

Towards Automated Materials Analysis: Deep Learning Denoising and Phase Identification from 4D-STEM

Ethan Lo
Fanzhi Su

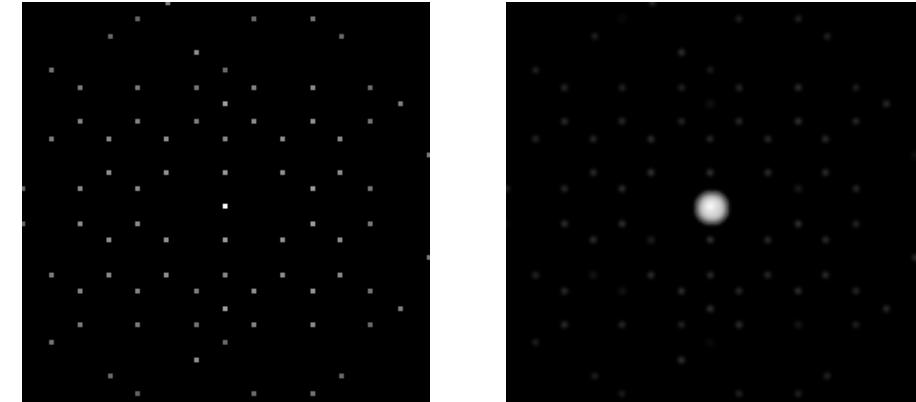
Problem Statement

- 4D STEM images suffer from
 - Low signal to noise ratio
 - Complex noise
- Need denoising to extract useful features
 - Phase and crystal structure
- NMC 811 is the material selected
 - Based on in-house dataset

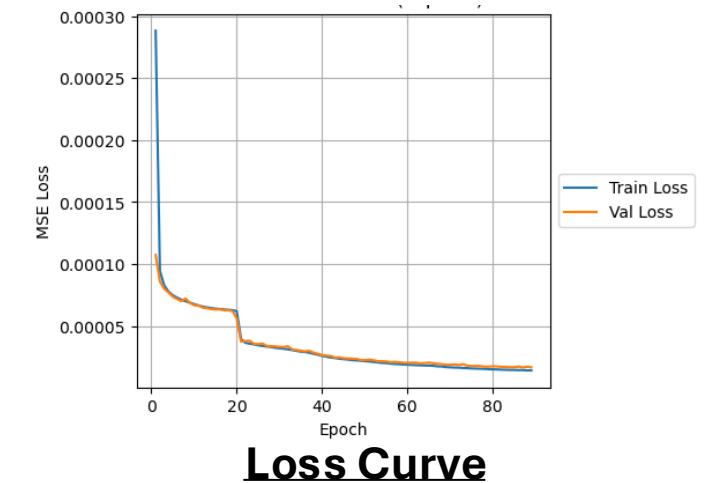


Generation of clean noisy image and NN training

- Generated clean image through materials project database
- Noised image using a range of different noises
 - Poisson
 - Halo
 - Spot Dimming ...
- Trained using the dense U-Net architecture
 - Gives better feature extraction power



