

## MASTER'S THESIS

### Image segmentation based on the statistical and contour information

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# Image Segmentation based on the Statistical and Contour Information

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for the degree of  
Master of Philosophy

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# Abstract

Image segmentation is a hot research topic in pattern recognition, computer vision and image processing. It is one of the most important techniques in these fields. Its aim is to segment the image into a few areas with different characteristics and then select the interested targets, which can provide reference for the subsequent processes, such as classification and searching. Image segmentation is great important because the segmentation result will affect and decide the accuracy of the subsequent analysis and comprehension.

The following works have been done in this research:

- An improved thersholding approach based on the maximal variance method is presented in this thesis. The process of searching for the threshold by maximal variance is actually a searching course to find the optimum, so the genetic algorithm is used to search the global threshold. Furthermore, the characteristic of the fast optimizing by the genetic algorithm can be suit to our purpose to obtain a high efficiency. However, the traditional genetic algorithm has some disadvantages. Therefore, an improved genetic algorithm is proposed. In this new method, the weakness of the traditional genetic algorithm on the aspects of the global searching and converging rate can both be surmounted. The experiments with simulated data show that our proposed method can obtain a good global threshold which is approximated to the optimal value in the image, specifcilly there is an overlap between the distributions of the object and background. The experiments with the real images show that our proposed method can segment the objects from the background more significative by searching the global threshold. The new approach can also reduce the searching time.
- Urinary sediments are very important to help doctor diagnose the diseases such as kidney inflammation, urethra inflammation, bladder inflammation and so

on. In this thesis, we focus on the problem of edge segmentation of white and red blood cells in urinary sediments images. According to the characteristics of these medical images, it is necessary to make use of many different properties of the images and the segmentation should through many steps. In the proposed scheme, first, the variance transform and morphology processing are used to erase the effect of the uneven illumination and overlapped distributions, hence the particles can be located. Secondly, based on canny edge, the contour reconstruction of the particle is used to obtain the detail of the edges of the cells. Thirdly, a method based on the distance image and the global-local maximum is proposed to segment these cells, which are closed each other. The experiment results show that the proposed new method can segment the urinary sediment images effectively and precisely.

- Last, we aim at reducing the segmentation error for multiple-touching and overlapping part of the connected digits. A new method to segment the merged numerals is proposed. Firstly, we use the contour and component analysis to pre-segment the merged numerals and separate the numerals into touched and untouched types, the merged-untouched numerals can be segmented successfully. Then, we proposed a new energy model based on wavelet multi-scale analysis and Gradient Vector Flow (GVF) model. For the touched numerals, we analyzed their contour features and proposed a searching method to find the segmentation path and apply the energy model to confirm the segmentation path. Experiments show that our proposed segmentation method can receive a positive result so that the separated digits can be obtained, which have more natural shape comparing with other algorithms. Furthermore, the merged numeral string with overlap can also be segmented, and the segment error rate of our method is lower than that of some other methods.

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