Professor Pegah Khosravi's Works in the Works Talk on March 18, 2025

Reviewed by Dr. Sarah Price, Humanities Department, NYCCT

In her talk "AutoRadAi; A Versatile Artificial Intelligence Framework Validated for Detecting Extracapsular Extension in Prostate Cancer", Dr. Pegah Khosravi talked through her process of developing an innovative artificial Intelligence (AI) tool to aid doctors and hospitals in analyzing MRI scans for the diagnosis and treatment of prostate cancer. In her talk, she first gave an overview of her academic and professional journey as well as AI and machine learning concepts, then explained the process for developing AI learning tools, and lastly demonstrated how she continued to develop these concepts and tools to analyze MRI images to help doctors more accurately diagnose patients with prostate cancer prior to surgical intervention.

Dr. Khosravi started her presentation by explaining that AI is a very old concept that enables the machine to mimic human behavior or mimic specific tasks requiring human thinking. This is done through Machine learning. Dr. Khosravi explained that there are 3 major categories of Machine Learning methods: 1) unsupervised methods, 2) supervised machine learning, which she explored further in her presentation, and 3) reinforcement learning. For the purposes of her research, Dr. Khosravi focused on Supervised Machine learning. Supervised Machine Learning is an AI learning methodology in which the AI program begins with what Dr. Khosravi labelled as "ground truths", or ground floor knowledge that is input by the researcher or doctor, rather than having the AI program building knowledge from scratch. This process allows the physicians or researchers to provide information that develops into a deep neural network algorithm that, in this case, is eventually able to analyze images from MRI scans for signs of prostate cancer, based on previously diagnosed images input by the physicians. Dr. Khosravi developed a Convolution Neural Network (CNN) using images through small sliding filters, or kernels, to extract local features of the images and then analyze the visual data present. Using this methodology and network-based AI developmental learning practice, Dr. Khosravi was able to transfer the AI learning practices, allowing the lower-level features learned through pre-training practices to be reused, while the higher-level layers of the AI algorithm were then fine-tuned or retrained onto the new target data set. In this way, Dr. Khosravi trained her AI model based on MRI images with tumors vs. images without tumors to develop out the algorithm. Through this transfer learning process, the first level of the model classifies the benign vs. cancerous images, then the second level model classifies the high-risk vs. low risk cases, and finally the machine then estimates the likelihood of cancerous or non-cancerous tumors.

In partnership with AdventHealth as part of the Global Robotics Institute in Orlando, FL, Dr. Khosravi was able collaborate with health care practitioners to test this AI model in a clinical setting, and thus AutoRadAI was born. Using 1,001 patients and their 100,000 MRI images, the AutoRadAI program was trained to first convert and normalize MRI images to uniform sizing, coloring, etc. in order to be compatible with the CNN image processing. Then, using the CNN model to identify and extract distinct MRI slices that contained regions of interest, the algorithm learned to cut down on and disregard unnecessary images and focus on the region that was needed - images that focused on the prostate glands. The model then crops the selected images and assigned labels of ECE-Positive or ECE-Negative (positive or negative for Extracapsular extension). These labels were then confirmed based on post-surgery histopathological findings of

the health practitioners. When testing AutoRadAi diagnosis with patient in partnership with physicians, Dr. Khosravi found that in 100 patients, AutoRad AI can label ECE-Positive or ECE-Negative with 71% accuracy, whereas without the use of AutoRadAI., there is less consistent accuracy, and these labels are more dependent on the experience level of the physician.

Overall, Dr. Khosravi's presentation was both informative and timely, exploring questions of how AI can be used in aiding health care practitioners and avoiding invasive surgeries currently used in prostate cancer diagnosis. Her research and findings demonstrate positive avenues of AI development to create a more accurate picture of health risk to aid physicians in their cancer diagnoses.