

# **Solving X-ray and Cryo-EM Inverse Problems with Deep Learning\***

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## **Abstract**

X-ray free-electron lasers (XFELs) and cryogenic electron-microscopy (cryo-EM) generate a range of data analysis tasks which can be framed as inverse problems. The inverse problems sometimes must also be solved repeatedly, e.g. for every pulse at high repetition-rate XFEL. In such situations, deep learning is an attractive approach: once trained, a single pass through a neural network produces a solution for a new example, potentially orders of magnitude faster than a traditional iterative solver. Moreover, the neural network can share information between examples, potentially providing higher-quality solutions. Here I will show two examples: reconstructing amplitude and phase of XFEL pulses, and learning atomic-scale structures of biomolecules from cryoEM images.

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