Contribution ID: **71**   Type: **not specified**

Applications of Artificial Neural Networks in Electron Microscopy

Wednesday, 13 November 2019 11:25 (25 minutes)

Being charged particles, electrons have a more than 4 orders of magnitude stronger interaction with matter than X-rays or neutrons and may be focused into a spot with less than half an Angstrom in diameter. This makes electron microscopes (EM) very versatile tools for high-resolution imaging, but also diffraction and spectroscopy from very small volumes. The strong interaction with matter, however, comes at the cost of having to account for a complex scattering mechanism when aiming for quantitative comparison of experiment and simulation. In this talk I will present our own work of recovering the 3D structure of the scattering object from multiple electron scattering using deep artificial neural network (ANN) architectures, as well as the application of a multi-scale convolutional neural network for generic image reconstruction tasks.

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Session Classification: Morning 2