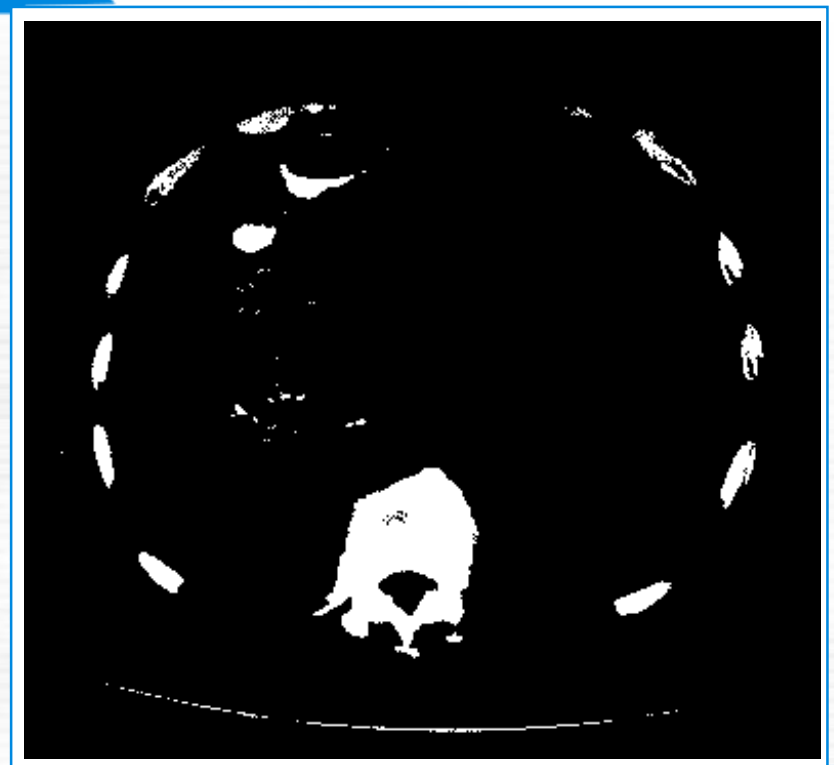
Segmentation

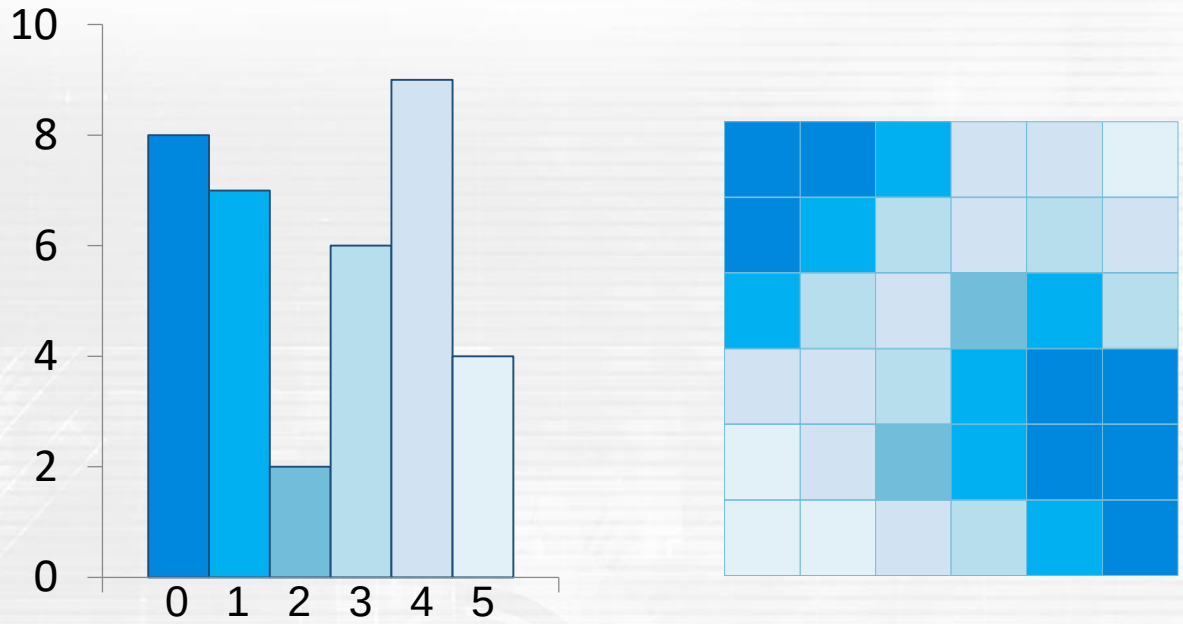
Segmentation

	Conventional methods	Deep Learning methods
Segmentation	Thresholding Region growing Graph cut Active contour model Active shape model	FCN U-Net DeepLab

