

# Illustration on parameters

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

## 1 FORMULA

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

## 2 DEFINITION

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### 2.1 EVERY PARAMETER

- ✚ *nuBase* ->  $v$ . This parameter is multiplied by the arc length of the zero level contour of  $\phi$ , and therefore can serve to smooth the final contour of segmentation.
- ✚ *muBase* ->  $\mu$ . 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).

```
imgOut = imadjust_ya(img, bandWidth, 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

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- ✚ *bandwidth*: determined by data set. For CT image without shading artifacts (in  $\text{mm}^{-1}$ ), [0.015 – 0.025] is a good choice.
- ✚ *sigma*: 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.