SEMINAR NOTICE

Department of Electrical and Systems Engineering

AUTOMATIC SEGMENTATION ALGORITHMS FOR MR IMAGES

PhD Preliminary Research Examination

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Abstract: Spinal cord injuries can be catastrophic, and effective treatments are still lacking. Magnetic resonance imaging (MRI) is a key tool for non-invasive diagnosis of such injuries, as well as evaluation of treatment efficacy. However, accurate, quantitative methods for such analyses are needed. In our research, we propose a multi-step, multidimensional approach, utilizing the Classification Expectation Maximization (CEM) algorithm, for MRI segmentation of spinal cord tissues. Using multiple images of each spinal slice with different diffusion direction weightings, we jointly estimate the maximum likelihood tissue classifications. We employ edge detection on a binary classification image to find a non-parametric curve encapsulating the entire spinal cord. We evaluate the algorithm using data from in vivo DTI of control and injured mouse spinal cords. We demonstrate that the algorithm remains accurate for whole spinal cord, white matter, and hemorrhage segmentation in the presence of significant injury. We show that the results of the method are at least on par with expert manual segmentation.

Lung cancer is the leading cause of cancer-related deaths in the US. As in the case of spinal cord injuries, MRI is a key tool for measuring tumor in lung tissue and evaluating treatment efficacy. Whole lung segmentation, for the purpose of finding the whole lung average intensity, has been proposed as a method of tumor-burden estimation. We propose a model-based lung segmentation algorithm, utilizing the Nelder-Mead simplex method for optimization of a multi-faceted cost function. This proposed cost function optimizes the fit of the model parameters to the image itself, rather than to an existing non-parametric curve, as in previous applications of the simplex method to model-fitting problems. We demonstrate that our algorithm produces well-fitted lung segmentations for a wide variety of lung shapes and tumor burdens. Other potential applications include prostate segmentation in MR images for prostate cancer analysis.

DATE: Tuesday, March 23, 2010
TIME: 10:00 a.m.
PLACE: Bryan Hall, Room 305

Thesis advisor:
Dr. Arye Nehorai

This seminar is in partial fulfillment
of the Doctor of Philosophy degree

Washington University in St. Louis
SCHOOL OF ENGINEERING & APPLIED SCIENCE