Thresholding



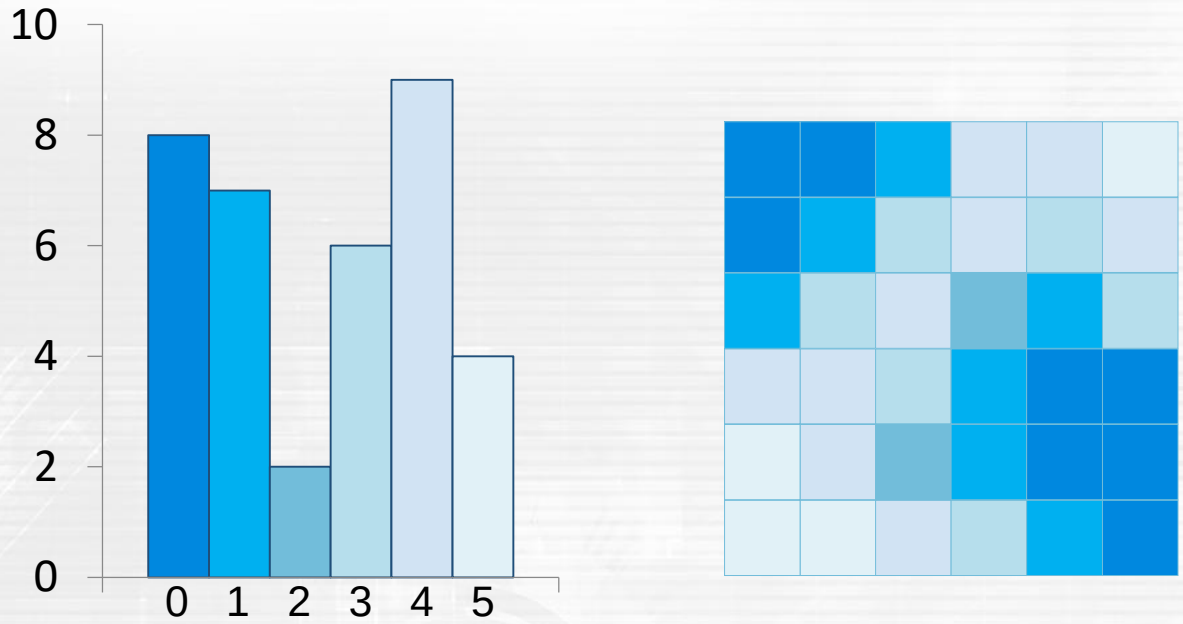
Otsu Thresholding



A 6-level greyscale image and its histogram

출처 http://www.labbookpages.co.uk/software/imgProc/otsuThreshold.html

Otsu Thresholding



A 6-level greyscale image and its histogram

- Within Class Variance

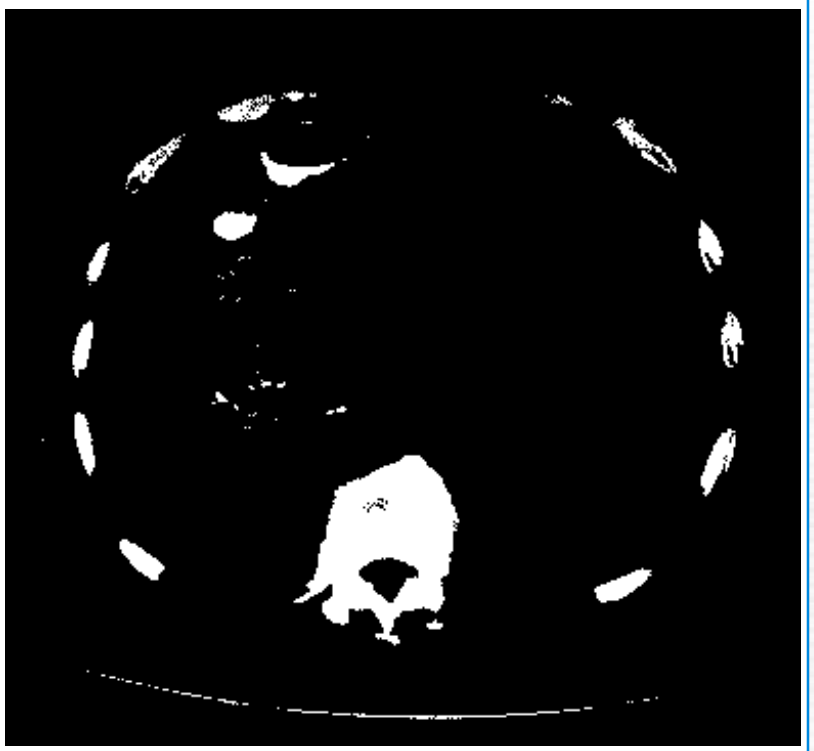
$$\sigma_w^2 = W_b\sigma_b^2 + W_f\sigma_f^2$$

