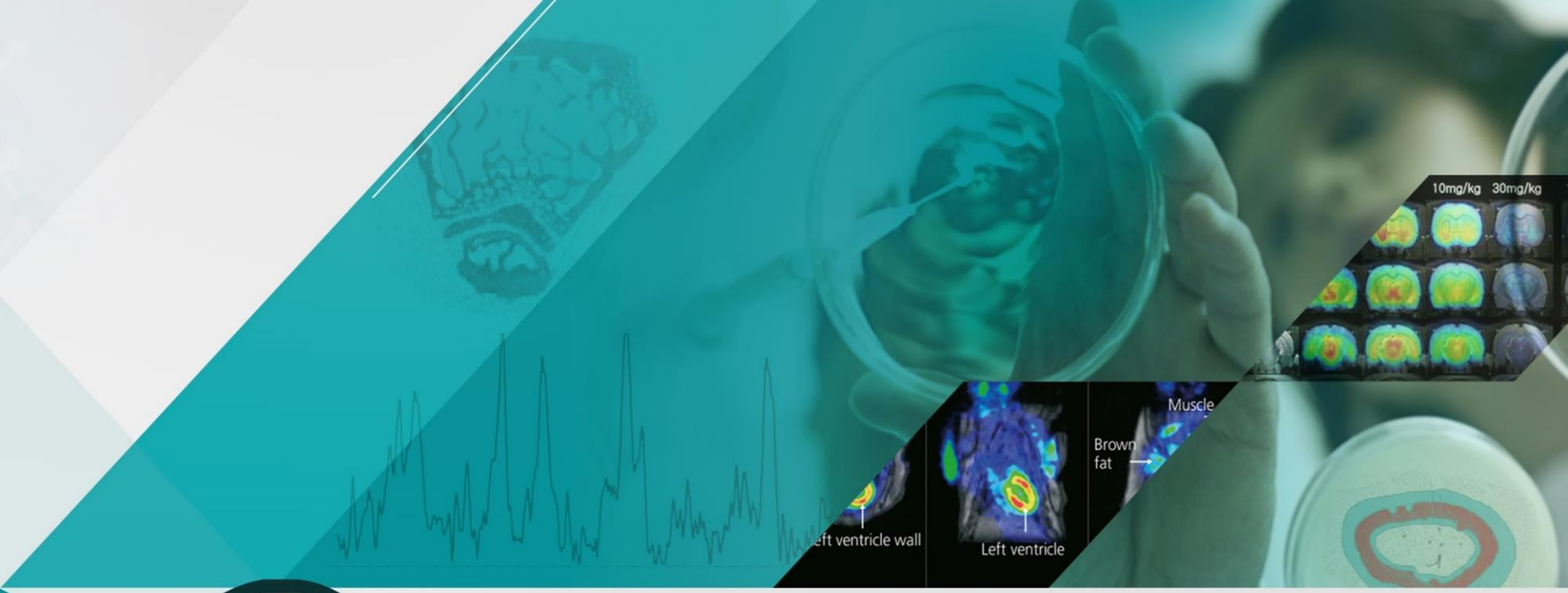

Asan J & Image J 실무연수강좌

Basics of Image Processing #2

박 범 우
Biomedical Imaging Infrastructure

C-BiND 신약개발 바이오이미징
서울아산병원 Asan Medical Center
보건복지부

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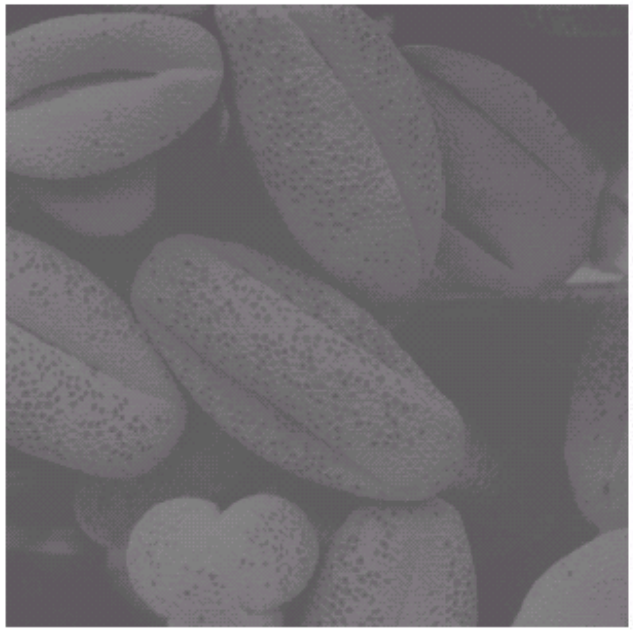
신약개발 융합 바이오이미징 센터
Center for Bio-imaging of New Drug Development

