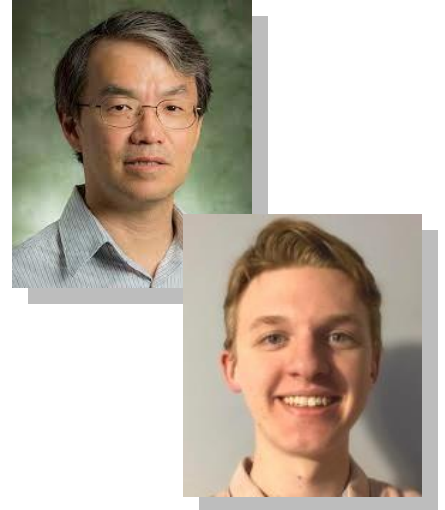# CoCo Seminar Series
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Using Machine Learning to Analyze SRS Images of Cancer Cells

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Wednesday March 23, 2022   12:00-1:00pm EDT
Hybrid (EB-T1 & Zoom; meeting link available on http://coco.binghamton.edu/)

Cancer is a genetic disease involving multiple mutations interacting within a complex system. Two hallmarks of cancer cells are abnormal lipid metabolism and chromosomal changes. Automatic quantification of these markers can help elucidate cancer mechanisms. Stimulated Raman Scattering (SRS) microscopy is a stain-free, laser-scanning imaging technology that utilizes two coherent laser beams (the pump and Stokes) to stimulate vibration of chemical bonds in molecules. Different bonds have different resonant vibrational frequencies, and thus SRS microscopy can achieve rapid chemical imaging at high-resolution, enabling live cell imaging and near-instant, stain-free pathological imaging. We present two projects using SRS imaging. The cell structure project uses ML and computational geometry techniques such as U-Net and Mask R-CNN to elucidate and quantify cell structures such as nuclei and lipid droplets. Such features are especially relevant for cancer research, but difficult to study with traditional machine vision techniques. Deep learning overcomes these challenges by using a feedback approach to "teach" the neural network what is important. In addition, we have also been working on a hyperspectral SRS project, which utilizes multiple Raman wave numbers to increase the ability to resolve multiple chemical species. In particular, this approach holds promise for quantifying DNA content, which is important to characterize cancer cell polyploidy. The SRS spectra is the mixture of the spectra of various pure substances present in each pixel so unmixing must be performed to find the relative abundances of these substances.

Kenneth Chiu is an Associate Professor in the Department of Computer Science at Binghamton University. He obtained his PhD in Computer Science from Indiana University. His research interests include cyberinfrastructure for instruments and sensors, web services performance, and middleware for scientific computing. This talk is based on a project supported by the CoCo ORC's seed funding program.

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