- Between Class Variance

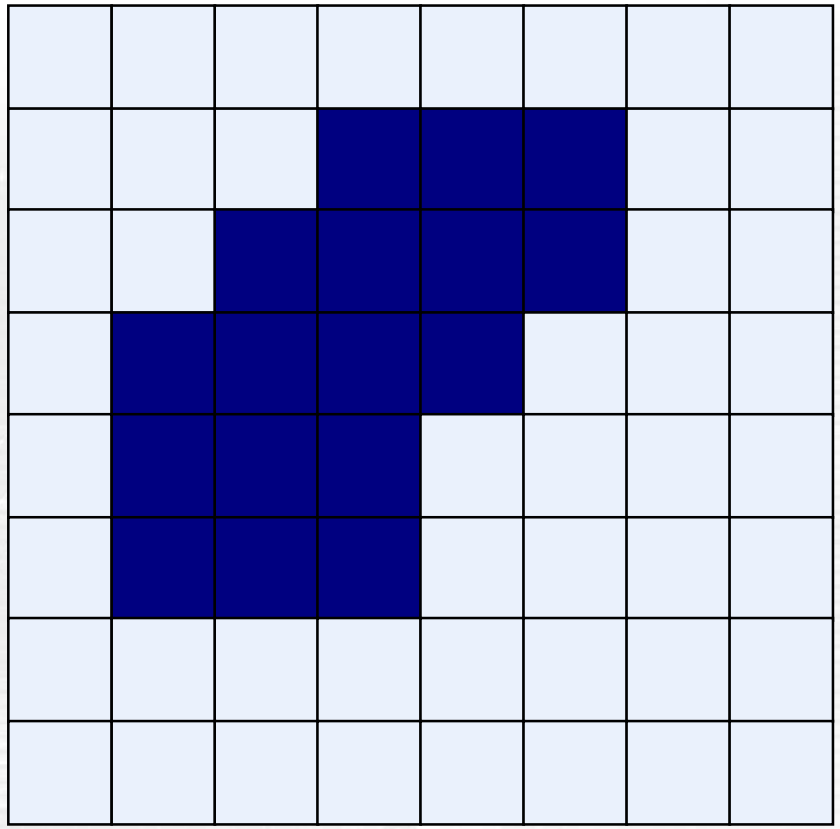
$$\sigma_B^2 = W_b W_f (\mu_b - \mu_f)^2$$

