Illustration on parameters

For the Level-Set method, by Pengwei Wu, 10/2/2015.

1 FORMULA

$$F(\phi, c, b) = \int \sum_{i=1}^{N} \left(\int K(y-x)|I(x) - b(y)c_i|^2 dy \right) M_i(\phi(x)) dx + \mu \int p|\nabla\phi|dx + \nu \int |\nabla H(\phi)|dx$$

2 DEFINITION

2.1 EVERY PARAMETER

- $nuBase$ -> ν. This parameter is multiplied by the arc length of the zero level contour of ϕ, and therefore can serve to smooth the final contour of segmentation.
- $muBase$ -> μ. This parameter is multiplied by the signed distance function, and therefore serves with a similar effect as $nuBase$.
- $iterOuter$ is the number of iterations used to solve the optimization formula.
- $sigma$ is the radius of the neighborhood, which is used to control K in the original formula.
- $timeStep$ is the step size used to solve the optimization formula.
- N_{class} -> N is the number of segmented materials (cannot be changed).
- $epsilon$, used for Heaviside and Dirac functions (no need to be adjusted).

2.2 PRE-PROCESSING PARAMETERS

Before segmentation, we may need to enhance the original image (like adjusting the window).

$$\text{imgOut} = \text{imadjust\_ya}(\text{img}, \text{bandWidth}, \text{booNormalize})$$

Using the function above to perform image enhancement, where img is the original image, bandwidth is the window you would like to use ([0.015 0.025] for example), and booNormalize should always be set as 0.

2.3 SUMMARY

On the whole, only the first four parameters in section 2.1 and the one parameter in section 2.2 need to be adjusted.

3 HOW TO

- $bandwidth$: determined by data set. For CT image without shading artifacts (in mm^{-1}), [0.015 0.025] is a good choice.
- $s$igma: The algorithm becomes less tolerate to shading artifacts with a large $sigma$. [3 – 10] is a common range.
- $nuBase$: The contour becomes more smooth with a large $nuBase$. [0.001 – 0.01] is a common range.
- $muBase$: The contour becomes more smooth with a large $muBase$. [0.05 – 0.5] is a common range.
- Note that with $nuBase$ and $muBase$ becomes larger, the algorithm becomes relatively less sensitive to brightness change.
- $iterOut,$ no need to illustrate. [100 – 500] is a common range.