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Improving X-ray Tomography Reconstruction Using Deep Learning

Abstract

In tomography, acquired projection data are often limited in one or more ways due to unavoidable experimental constraints. In such cases, popular reconstruction algorithms typically produce inaccurate images. More accurate iterative algorithms, on the other hand, often have prohibitively high computational costs. Using machine learning to improve image quality in tomography is a recently proposed alternative, for which promising results have been shown. Early attempts have focused on using a certain standard type of neural network, which has several disadvantages when applied to large tomographic images, preventing wide application in practice. In this talk, I will present the use of Mixed-Scale Dense convolutional neural networks, which were specifically designed to avoid these disadvantages, to improve tomographic reconstruction from (severely) limited data. Results will be shown for various types of data limitations and object types, for both simulated data and large-scale real-world experimental data. Results will be compared with popular tomographic reconstruction algorithms and existing machine learning algorithms.