- Image Windowing and Threshold
- Simple Transform

Image Windowing and Threshold

Windowing & Threshold



Original Image

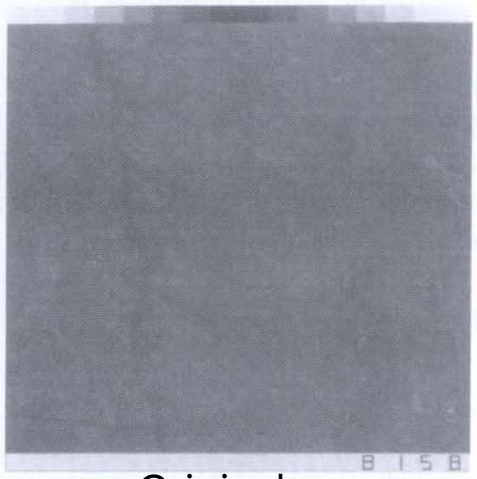
Contrast Stretched Image
By Windowing

Windowing is
displaying technique

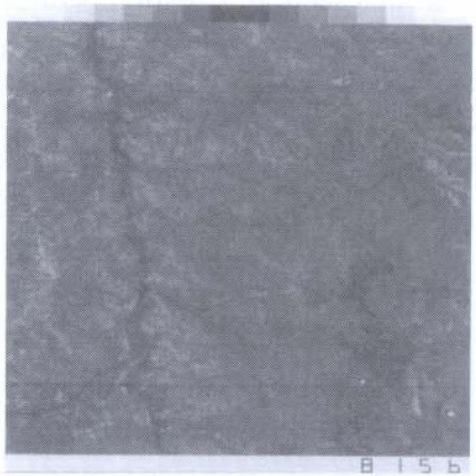
Binary (Mask) Image
By Threshold

Threshold is
selection technique

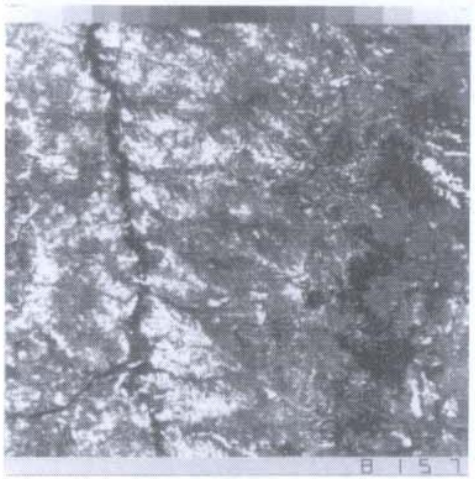
Contrast Stretching



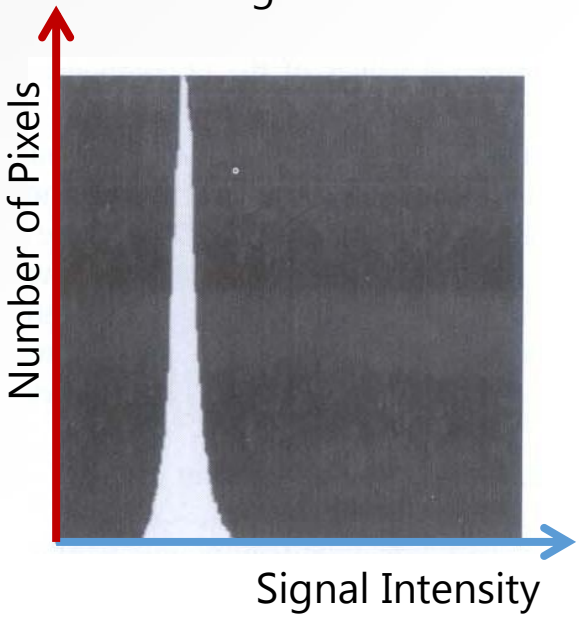
Original

