

Contents

Chinese Abstract	i
English Abstract	ii
Acknowledgment	iii
Contents	iv
Index of Figures	vi
Chapter 1 Introduction	1
Chapter 2 Conventional Image Segmentation Methods and Their Problems	4
2.1 Contour-Based Methods	4
2.2 Region-Based Methods	8
2.2 Motivation of the Hierarchical Segmentation Method	9
Chapter 3 Image Segmentation by Color Cue	12
3.1 Relationships between Pixels	12
3.2 Transformation to HSI Color Space	14
3.3 Multilevel Thresholding by Hue Histogram	19
Chapter 4 Segmentation by Texture Cue	23
4.1 The Filter Bank for Human Receptive Field	23
4.2 Texture Analysis	25
4.3 Region Merging	29
4.3.1 Order of Merging	30
4.3.2 Merging Predicate	32

Chapter 5 Experimental Results	36
5.1 Experiments for Texture Segmentation	36
5.2 Comparison of the Segmentation Results	42
Chapter 6 Conclusions and Future Works	46
Bibliography	49



List of Figures

Figure 2.1 (a) An untextured image, (b) a result using Sobel operator, and (c) a binarized image	6
Figure 2.2 (a) A textured image, (b) a result using Sobel operator, and binarized images using threshold (c) 0.2 and (d) 0.1	7
Figure 2.3 The processing flow of the image segmentation method in this thesis	11
Figure 3.1 Images to demonstrate (a) 4-adjacency, and (b) 8-adjacency	13
Figure 3.2 An example to demonstrate connected components	13
Figure 3.3 RGB color cube	14
Figure 3.4 HSI color mode	16
Figure 3.5 An example to demonstrate the elimination of a hue undefined region	18
Figure 3.6 An example of the peak finding algorithm	20
Figure 3.7 (a) Result after multilevel thresholding and (b) the hue histogram of (a)	21
Figure 3.8 (a) Result after multilevel thresholding and (b) the hue histogram of (a)	21
Figure 3.9 (a) and (b) are results after merging small regions to their most similar adjacent regions	22
Figure 4.1 (a) and (b) are the even and odd symmetric filters in the horizontal direction, and (c) and (d) in the vertical direction	26
Figure 4.2 An example of texture analysis	28
Figure 4.3 The result of texture analysis shown as images	29
Figure 4.4 The model of image generation	35

Figure 4.5 Results of region merging after texture analysis	35
Figure 5.1 (a) An image clip and the results of region merging with (b) Q=4 and (c) Q=2 and (d) Q=1	38
Figure 5.2 Results of the region merging after texture analysis with (a) Q=8, (b) Q=4, (c) Q=2, (d) Q=1	38
Figure 5.3 (a) An image clip and the results of region merging with (b) Q=4 and (c) Q=2 and (d) Q=1	39
Figure 5.4 Results of the region merging after texture analysis with (a) Q=8, (b) Q=4, (c) Q=2, (d) Q=1	39
Figure 5.5 (a) Original image and results of texture segmentation with (b) Q=8 and (c) Q=4 to the whole image, and (d) a result of our segmentation method with Q=8	41
Figure 5.6 (a) The original image, (b) the result after 1 st stage segmentation, (c) the result after 2 nd stage segmentation, and (d) a result obtained by JSEG	43
Figure 5.7 (a)(e) The original images, (b)(f) the results after 1 st stage segmentation, (c)(g) the results after 2 nd stage segmentation, and (d)(h) results obtained by JSEG	44
Figure 5.8 Results of image segmentation for car images	45
Figure 6.1 Bad segmentation results for black-white regions	48