

Notice and Invitation

Oral Defense of Doctoral Dissertation
The Volgenau School of Engineering, George Mason University

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Bachelor of Engineering, Osmania University, 2006
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Longitudinal Lesion Tracking in Magnetic Resonance Images

Monday, March, 6th, 2017, 11AM-1PM
Showcase Room, Research Hall
All are invited to attend.

Committee

Dissertation Chair, Dr. Vasiliki N. Ikonomidou
Committee Member, Dr. Jana Kosecka
Committee Member, Dr. Siddhartha Sikdar
Committee Member, Dr. Kathleen E. Wage

Abstract

Lesion volume on magnetic resonance images is one of the surrogate markers that is routinely used for monitoring Multiple Sclerosis (MS) disease progression. Studies suggest that in addition to lesion volume, individual lesion dynamics on T₂-weighted images convey valuable information in monitoring disease modifying therapy. These lesion dynamics can predict conversion to permanent tissue damage, which can potentially improve repair capacity. Currently, lesion volume is delineated manually, which is subject to large inter-rater and intra-rater variability. Furthermore, manual techniques can be expensive and time consuming.

Automatic approaches to segment and track lesions on T₂-weighted images have not been suggested. In this defense, I will present a lesion segmentation and tracking technique in serial MR data, showcased on a dataset consisting of images from twenty patients scanned monthly for a year. Our technique uses a modified unified segmentation algorithm to delineate MS lesions. Manual tracing of lesions on any image within the longitudinal data are used to create lesion priors. Subtraction images are used to propagate these priors to all the other images in the longitudinal data. Lesion load is measured on all the last time-point images for each subject in our data using the proposed automatic lesion segmentation. The results are validated qualitatively by a trained observer and quantitatively by evaluating the overlap metrics.

The main contribution of our approach is the ability to not only follow total lesion volume changes, but also individual lesion sizes over time. To this end, eleven MRIs per subject, representing eleven different timepoints, are segmented and the total T₂-lesion volume is computed. A lesion counting approach is used to identify individual lesions. Their volumes are estimated and changes are tracked over a year to understand individual T₂-lesion dynamics. Longitudinal tracking of individual lesions and the lesion segmentation approach presented here can benefit multiple studies in understanding MS disease progression.