הטכניון מכון טכנולוגי לישראל
TECHNION Israel Institute of Technology

Faculty of Mechanical Engineering
הפקולטה להנדסת מכונות

MECHANICAL ENGINEERING STUDENT SEMINAR

Wednesday, July 27 2022 at 11:00, **Online:** https://technion.zoom.us/j/98313850234

Computational diagnosis of Diabetic Macular Edema using deep learning techniques on Optical Coherence Tomography data

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In the developed world, diabetic retinopathy is the leading cause of preventable blindness among the working age population. Of an estimated 451 million people with diabetes worldwide, nearly 10% are afflicted with a vision-threatening disease, with diabetic macular edema (DME) being the leading etiology. Optical coherence tomography (OCT) is essential in the diagnosis and management of DME. This imaging modality, based on optical reflectivity, is used to obtain cross-section and three-dimensional high-resolution images of the macula. Currently, OCT derived measures are the standard of care in the diagnosis of DME and in monitoring of therapeutic effects. The analysis of OCT and identification of its related pathological features is complex and requires highly trained retina experts. Manual interpretations are extremely time consuming, with variable repeatability and interobserver agreement.

Computer-Aided Diagnosis (CAD) systems facilitate interpretation of medical images, with rising global interest. In recent years, deep-learning, a class of machine learning inspired by the neuronal layers that constitute the human brain, has generated a revitalization in the fields of artificial intelligence and computer vision. Deep-learning models have been applied in CAD, leading to meaningfully improved results and higher ability to automatically detect abnormalities on medical images. To date however no retinal CAD system have matured into implementation for routine clinical use, largely due to many challenges associated with the uniqueness of the OCT data.

As part of our research, we developed tool for the clinical care of DME, by providing computational-based quantitative and qualitative analysis of OCT. A data-centric approach was introduced to take full advantage of the OCT data, that is used for training and evaluation of models, without affecting the intrinsic pattern and altering the realism of OCT images. Furthermore, the development of novel deep learning methods focusing on the model architecture for OCT data were addressed. A 2D convolutional neural network was proposed to analyze the cross-sectional OCT images and was subsequently extended to OCT volumetric data (3D). All results were analyzed and validated by medical experts. Finally, a detailed outline of the milestones for the analysis of oct volumes over time (4D) was elaborated. Through a continuous collaboration with ophthalmologists from Rambam hospital, our methods were validated both analytically and clinically. Evaluation was based on examining the algorithm's results and its clinical significance.

Note: the seminar will be given in Hebrew

Seminars Coordinator: Assoc. Prof. Matthew Suss.