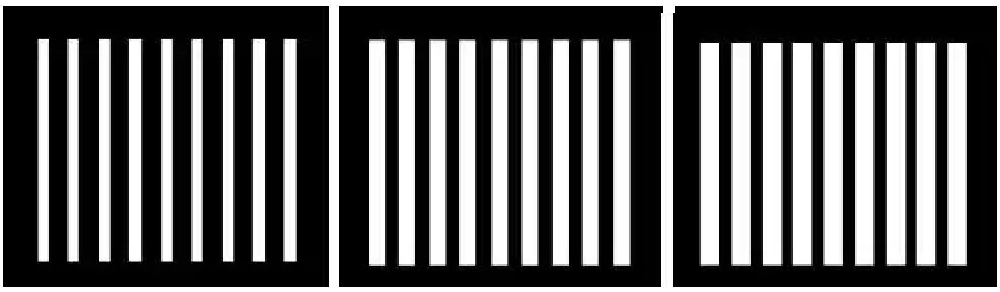
1-



2-



3-



(ii) Write an expression for 2-D discrete convolution.

ans-

convolution in one dimension:

$$f(x) * g(x) = \int_{-\infty}^{\infty} f(\alpha)g(x-\alpha)d\alpha.$$

The Fourier transform of this expression is

$$\begin{aligned} \Im[f(x) * g(x)] &= \int_{-\infty}^{\infty} \left[\int_{-\infty}^{\infty} f(\alpha)g(x-\alpha)d\alpha\right] e^{-j2\pi ux}dx \\ &= \int_{-\infty}^{\infty} f(\alpha) \left[\int_{-\infty}^{\infty} g(x-\alpha)e^{-j2\pi ux}dx\right] d\alpha. \end{aligned}$$

The term inside the inner brackets is the Fourier transform of $g(x-\alpha)$. But,

$$\Im[g(x-\alpha)] = G(u)e^{-j2\pi u\alpha}$$

so

$$\begin{aligned} \Im[f(x) * g(x)] &= \int_{-\infty}^{\infty} f(\alpha)\left[G(u)e^{-j2\pi u\alpha}\right] d\alpha \\ &= G(u)\int_{-\infty}^{\infty} f(\alpha)e^{-j2\pi u\alpha}d\alpha \\ &= G(u)F(u). \end{aligned}$$

This proves that multiplication in the frequency domain is equal to convolution in the spatial domain. The proof that multiplication in the spatial domain is equal to convolution in the spatial domain is done in similar way.

A- which are the following statements correct about filters-

(1) The median filter uses to remove Salt & pepper noise
(2) Burst filter uses to remove Impulse noise
(3) Gaussian filter is a Nonlinear filter
(4) In a Bilinear filter blur in the image increases as the sigma of the range kernel increases

Ans-1,4

B -which are the following statements correct about clustering -

(1) intra-class variance is low(high similarity) in clustering
(2) inter-class variance is low (high similarity) in clustering
(3) K-means clustering unsupervised learning method requires labels but not data
(4) K-means clustering guaranteed to converge in finite iterations
(5) K-means clustering is useful for pattern recognition when we don’t know what to look for

Ans- 1,4,5