출처 http://www.labbookpages.co.uk/software/imgProc/otsuThreshold.html

Morphological Processing



Morphological Processing



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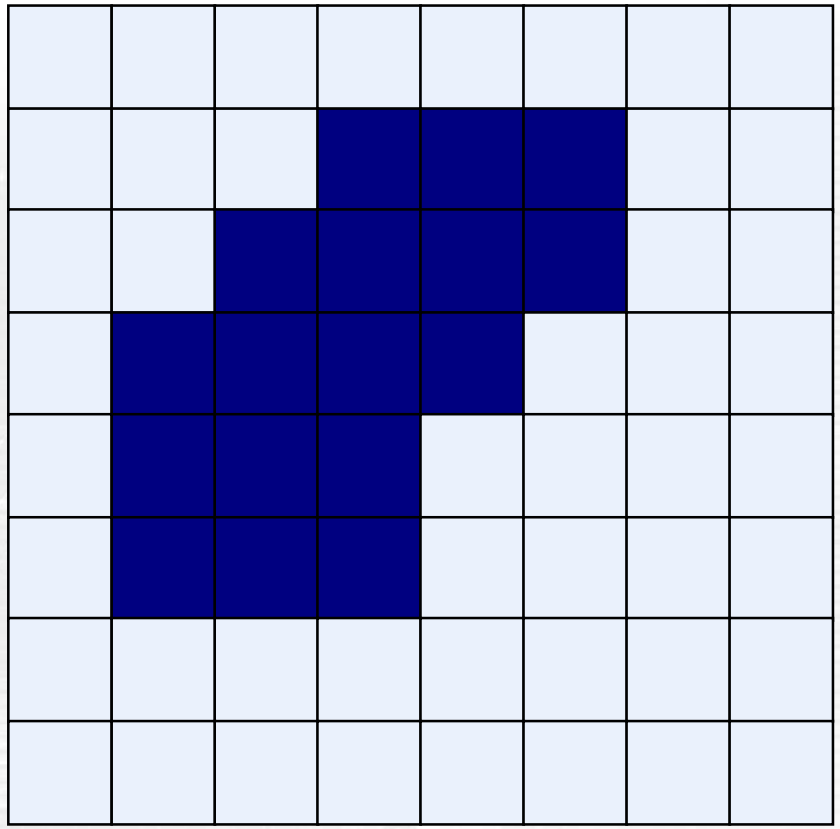
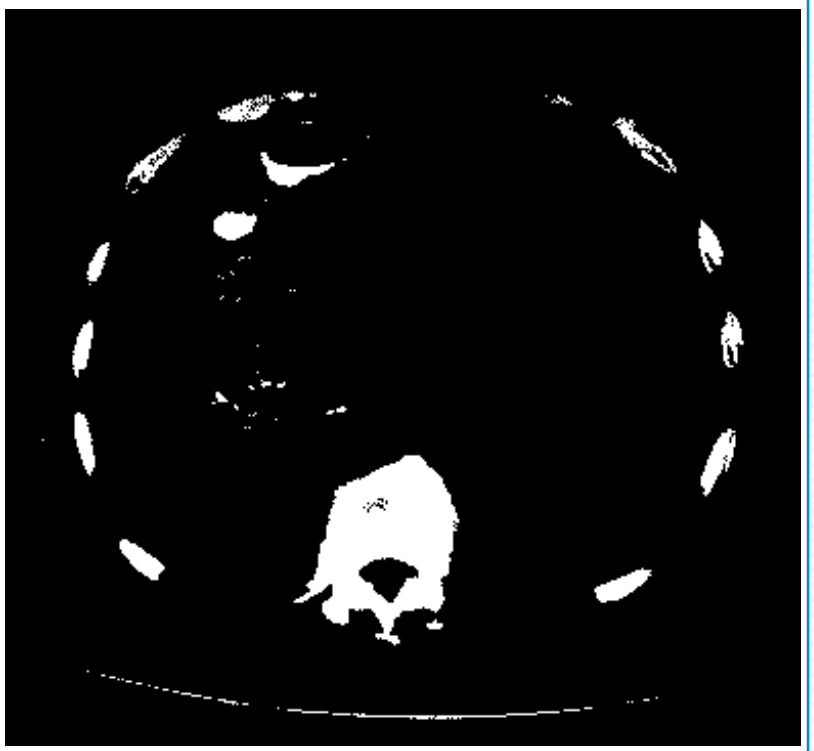
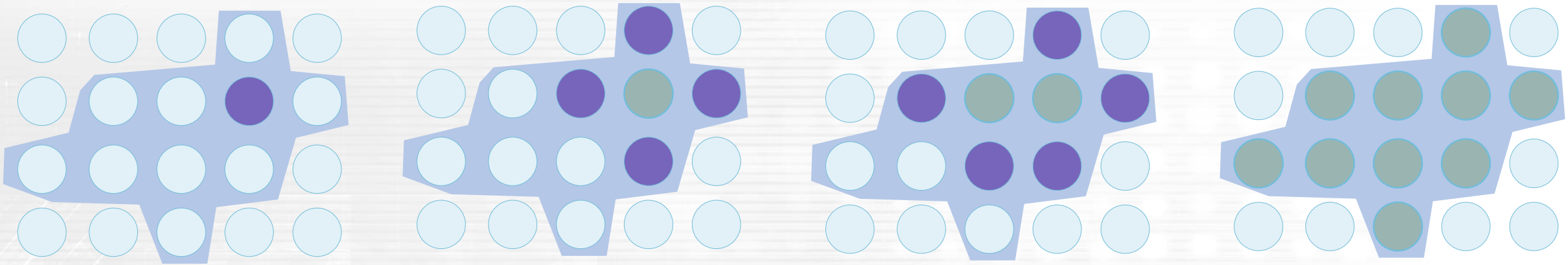


