Monte Carlo Method in Image Segmentation

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Proposal of Digital Signal Process Project

For the project of ECE446, I selected two papers '*Contour segmentation in 2D ultrasound medical images with particle filtering*'[1] and '*MCMC Shape Sampling for Image Segmentation with Nonparametric Shape Priors*'[2]. The **central theme** shared by this two papers is using Monte Carlo method to do image segmentation.

These two papers have a **strong correlation with our course**, as image segmentation is always an attractive and challenging domain, and can be achieved by digital signal and image processing theory learned from our courses. Image segmentation can help people extract information they would like to focus on; for example, segmentation techniques are a valuable tool in medical diagnostics for cancer tumors and cysts; and also in industry field, it can improve the efficiency in product quality inspection and defects detection. However, segmenting complicated images of low quality is a challenging problem, and that's **the problem aim to solve by these two papers**, to implement and improve the segmentation quality in complex images.

The reason why I think these two papers appear to be **interesting and important** in this area is their ideas, which is **utilize the Monte Carlo method in statistics to solve the problems in signal and image processing field** to achieve the purpose of complex image segmentation. Using the intersections between different subjects to achieve and improve goals is always an amazing and exciting thing.

Definitely, they also have a lot **differences in achieving their goals**. **The first paper**, which published on 2011, focuses on contour extraction using Monte Carlo algorithm for extracting lesion contours in ultrasound medical images[1]. The feature is extracted by particle filter, a very famous method in image processing domain. **For the second paper**, which published on 2016, has a lot improvements compared with the first one. It aims to segment images of low quality or with missing data, and proposed a Markov chain Monte Carlo (MCMC) sampling-based image segmentation algorithm[2]. I will compare their differences and improvements to better understand their key points based on a same method: Monte Carlo method.

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References:

[1] Angelova, Donka , and L. Mihaylova . "Contour segmentation in 2D ultrasound medical images with particle filtering." *Machine Vision & Applications* 22.3(2011):551-561.

[2] Erdil, Ertunc, et al. "MCMC Shape Sampling for Image Segmentation with Nonparametric Shape Priors." *Computer Vision & Pattern Recognition* 2016.