香港浸會大學理學院
HKBU Faculty of Science

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DEPARTMENT OF COMPUTER SCIENCE

PhD Degree Oral Presentation

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Time:	4 July 2014 (Friday) 2:00 pm – 4:00 pm (35 mins presentation and 15 mins Q & A)
Venue:	SCT716, Cha Chi Ming Science Tower, HSH Campus

"On Study of Lip Segmentation in Color Space"

Abstract

In this thesis, we mainly address two issues in the lip segmentation problem which plays an essential role in variety of computer vision applications: 1) to investigate how to perform the segmentation without knowing the true segment number in advance, and 2) to investigate how to select the local optimal observation scale for each structure from the viewpoint of image segmentation effectively.

Regarding to the first issue, we propose two segment number independent lip segmentation methods. In the first one, we build up a hierarchical model, in which each layer corresponds to one segment cluster. Subsequently, a Markov random field (MRF) derived from this model is obtained such that the segmentation problem is formulated as a labeling optimization problem under the maximum a posteriori- Markov random field (MAP-MRF) framework. Suppose the pre-assigned number of segment clusters may over-estimate the ground truth, whereby leading to the over-segmentation. We present a rival penalized iterative algorithm capable of performing segment clusters and over-segmentation elimination simultaneously. Based upon this algorithm, we propose a lip segmentation scheme, featuring the robust performance to the estimate of the number of segment clusters. In the second method, we present an fuzzy clustering objective function which is derived from the partition entropy (PE) and implemented using Havrda-Charvat's structural α-entropy. This objective function features that the coincident (or close) cluster centroids in pattern space can be equivalently substituted by one centroid with the function value unchanged. According to the property of PE, the minimum of the proposed objective function can be reached as long as the two following conditions are satisfied: 1) the number of positions occupied by cluster centroids in pattern space is equal to the truth cluster number, and 2) these positions are coincident with the optimal cluster centroids obtained under PE criterion. In implementation, we firstly define some clusters whose number is greater than or equal to the ground truth and initialize them randomly. Then, a cooperative iterative algorithm is utilized to minimize the proposed objective function. Gradually, the algorithm converges, the initial over-partition will be faded out with the redundant centroids superposed over the convergence of the algorithm.

For the second issue, we propose an MRF based method with taking local scale variation into account to deal with the lip segmentation problem. We firstly suppose that each pixel in a given image has its own optimal observation scale from the viewpoint of segmentation. The scale map are viewed as an MRF defined on the regular pixel lattice. Then, the scale selection and lip segmentation problems are integrated under the MAP-MRF framework. Specifically, to make the proposed method more robust, we incorporate it into the hierarchical model, under which the lip segmentation can be performed without the true segment number beforehand. The optimal scale map and the corresponding segmentation result are obtained by minimizing the objective function via an iterative algorithm.

Finally, based upon the three proposed methods, we conduct some lip segmentation experiments, respectively. The results show the efficacy of the proposed methods in comparison with the existing counterparts.

***** ALL INTERESTED ARE WELCOME *****