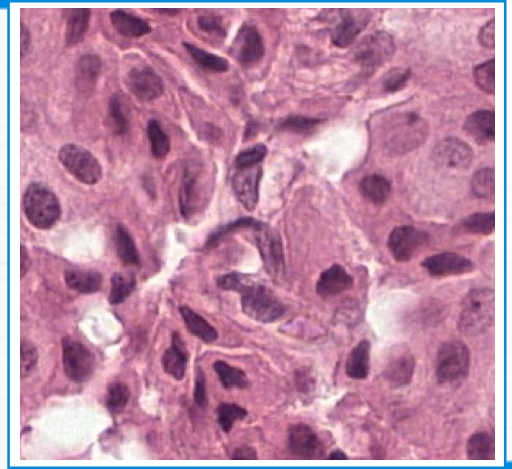
Morphological Processing



Region Growing

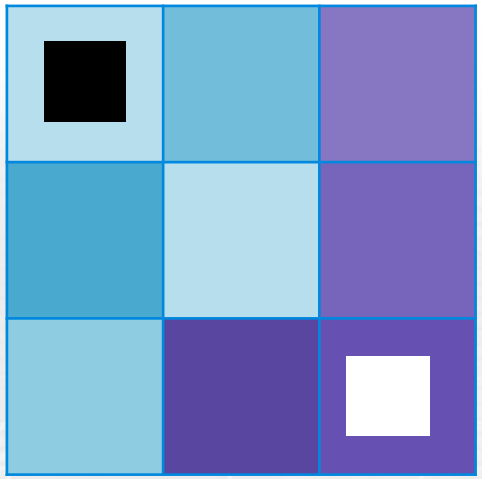


Watershed Algorithm

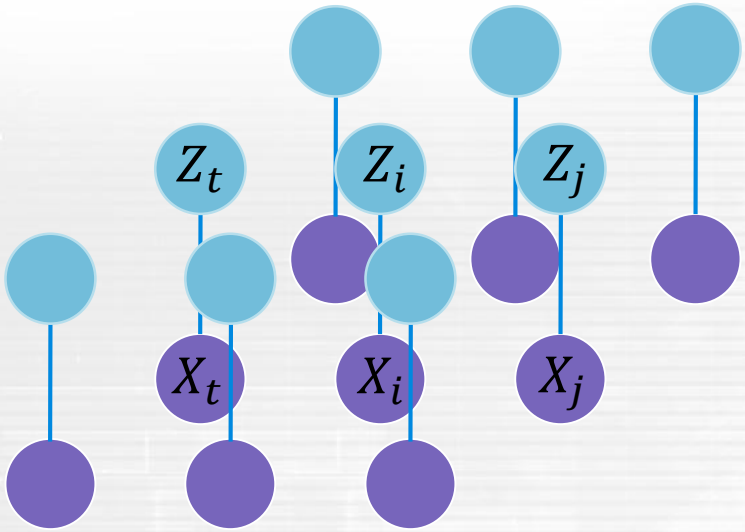


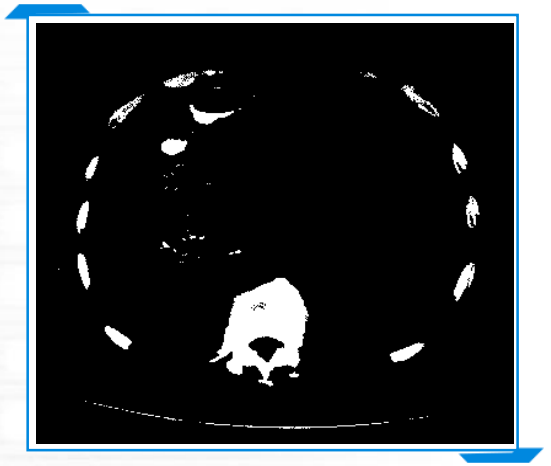
출처 https://camelyon17.grand-challenge.org/Data/