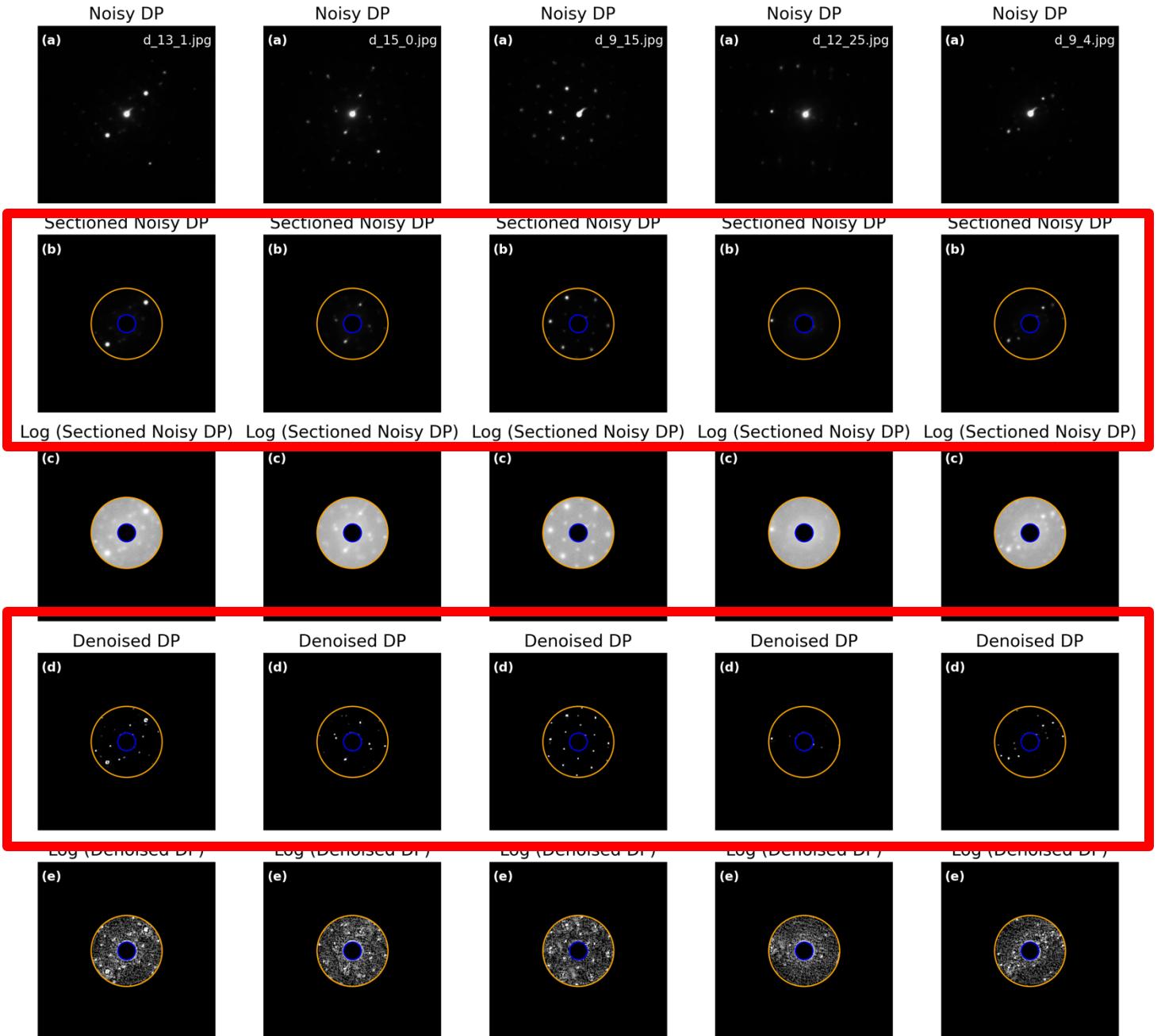
Clean Image Noisy Image



Evaluation

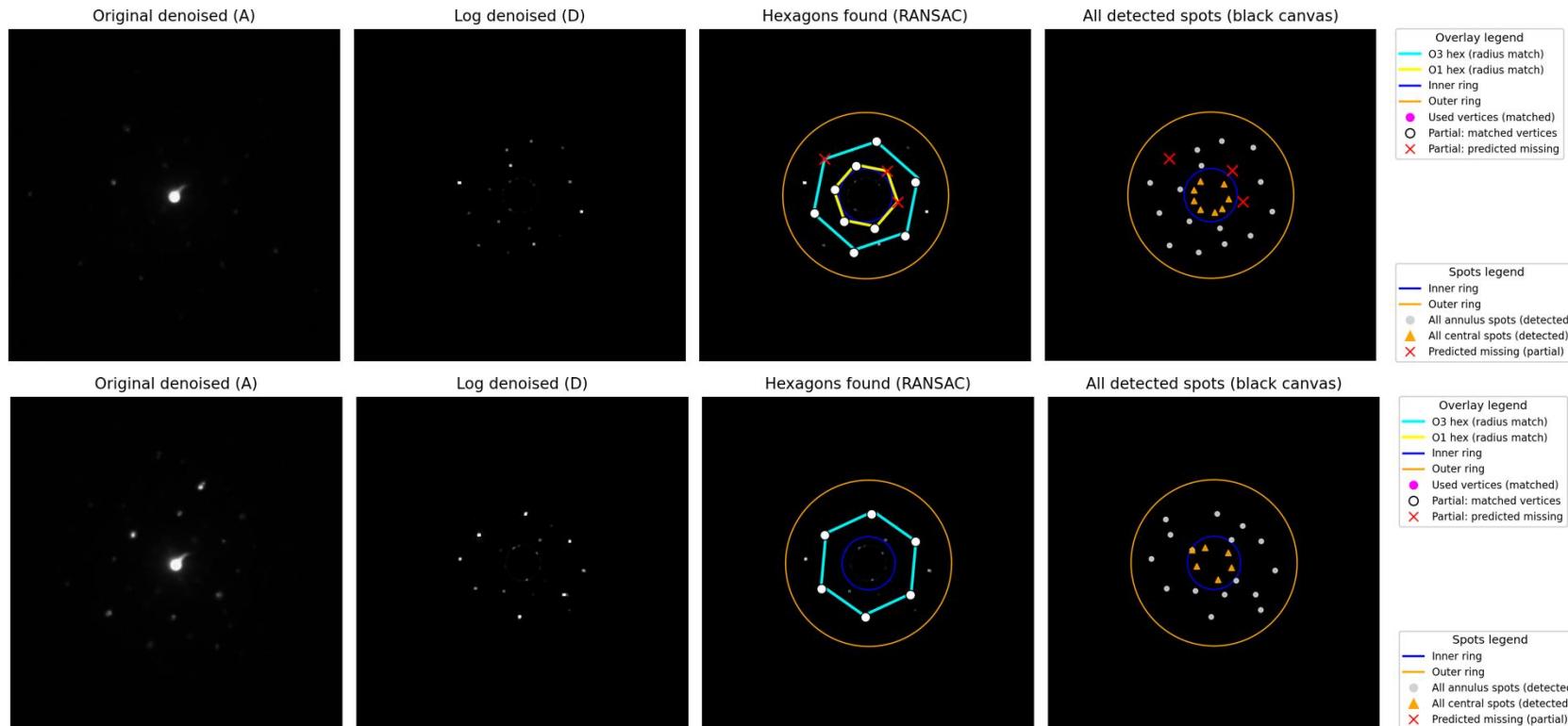
Denoised result
show much better
visibility

Allow phase
identification to
take place



Phase identification

- O1 and O3 Phase is the key phase for NMC 811



Both O1 and O3 present

O1 Present Only

Grid Map

