Announcing the Final Examination of Naji Khosravan for the degree of Doctor of Philosophy

Time & Location: November 5, 2019 at 1:15 PM in ENG2 202A
Title: COLLABORATIVE ARTIFICIAL INTELLIGENCE ALGORITHMS FOR MEDICAL IMAGING APPLICATIONS

Radiology screening is proved to be a vital step for cancer detection in many applications. However, human errors stay as a significant issue in this process. Missing cases and over-diagnosis can have serious outcomes and increase mortality rate. Computer-aided diagnosis (CAD) tools help radiologists to reduce diagnostic errors such as missing tumors and misdiagnosis.

In this dissertation, we aim to develop a paradigm shifting CAD system, called collaborative CAD (C-CAD), that unifies CAD and eye-tracking systems in realistic radiology room settings. We propose a novel graph-based analysis as our collaboration medium between the radiologist and our machine learning algorithms for medical image analysis.

We first developed an eye-tracking interface providing radiologists with a real radiology room experience. Further, we develop a graph-based clustering and sparsification algorithm to transform eye-tracking data (gaze) into a graph model to interpret patterns quantitatively and qualitatively.

Second, we develop a local image analysis algorithm. Once we extracted radiologists’ ROIs, using our graph formulation, we incorporate our deep learning algorithm to locally analyze radiologists ROIs. We first show this process with a pilot study. Then, we develop a semi-supervised multi-task network to perform segmentation and diagnosis of abnormalities in the ROIs jointly. The specific design of our algorithm, in this step, targets two critical challenges in medical image analysis: generalization and lack of large scale annotated data for training.

Finally, we introduce two global image analysis modules. The global image analysis modules will help for a better screening by handling the areas that are totally missed by radiologists during the screening. The goals of global modules are: 1) Capturing tiny abnormalities that can be missed during the screening process, and 2) performing structure/organ segmentation to better guide the radiologists for high risk areas in case of abnormalities in organs with complex shape.

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Approved for distribution by Ulas Bagci, Committee Chair, on October 14, 2019.

The public is welcome to attend.