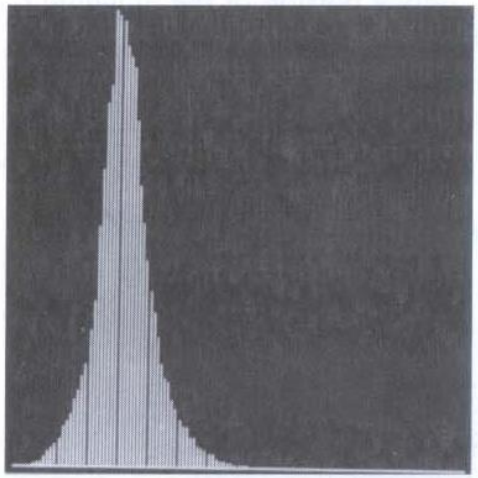


Min=0.17, Max=0.64

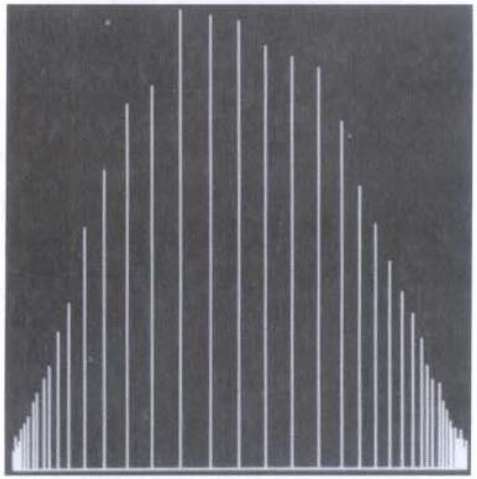


Min=0.24 Max=0.35



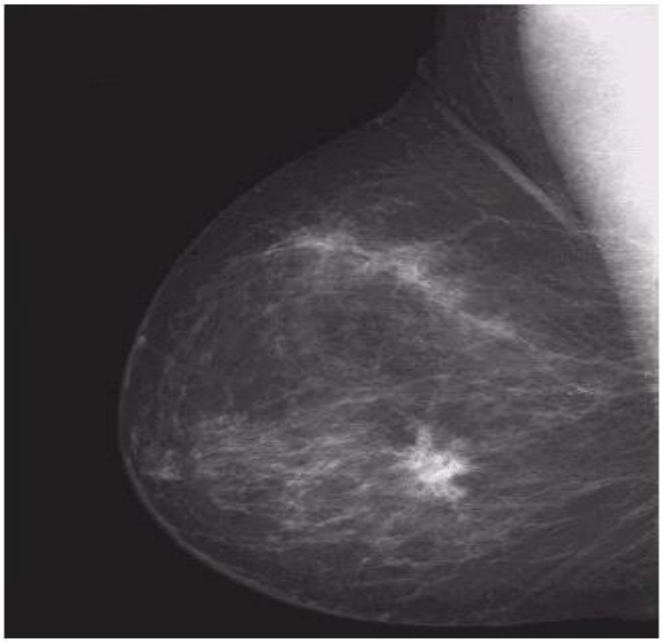


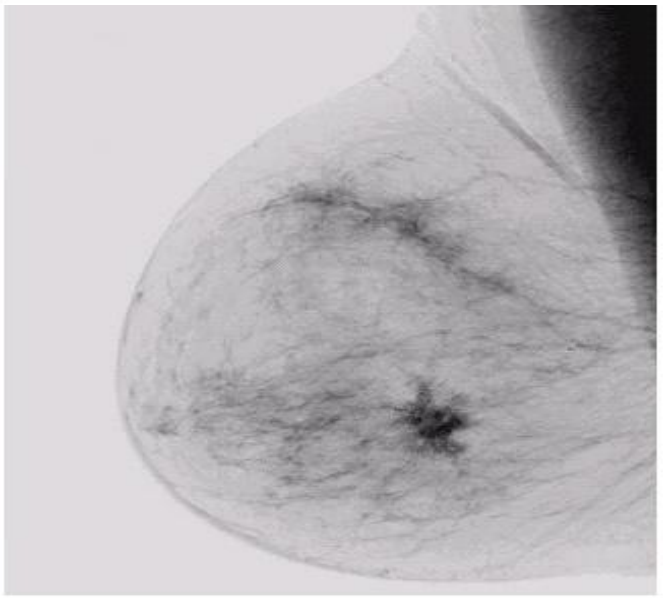
Enhanced histogram



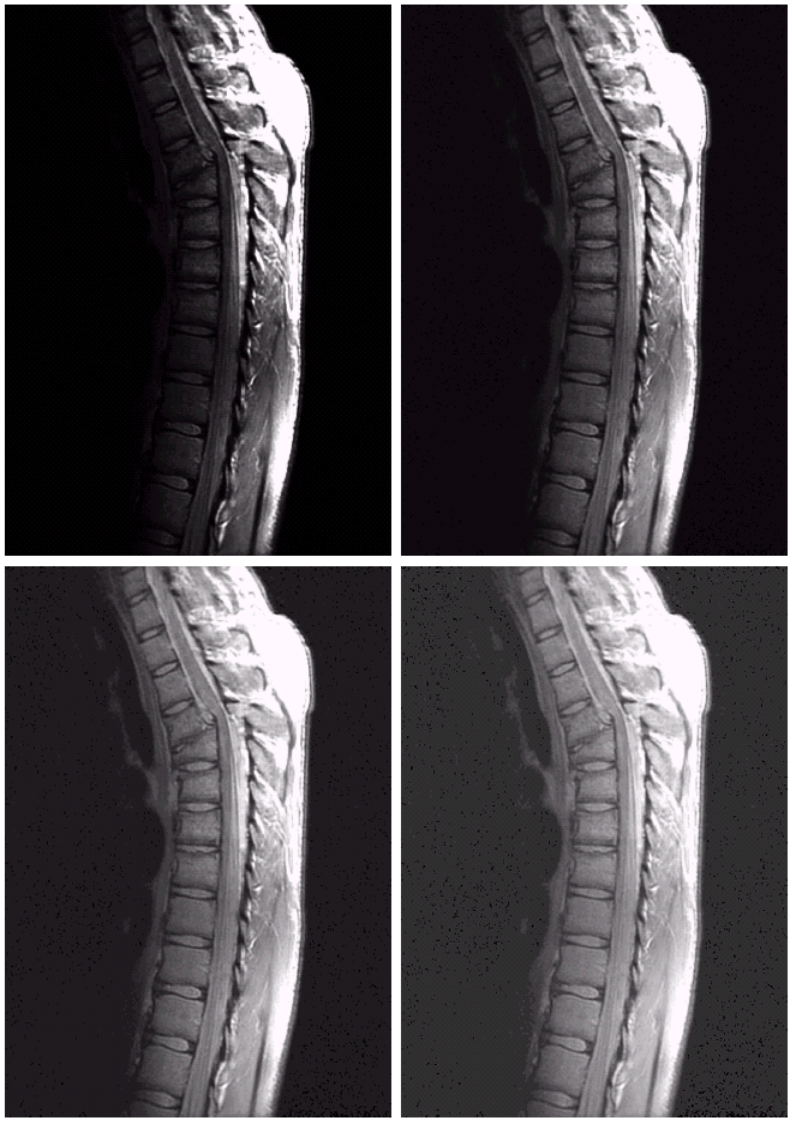
Enhanced histogram

Negative Image

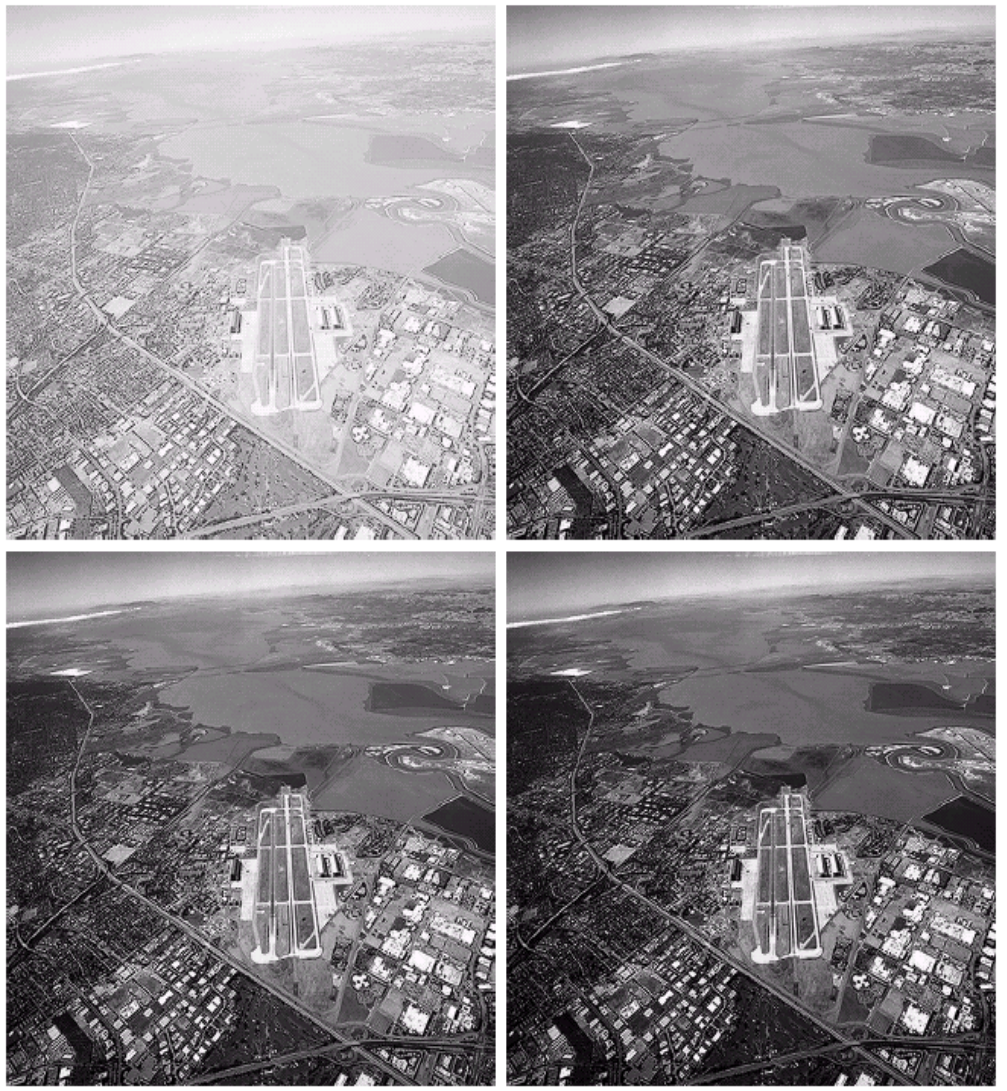




Windowing

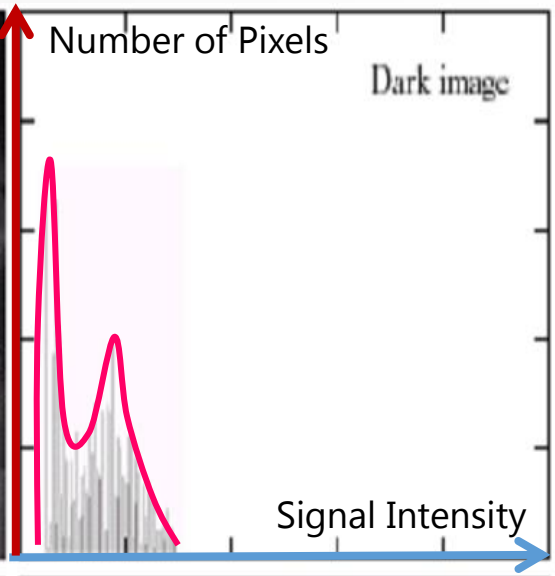


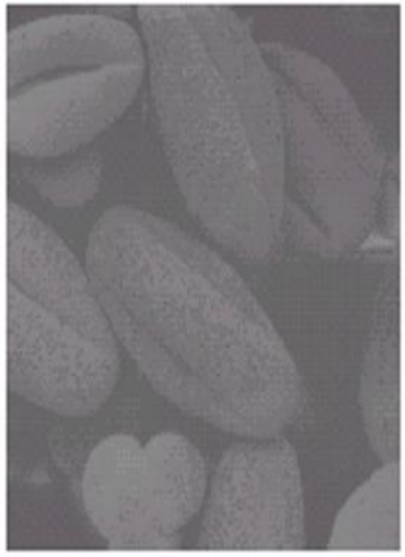
Display image **brighter** than original

