Texture image segmentation and applications to colonic polyps in wireless capsule images

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Abstract

The inner tubular like structure of the intestinal tract consists of two major regions: lumen and mucosa (a membrane lining the lumen cavities). Abnormal tissues and lesions like polyps are usually seen as exterior parts of the mucosa, and the lumen is filled with intestinal juices of the human digestive system. Wireless capsule endoscopy (WCE) is a new imaging modality in gastroenterolgy, which provides an inner color view of the human digestive system and helps physicians to identify abnormalities. One major problem with this new WCE technology is that it generates a huge number of images per exam. Therefore, it is very relevant to design a computerized and also fast method for the inspection of WCE images.

In this work a variational segmentation model with texture information, using weighted gradient information, is proposed, and then applied to WCE polyp images. The model relies on the Chan and Vese model without any edge-detectors, and incorporates a new input term, defined by the smoothed product of the image with its gradient magnitude. Using this model, segmentation of images, with texture objects, is effectively achievied, by differentiating regions displaying different textural information. Moreover, a fast numerical scheme based on the dual formulation of the variational segmentation model, is also considered for its numerical implementation. The performance and efficiency of the proposed model is tested on several WCE polyp images, presenting texture information, and illustrative segmentation results are shown.

Keywords: segmentation, texture, variational models, wireless capsule endoscopy.

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