Labeling Problem

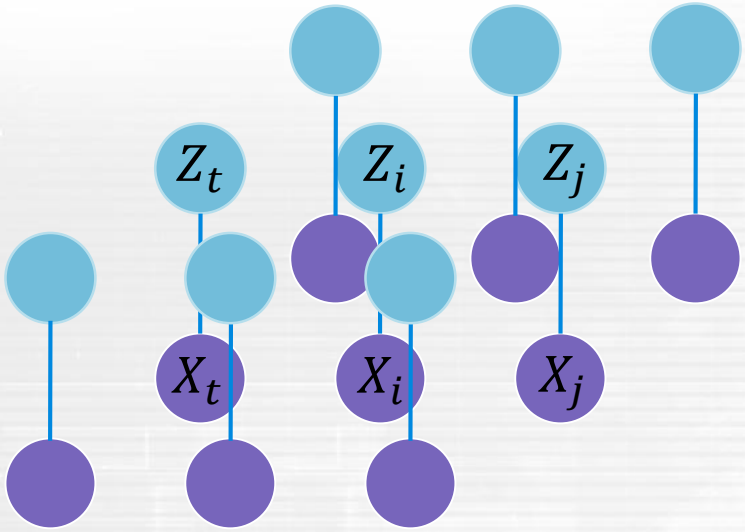


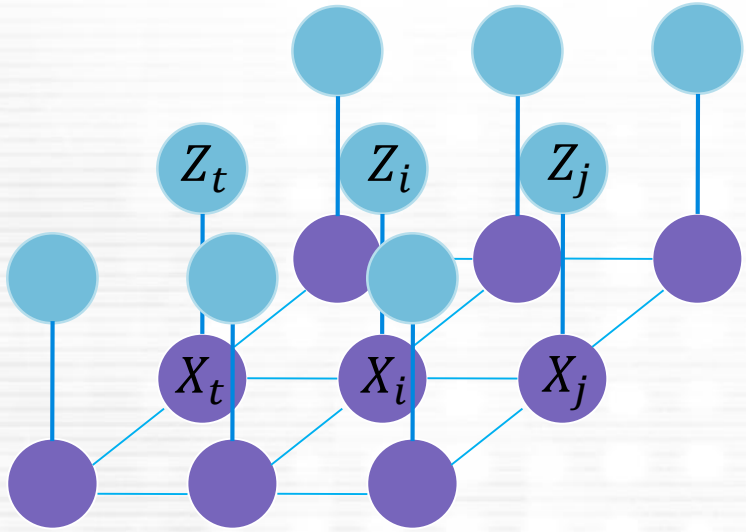
Labeling Problem



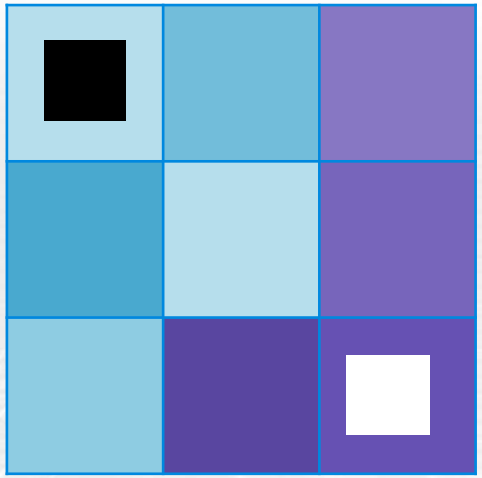


Labeling Problem





Optimization



Optimization

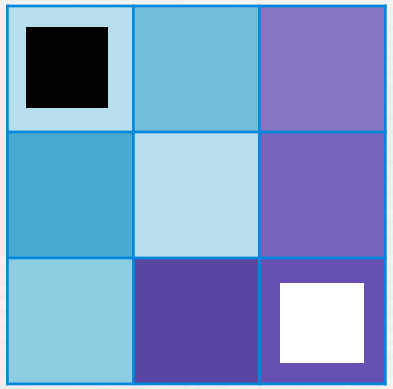
$$P(x_1, x_2, \dots, x_N | z_1, z_2, \dots, z_N) \propto e^{-E(x_1, x_2, \dots, x_N | z_1, z_2, \dots, z_N)}$$

Take negative logarithm

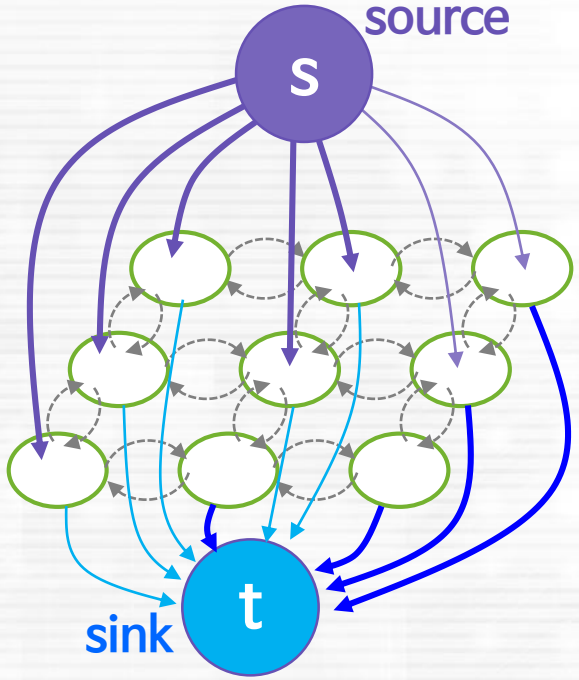
$$\begin{aligned} E(x_1, x_2, \dots, x_N | z_1, z_2, \dots, z_N) &= -\log P(x_1, x_2, \dots, x_N | z_1, z_2, \dots, z_N) \\ &= -\log \prod_i P(z_i | x_i) \prod_{(i,j)} P(x_i, x_j) \\ &= \sum_i \theta_i(z_i | x_i) + \sum_{(i,j)} \theta_{ij}(x_i, x_j) \end{aligned}$$