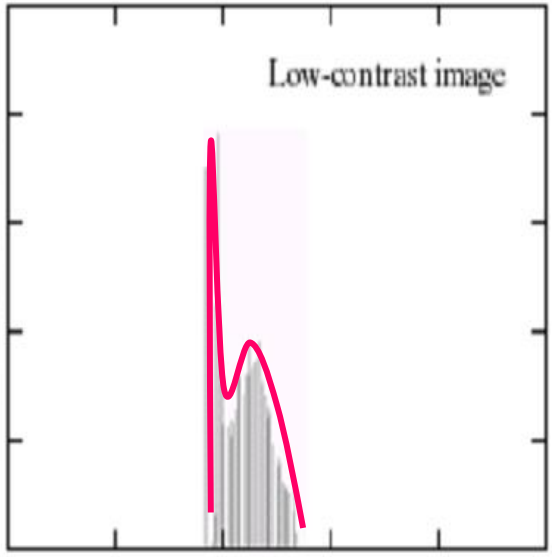


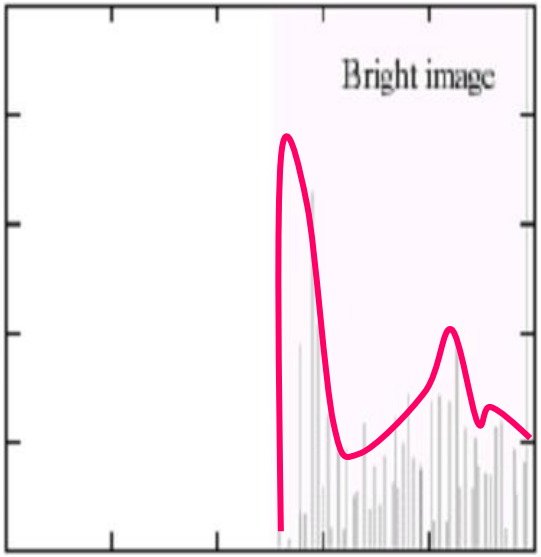
Display image **darker** than original

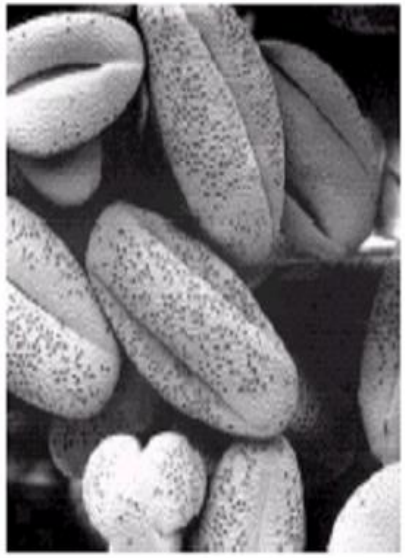
Brightness & Contrast

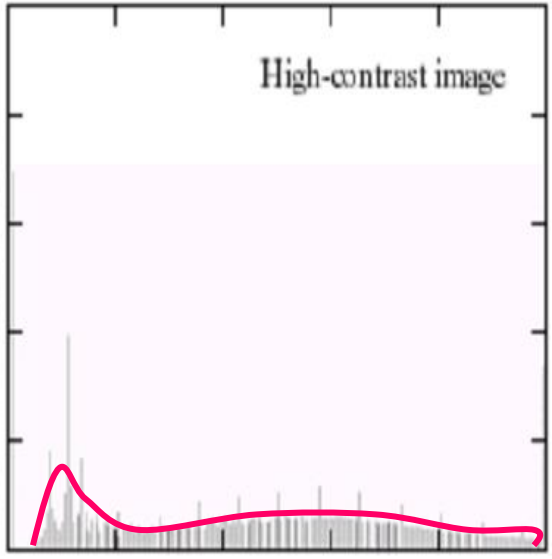




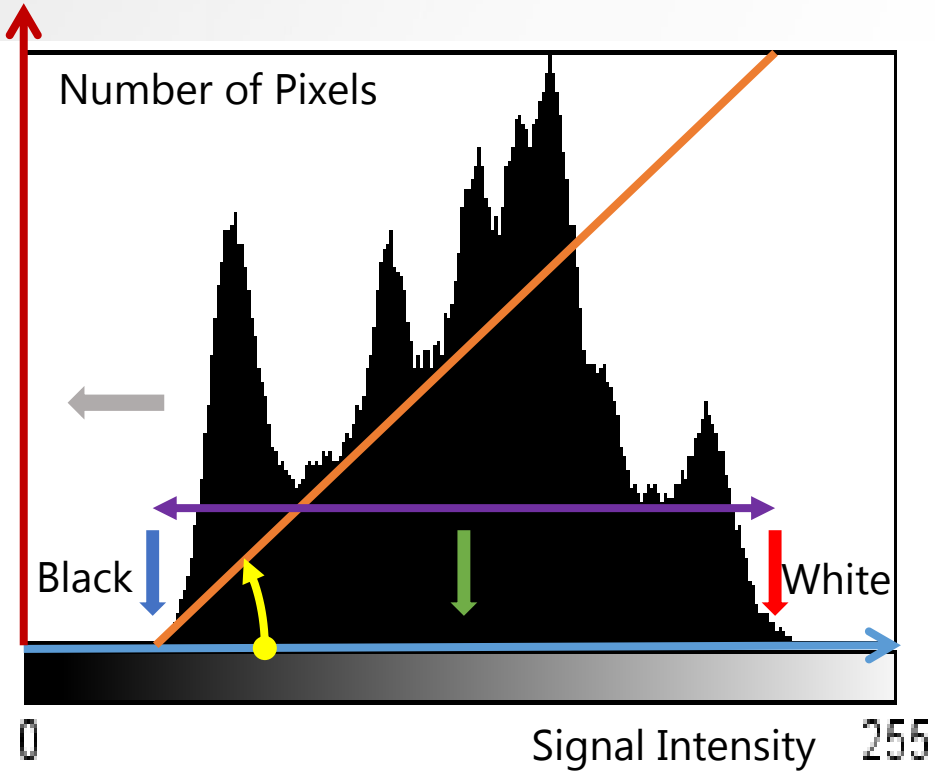








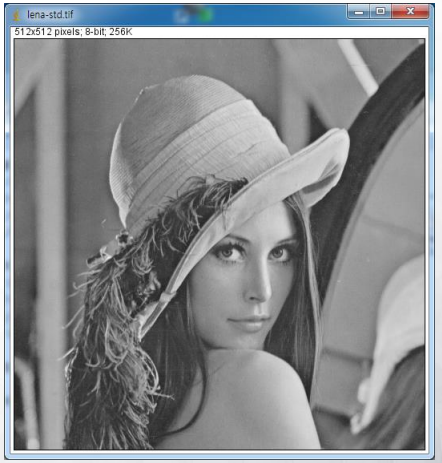
Various Terminology for Windowing



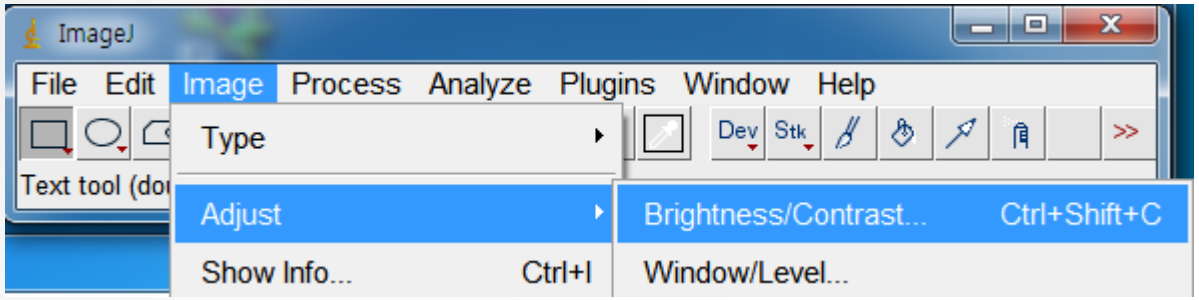
Count: 262144
Mean: 128.229
StdDev: 42.764

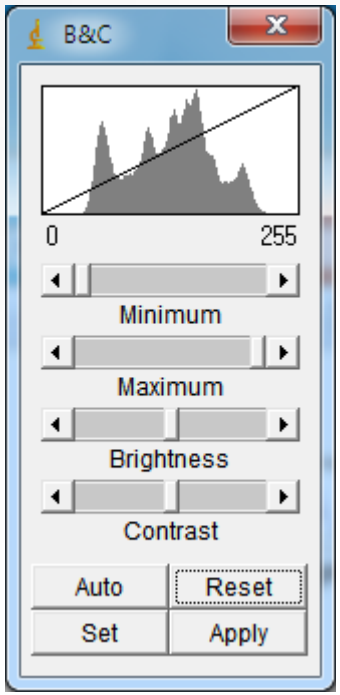
Min: 35
Max: 240
Mode: 154 (3171)

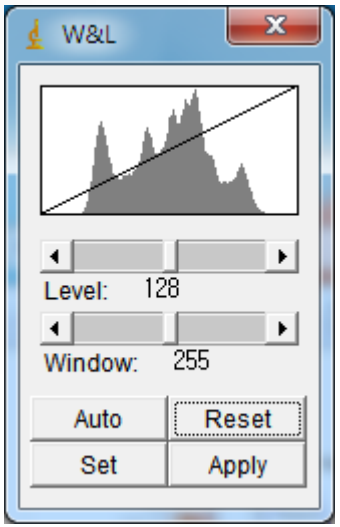
- Lower than Min be displayed Black
- Upper than Max be displayed White
  - **Min**
  - **Max**
  - **Window Level(WL)**
  - **Window Width(WW)**
  - **Contrast**
  - **Brightness**



Example for Windowing on ImageJ



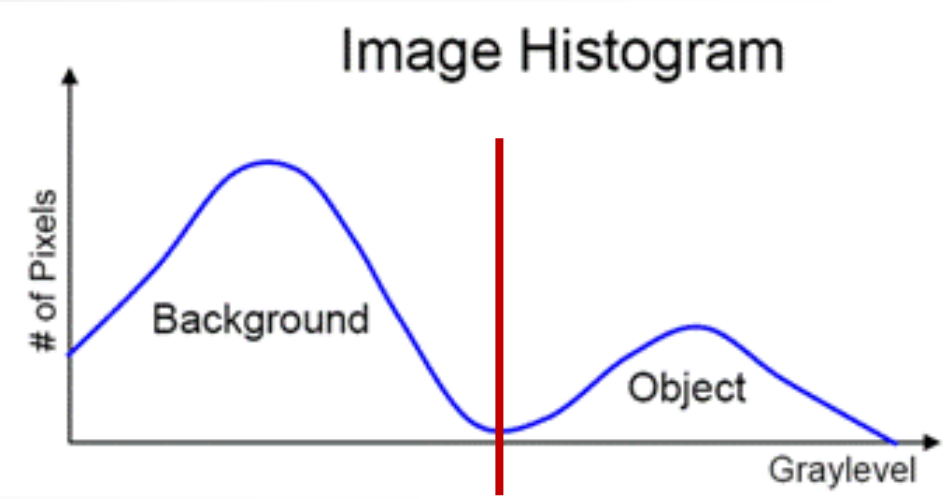


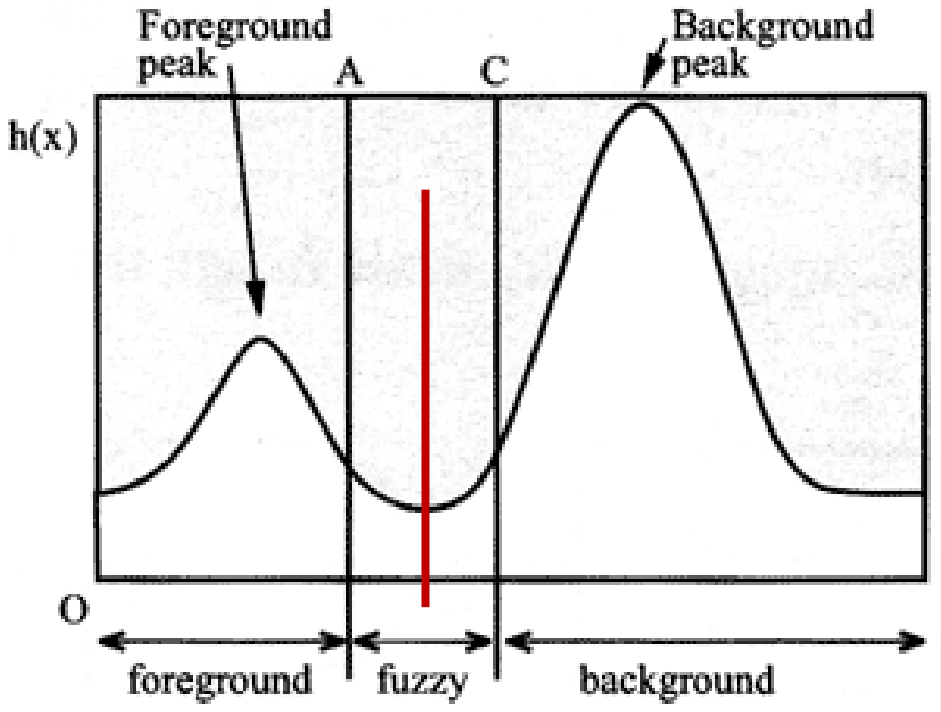


1. Min-Max
    1. Min: 0
    2. Max: 255
2. Window Level & Width
    1. WL: 128
    2. WW: 255
3. Contrast & Brightness
    1. Contrast: 1
    2. Brightness: 0

Try to use Lena!

