IMAGE SEGMENTATION IN PRESENCE OF MULTIPLICATIVE NOISE

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Abstract. In this work, we propose a new algorithm for image segmentation in presence of multiplicative noise. This algorithm is based on the topological gradient approach coupled with a watershed technique and the G. Aubert & J-F. Aujol algorithm to remove multiplicative noise in image. The use of the topological gradient for detecting the main edges of the image avoid an over-segmentation which usually appears with the watershed technique. Experimental results obtained illustrate the efficiency of our approach.

1. Introduction

The multiplicative noise model is considered for active images type (microscopic imaging, Laser image, tomography image, (SAR) images). The presence of this type of noise is modeled in the following equation :

$$v = u\eta, \tag{1.1}$$

where $u : \Omega \subset \mathbb{R}^2 \to \mathbb{R}$ is the original image, v the observed image and η is a multiplicative noise.

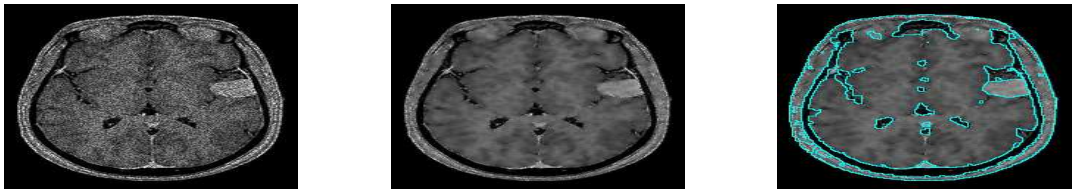
In order, to remove or decrease the effect of speckle noise Aubert and Aujol [1] proposed to solve the following problem :

$$\begin{cases} -\text{div}\left(c\dfrac{\nabla u}{|\nabla u|}\right) + \dfrac{u-v}{u^2} &= 0 \ in\ \Omega, \\ c\dfrac{\nabla u}{|\nabla u|}\cdot n &= 0 \ on\ \partial\Omega. \end{cases} \tag{1.2}$$

The idea of our work is to use the topological gradient approach [2] applied in log transform of (1.1) to detect the edges of the image in order to preserve them during the reconstruction process and avoid an over-segmentation which usually appears with the watershed technique [3]. Then, we propose to segment the restored image u solution of the problem (1.2) with the new watershed algorithm [3].

2. Numerical results

We have tested our method on the brain slice that contain a tumor. The segmented image (see Figure 1(c)) is visually excellent, as it is possible to see the tumor present in the brain slice.



(a) (b) (c)

Figure 1. (a): The noisy image, (b) the restored image, (c) the segmented image.

References

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