Likelihood term Prior term

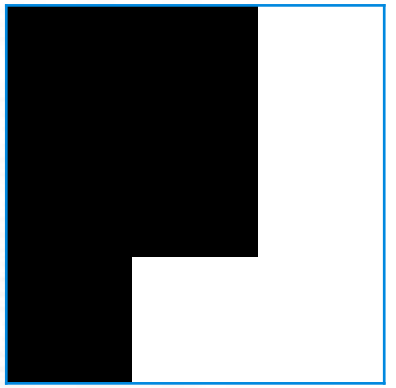
Graph Cut - Min cut / Max flow



Image



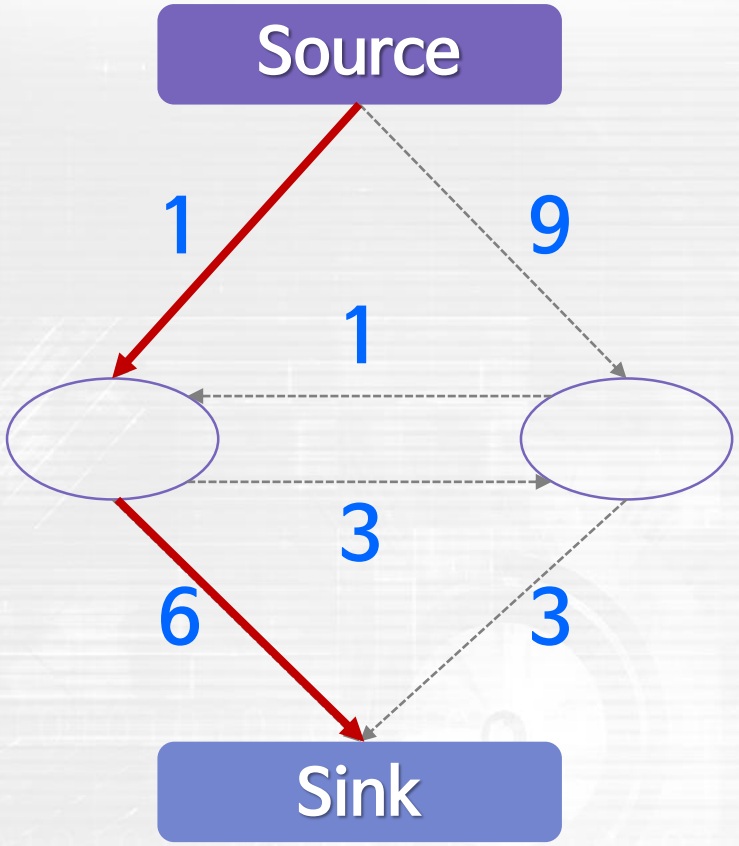
Graph



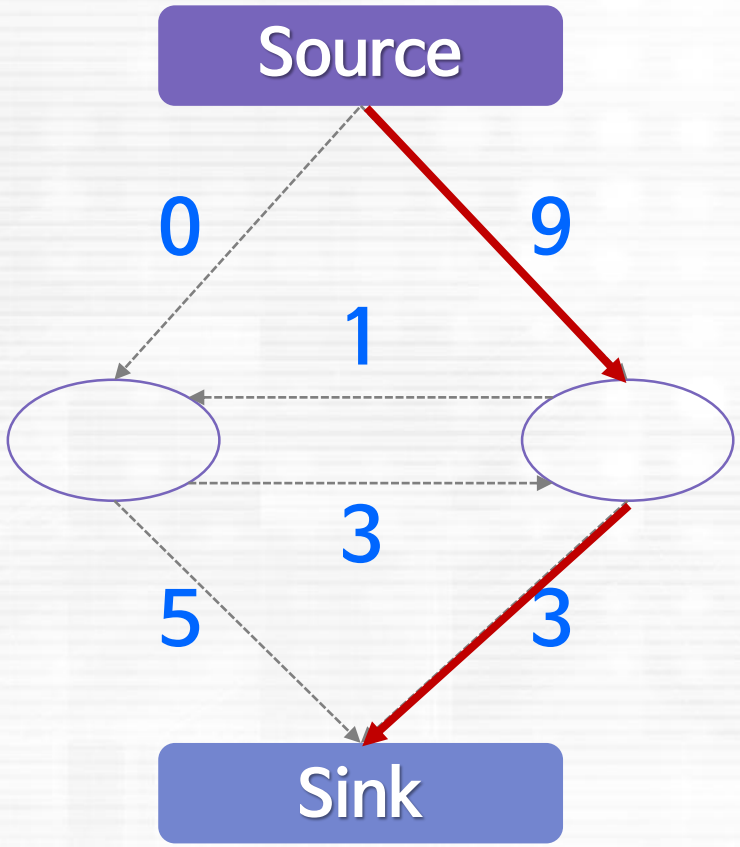
Segmentation result

Max Flow Algorithms