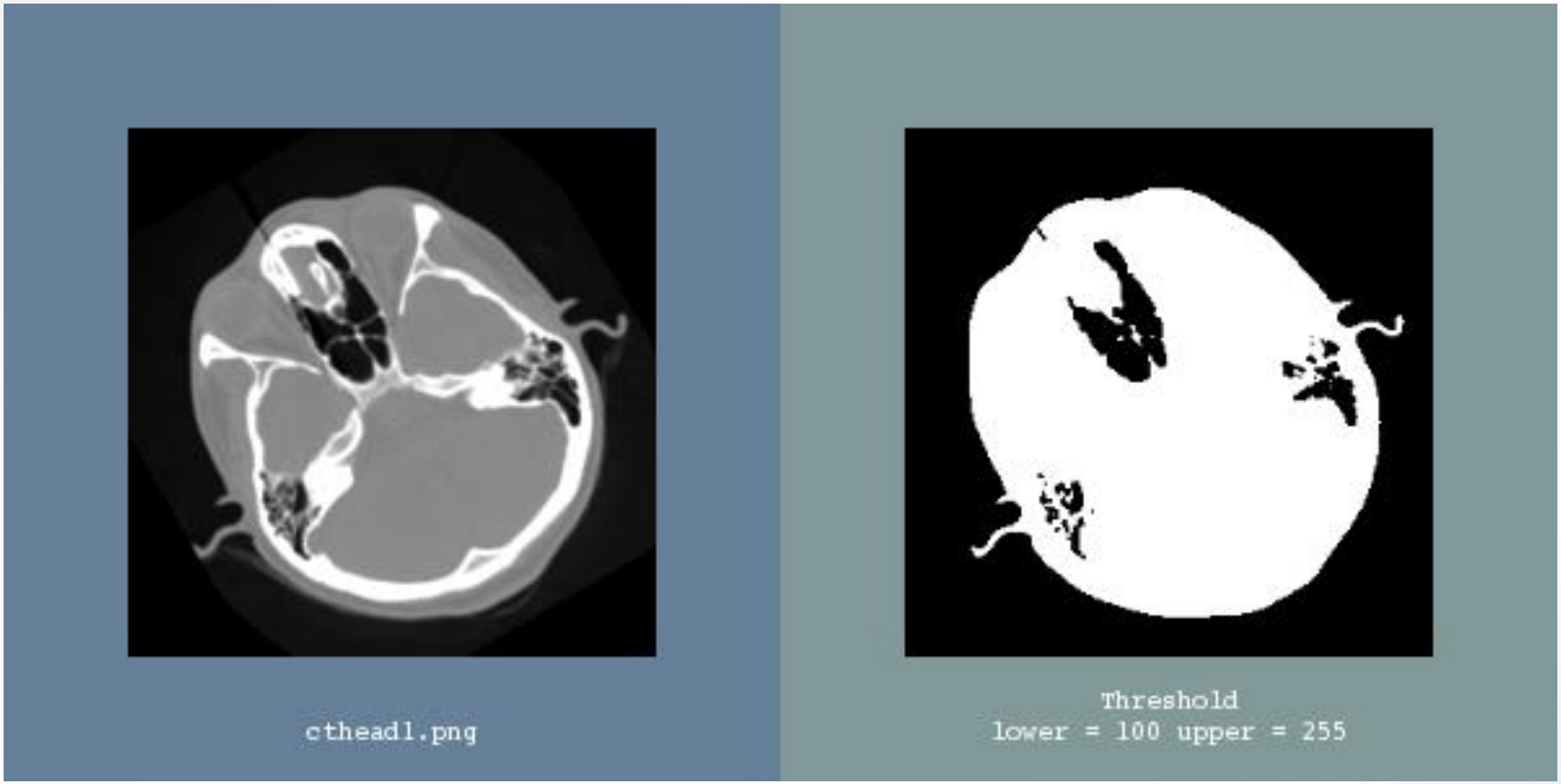
Threshold





Threshold Value (Signal intensity level) is important role to separate object from background.

