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Regularization for Undersampled Ptychography

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Abstract: Ptychography becomes increasingly ill-posed when the overlap between neighboring scan points is reduced, inhibiting the object reconstruction. Here, we discuss and show reconstructions with low-overlap ratios by regularizing with priors such as Total-Variation and Structure-Tensor-Prior. © 2021 The Author(s)

1. Introduction

X-ray ptychography is a versatile technique to achieve nanometer resolutions in imaging. It has found several applications in both research and industry, e.g., in biology and material sciences.

In X-ray ptychography, a focused, coherent probe beam $P(r)$ interacts with an object $O(r)$. The resulting wavefront $\psi(r)$ then propagates in free-space to the far-field, which can be approximated by the Fourier-transform of