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Programmatic and Deep Learning Analysis Pipelines for 4D-STEM Materials Science Experiments

Tuesday, 12 April 2022 10:00 (1 hour)

Many materials science studies use scanning transmission electron microscopy (STEM) to characterize atomic-scale structure. Conventional STEM imaging experiments produce only a few intensity values at each probe position. However, modern high-speed detectors allow us to measure a full 2D diffraction pattern, over a grid of 2D probe positions, forming a four dimensional (4D)-STEM dataset. These 4D-STEM datasets record information about the local phase, orientation, deformation, and other parameters, for both crystalline and amorphous materials. However, 4D-STEM datasets can contain millions of images and therefore require highly automated and robust software codes in order to extract the target properties. In this talk, I will introduce our open source py4DSTEM analysis toolkit, and show how we use these codes to perform data-intensive studies of materials over functional length scales. I will also demonstrate some applications of modern machine learning tools, in order to perform measurements on electron diffraction patterns were property signals have been scrambled by multiple scattering of the electron beam. All of our analysis, simulation, and machine learning codes and datasets are freely available for download, as we try to adhere to FAIR data principles.

Poster title

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