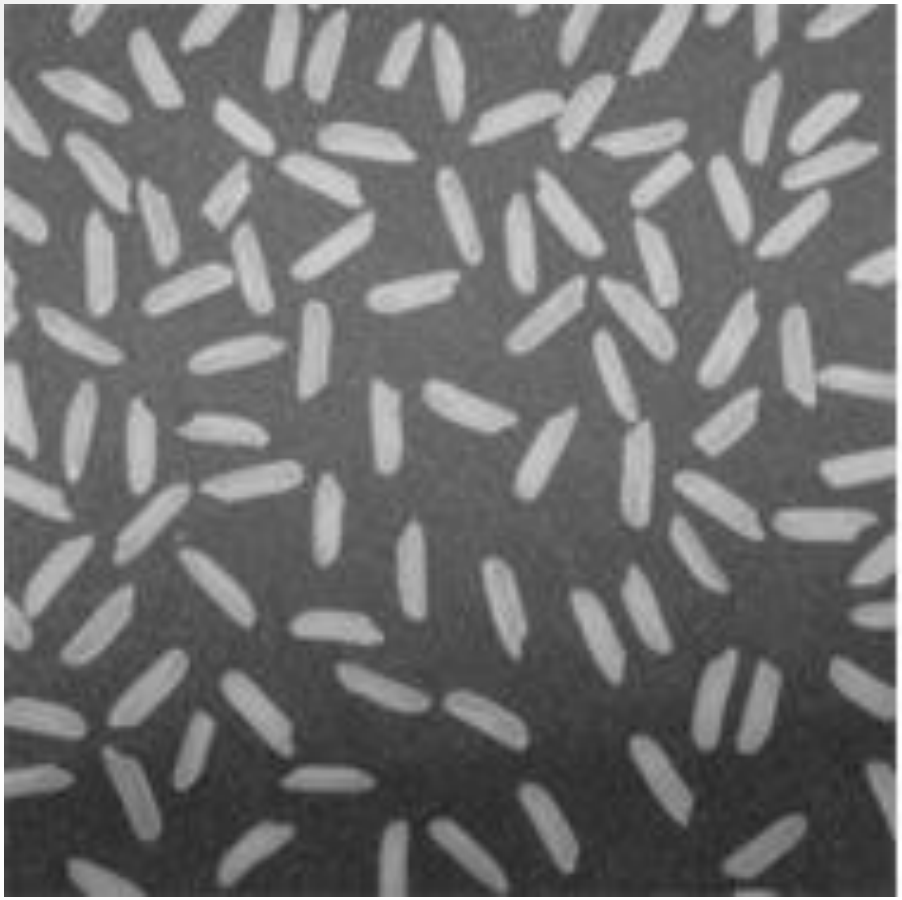
Example for Threshold #1



Original image

Binary image

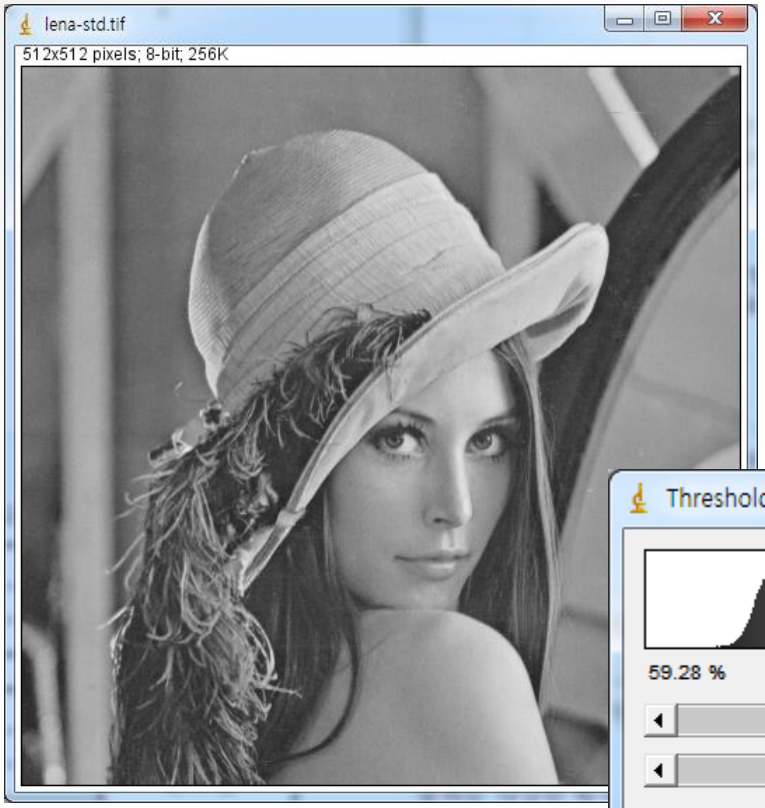
Example for Threshold #2



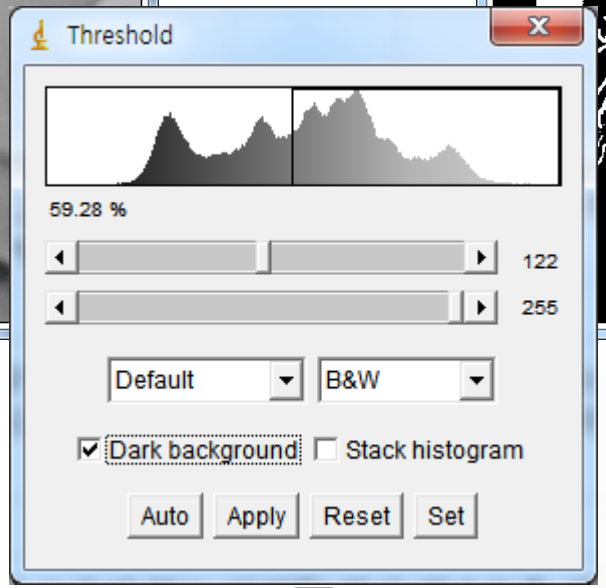
Original image

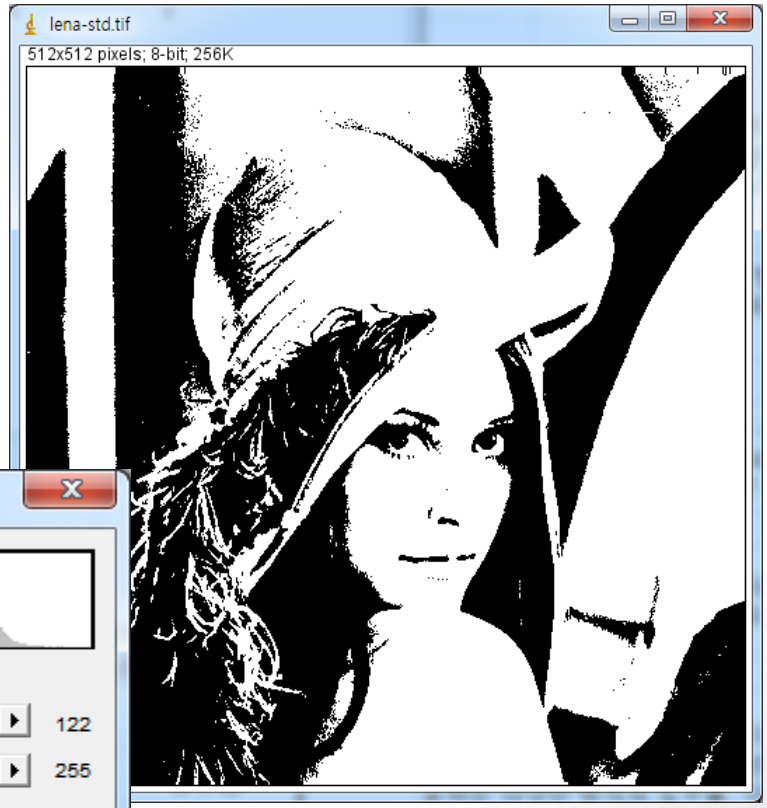
Binary image

Example for Threshold -Lena-



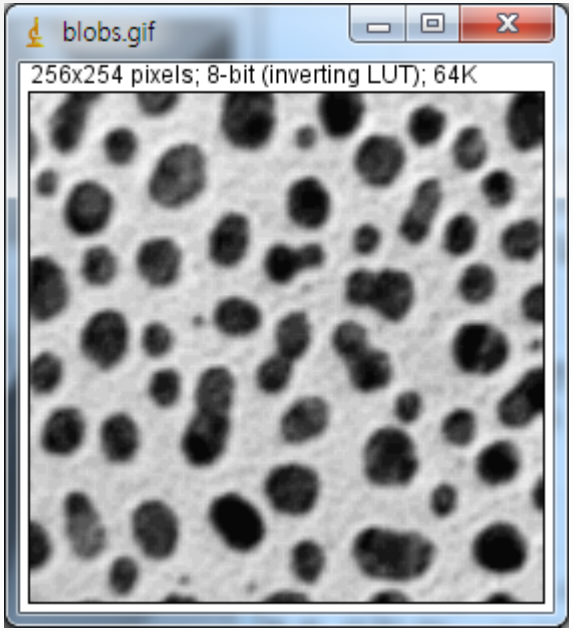
Original image



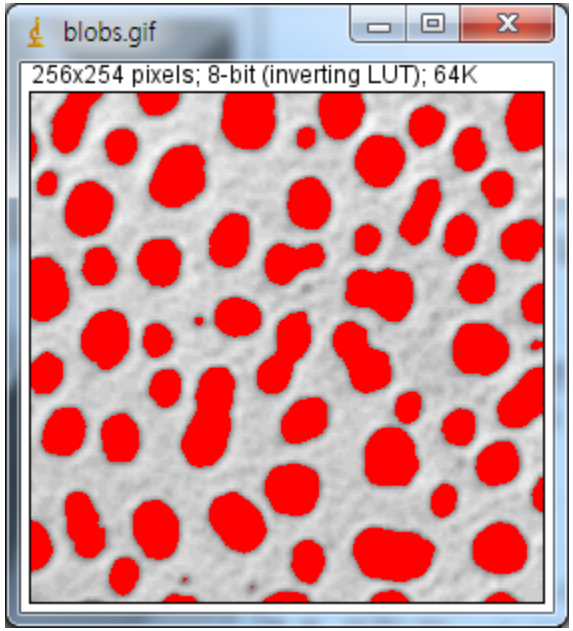


Binary image

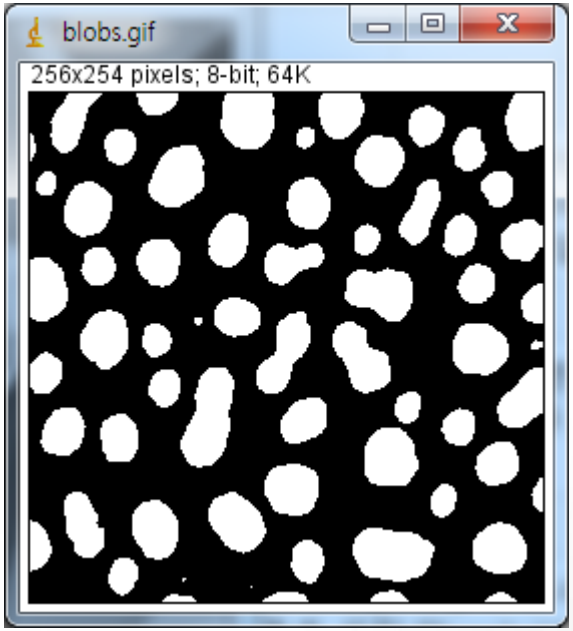
Example for Threshold -blob-



Original image



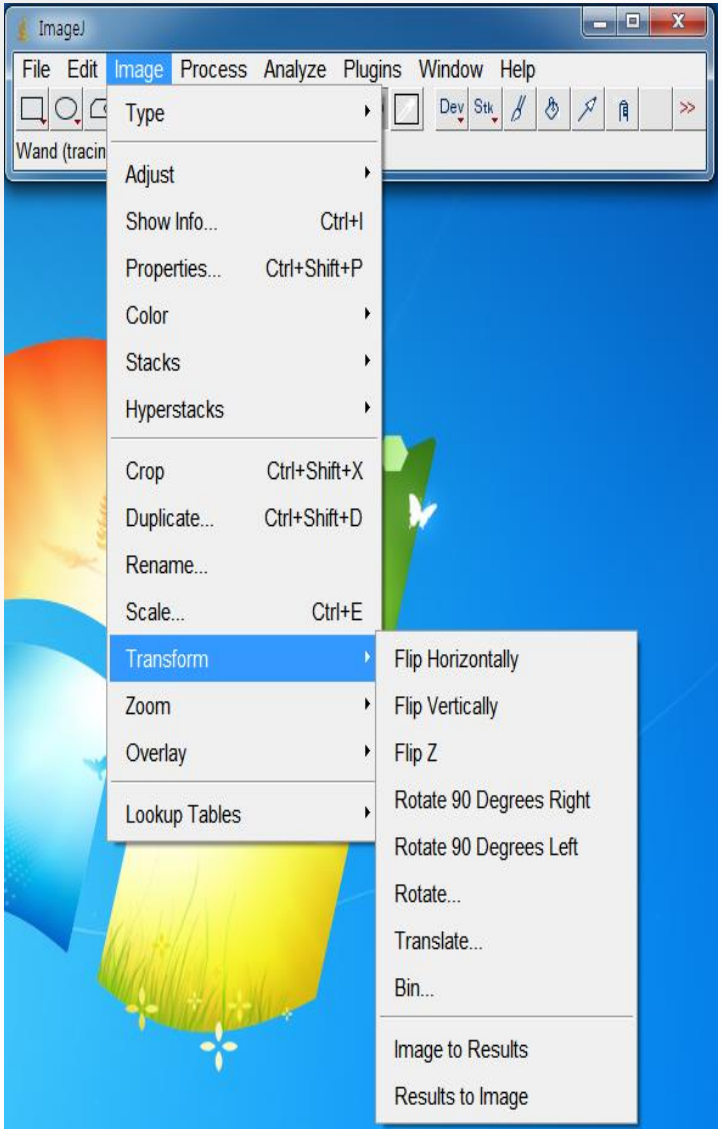
Overlay Mask

