Biomedical Informatics Grand Rounds

Wednesday, February 7, 2024

3:00 pm – 4:00 pm

Overcoming Annotation Barriers in Localized Pathology Prediction Models

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In-Person: MART Room 7M-0602

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Bio: Prof. Tasdizen received the B.S. degree in electrical and electronics engineering from Bogazici University, Istanbul, Turkey. He received the M.S. and Ph.D. degrees in engineering from Brown University. He is currently a professor at the Department of Electrical and Computer Engineering, University of Utah. His research interests include image processing and computer vision with a focus on applications in biological, medical image analysis and material science. He is a recipient of the National Science Foundation's CAREER Award. His research has been funded by NSF, NIH, VAH, DOE and DHS.

Abstract: Machine learning models that provide localized predictions offer advantages in medical image analysis including improved trust and interpretability. However, such models are trained either in a weakly supervised manner or in a supervised manner with localized ground truth, e.g. annotated bounding boxes, which can be very difficult to obtain. In this talk, I will discuss our efforts to build localized prediction models for radiology and histopathology images using systems-level and semi-supervised learning approaches. In radiology, we propose to take advantage of radiologists' routine workflows when interpreting chest x-rays by capturing eye-tracking data during report dictation. Gaze fixations from eye-tracking are then aligned with the transcribed report using time-stamps and utilized in training as an alternative to annotated bounding boxes. Five board-certified thoracic radiologists participated in a study to collect an eye tracking dataset of approximately 3,000 images from MIMIC-CXR. We then compare supervision with radiologist gaze to supervision with manually annotated bounding boxes and to weak supervision with no localization. In histopathology, we focus on classification models at the scale of tiles from whole-slide images. We formulate a novel semi-supervised learning approach that uses Hematoxylin and Eosin stain separation to achieve multiple views of the data coupled with a contrastive loss for regularization. We experiment with clear cell renal cell carcinoma datasets from our institution and The Cancer Genome Atlas (TCGA), comparing our model with state-of-the-art semi-supervised and self-supervised learning approaches. We demonstrate improved accuracy when a limited number of annotated tiles are available.

Educational Objectives:

1. Understand how machine learning methods can help with outcome predictions on radiology images and pathology images.
2. Understand how eye-tracking and pathology report information can be incorporated to improve machine learning prediction power/interpretability on radiology images.
3. Understand how color-deconvolution based contrastive learning can improve pathology image analysis.

Disclosure Statement: Dr. Tolga Tasdizen is a member of the scientific advisory board for nView Medical and Xenter Inc.

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