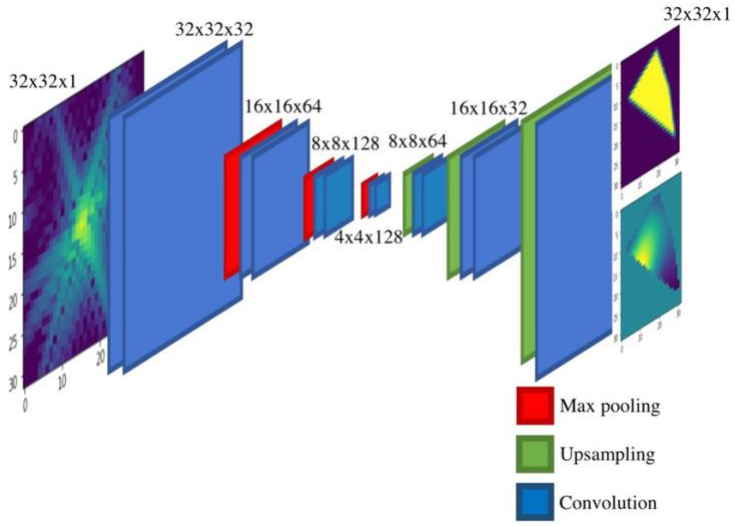
Coherent X-ray diffraction imaging (CDI) is a powerful technique for *operando* characterization. Visualizing defects, dynamics, and structural evolution using CDI, however, remains a grand challenge since state-of-the-art iterative reconstruction algorithms for CDI data are time-consuming and computationally expensive, which precludes real-time feedback. Such computational challenges associated with image reconstruction are forecast to become even more acute following the arrival of next generation light sources, when the resolution of the acquired data and consequently the size of the data sets will be orders of magnitude larger. Furthermore, the reconstruction algorithms require human inputs to guide their convergence, which is a very subjective process. The need of the hour is an automated workflow that would enable real-time image recovery from raw X-ray diffraction data.

In this talk, I will describe our work in the use of deep convolutional neural networks (CDI NN) in inverting coherent x-ray diffraction data to real-space structure and strain. Once trained, CDI NN is hundreds of times faster, and potentially more robust than traditional phase retrieval algorithms used for image reconstruction from coherent diffraction data, opening up the prospect of real-time strain imaging at the nanoscale. [1]



[1] Cherukara, Mathew J., Youssef SG Nashed, and Ross J. Harder. "Real-time coherent diffraction inversion using deep generative networks." Scientific reports 8.1 (2018): 16520.