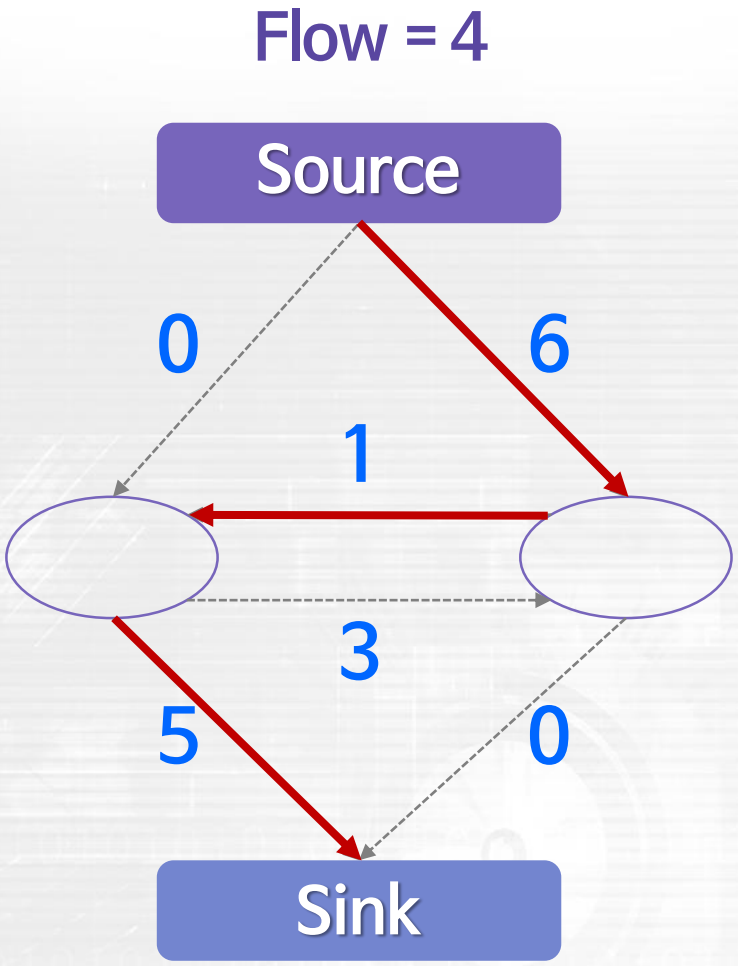
Flow = 0

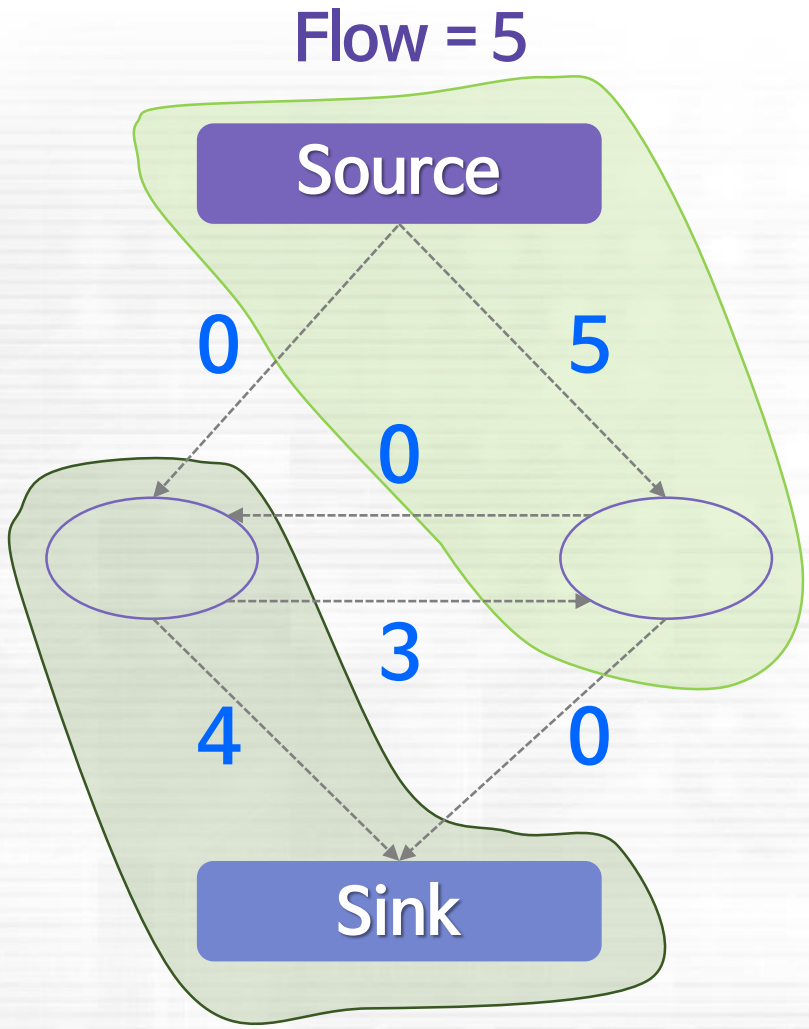


Flow = 1

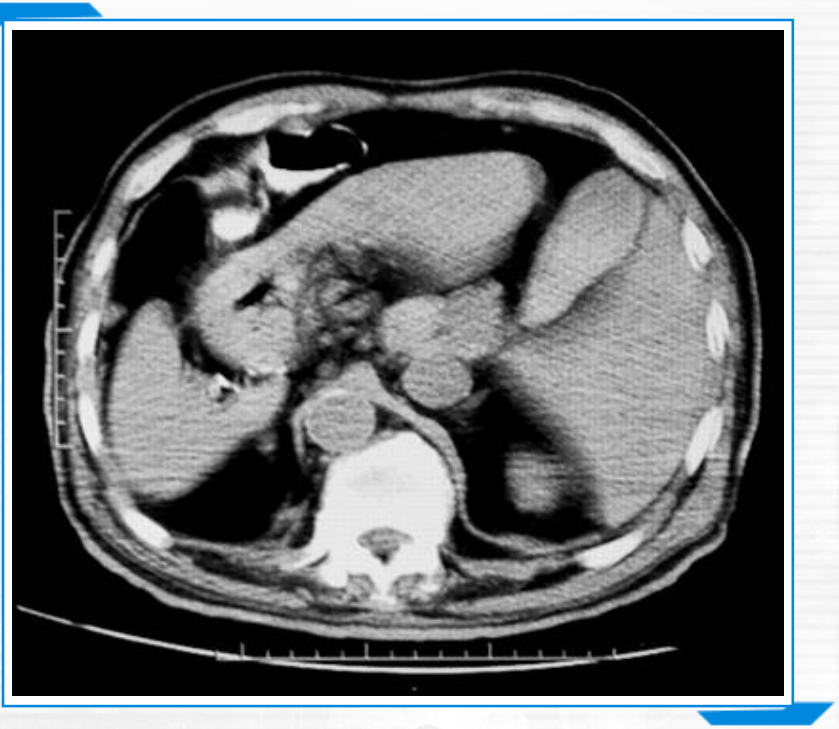


Max Flow Algorithms





Graph Cut



$$E(x,z,\lambda) = \sum \theta_i(z_i|x_i) + \lambda \sum \theta_{ij}(x_i,x_j)$$