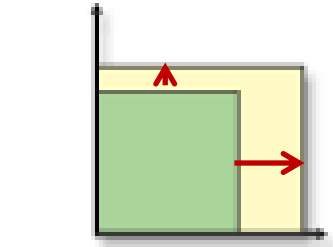


Binary image

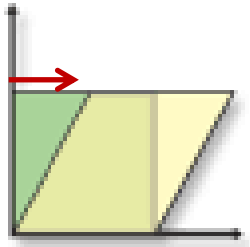
Simple Transform

Transformation

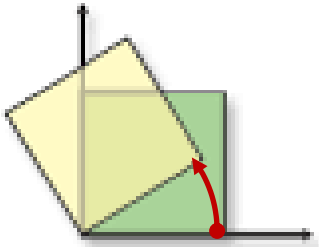




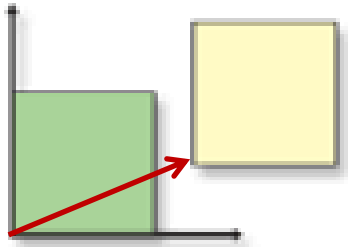
DIFFERENTIAL SCALING



SKEW



ROTATION



TRANSLATION

Flip

Original image

Flip Horizontally

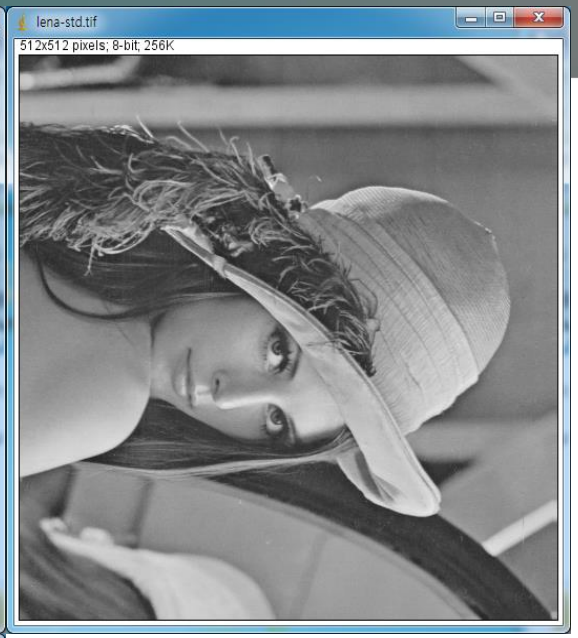
Flip Vertically

Flip Vertically & Horizontally

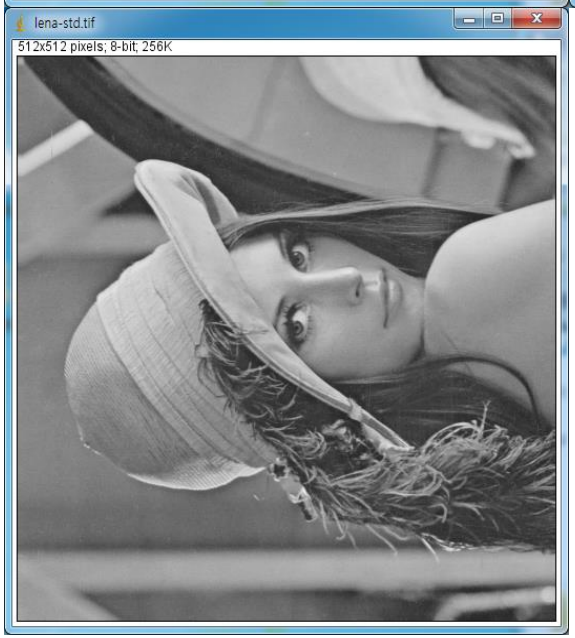
Rotate

Original image

90° Right

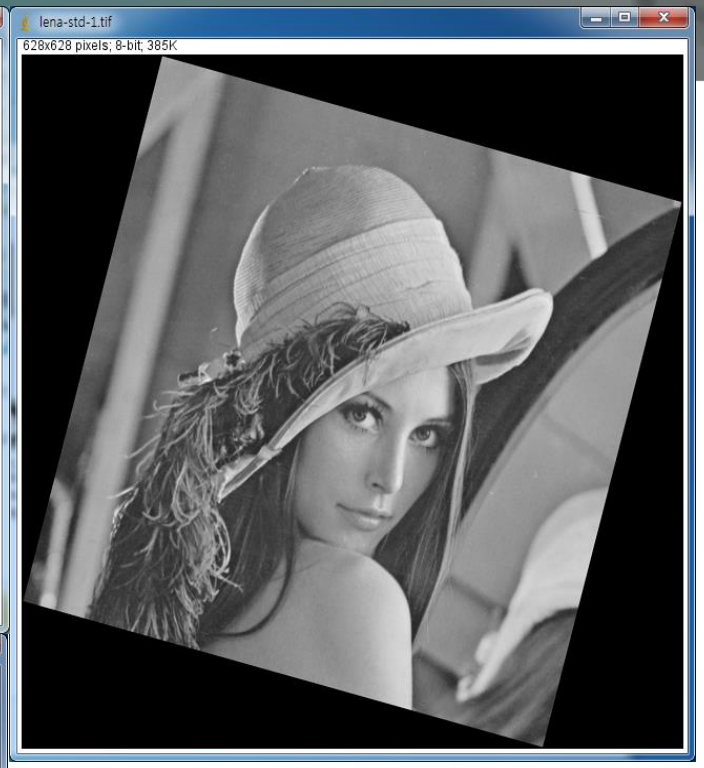


90° Left

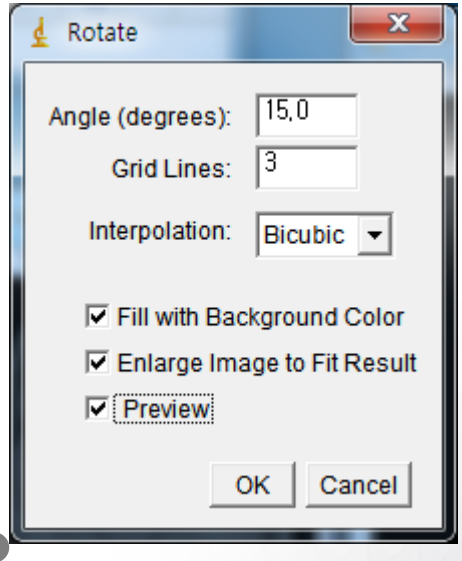


Original image

15° Right
Enlarge image



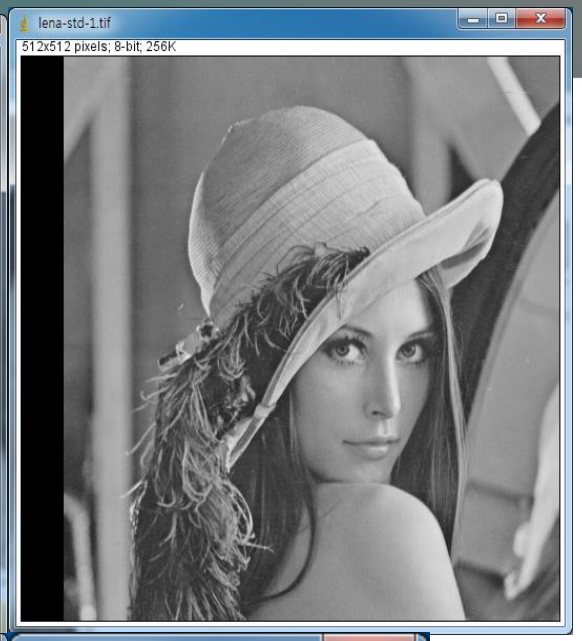
15° Right



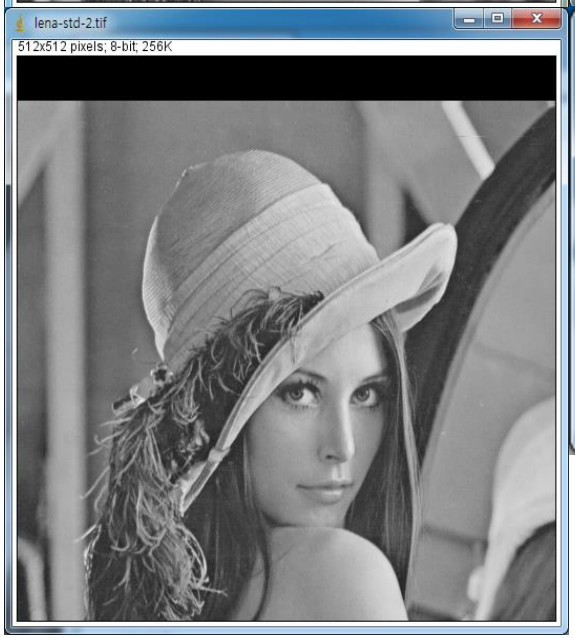
Translate

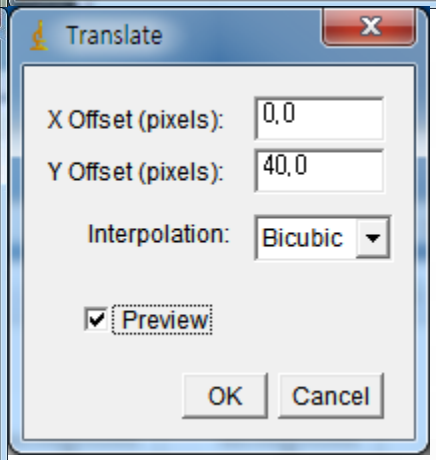
Original image

40 pixels
X-axis



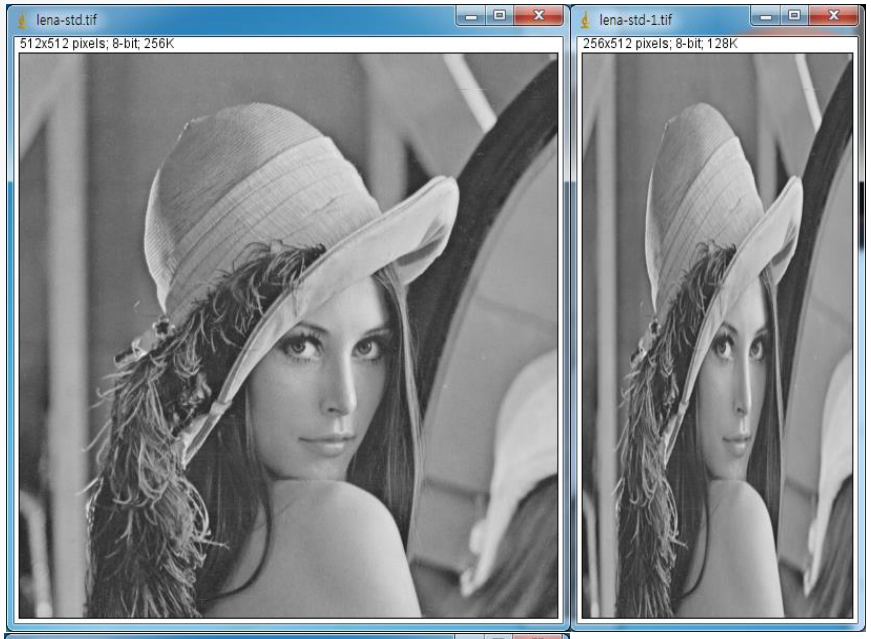
40 pixels
Y-axis





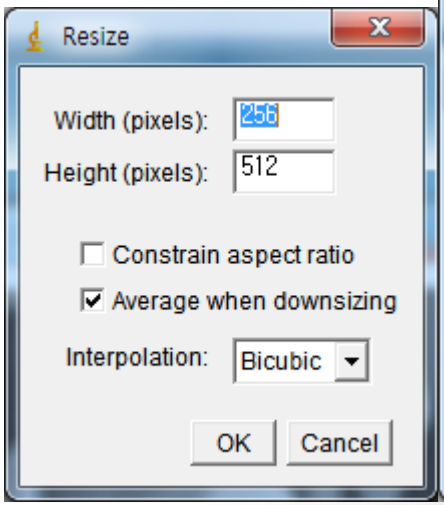
Scaling

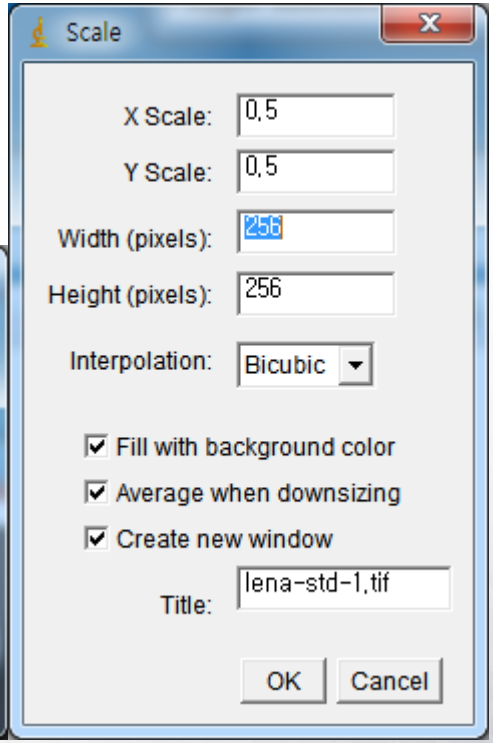
Original image

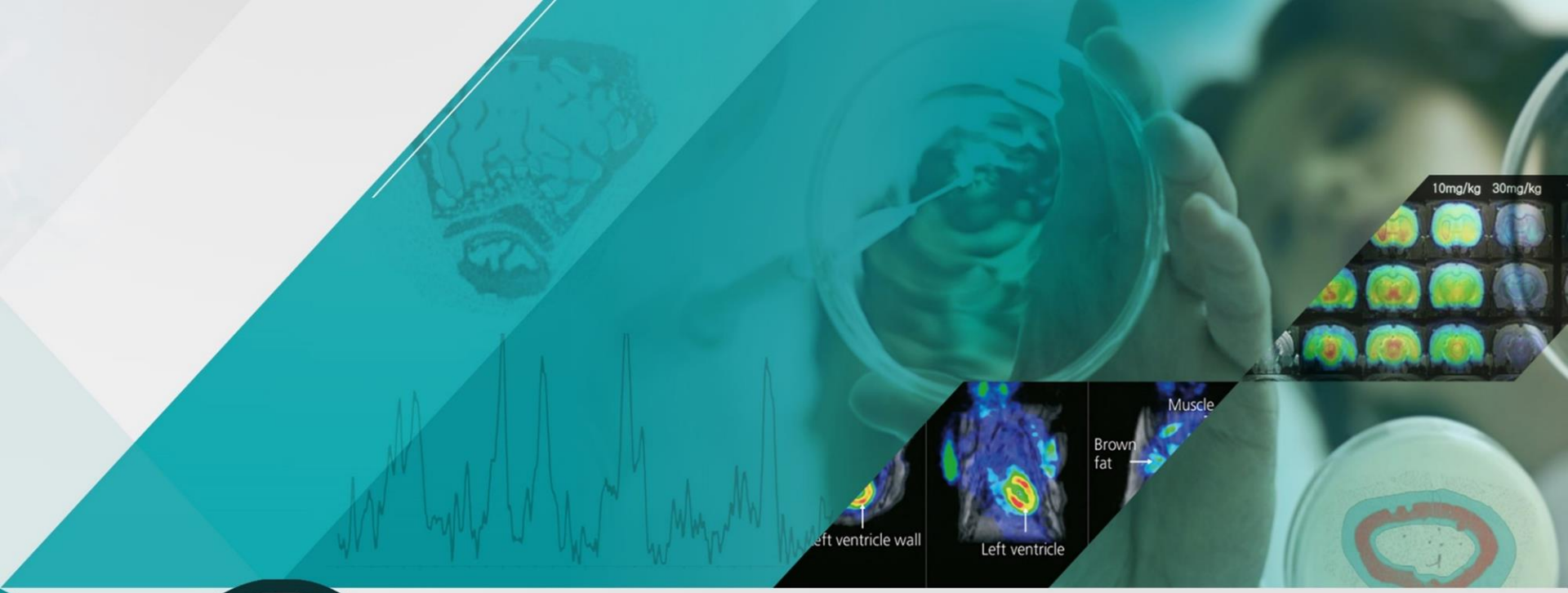


For X-axis
x0.5 scaling

For Y-axis
x0.5 scaling






10mg/kg
30mg/kg
Muscle
Brown fat
ft ventricle wall
Left ventricle

Thank you